From: (b) (6)
Sent: Tue, 8 Oct 2019 22:29:27 +0200
To: (b) (6)
Subject: Fwd: Flu (All in-inclusive planning discussion before preview to AMA)
Attachments: 20190213 NSC Influenza Strategy Brief Final updated numbers from updated CEA Report 20190905.pptx, ATT00001.htm

Let us discuss

Begin forwarded message:

From: "Kadlec, Robert (OS/ASPR/IO)" (b) (6)
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6), "Redfield, Robert R. (CDC/OD)" (b) (6), "Conrad, Patricia (NIH/NIAID) [E]" (b) (6) "Strength-McGaughey, Tracie (CDC/OD/OCS)" (b) (6), "Giroir, Brett (HHS/OASH)" (b) (6) "Bright, Rick (OS/ASPR/BARDA)" (b) (6), "Shuy, Bryan (OS/ASPR/IO)" (b) (6), "Ford-Barnes, Arwenthia (OS/ASPR/IO)" (b) (6), "Waters, Cicely (OS/ASPR/OEA)" (b) (6), "Disbrow, Gary (OS/ASPR/BARDA)" (b) (6), "Blatner, Gretta (OS/ASPR/BARDA)" (b) (6) "Johnson, Anthony (OS/ASPR/BARDA)" (b) (6), "Kerr, Lawrence (HHS/OS/OGA)" (b) (6), "Johnson, Robert (OS/ASPR/BARDA)" (b) (6), "Marks, Peter (FDA/CBER)" (b) (6)>, "Kouzoukas, Demetrios (CMS/OA)" (b) (6)
Subject: Flu (All in-inclusive planning discussion before preview to (b) (6)

All – Please bring/write two paragraphs regarding your pertinent section for discussion?

Protecting America From Influenza Updated 9/5/2019 for S1 Brief on the EO

FINAL DRAFT, FOUO, PREDECISIONAL

The 1918 “Great Influenza”: What it Did to America.

675,000 American Deaths

Over $50 Billion in Economic Losses

Over 7,000,000 Hospitalized

Over 2% Who Became Sick Died

Current: FLU Preparedness-Gains & Liabilities 2006 $7.0 B Supplemental (Expended)

Gains

- Two new vaccine types licensedTen-fold increase in domestic production capacityDeveloped 2 new kinds of antiviral drugsNational drug & vaccine stockpileImproved diagnosticsOver 13,000 jobs created/supported

Liabilities

- Continued delays in diagnosis: Leads to spread of disease Domestic vaccine manufacturing Low efficacy & still takes too longNo antiviral drugs approved for hospitalized patientsNot enough critical supplies. Most made outside the U.S.: needles & syringes, masks & respirators.

Defeating the FLU Threat (DHHS)

(10 year effort)

VACCINE PRODUCTION
Made in U.S.A. Better, faster flu vaccines;Expanded domestic production

$2.5B Investment

IMPROVED VACCINE AND VACCINE IMPACTMade in the U.S.A.Expanded access;Improved delivery

$6.3B Investment

DETECTION AND TRACKING
Made in the U.S.A.Earlier detection;
Available at the point of need

$1.5B Investment

TREATMENT AND CONTROLMade in the U.S.A.More effective; Better protective devices; Manufactured faster

$2.7B Investment

Defeating the FLU Threat (DHHS)
A Ten Year Sustained Investment of $11+B

	VACCINE PRODUCTION	IMPROVED VACCINE AND VACCINE IMPACT	DETECTION AND TRACKING	TREATMENT AND CONTROL
ASPR / BARDA	$2.1B	$1.2B	$0.4B	$2.0B
CDC	$0.3B	$1.7B	$1.0B	$0.5B
FDA	$.09	$.04	$.02	$0.08
NIH (National Institutes of Health)	$0	$3.4B	$0.035B	$0.115B
TOTAL	**$2.5B**	**$6.3B**	**$1.5B**	**$2.7B**

Impact of Success

Savings: Annually: up to $9 B; During a Pandemic: $0.7-0.9 T

Current Situation Seasonal Influenza$30B Immediate cash cost$361B Total cost140,000 – 960,000 Hospitalizations12,000–79,000 DeathsVaccine mismatch occurs in 3 out of 13 yearsPandemic Influenza$413 to $3,790B Economic loss 670,000-4,300,000 Hospitalizations 54,000->500,000 Deaths Every week delay in availability of current vaccines costs $41B/week through the first 12 weeks A vaccine with 30% improved efficacy could save -$53B/week through the first 12 weeks

Outcomes of Proposed ImprovementsSeasonal InfluenzaRecombinant-based vaccines: $8.9B in savings in H3N2 predominant years Faster vaccine: $14.9B in savings in mis-matched yearsTotal Impact of Layered Countermeasures: (BARDA)793K-4.31M cases prevented392K-2.13M medical visits prevented22K-146K hospitalizations prevented2K-13K lives savedPandemic Influenza Current vaccine available at outset of pandemic saves $730B Vaccine with 30% improved efficacy and available at outset of pandemic saves $953B

From: (b) (6)
Sent: Wed, 12 Feb 2020 11:00:11 -0500
To: Handley, Gray (NIH/NIAID) [E]
Cc: Auchincloss, Hugh (NIH/NIAID) [E];Conrad, Patricia (NIH/NIAID) [E]
Subject: Re: Request your Advice

Right now there are no travel alerts to THAILAND (please check just to be sure). That being the case, I would monitor the situation and if nothing changes over the next week or so, I would go ahead with the trip. If there is sustained person to person transmission there, I would cancel meeting.

On Feb 11, 2020, at 10:57 AM, Handley, Gray (NIH/NIAID) [E]
(b) (6) wrote:

Tony, After a year of planning, we are convening the annual Emerging Infectious Diseases of the Western Pacific on February 24-27 in Bangkok, Thailand. The focus this year is on emerging viral diseases so in many ways it is timely and we have included a special session on nCoV. There is considerable nervousness among U.S. participants due to worries about nCoV exposure and possible quarantine upon return to the U.S. About 20 U.S. and foreign participants have decided not to attend – often citing family concerns.

CDC tells me that they are not considering issuing any recommendation to limit travel to Thailand. The Thai Ministry of Public Health, our local host, has said they are comfortable proceeding and feel they have good control over the situation with all identified cases isolated and contacts traced and under surveillance. The U.S. Health Attaché and DoD scientists stationed in Bangkok tell us that life is normal other than widespread use of surgical masks in the streets. Our Japanese colleagues who are our meeting co-organizers, are cautious but so far see no reason to postpone or cancel the meeting. We have also had feedback from some of the participants noting that this meeting is timely and provides a useful opportunity to discuss nCoV research collaboration that can involve U.S. and regional scientists.

We have notified the ~300 registrants that if they have been exposed to nCoV (for example in health care settings) that they should consider not attending. We have assured transit routing avoids Chinese and Hong Kong airports. We are continuing to track any changes that might alter the risk/benefit assessment.

Bottom line, are you OK with our current decision to proceed with convening this scientific conference in Bangkok in about two weeks?

Thanks.

Gray

From: (b) (6)
Sent: Fri, 14 Feb 2020 18:52:46 -0500
To: Conrad, Patricia (NIH/NIAID) [E]
Subject: Fwd: nCoV WHTF Documents and Deliverables for Review
Attachments: 20200214 Supply Chain Update.pdf, ATT00001.htm, nCoV_CountryRiskMatrix14 Feb.pdf, ATT00002.htm, NEEDLES.docx, ATT00003.htm, remdensivir.docx, ATT00004.htm, FACE MASKS.docx, ATT00005.htm, WHTF Framework Decision Tree_V4.pptx, ATT00006.htm, Phases of USG nCoV Response _WHTF_13 Feb_PCC_Master.FINAL.DOCX, ATT00007.htm

Note last line of email regarding Task Force meetings.

Begin forwarded message:

From: "Ferro, Phil J. EOP/NSC" (b) (6)
Date: February 14, 2020 at 5:39:32 PM EST
To: (b) (6) (OS/IOS)" (b) (6)>, AS2KTC (b) (6), (b) (6) , "Bigley, Mark C. EOP/OMB" (b) (6), "Blair, Robert B. EOP/WHO" (b) (6), "Harrison, Brian (HHS/IOS)" (b) (6) "Butterfield, Nicholas W. EOP/WHO" (b) (6), "Campana, Alexandra D. EOP/WHO" (b) (6), "Cetron, Marty (CDC/DDID/NCEZID/DGMQ)" (b) (6), "Chafin, Kelly B. EOP/NSC" (b) (6) "Conant, Ann M. EOP/OMB" (b) (6) (b) (6) USN WHMO/WHMU" (b) (6), "Conrad, Patricia (NIH/NIAID) [E]" (b) (6), "Davis, May M. EOP/WHO" (b) (6), "Ditto, Jessica E. EOP/WHO" (b) (6), DL Chief of Staff Office <DLChiefofStaffOffice@WHO.eop.gov>, "donna.o'berry (b) (6)" (b) (6), "Duffey, Michael P. EOP/OMB" (b) (6), "Eisenberg, John A. EOP/WHO" (b) (6), "Fabina, Lauren C. EOP/NSC" (b) (6), "Fauci, Anthony (NIH/NIAID) [E]" (b) (6), "Ferro, Phil J. EOP/NSC" (b) (6), "Grogan, Joseph J. EOP/WHO" (b) (6), "Hemme, Jake W. EOP/NSC" (b) (6), "Hennessey, Millicent S. EOP/NSC" (b) (6), "Hoelscher, Douglas L. EOP/WHO" (b) (6), "Kan, Derek T. EOP/OMB" (b) (6), (b) (6) (b) (6) "Liddell, Christopher P. EOP/WHO" (b) (6), "Miller, Julie L. EOP/OMB" (b) (6), "Mulvaney, Mick M. EOP/WHO" (b) (6), "OS Salesses, Robert" (b) (6), "Pataki, Tim A. EOP/WHO" (b) (6), "Pottinger, Matthew F. EOP/WHO" (b) (6), "Riggs, Charlotte R. EOP/WHO" (b) (6), "Redfield, Robert R. (CDC/OD)" (b) (6),

"Kadlec, Robert (OS/ASPR/IO)" (b) (6), "Ruggiero, Anthony J. EOP/NSC" (b) (6), "Scher, Adam A. EOP/OMB" (b) (6), "Shellooe, Ryan P. EOP/NSC" (b) (6), "Sinclair, Michael R. EOP/NSC" (b) (6), "Szabat, Joel (OST)" (b) (6), "Troye, Olivia EOP/NSC" (b) (6), "Williams, Michael B. EOP/WHO" (b) (6), "Woolfolk, Jon J. EOP/OVP" (b) (6)

Subject: nCoV WHTF Documents and Deliverables for Review

Good Afternoon WHTF,

WHTF members have concurred with the proposed CONOP to repatriate American citizens from Japan.

Please find the following documents attached for consideration by the TF. If amenable to the group, we would propose discussion by the TF at a future date.

- Dr. Navarro has provided three memos with recommendations
  - (b) (5)
  -
  -
- Supply chain update from NEC
- Country matrix for spread of nCoV to other countries that (b) (5)
- Updated phased response to nCoV white paper
- US response to nCoV decision tree

Currently, there are no TF calls scheduled Saturday – Monday.

Best Regards,

Phil

Philip J. Ferro, PhD, MS
Director for Countering Biological Threats
National Security Council
(b) (6) (O) (b) (6) (cell)
(b) (6)

Supply Chain Update

National Economic Council

February 14, 2020

Overview

(b) (5)

Delivery Logistics

(b) (5)

Macro View

(b) (5)

Next Steps

(b) (5)

(b) (5)

(b) (5)

(b) (5)

2.14.20

MEMO TO COVID-19 TASK FORCE

THROUGH COS, NSA

FROM PETER NAVARRO

(b) (5)

2.14.20

MEMO TO COVID-19 TASK FORCE

THROUGH COS, NSA

FROM PETER NAVARRO

(b) (5)

2.14.20

MEMO TO COVID-19 TASK FORCE

THROUGH COS, NSA

FROM PETER NAVARRO

(b) (5)

[redacted]

U.S. Government Response to SARS-CoV2 Decision Tree

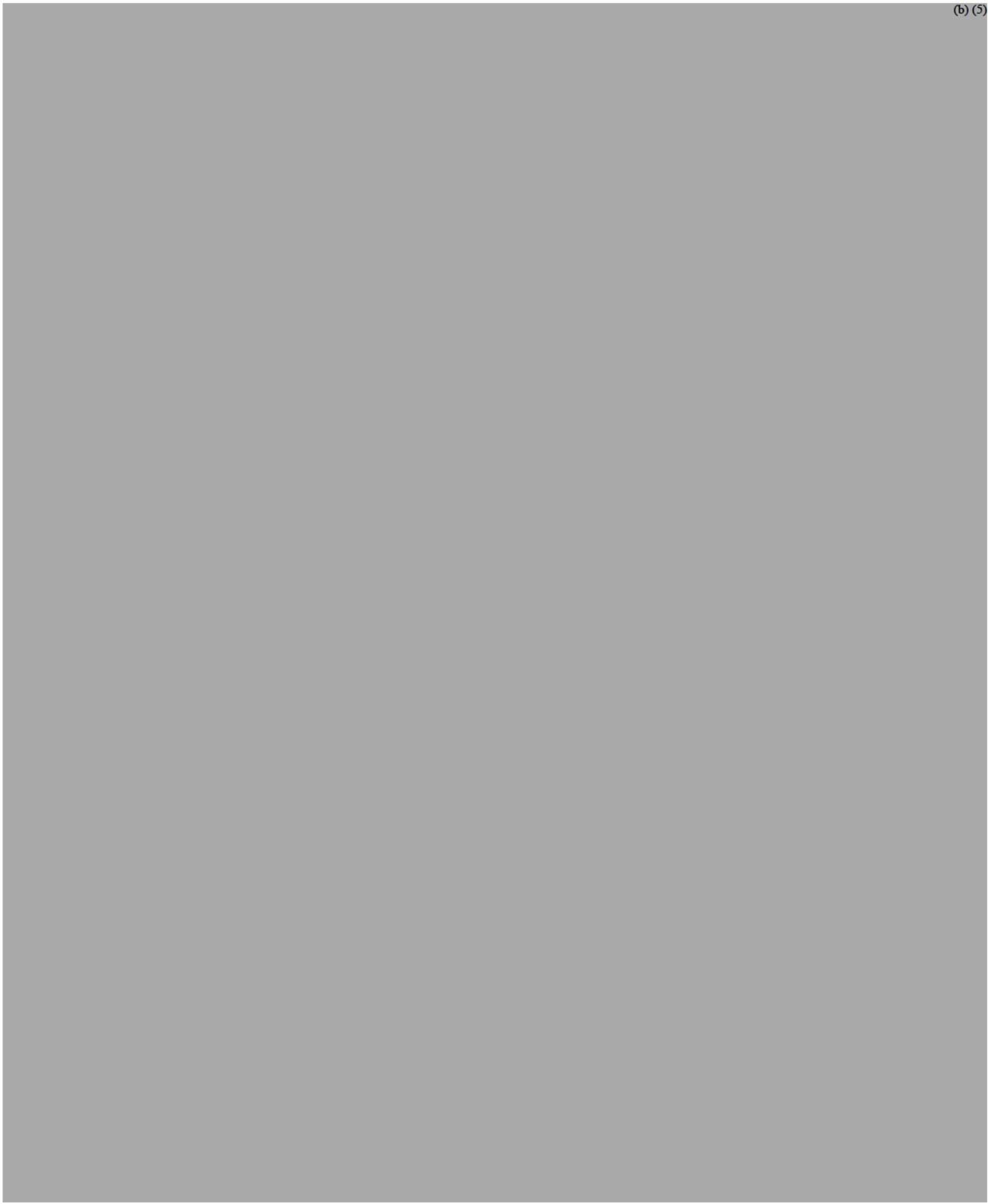
(b) (5)

(b) (5)

[redacted]

(b) (5)

(b) (5)



(b) (5)

[redacted]

(b) (5)

From: (b) (6)
Sent: Tue, 25 Feb 2020 19:07:15 -0500
To: McNeil Jr, Donald G
Subject: Re: thought from a kibbitzer...

You make some very good points, Donald.

On Feb 25, 2020, at 4:48 PM, McNeil Jr, Donald G <mcneil@nytimes.com>wrote:

I was just watching the HHS briefing online, and thinking about an article I read this morning, and Bruce Aylward's description of what he saw in China, and a lot of videos I've watched on the South China Morning Post website (they're doing great coverage.).

In China, we in the media tend to report the horrors and the lockdown and the government's early lies...

But the truth is that a lot of average Chinese behaved incredibly heroically in the face of the virus: 25,000 doctors and nurses went into Wuhan to help, knowing they might die. Average people gave up their stockpiles of masks so they could be shipped to Wuhan. Neighborhood committees brought food to thousands of little old ladies and checked on them every day, even as they asked them to stay behind their doors for fear of infection.

Meanwhile, in America, people tend to act like selfish pigs interested only in saving themselves. How can I hoard a mask? Where's my vaccine? This morning, I read this appalling article from Alabama. Here you have Americans coming back from a horrifying experience overseas, and the President -- who is popular in Alabama -- asks Alabamans to take some of those fellow Americans in. There is zero risk because they're going to be housed on a naval base.

And yet, the answer is "No! Keep them out!" And their legislators encourage it....

I dunno -- that's the kind of behavior I expect from my fellow New Yorkers, not from Alabama.

If the virus arrives -- and we both know it will -- America is going to have to do better than that. Like the Chinese, Americans are going to have to look out for each other the way we haven't since 9/11. Or maybe since World War II.

But that's not the tone of the HHS briefings. They're an aggressive, defensive, almost smart-alecky "we got this" tone. The only time the tone was right when you were the third to take the mike and explain things to that kid shouting from the back without a mike about "What's the real message? What do we do?"

Maybe there could be some thought given to mentally preparing Americans to work together in the face of the crisis? Quarantines are a very aggressive approach -- but they require a lot of compassion or the people quarantined suffer.

I might get around to writing an article about this, but my editors keep grabbing me for minute by minute stuff and I'm way behind.

Donald

From: (b) (6)
Sent: Wed, 26 Feb 2020 15:01:39 -0500
To: Folkers, Greg (NIH/NIAID) [E]
Cc: Eisinger, Robert (NIH/NIAID) [E]
Subject: Re: ASF and CLIFF ------- DRAFT response to Eli at NEJM

Please send this to Eli. Thanks

On Feb 26, 2020, at 12:49 PM, Folkers, Greg (NIH/NIAID) [E] (b) (6) >wrote:

Dear Eli,

(b) (5)

[redacted]

From: Laurencot, Elizabeth <elaurencot@nejm.org>
Sent: Wednesday, February 26, 2020 11:54 AM

To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Folkers, Greg (NIH/NIAID) [E] (b) (6); Conrad, Patricia (NIH/NIAID) [E] (b) (6); Eisinger, Robert (NIH/NIAID) [E] (b) (6); Lane, Cliff (NIH/NIAID) [E] (b) (6)
Subject: RE: NEJM content proof (Fauci)
Importance: High

Dear Dr Fauci,

I have a follow-up query regarding the following revised text:

(b) (5)

Thank you very much for your consideration!

Best,
Eli

From: Laurencot, Elizabeth
Sent: Wednesday, February 26, 2020 9:04 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Folkers, Greg (NIH/NIAID) [E] (b) (6) Conrad, Patricia (NIH/NIAID) [E] (b) (6); Eisinger, Robert (NIH/NIAID) [E] (b) (6); Lane, Cliff (NIH/NIAID) [E] (b) (6)
Subject: RE: NEJM content proof (Fauci)

Dear Dr Fauci,

Many thanks for your quick reply and for the clear list of responses regarding the proof. I will review today and will let you know if there are any items needing further discussion.

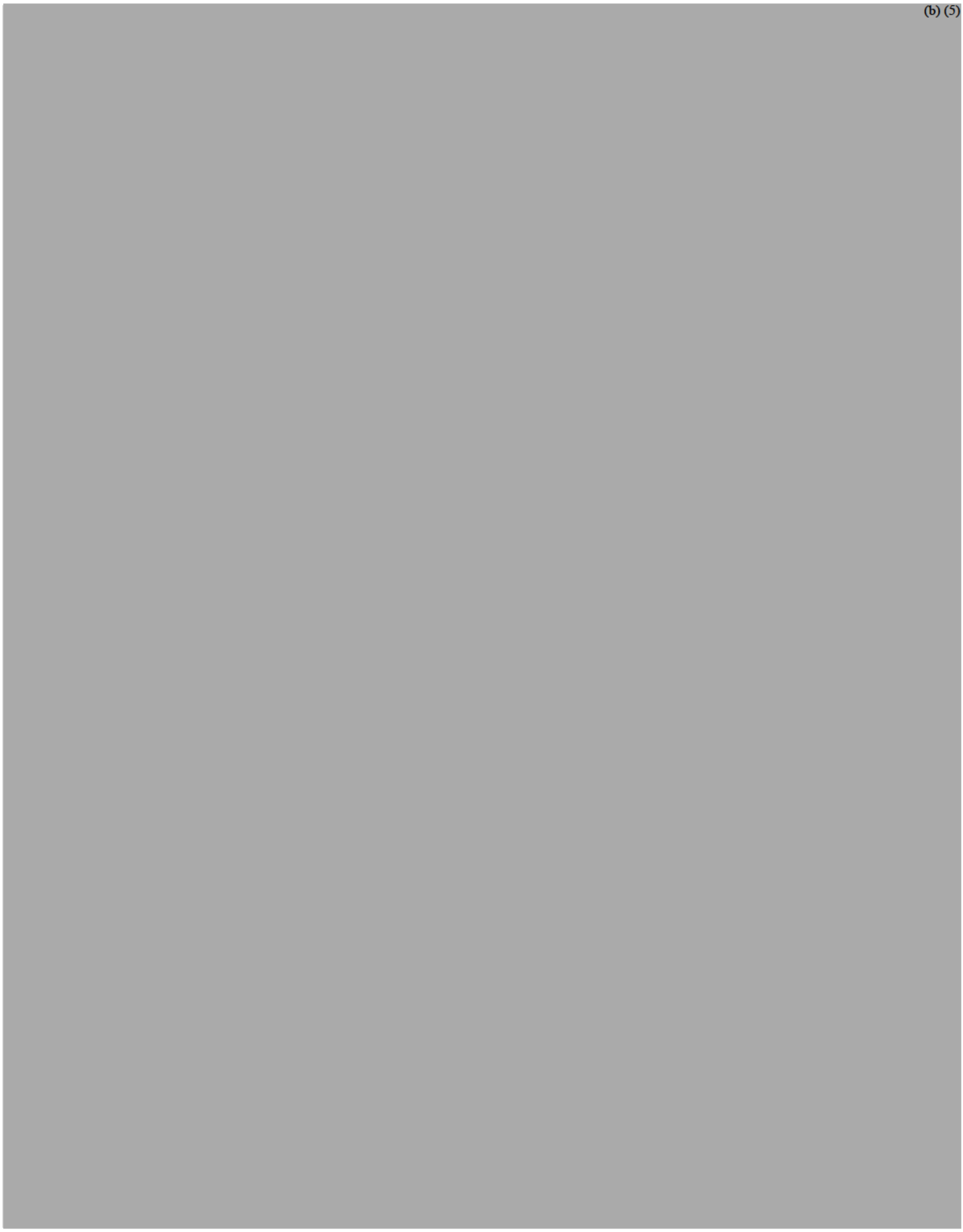
The current plan is for publication early Friday afternoon. As I mentioned yesterday, there is a new article on Covid-19 that is also scheduled for publication that day, and the Journal editors would like you to mention it in your editorial. I expect to be able to send you a proof of that article sometime today.

Best,
Eli

From: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Sent: Wednesday, February 26, 2020 7:37 AM
To: Laurencot, Elizabeth <elaurencot@nejm.org>
Cc: Folkers, Greg (NIH/NIAID) [E] (b) (6) Conrad, Patricia (NIH/NIAID) [E] (b) (6); Eisinger, Robert (NIH/NIAID) [E] (b) (6); Fauci, Anthony (NIH/NIAID) [E] (b) (6) Lane, Cliff (NIH/NIAID) [E] (b) (6)
Subject: RE: NEJM content proof (Fauci)

Dear Eli,
Here are my answers to your queries, and couple other minor changes:

(b) (5)


(b) (5)

(b) (5)

Thanks,
Tony

Anthony S. Fauci, MD
Director
National Institute of Allergy and Infectious Diseases
Building 31, Room 7A-03
31 Center Drive, MSC 2520
National Institutes of Health
Bethesda, MD 20892-2520
Phone: (b) (6)
FAX: (301) 496-4409
E-mail: (b) (6)

From: Laurencot, Elizabeth <elaurencot@nejm.org>
Sent: Tuesday, February 25, 2020 8:51 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: NEJM content proof (Fauci)
Importance: High

Dear Dr Fauci,

Attached is the content proof of your editorial. **Please read *ALL* of the following instructions and information carefully before** you begin reviewing your proofs.

First, please **stop and take a moment now** to confirm receipt, so that we can be assured that your proofs did not end up in a spam folder.

Your editorial has been edited for grammar, consistency, readability, adherence to Journal style, and clarity for nonspecialist readers. To expedite publication, we do not ask authors for specific approval of routine changes; please read the entire article to make sure your meaning has been retained. Note that we may be unable to make changes that conflict with Journal style or create grammatical or other problems. Finally, please note that a delayed or incomplete response may delay publication of your editorial.

Please read the entire proof carefully, including all queries. Please return your query replies and proof corrections ****before 12pm (US Eastern) this Friday, February 28, 2020****.

Instructions are provided below. Note that you will be reading for content only; the article will be rendered for print after the content has been finalized.

The Journal's senior medical editors will be reading your article at this stage. If they have any additional comments or queries for you, I will forward them to you in the next few days.

TO ANSWER THE QUERIES: The proof contains in-line numbered query markers and a numbered list of queries at the end. The query markers and the queries are linked, so you can jump back and forth within the file. Please respond to all the queries (see below for instructions; please do ****NOT**** use e-annotation tools) and convey any additional changes as needed.

TO RESPOND BY E-MAIL: If your corrections and your responses to the queries are straightforward, we encourage you to respond by replying to this message. Please copy and paste the list of queries into an e-mail message or a Word document and type your responses there. You may also include a list of changes (e.g., page 1, line 20, change xxx to yyy). Again, please do ****NOT**** use e-annotation tools in the PDF file; the marks are small and easy to miss, which may lead to errors in your article.

Please note that this material is confidential and embargoed until publication. If you have questions about our embargo policy, please contact NEJM Media Relations at 781-434-7847 or at Mediasupport@nejm.org.

Again, please do confirm receipt at this time. Thank you very much for your efforts with these content proofs!

Best,
Eli

Elizabeth Laurençot
Senior Manuscript Editor
New England Journal of Medicine

617-487-6547
elaurencot@nejm.org

TO READ THE PROOF: You will need Adobe Acrobat Reader software (version 4.0 or later) to view this file. Acrobat Reader is available free of charge at the Adobe Web site (http://www.adobe.com/products/acrobat/readermain.html).

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<NEJMoa2002032_Guan_Content2_Author.pdf>

From: (b) (6)
Sent: Thu, 27 Feb 2020 17:43:18 -0500
To: Conrad, Patricia (NIH/NIAID) [E]
Subject: Fwd: Dr. Fauci--Coronavirus comment 3/2 Healthline MEDIA

Sent from my iPhone

Begin forwarded message:

From: Kristen Fischer (b) (6)>
Date: February 27, 2020 at 5:20:21 PM EST
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Dr. Fauci--Coronavirus comment 3/2 Healthline MEDIA

Hi there,

I'm writing for Healthline about coronavirus and how the virus spread may be different in the Southern Hemisphere (they mention that in the story below). Care to weigh in?

I'd love to know:
1. Will coronavirus be any less severe in the Southern Hemisphere due to the summer weather there at the moment?
2. Will the virus spread in North America slow down due to geography or warmer weather at all? What can we expect in 3 months--and in one year as far as coronavirus in the U.S.?
3. Will it differ in how it spreads/tapers off in Asia, due to proximity of the outbreak?
4. Will this eventually be gone or will it be something that is a new health threat that could return in a year or so?
5. Any insight into the outlook of coronavirus, how it will spread or how long it will be active?

Looking for a brief email response by Monday morning at 10 a.m. Let me know if you can assist!

Warmly,
Kristen Fischer

--
Kristen Fischer
www.kristenfischer.com
(b) (6)

Brazilian Who Visited Italy Is First Coronavirus Patient in Latin America

Health officials were scrambling to track the man's movements after his infection was confirmed.

By Ernesto Londoño, Manuela Andreoni **and** Letícia Casado
Feb. 26, 2020

RIO DE JANEIRO — A 61-year-old São Paulo man who returned recently from a business trip to Italy has tested positive for the coronavirus, Brazilian health officials said on Wednesday, confirming the first known case in Latin America and sending a shudder through the entire region.

Officials were scrambling on Wednesday to track down the other passengers on the flight the man took to Brazil and to find others who had contact with him in recent days. The infection news broke in the midst of Brazil's Carnival celebrations, popular with foreign visitors.

The first confirmed case also compounded concerns about the potential economic toll on Latin America from the coronavirus, which

has since spread to more than two dozen countries around the world. Stock prices plunged in Brazil and Mexico on Wednesday amid growing signs that emergency measures aimed at containing the spread could jam supply chains and impede freedom of movement for a lengthy period.

“Everything is pointing to this epidemic being longer than we had anticipated,” said Welber Barral, a commerce expert in Brazil. “Global supply chains are integrated.”

The diagnosis was announced by the health minister, Luiz Henrique Mandetta, who added that Brazil was investigating 20 additional potential cases, including 12 patients who recently traveled to Italy.

The man was said to have traveled to northern Italy from Feb. 9-21. Although the virus originated in China, there has been a surge of cases in Italy, most notably in the northern region of Lombardy.

As the virus spread briskly across international borders in recent weeks, Latin America was spared.

But health officials in the region have been on high alert, anticipating that it was only a matter of time before the virus arrived. “It’s a global world,” Mr. Mandetta said. “It’s an interconnected world.”

Answers to your most common questions:

Updated Feb. 26, 2020

What is a coronavirus?
It is a novel virus named for the crownlike spikes that protrude from its surface. The coronavirus can infect both animals and people and can cause a range of respiratory illnesses from the common cold to more dangerous conditions like Severe Acute Respiratory Syndrome, or SARS.

How worried should I be?
New outbreaks in Asia, Europe and the Middle East are renewing fears of a global pandemic. The Centers for Disease Control and Prevention warned this week that Americans should brace for the likelihood that the virus will spread to the United States.

How do I keep myself and others safe?
Washing your hands frequently is the most important thing you can do, along with staying at home when you're sick.

What if I'm traveling?
The C.D.C. has warned older and at-risk travelers to avoid Japan, Italy and Iran. The agency also has advised against all nonessential travel to South Korea and China.

How can I prepare for a possible outbreak?
Keep a 30-day supply of essential medicines. Get a flu shot. Have essential household items on hand. Have a support system in place for eldery family members.

Where has the virus spread?
The virus, which originated in Wuhan, China, has sickened more than 80,000 people in at least 33 countries, including Italy, Iran and South Korea.

How contagious is the virus?
According to preliminary research, it seems moderately infectious, similar to SARS, and is probably transmitted through sneezes, coughs and contaminated surfaces. Scientists have estimated that each infected person could spread it to somewhere between 1.5 and 3.5 people without effective containment measures.

Who is working to contain the virus?
World Health Organization officials have been working with officials in

China, where growth has slowed. But this week, as confirmed cases spiked on two continents, experts warned that the world was not ready for a major outbreak.

[READ MORE]

Lívio Ribeiro, an economist at Fundação Getúlio Vargas University who studies China, said he expected the fallout in Latin America from the coronavirus will be greater than that of the 2003 SARS outbreak, which also originated in China.

Several of the leading economies in the region had been growing sluggishly, if at all, even before the coronavirus scare.

“This is a moment of great aversion to risk,” Mr. Ribeiro said. “Regardless of whether an economy is dependent on China or not, everyone is being affected.”

Brazil health officials said medical personnel had been given detailed guidance on diagnostic and treatment protocols for the coronavirus. But experts warned that funding cuts in recent years had left Brazil ill-equipped to grapple with an epidemic.

Mr. Mandetta told a news conference that the case might shed light on how the virus spreads in warmer climates. “This is a new virus,” Mr. Mandetta said, noting experts have yet to ascertain “how it behaves.”

Earlier, Mr. Mandetta told the G1 news site that officials were hopeful that the virus would not spread briskly in Brazil given the summer time of year in the Southern Hemisphere.

The Brazilian man who tested positive sought care at Albert Einstein Israelite Hospital in São Paulo on Tuesday after coming down with a fever, a cough and a sore throat. The patient is in stable condition and has been asked to remain in quarantine at home for at least 14 days, officials said.

The São Paulo case emerged two days after a group of Brazilians who had been in quarantine after returning home from Wuhan, China, the epicenter of the outbreak, were found to be healthy and allowed to resume normal activities.

José Gomes Temporão, a former health minister who oversaw Brazil’s response to the H1N1 virus in 2009 and 2010, said Brazil has a solid health surveillance system, which could enable officials to diagnose cases promptly.

But, in contrast to Mr. Mandetta’s optimism, he also cautioned that spending cuts had crippled the public health care system in recent

years, leaving the government poorly prepared to grapple with an epidemic.

“We are cutting resources to public health, and we will need additional resources now,” Mr. Temporão said.

Dr. Nancy Bellei, an infectious disease specialist, said that personnel at the private hospital where the 61-year-old patient sought care appeared to have acted quickly and to have followed best practices. But she, too, expressed concerns about whether Brazil’s underfunded, overburdened public hospitals were ready for an influx of patients.

“We need to see how the public system is going to handle this situation because the number of cases is bound to increase,” she said.

Brazil receives a surge of international visitors during this time of year as tourists come for Carnival, Dr. Bellei said, and “that means there’s a large flow of people.”

Estevão Portela, the deputy director for clinical services at Brazil’s Evandro Chagas Institute for infectious diseases, said the way the virus spreads in the country may yield valuable information about the nature of the disease in warmer climates.

“Brazil has an opportunity to contribute with research,” he said.

But Mr. Portela said the virus also could bring into sharp focus how badly Brazil needs to strengthen the public health system, which has been commended for its response to previous crises but now struggles with spending cuts.

Brazilian Who Visited Italy Is First Coronavirus Patient in Latin America

Health officials were scrambling to track the man's movements after his infection was confirmed.

Brazilians returning from Wuhan, China, on Feb. 9 were placed in quarantine. Everyone on that flight was given a clean bill of health. Credit...Andressa Anholete/Getty Images

By Ernesto Londoño, Manuela Andreoni and Letícia Casado

Feb. 26, 2020

RIO DE JANEIRO — A 61-year-old São Paulo man who returned recently from a business trip to Italy has tested positive for the coronavirus, Brazilian health officials said on Wednesday, confirming the first known case in Latin America and sending a shudder through the entire region.

Officials were scrambling on Wednesday to track down the other passengers on the flight the man took to Brazil and to find others who had contact with him in recent days. The infection news broke in the midst of Brazil's Carnival celebrations, popular with foreign visitors.

The first confirmed case also compounded concerns about the potential economic toll on Latin America from the coronavirus, which has since spread to more than two dozen countries around the world. Stock prices plunged in Brazil and Mexico on Wednesday amid growing signs that emergency measures aimed at containing the spread could jam supply chains and impede freedom of movement for a lengthy period.

"Everything is pointing to this epidemic being longer than we had anticipated," said Welber Barral, a commerce expert in Brazil. "Global supply chains are integrated."

The diagnosis was announced by the health minister, Luiz Henrique Mandetta, who added that Brazil was investigating 20 additional potential cases, including 12 patients who recently traveled to Italy.

The man was said to have traveled to northern Italy from Feb. 9-21. Although the virus originated in China, there has been a surge of cases in Italy, most notably in the northern region of Lombardy.

As the virus spread briskly across international borders in recent weeks, Latin America was spared.

But health officials in the region have been on high alert, anticipating that it was only a matter of time before the virus arrived. “It’s a global world,” Mr. Mandetta said. “It’s an interconnected world.”

The Coronavirus Outbreak

Answers to your most common questions:

Updated Feb. 26, 2020

What is a coronavirus?
It is a novel virus named for the crownlike spikes that protrude from its surface. The coronavirus can infect both animals and people and can cause a range of respiratory illnesses from the common cold to more dangerous conditions like Severe Acute Respiratory Syndrome, or SARS.

How worried should I be?
New outbreaks in Asia, Europe and the Middle East are renewing fears of a global pandemic. The Centers for Disease Control and Prevention warned this week that Americans should brace for the likelihood that the virus will spread to the United States.

How do I keep myself and others safe?
Washing your hands frequently is the most important thing you can do, along with staying at home when you're sick.

What if I'm traveling?
The C.D.C. has warned older and at-risk travelers to avoid Japan, Italy and Iran. The agency also has advised against all nonessential travel to South Korea and China.

How can I prepare for a possible outbreak?
Keep a 30-day supply of essential medicines. Get a flu shot. Have essential household items on hand. Have a support system in place for eldery family members.

Where has the virus spread?
The virus, which originated in Wuhan, China, has sickened more than 80,000 people in at least 33 countries, including Italy, Iran and South Korea.

How contagious is the virus?
According to preliminary research, it seems moderately infectious, similar to SARS, and is probably transmitted through sneezes, coughs and contaminated surfaces. Scientists have estimated that each infected person could spread it to somewhere between 1.5 and 3.5 people without effective containment measures.

Who is working to contain the virus?
World Health Organization officials have been working with officials in China, where growth has slowed. But this week, as confirmed cases spiked on two continents, experts warned that the world was not ready for a major outbreak.

[READ MORE]

Lívio Ribeiro, an economist at Fundação Getúlio Vargas University who studies China, said he expected the fallout in Latin America from

the coronavirus will be greater than that of the 2003 SARS outbreak, which also originated in China.

Several of the leading economies in the region had been growing sluggishly, if at all, even before the coronavirus scare.

“This is a moment of great aversion to risk,” Mr. Ribeiro said. “Regardless of whether an economy is dependent on China or not, everyone is being affected.”

Brazil health officials said medical personnel had been given detailed guidance on diagnostic and treatment protocols for the coronavirus. But experts warned that funding cuts in recent years had left Brazil ill-equipped to grapple with an epidemic.

Mr. Mandetta told a news conference that the case might shed light on how the virus spreads in warmer climates. “This is a new virus,” Mr. Mandetta said, noting experts have yet to ascertain “how it behaves.”

Earlier, Mr. Mandetta told the G1 news site that officials were hopeful that the virus would not spread briskly in Brazil given the summer time of year in the Southern Hemisphere.

The Brazilian man who tested positive sought care at Albert Einstein Israelite Hospital in São Paulo on Tuesday after coming down with a fever, a cough and a sore throat. The patient is in stable condition and has been asked to remain in quarantine at home for at least 14 days, officials said.

The São Paulo case emerged two days after a group of Brazilians who had been in quarantine after returning home from Wuhan, China, the epicenter of the outbreak, were found to be healthy and allowed to resume normal activities.

José Gomes Temporão, a former health minister who oversaw Brazil's response to the H1N1 virus in 2009 and 2010, said Brazil has a solid health surveillance system, which could enable officials to diagnose cases promptly.

But, in contrast to Mr. Mandetta's optimism, he also cautioned that spending cuts had crippled the public health care system in recent years, leaving the government poorly prepared to grapple with an epidemic.

"We are cutting resources to public health, and we will need additional resources now," Mr. Temporão said.

Dr. Nancy Bellei, an infectious disease specialist, said that personnel at the private hospital where the 61-year-old patient sought care appeared to have acted quickly and to have followed best practices. But she, too, expressed concerns about whether Brazil's underfunded, overburdened public hospitals were ready for an influx of patients.

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But Mr. Portela said the virus also could bring into sharp focus how badly Brazil needs to strengthen the public health system, which has been commended for its response to previous crises but now struggles with spending cuts.

--
Kristen Fischer
www.kristenfischer.com
(b) (6)

World Health Organization

HEALTH EMERGENCIES programme

From: (b) (6)
Sent: Tue, 3 Mar 2020 13:36:59 -0500
To: Barasch, Kimberly (NIH/NIAID) [C]
Subject: Fwd: Informal coronavirus teleconference: agenda + background documents
Attachments: image001.png, ATT00001.htm, 01 March_Chapeau_Critical preparedness readiness and response actions for COVID 19_DRAFT.pdf, ATT00002.htm, 01 March_COVID 2019 response scenarios_DRAFT.pdf, ATT00003.htm, 01 March_Preparing for Widespread Community Transmission_DRAFT.pdf, ATT00004.htm, 18624 Swisscom Call code.docx, ATT00005.htm

For the7 am folder pls

Sent from my iPhone

Begin forwarded message:

From: "KABIR, Sophia" (b) (6)
Date: March 3, 2020 at 1:35:53 PM EST
To: SHOC (b) (6) Office of the Director-General <DGOffice@who.int>, "Redfield, Robert R. (CDC/OD)" (b) (6) "mdcfda@nus.edu.sg" <mdcfda@nus.edu.sg>, "Johan.giesecke@ki.se" <Johan.giesecke@ki.se>, "NkengasongJ@africa-union.org" <NkengasongJ@africa-union.org>, "WielerLH@rki.de" <WielerLH@rki.de>, "Chris.Whitty@dhsc.gov.uk" <Chris.Whitty@dhsc.gov.uk>, "david@4sd.info" <david@4sd.info>, "chikwe.ihekweazu@ncdc.gov.ng" <chikwe.ihekweazu@ncdc.gov.ng>, David Heymann <david.heymann@lshtm.ac.uk>, "Felicity Harvey (b) (6), "Chris.Elias" <Chris.Elias@gatesfoundation.org>, "richard.hatchett@cepi.net" <richard.hatchett@cepi.net>, Jeremy Farrar <J.Farrar@wellcome.ac.uk>, "drtheresa.tam@canada.ca" <drtheresa.tam@canada.ca>, "toni.frisch@eda.admin.ch" <toni.frisch@eda.admin.ch>, "Fauci, Anthony (NIH/NIAID) [E]" (b) (6), "tfrieden@RTSL.org" <tfrieden@RTSL.org>, "sberkley@gavi-vaccinealliance.org" <sberkley@gavi-vaccinealliance.org>, "Peter.Piot@lshtm.ac.uk" <Peter.Piot@lshtm.ac.uk>, "GREIN, Thomas" <greint@who.int>, "COX, Paul Michael" (b) (6) "SCHWARTLANDER, Bernhard F." <schwartlanderb@who.int>, "MINHAS, Raman" <minhasr@who.int>, "jason.peat@ifrc.org" <'jason.peat@ifrc.org'>, "Conrad, Patricia (NIH/NIAID) [E]" (b) (6), "MAHJOUR, Jaouad" <mahjourj@who.int>, "FALL, Ibrahima Soce" (b) (6) "Thomas R. Frieden" <trfrieden@resolvetosavelives.org>, "elhadj.sy" <elhadj.sy@ifrc.org>, Lynn Banks <Lynn.Banks@gatesfoundation.org>, President | Resolve to Save Lives <president@resolvetosavelives.org>, "amadou.sall@pasteur.sn" <amadou.sall@pasteur.sn>, "howard.njoo@canada.ca" <howard.njoo@canada.ca>, "AL-SHORBAJI, Farah" (b) (6) "SchwabKlaus@weforum.org" <SchwabKlaus@weforum.org>, Robynn Leidig <rleidig@resolvetosavelives.org>, "DRURY,

Patrick Anthony" (b) (6), "Dr VAN KERKHOVE, Maria" (b) (6), "lucilleb@nicd.ac.za" <lucilleb@nicd.ac.za>, "wampofo@noguchi.ug.edu.gh" <wampofo@noguchi.ug.edu.gh>, "docmohw@snu.ac.kr" <docmohw@snu.ac.kr>, "gaof@im.ac.cn" <gaof@im.ac.cn>, cherylc <cherylc@nicd.ac.za>, "GRAAFF, Peter Jan" <graaffp@who.int>, "POOLE, Marcia" (b) (6), Tarik Mohammed <tarik.mohammed@ncdc.gov.ng>, "hfore@unicef.org" <hfore@unicef.org>, "(SPmig) Carlos Navarro Colorado" <cnavarrocolorado@unicef.org>, "wuzunyou@chinaaids.cn" <wuzunyou@chinaaids.cn>, Ryan Morhard <Ryan.Morhard@weforum.org>, "BRIAND, Sylvie" (b) (6), "MORGAN, Oliver" (b) (6), "Harries, Jenny" <Jenny.Harries@dhsc.gov.uk>, "Awwad, David (NIH/NIAID) [C]" (b) (6) "SIMONSON, Stewart" (b) (6)>, "SINGER, Peter Alexander" (b) (6), "(SPmig) Carlos Navarro Colorado" <cnavarrocolorado@unicef.org>

Cc: "RYAN, Michael J.' (b) (6)>, "FARES, Christine Youssef" (b) (6) "BOKO, Ivana' (b) (6)

Subject: Informal coronavirus teleconference: agenda + background documents

(b) (5)

If you experience any technical difficulties joining this conference call, please contact the WHO HQ EOC operator at: **+41 227 912 490**

Best,

Sophia

-----Original Appointment-----
From: RYAN, Michael J.
Sent: Tuesday, February 25, 2020 10:07 AM
To: RYAN, Michael J.; SHOC; Office of the Director-General; (b) (6); mdcfda@nus.edu.sg; Johan.giesecke@ki.se; NkengasongJ@africa-union.org; WielerLH@rki.de; Chris.Whitty@dhsc.gov.uk; david@4sd.info; chikwe.ihekweazu@ncdc.gov.ng; david.heymann@lshtm.ac.uk; Felicity Harvey (b) (6) Chris Elias; richard.hatchett@cepi.net; Jeremy Farrar; drtheresa.tam@canada.ca; toni.frisch@eda.admin.ch; (b) (6); tfrieden@RTSL.org; sberkley@gavi-vaccinealliance.org; Peter.Piot@lshtm.ac.uk; GREIN, Thomas; COX, Paul Michael; SCHWARTLANDER, Bernhard F.; MINHAS, Raman; 'jason.peat@ifrc.org'; (b) (6); MAHJOUR, Jaouad; FALL, Ibrahima Soce; Thomas R. Frieden; Elhadj SY; Lynn Banks; President | Resolve to Save Lives; amadou.sall@pasteur.sn; howard.njoo@canada.ca; AL-SHORBAJI, Farah; SchwabKlaus@weforum.org; Robynn Leidig; DRURY, Patrick Anthony; Dr VAN KERKHOVE, Maria; lucilleb@nicd.ac.za; wampofo@noguchi.ug.edu.gh; docmohw@snu.ac.kr; gaof@im.ac.cn; Cheryl Cohen; GRAAFF, Peter Jan; POOLE, Marcia; Tarik Mohammed; hfore@unicef.org; 'cnavarrocolorado@unicef.org'; 'wuzunyou@chinaaids.cn'; Ryan Morhard; BRIAND, Sylvie; MORGAN, Oliver; Harries, Jenny; Awwad, David (NIH/NIAID) [C]; SIMONSON, Stewart
Cc: SINGER, Peter Alexander
Subject: Informal coronavirus teleconference
When: Wednesday, February 26, 2020 1:00 PM-2:00 PM (UTC+01:00) Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna.
Where: Upper SHOC (For Call in: please see dial in details attached)

Dear colleagues,

Dr Tedros would like to invite you to the next informal discussion about the ongoing 2019 novel coronavirus.

The teleconference will be hosted tomorrow Wednesday, 26 February at 13:00 CET and the dial-in number with a passcode is attached.

If you experience any technical difficulties joining this conference call, please contact the WHO HQ EOC operator at: +41227912490

It would be appreciated if you could kindly confirm your participation to Ms Sophia Kabir, email: kabirso@who.int ; mobile no (b) (6)

Best,

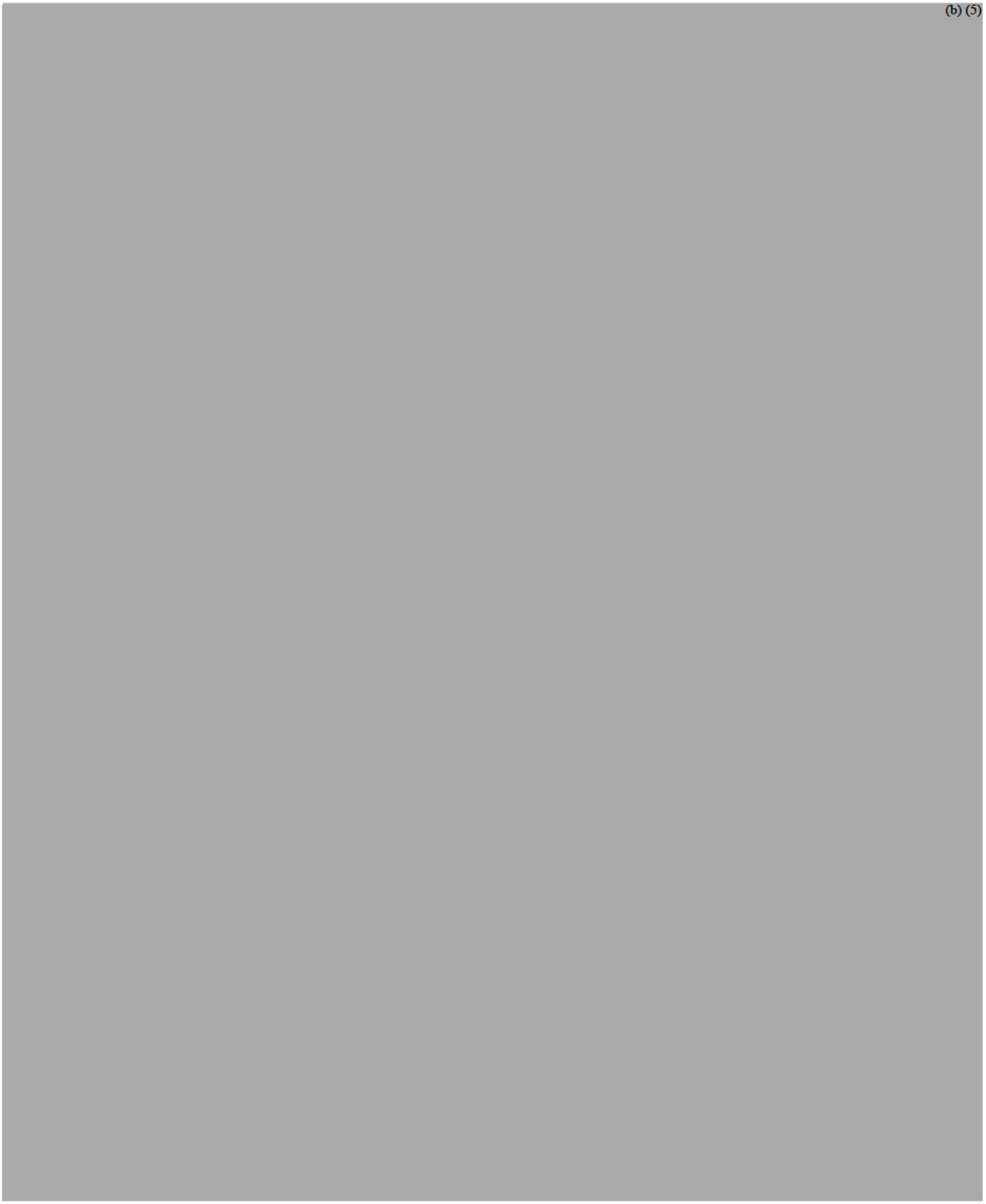
Mike

Sophia Kabir
Executive Officer
Office of the Executive Director
WHO Health Emergencies Programme (WHE)
Tel. +41 22 791 2555
Mobile (b) (6)

Website: WHO in emergencies | WHO Facebook | WHO Twitter

World Health
Organization

HEALTH
EMERGENCIES
programme

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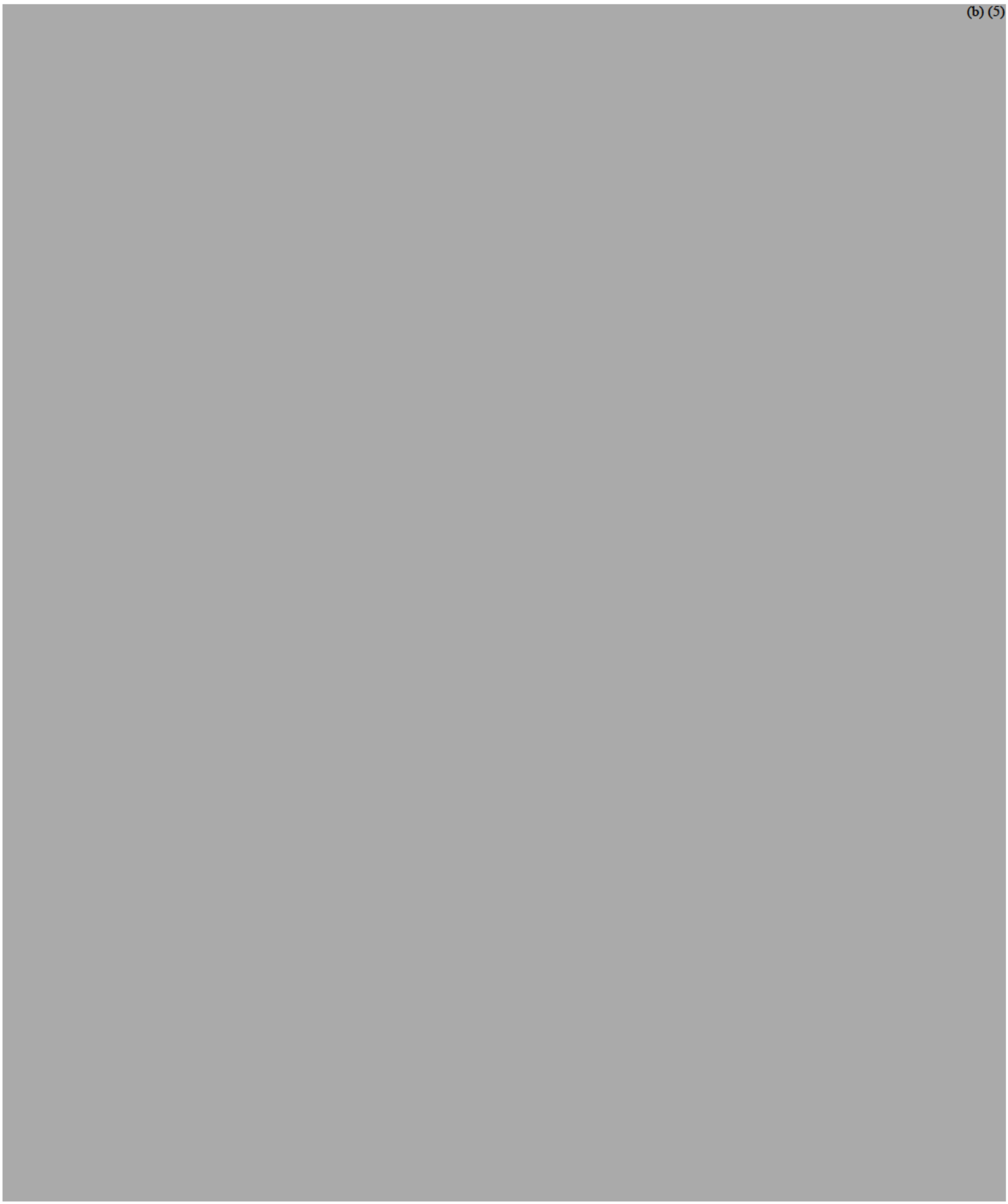
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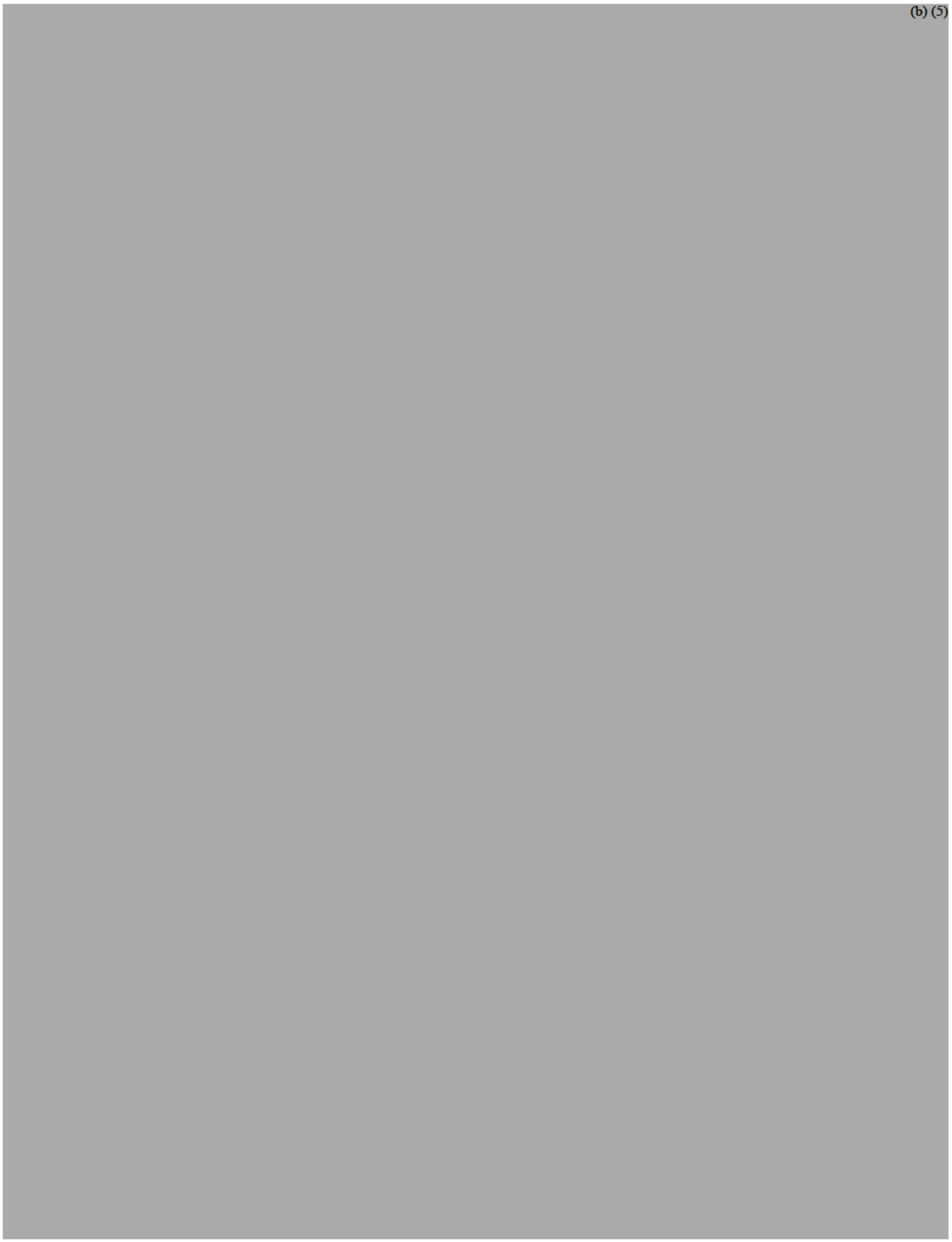
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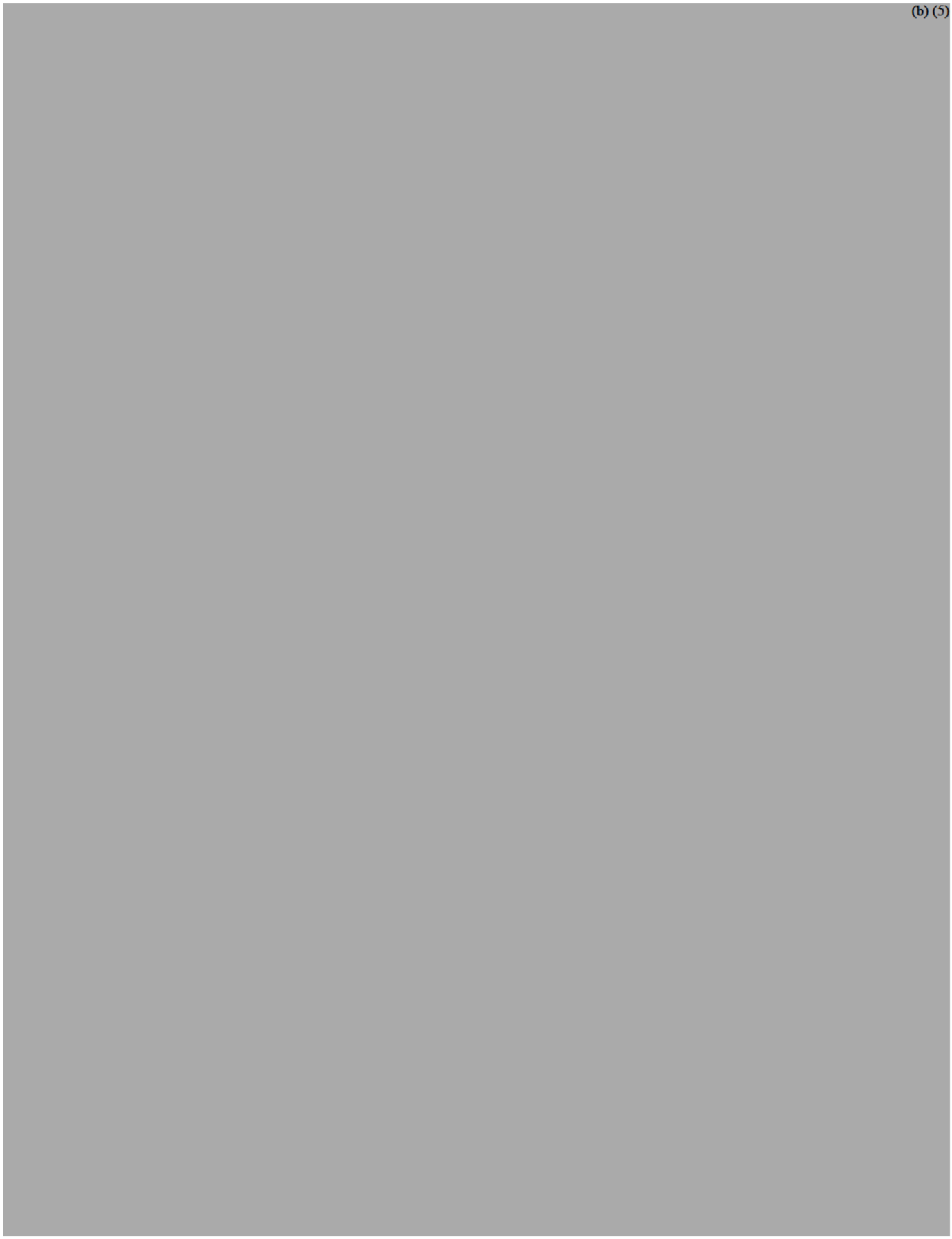
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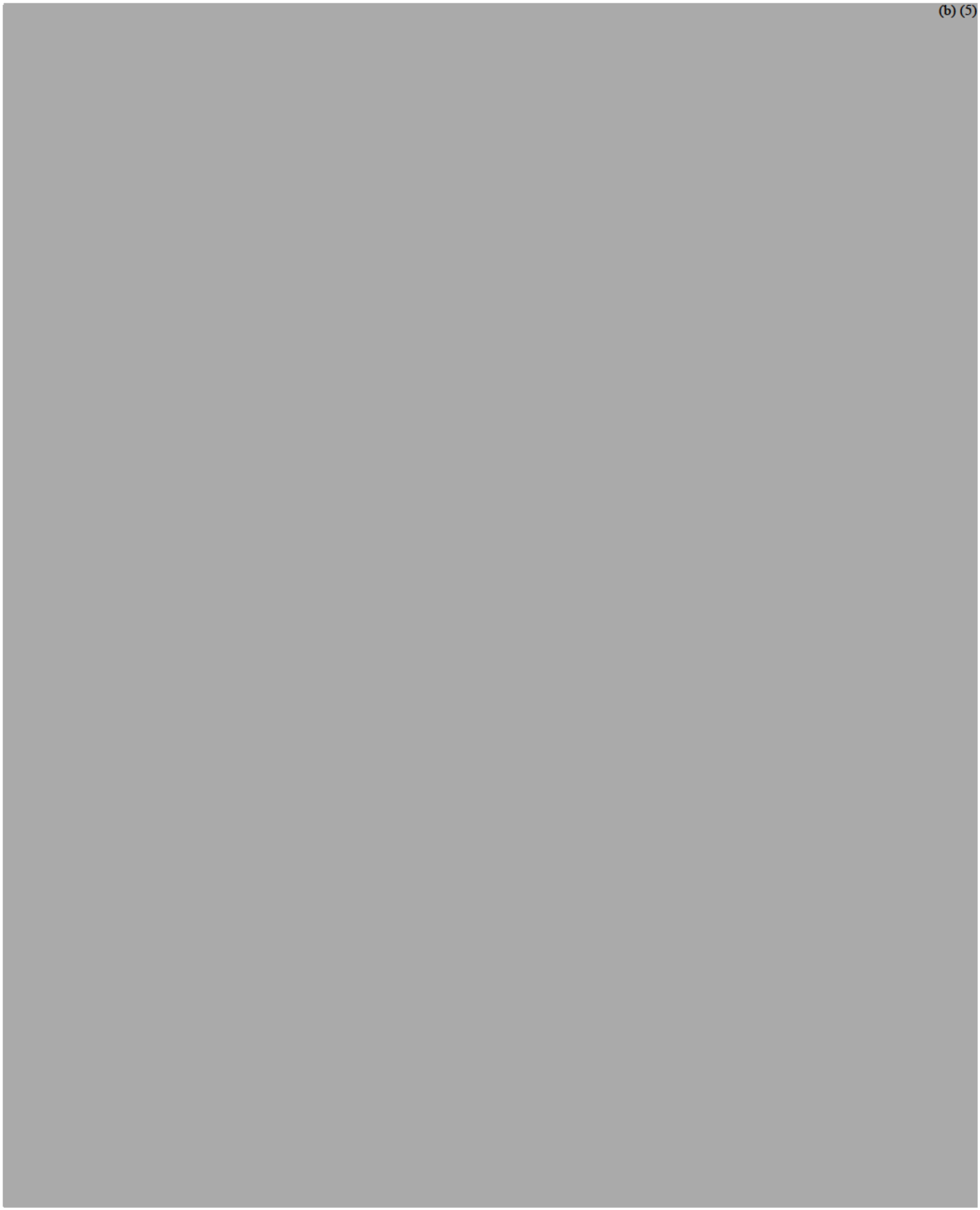
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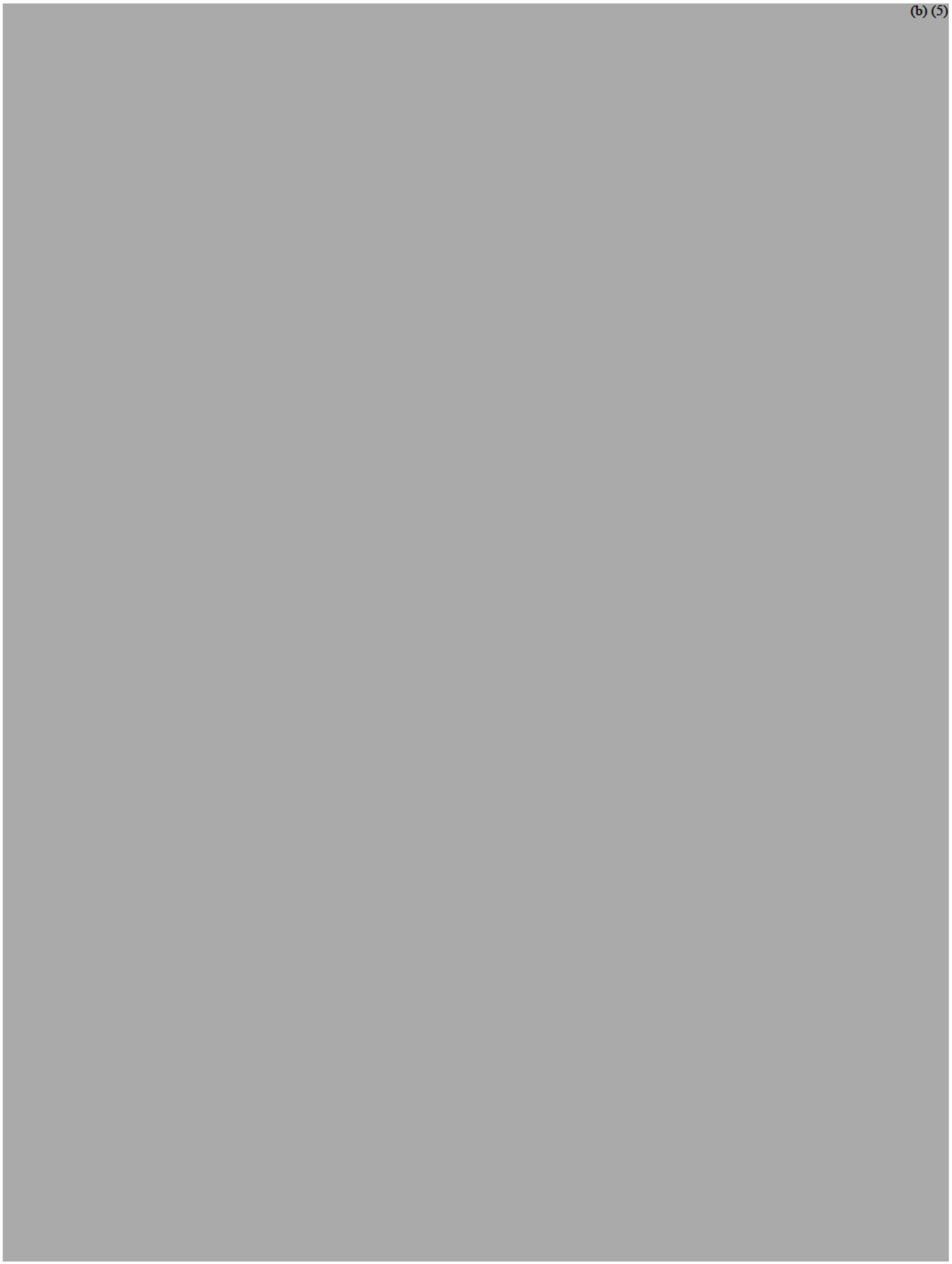
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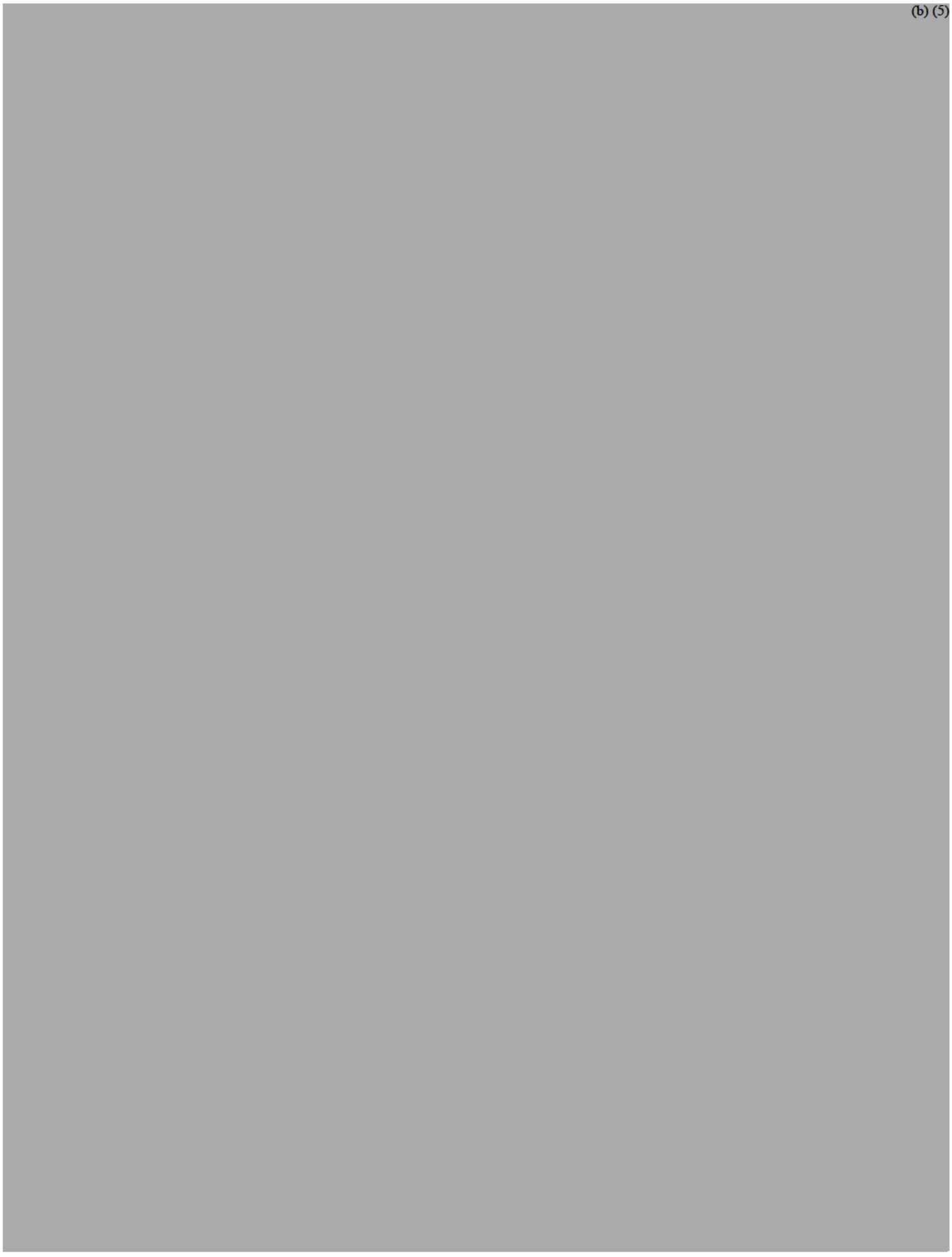
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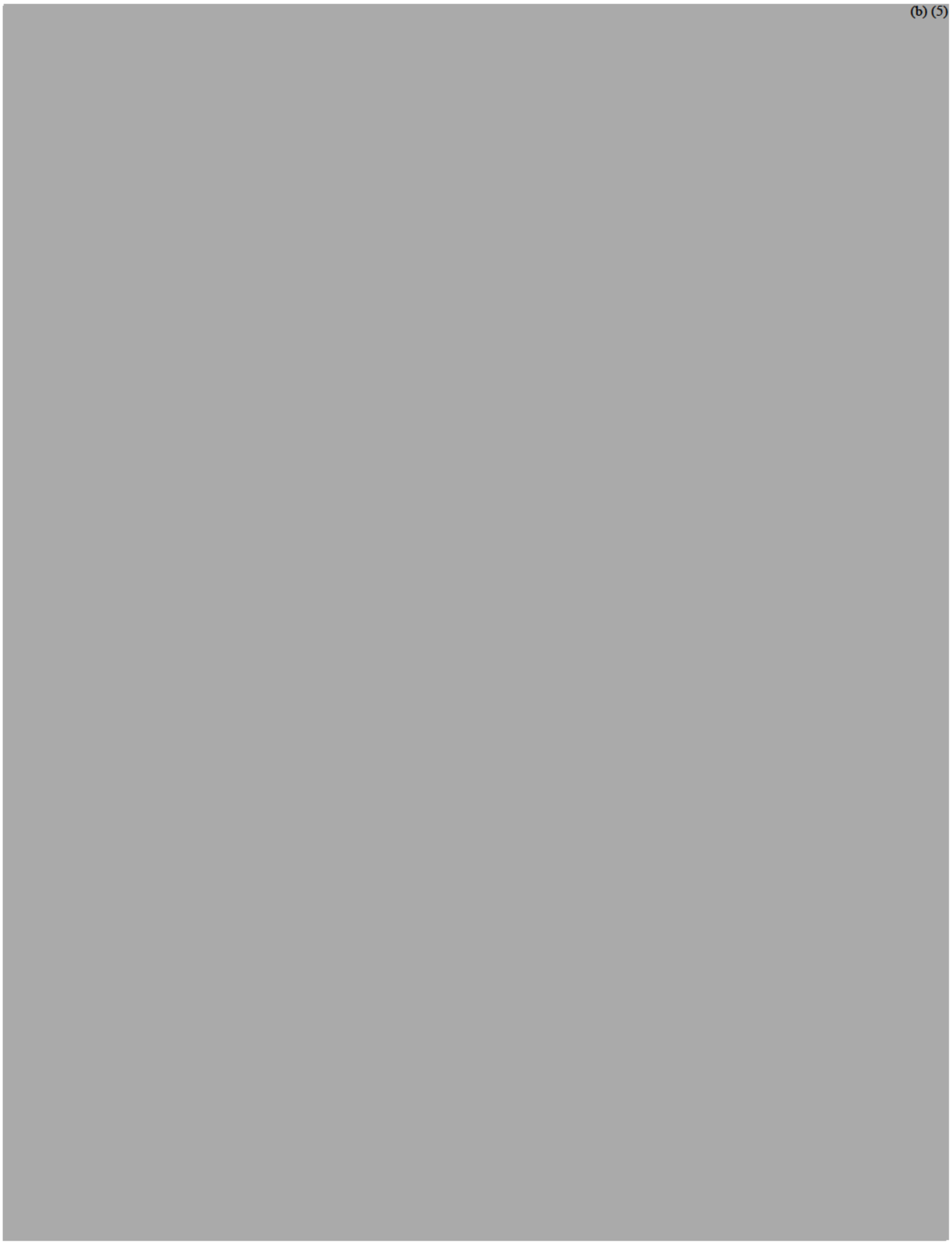
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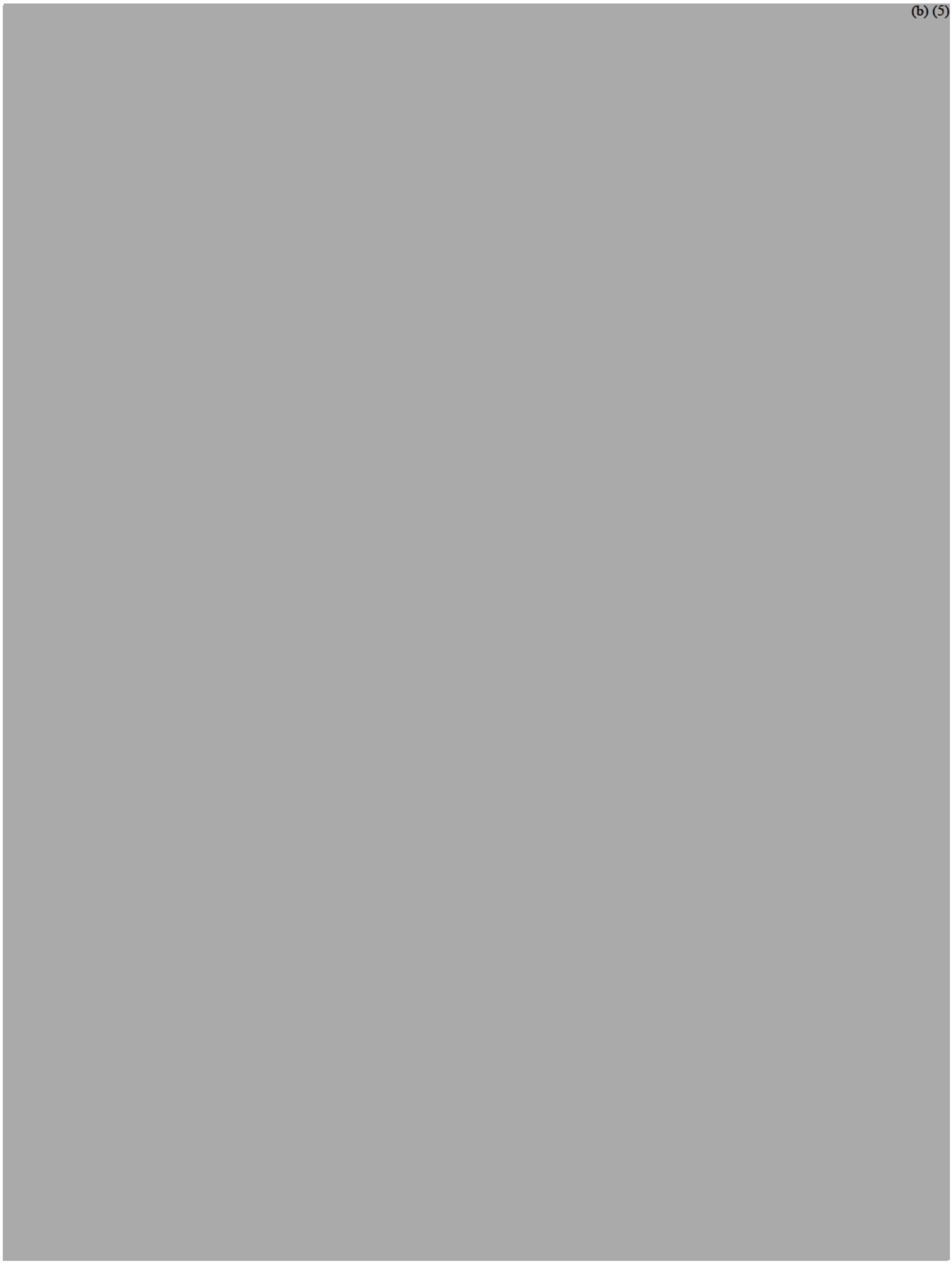
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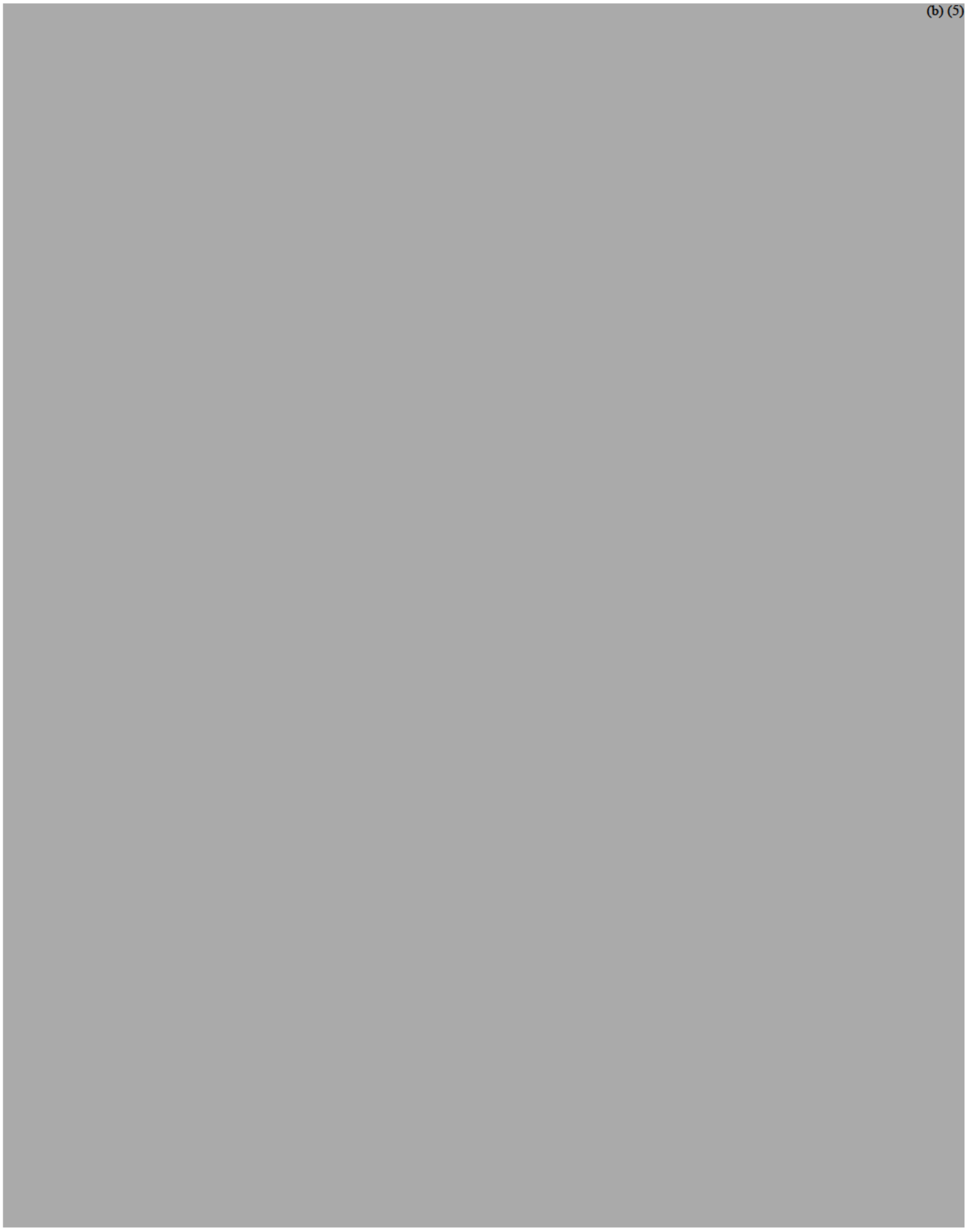
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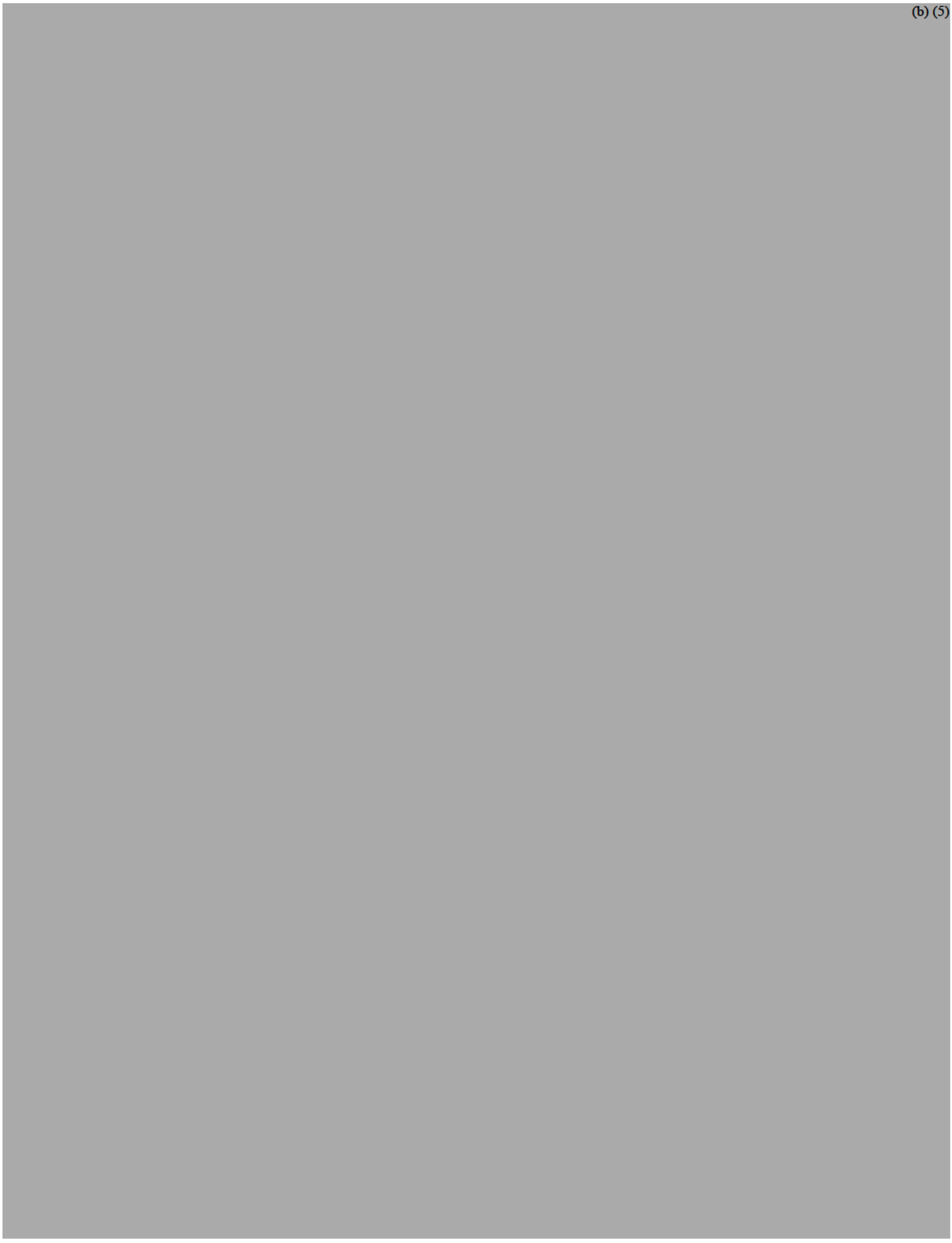
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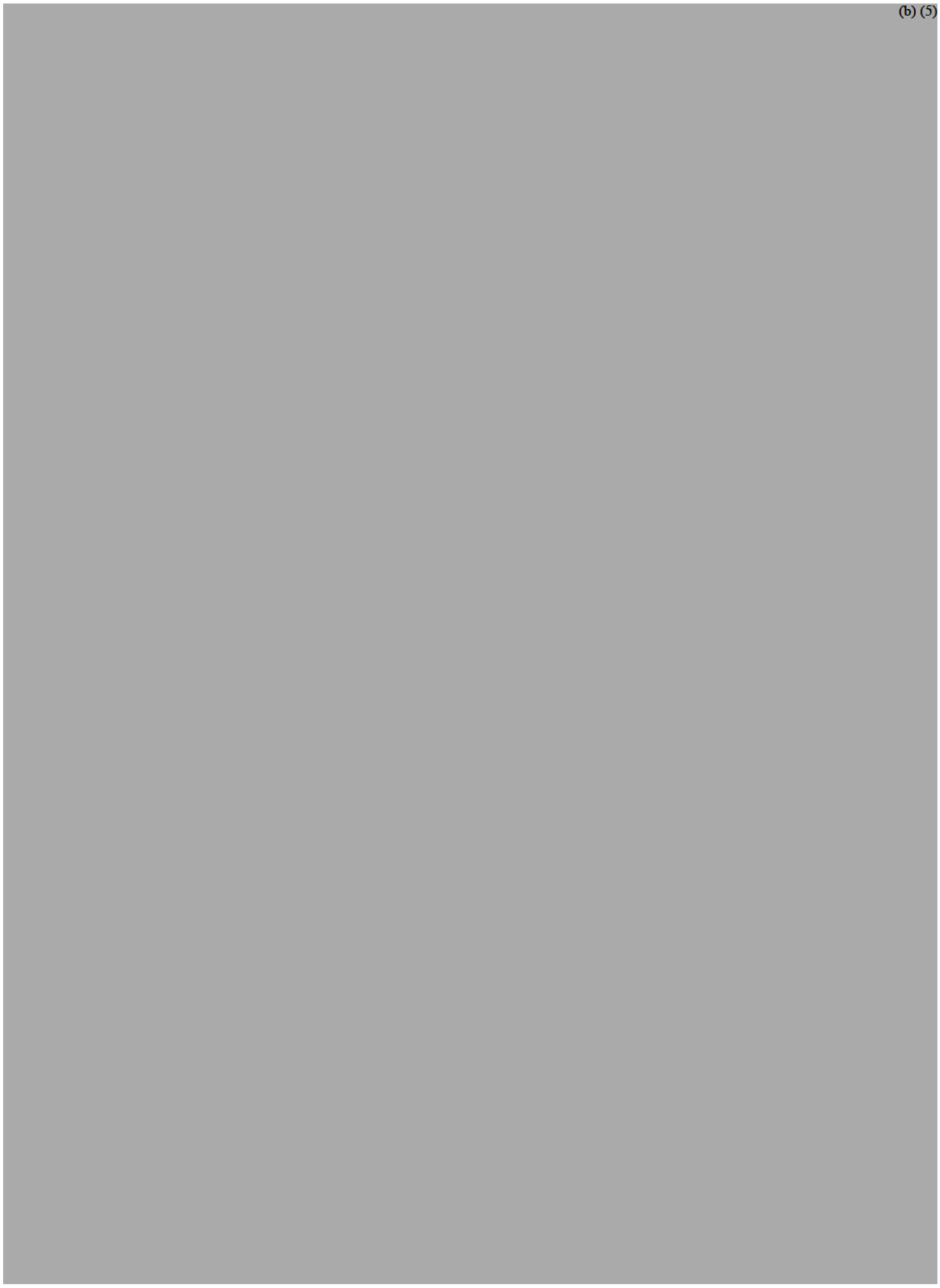
(b) (5)

Dear participant

To join the upcoming teleconference, please call:

From inside WHO
(b) (6)

From others countries please call:

Country	Number	Access Code
Argentina	+54 115 984 12 00	(b) (6)
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Austria	+43 720 880 876	
Belgium	+32 280 835 50	
Brazil	+55 213 958 07 18	
Bulgaria	+35 924 917 399	
Canada	+1 613 686 43 59	
Chile	+56 225 95 28 26	
China	+86 105 789 7457	
Croatia	+38 51 777 63 03	
Cyprus	+35 72 503 02 78	
Czech Republic	+42 024 601 95 32	
Denmark	+45 699 182 15	
El Salvador	+50 32 113 37 10	
Estonia	+37 26 68 12 68	
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France	+33 1 77 69 68 25	
Germany	+49 698 991 47 25	
Georgia	+99 57 067 773 41	
Greece	+30 211 198 00 81	
Hong Kong	+85 258 084 851	
Hungary	+36 180 881 90	
Ireland	+35 314 845 940	
India	+91 11 712 79 153	
Israel	+97 237 219 661	
Italy	+39 02 479 211 40	
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Kazakhstan	+771 727 274 71	
Lathvia	+37 16 765 25 76	
Lithuania	+37 052 05 89 83	
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Malaysia	+603 921 220 20	
Malta	+35 62 778 01 98	
Mexico	+52 554 624 02 27	
Netherlands	+31 108 920 271	
New Zealand	+64 99 25 03 39	
Norway	+47 210 189 41	
Panama	+507 836 51 38	
Peru	+51 17 08 54 63	
Philippines	+632 231 22 15	
Poland	+48 221 168 469	
Portugal	+351 308 800 872	
Puerto Rico	+17 879 05 73 62	
Russia	+749 540 220 27	
Romania	+40 318 107 181	
Singapore	+65 315 813 05	
Slovakia	+42 123 300 69 18	
Slovenia	+38 61 600 49 18	
South Africa	+27 10 590 11 04	
South Korea	+82 707 488 31 02	
Sweden	+46 840 309 949	
Switzerland (English)	+41 58 262 07 22	
Switzerland (Italiano)	+41 58 262 07 44	
Switzerland (Deutsch)	+41 58 262 07 11	

		(b) (6)
Switzerland (Français)	+41 58 262 07 33	
Spain	+34 931 816 661	
Tadzhikistan	+99 242 782 22 70	
Turkey	+90 21 290 025 60	
United Kingdom	+44 203 370 57 19	
United States	+1 646 381 08 89	

From: (b) (6)
Sent: Mon, 9 Mar 2020 13:15:29 -0400
To: Auchincloss, Hugh (NIH/NIAID) [E]
Subject: Fwd: testing

From patty

Can you pls respond or re direct

Sent from my iPhone

Begin forwarded message:

From: Andrew Dahl (b) (6)
Date: March 9, 2020 at 1:13:39 PM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: testing

Tony,

You are doing a great job--no wonder your voice is hoarse.

I have a cousin who currently is in London. She tells me that NHS employees with masks and gloves go to people's homes or apartments to test them(take PCR samples) if the individuals suspect corona. This appears to be a better public health system of testing than having people go to a doctor's office, infect an entire waiting room only then be sent to Quest or equivalent to be tested, where there will more chance of spread. The London example is much more likely to contain the virus.

Think about it. No need to reply.

Andy

--
Andrew A. Dahl, M.D., F.A.C.S.
(b) (6)

(b) (6)

From: (b) (6)
Sent: Wed, 11 Mar 2020 06:12:10 -0400
To: Lerner, Andrea (NIH/NIAID) [E]
Cc: Auchincloss, Hugh (NIH/NIAID) [E]
Subject: Fwd: Covid-19 patient in hospital without negative pressure room

Sent from my iPhone

Begin forwarded message:

From: miamiheart (b) (6)
Date: March 11, 2020 at 3:53:18 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Covid-19 patient in hospital without negative pressure room

Hi Dr. Anthony Fauci,

I saw you on Meet the Press this weekend and you were so awesome! Very informative, calm, assuring but with the right amount of instilling the need for us all to move forward with the appropriate caution for ourselves. It's extremely reassuring to have you leading and guiding us during this time.

I'm emailing you because I work at Kaiser Permanente Hospital in Downey, California. Our administration initially said if any Covid-19 patient came into the hospital needing emergeny care and needing to be admitted they would be given an N95 mask and put in a negative pressure room. Now they reversed that decision and said they'd be put in a regular positive pressure roomn even after I showed them the CDC's recommendation for both confimed and possible Covid-19 cases needing to be placed in negative pressure rooms/AIIR.

Well tonight a possible Covid-19 patient came to the Emergency Room and had to be admitted to the ICU. The patient was given just a regular mask and put in an elevator to the ICU. Management would not confirm if the patient was in a negative pressure room and wouldn't give staff N95 masks. I again showed them the CDC website hospital protocol Covid-19 recommendations but same response. And even was yelled at by the hospital nursing supervisor for asking about it.

I feel this is not safe at all for other patients, visitors and staff if the air is being recirculated not vented outside or through a hepa filter before recirculating back through the hospital. I don't know what to do. Please help. The hospital main phone number is 562-657-9000 the Chief of the hospital is Dr J.T. Lee 562-657-4000

I know you're extremely busy now but any help or guidance is appreciated..even if it's just to confirm that any confirmed or suspected Covid-19 patient needs to be in a negative pressure room. Thanks so much!

Sincerely,

Kara Smalls

From: (b) (6)
Sent: Fri, 13 Mar 2020 06:26:43 -0400
To: Cassetti, Cristina (NIH/NIAID) [E]
Subject: Fwd: Urgent information about a Corona Virus Management Device
Attachments: Medixair Micro virus report.pdf, ATT00001.htm, Medixair White Paper - 2016 Jan.pdf 1.pdf, ATT00002.htm

Please handle

Begin forwarded message:

From: Ani John (b) (6)
Date: March 13, 2020 at 3:13:38 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Urgent information about a Corona Virus Management Device

Dear Dr. Fauci
Given the gravity of the corona pandemic, my brother and I are reaching out to make you aware of product that we think could help mitigate the spread of the virus and protect health care workers as well as the public. We have already tried the usual channels to contact the White House and the emergency authorization use division at the FDA but also wanted to bring this to your attention also.

Medixair^{TM}, an ultraviolet (UVc) air sterilizer with proven, well established unique patented germicidal technology to effectively and safely eradicate viruses and bacteria up to 99.9%. It is capable of delivering a log6 reduction in microbial concentration, by penetrating the nucleus of microorganisms, disrupting their DNA thus destroying the ability of the organism to reproduce; effectively rendering it harmless.

Medixair^{TM} is a portable unit and can easily be installed in a variety of settings including hospitals, emergency rooms, waiting rooms, dentist offices, cruise ships and airport lounges. In both clinical trials and under in-vitro testing conditions (see attached white paper), Medixair^{TM} has been demonstrated to be highly effective in protecting patients and health care workers from pathogens (e.g. MRSA, Clostridium Difficile) and also by preventing cross infection. Specifically, Medixair^{TM} was tested and found effective for a strain of Coronavirus known as FCoV and thus COVID-19 would have the same susceptibility to eradication with UVc within a relatively short period of time (attached).

Medixair^{TM} has been on the market since 2005 and is fully CE marked to EN standards. Currently it has been safely and effectively used in acute hospitals, dental surgeries, in UK, Malaysia, India, Israel, and Southern Africa.

Please let us know how we can help make these units available for use in the US during this critical period of time.

Kind regards,

Ani John, BSN, MPH, PhD
San Ramon, California

Mathew Kaye,
Manufacturer of Medixair^{TM}
Dudley, United Kingdom

P A T H O G E N S O L U T I O N S

March 2002

Microbiological Report

Evaluation of the anti-viral performance of the Medixair UVc device

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Laboratories Ltd.

Conducted by

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CONTENTS

1.0 Introduction

The effectiveness of Pathogen Solutions UVc air sterilisation unit (Medixair) has previously been successfully evaluated against a wide range of airborne bacteria and fungi, both in the laboratory and in field trials.

Work has been undertaken to demonstrate the potential of the device to reduce airborne viral particles in the environment.

It has already been shown that UVc (Rauth 1965; Setlow 1961) inactivates pathogens according to the standard decay equation.

$$S = \exp(-kIt).$$

Where:

- S = Represents the fraction of the original population, which survive exposure at time t.
- I = UVc intensity.
- k = The rate constant k has been determined experimentally for a range of bacteria, spores, fungi and viruses.

In the literature the consensus is that generally viruses are shown to be more susceptible to UV irradiation than other forms of micro-organisms. A range of derived K values for viruses, in air, are given.

Organism	**K=cm^2/μj**
Vaccina (2)	1.53e^{-3}
Echo virus (3)	2.17e^{-4}
Coxsakie virus (2)	1.11e^{-3}

This increased susceptibility, demonstrable in many genera of virus particles, is directly related to the lack of a nucleic acid repair mechanism, lack of cytoplasmic shielding whilst in the atmosphere and the impact of UVc irradiation on low gene numbers.

"viruses are shown to be more susceptible to UV irradiation than other forms of micro-organisms"

Inactivation of virus particles is considered to be due to the mechanism of pyridine nucleotide dimerisation and at higher energies by chromosome fractionation.

In this study we have we have investigated the performance of the Medixair UVc air sterilisation unit in the inactivation of four common virus groups which cover particles composed of either double strand DNA, single strand DNA, double strand RNA or +single strand RNA.

The work was conducted in specially constructed apparatus consisting of two H.E.P.A. vented chambers (each of 7m^3 volume) interconnected by the Medixair UVc air sterilisation unit. (See figure 1).

The chamber (A) was subject to periodic aspiration with an aerosol containing virus particles. Atmosphere from chamber A was

transferred to chamber B via the Medixair UVc air unit. The numbers of airborne viral particles were monitored in both chambers. By operating these conditions over a period of time, with and without the UVc source in operation, it has been possible to demonstrate the effect of the sanitisation effect of the device on virus particles.

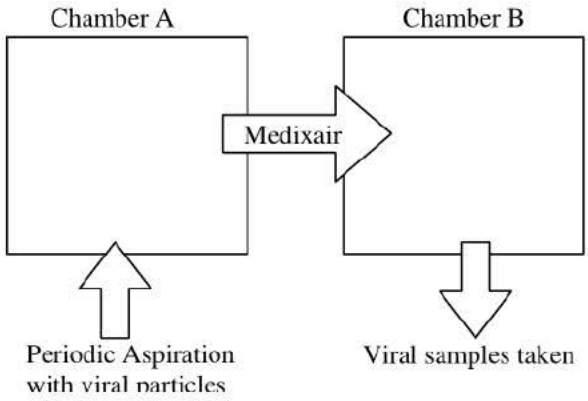


Figure 1. Experimental Apparatus.

In this manner, in contrast to previous work, which involved bacterial strains, we set out to demonstrate the efficiency of the device in respect to a constant flow of viral particles. In this instance, in contrast to previous trials, the airflow was linear.

To clarify, contaminated atmosphere from chamber A was transferred to sampling chamber B by the action of the Medixair fan. Giving the predictions concerning the high degree of viral susceptibility to UVc, it was considered that a re-circulation of particles was not required.

In contrast to previous trials we have introduced the concept of "replacement of challenge" to the experimental design. In this case we have conducted these trials with the delivery of repeated viral dosage to the challenge chamber over a 3.5hour period.

The challenge level was very high, ranging between Log10 and Log 2 viral particles per m^3 of air. The quantity of viral particles was introduced at 30minute intervals during the delivery period.

When interpreting the data it is important to recognise that the experimental design included both evaluation of viral decay, with and without the UVc device operating. The intention was to be able to demonstrate the lethality specifically attributable to the use of the Medixair unit with respect to airborne virus particles.

We have therefore sought to obtain consistent results, which demonstrate repeatability. We consider this approach closely models the type of environmental challenge the Medixair unit was designed to manage.

2.0 The Virus Particles

Table (A) below details structural and genomic information relating to the virus particles employed during this series of experiments.

Table A.

Virus	*Nucleic acid*	*Family*	*Genome Data*
E.coli T4 Phage	ds DNA	Myoviridae (T4 like phages)	Genomes have a Mr of about 120 10^6 (169 kbp), corresponding to 48% of particle weight, inasmuch as known contain 5-hydroxymethylcytosine (HMC) instead of thymine and are glycosylated, have a G+C content of 35%, and are circularly permuted and terminally redundant.
FCoV^A	"+" ss RNA	Nidovirales (genus corona virus)	The Corona virus genome is an infectious, linear, positive-sense, polyadenylated and, at least for arteri- and coronaviruses, 5 capped ssRNA molecule. The size Coronavirus is 20 to 25 kb . The coronavirus genome is the largest known non-fragmented viral RNA genome.
Saccaharomyces virus ScV-L-BC	ds RNA	Totiviridae	Virions contain a single linear molecule of uncapped dsRNA (4.6–6.7 kbp in size). The positive strand has two large overlapping ORFs; the length of the overlap varies from 16 to 130 nts. The first ORF encodes the viral major capsid protein with a predicted size of 76–81 103. In the case of ScV-L-A, the two reading frames together encode, via translational frameshift, the putative RNA-dependent RNA polymerase as a fusion protein (analogous to gag-pol fusion proteins of the retroviruses) with a predicted Mr of 170 103.
Vibrio phage fs1	ss DNA	Inovirdiae	Virions contain one molecule of infectious, circular, positive sense ssDNA. Inovirus genomes range from 6 kb to 9 kb.

FCoV^A attenuated non transmissible variant

2.1 Particle Preparation

All particles were cultured in and harvested from host cell lines. In the case of T4 phage, ScV-L-BC and fs1, each virus was obtained by enrichment from continuous culture vessels. FCoV was obtained after culture in a continuous epithelial cell line.

Purified Virions were obtained by ultra-sonic fractionation of the host cells, followed by filtration and centrifugation. Infective dispersions intended for aspiration were prepared in Phosphate buffered saline. Such dispersions were freshly obtained for each period of monitoring.

2.2 Particle Enumeration

Table B summarises the techniques employed for enumerating viable virons sampled from chambers A and B of the test apparatus. Due to the degree of uncertainty associated with viron enumeration, all data was recorded to the nearest integer for all orders of magnitude.

Table B

Virus	Mode of Enumeration
E.coli T4 Phage	Plague formation
$FCoV^A$	Real time PCR
Saccaharomyces virus ScV-L-BC	Plague formation /cytopathy
Vibrio phage fs1	Plague formation /cytopathy

$FCoV^A$ attenuated non-transmissible variant

3.0 Experimental Protocol and Sampling

All experiments were conducted in triplicate with appropriate containment and practise.

As described above our intention was to create an elevated level of atmospheric contamination with each type of viral particle in chamber "A". This was achieved by pressurised aspiration of viron particles as an aerosol with a particle size range of between <1 and 25 micron, these were introduced to chamber "A".

Dosing of chamber "A" occurred every 30 minutes for a period of 3.5 hours during each experiment. Air sampling was carried out at time 0 after dosing and 30 minutes thereafter. Sampling continued at thirty minute intervals and although dosing had been finished, air sampling continued for a total time of 4.5 Hours. Phosphate buffered saline was used as the medium for collection of the samples. The viral concentration was determined by the techniques described in table B above.

Air from Chamber "B" which had been passed through the Medixair UVc unit was sampled with the same time intervals, each instance occurring immediately subsequent to sampling of chamber "A".

Performance characteristics for each virus particle were determined by separate experiments.

In order to demonstrate random non-viability, control experiments were conducted by operating with the UVc source inactivated. This data is expressed in Tables 1-4 below, together with the magnitude of inactivation obtained whilst the UVc system was in operation.

The level of log reduction attributable to UVc has been corrected by subtraction of the log kill obtained during trials when the UVc source was not operating.

Results Tables

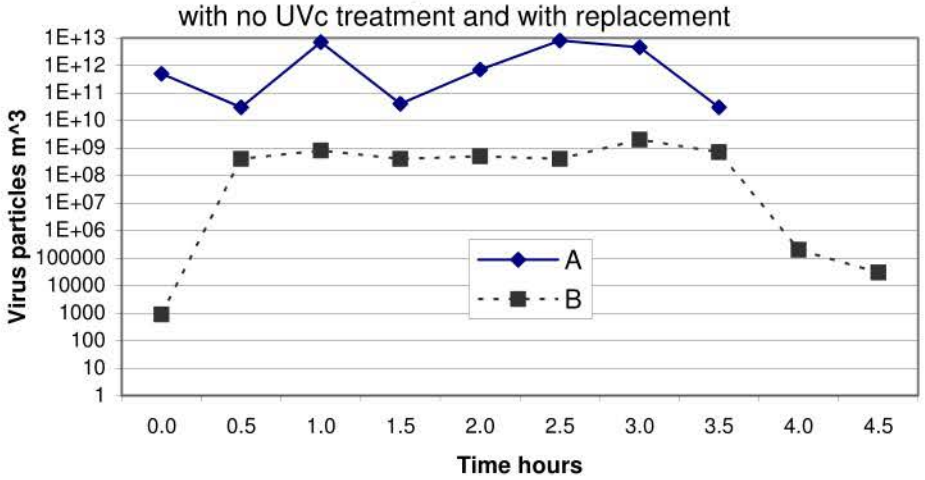
4.0 Results

Table 1 Inactivation of T4 Phage

Aspiration interval Hours	Aspirated virus particles units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc on**	Aspirated virus particles units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc off**
0.0	2.0E+10	0.0	0.0	5.0E+11	0.0	9.0E+02
0.5	3.0E+10	0.5	3.0E+01	3.0E+10	0.5	4.0E+08
1.0	4.0E+11	1.0	2.0E+02	7.0E+12	1.0	8.0E+08
1.5	7.0E+10	1.5	3.0E+02	4.0E+10	1.5	4.0E+08
2.0	5.0E+12	2.0	1.0E+02	7.0E+11	2.0	5.0E+08
2.5	8.0E+12	2.5	5.0E+02	8.0E+12	2.5	4.0E+08
3.0	4.0E+10	3.0	6.0E+02	4.6E+12	3.0	2.0E+09
3.5	8.0E+10	3.5	7.0E+02	3.0E+10	3.5	7.0E+08
4.0	0.0	4.0	6.0E+00	0.0	4.0	2.0E+05
4.5	0.0	4.5	1.0E+01	0.0	4.5	3.0E+04

UVcOff

Graph 1
Reduction of virus particles over 4.5 hours
with no UVc treatment and with replacement



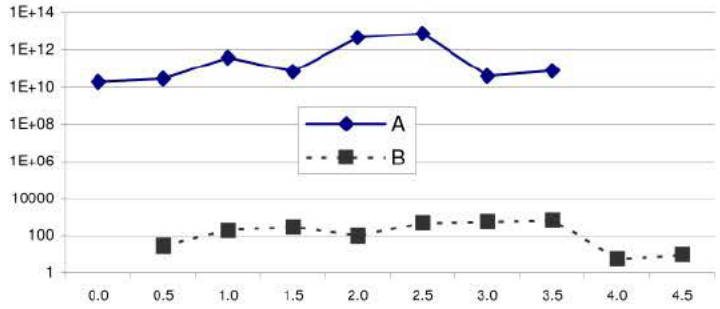
A : Level of Aspirated virus particles per m3 in the pre treatment chamber
B: Level of Aspirated virus particles per m3 in the post treatment chamber UVc off

Summary UVc Off

	Particles	Log
Total particle input over 3,5 hours	2.1E+13	13.3
Total particle recovery over 4,5hrs	5.2E+09	9.7
Depletion - UVc off	2.1E+13	3.6

UVC ON

Graph2
Reduction of Virus particles over 4.5 hours with UVc treatment and with replacement



A : Level of Aspirated virus particles per m^3 in the pre treatment chamber
B : Level of Aspirated virus particles per m^3 in the post treatment chamber UVc on

Summary UVc On

	Particles	Log
Total particle input over 3,5 hours	1.4E+13	13.1
Total particle recovery over 4,5hrs	2.4E+03	3.4
Correction for depletion		3.6
Corrected Depletion UVc on		6.1

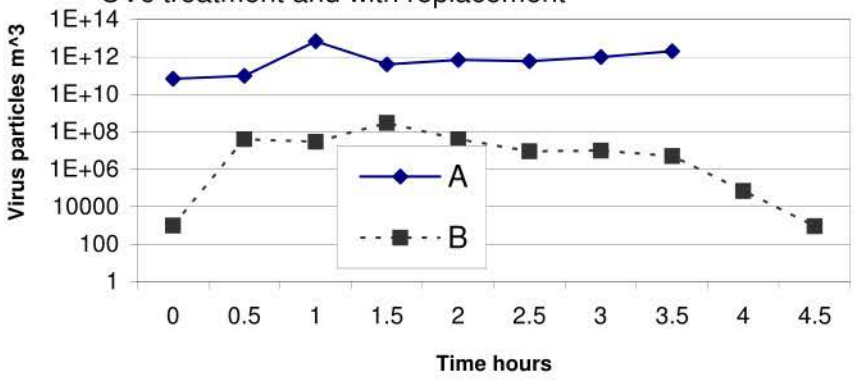
Table 2 Inactivation of Airborne FCoV

Interval Hours	Aspirated virus particles aspiration units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc on**	Aspirated virus particles units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc off**
0.0	3.0E+10	0.0	0.0	7.0E+10	0.0	1.0E+03
0.5	4.0E+11	0.5	3.0E+02	1.0E+11	0.5	4.0E+07
1.0	4.0E+11	1.0	4.0E+02	7.0E+12	1.0	3.0E+07
1.5	6.0E+10	1.5	7.0E+02	4.0E+11	1.5	3.0E+08
2.0	5.0E+11	2.0	5.0E+02	7.0E+11	2.0	4.0E+07
2.5	4.0E+12	2.5	7.0E+03	6.0E+11	2.5	9.0E+06
3.0	9.0E+11	3.0	4.0E+02	1.0E+12	3.0	1.0E+07
3.5	8.0E+11	3.5	8.0E+02	2.0E+12	3.5	5.0E+06
4.0	0.0	4.0	7.0E+01	0.0	4.0	7.0E+04
4.5	0.0	4.5	0.0E+00	0.0	4.5	9.0E+02

UVc Off

Graph 3

Reduction of Virus particles over 4.5 hours with no UVc treatment and with replacement



A : Level of Aspirated virus particles per m3 in the pre treatment chamber

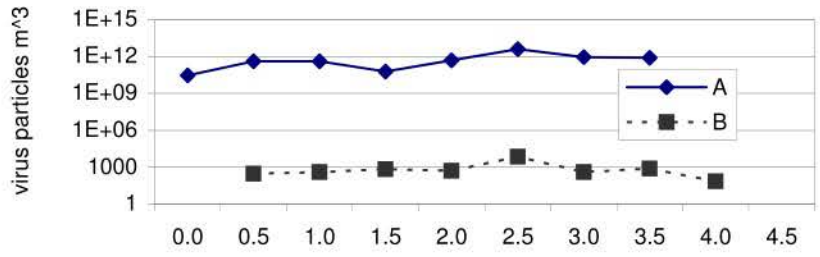
B : Level of Aspirated virus particles per m3 in the post treatment chamber UVc off

Summary UVc Off

	Particles	Log
Total particle input over 3.5 hours	1.2E+13	13.1
Total particle recovery over 4.5	4.3E+08	8.6
Depletion UVc off	1.2E+13	4.4

UVc On

Graph 4
Reduction of Virus particles over 4.5 hours with UVc treatment and with replacement



A : Level of Aspirated virus particles per m^3 in the pre treatment chamber
B : Level of Aspirated virus particles per m^3 in the post treatment chamber UVc on

Summary UVc On

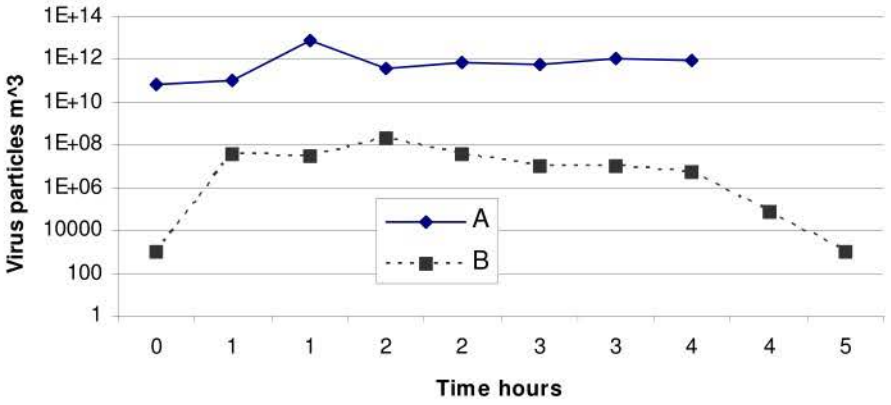
	Particles	Log
Total particle input over 3.5 hours	7.1E+12	12.9
Total particle recovery over 4.5	1.0E+04	4.0
Correecti for Depletion		4.4
Corrected Depletion UVc on		4.4

Table 3 Inactivation of airborne ScV-L-BC

Aspiration interval hours	Aspirated virus particles units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc on**	Aspirated virus particles units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc off**
0.0	3.0E+10	0.0	0.0	7.0E+10	0.0	1.0E+03
0.5	4.0E+11	0.5	3.0E+02	1.0E+11	0.5	4.0E+07
1.0	4.0E+11	1.0	4.0E+02	7.0E+12	1.0	3.0E+07
1.5	6.0E+10	1.5	7.0E+02	4.0E+11	1.5	2.0E+08
2.0	5.0E+11	2.0	5.0E+02	7.0E+11	2.0	4.0E+07
2.5	4.0E+12	2.5	7.0E+03	6.0E+11	2.5	9.0E+06
3.0	9.0E+11	3.0	8.0E+03	1.0E+12	3.0	1.0E+07
3.5	8.0E+11	3.5	4.0E+03	8.0E+11	3.5	5.0E+06
4.0	0.0	4.0	7.0E+01	0.0	4.0	7.0E+04
4.5	0.0	4.5	0.0E+00	0.0	4.5	9.0E+02

UVc Off

Graph 5
Reduction of Virus particles over 4.5 hours with no UVc treatment with replacement

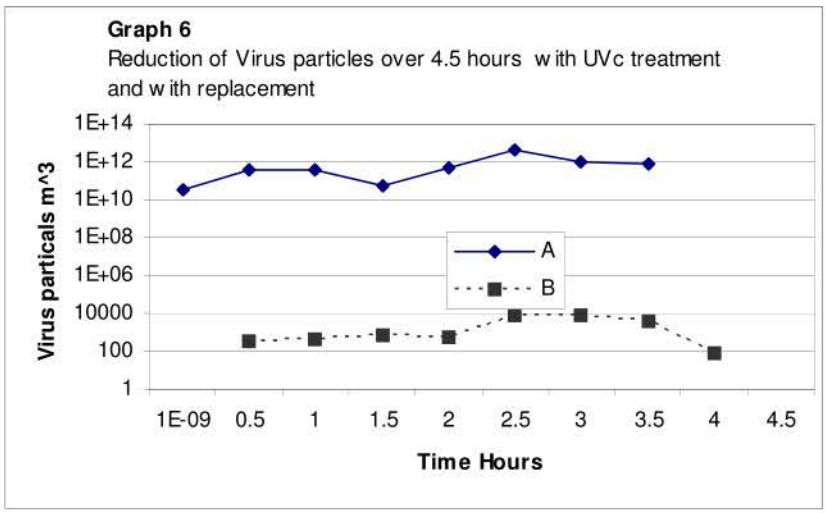


A : Level of Aspirated virus particles per m3 in the pre treatment chamber
B : Level of Aspirated virus particles per m3 in the post treatment chamber UVc off

Summary UVc Off

	Particles	Log
Total particle input over 3.5 hours	1.1E+13	13.0
Total particle recovery over 4.5	3.3E+08	8.5
Depletion UVc off	1.1E+13	4.5

UVC On



A : Level of Aspirated virus particles per m^3 in the pre treatment chamber

B : Level of Aspirated virus particles per m^3 in the post treatment chamber UVc on

Summary UVc On

	Particles	Log
Total particle input over 3.5 hours	7.1E+12	12.9
Total particle recovery over 4.5	2.1E+04	4.3
Correction for Depletion		4.5
Depletion UVc off		4.0

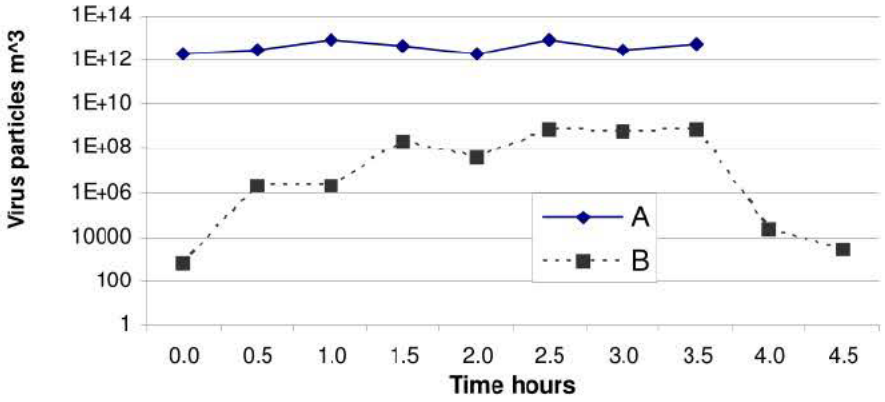
Table 4 Inactivation of airborne fs1 virus

Aspiration interval hours	Aspirated virus particles units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc on**	Aspirated virus particles units/m^3	Sampling time post aspiration	Recovered virus particles units/m^3 **UVc off**
0.0	1.0E+12	0.0	0.0	2.0E+12	0.0	7.0E+02
0.5	2.0E+12	0.5	8.0E+02	3.0E+12	0.5	2.0E+06
1.0	7.0E+12	1.0	2.0E+02	8.0E+12	1.0	2.0E+06
1.5	4.0E+11	1.5	8.0E+02	4.0E+12	1.5	2.0E+08
2.0	7.0E+12	2.0	1.8E+03	2.0E+12	2.0	4.0E+07
2.5	3.0E+12	2.5	2.4E+03	9.0E+12	2.5	7.0E+08
3.0	1.0E+12	3.0	1.7E+03	3.0E+12	3.0	6.0E+08
3.5	9.0E+12	3.5	6.0E+02	6.0E+12	3.5	7.0E+08
4.0	0.0	4.0	3.0E+01	0.0	4.0	2.0E+04
4.5	0.0	4.5	0.0E+00	0.0	4.5	3.0E+03

UVc Off

Graph 7

Reduction of Virus particles over 4.5 hours with no UVc treatment and with replacement



A : Level of Aspirated virus particles per m3 in the pre treatment chamber

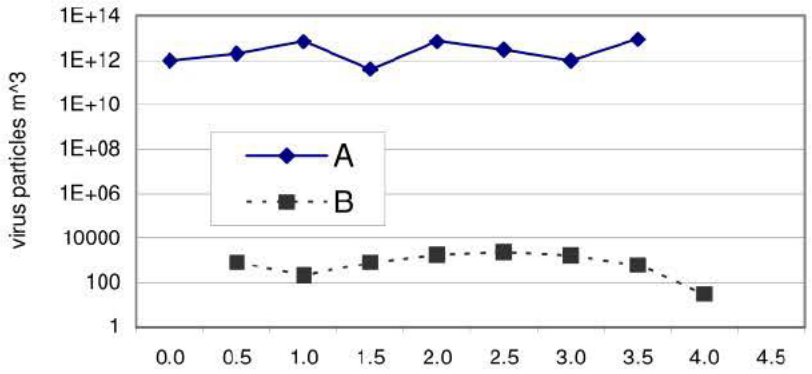
B : Level of Aspirated virus particles per m3 in the post treatment chamber UVc off

Summary UVc Off

	Particles	Log
Total particle input over 3.5 hours	3.7E+13	13.6
Total particle recovery over 4.5	2.2E+09	9.4
Depletion UVc off	3.7E+13	4.2

UVc On

Graph 8
Reduction of Virus particles over 4.5 hours with UVc treatment and with replacement



A : Level of Aspirated virus particles per m^3 in the pre treatment chamber
B : Level of Aspirated virus particles per m^3 in the post treatment chamber UVc on

Summary UVc On

	Particles	Log
Total particle input over 3.5 hours	3.0E+13	13.5
Total particle recovery over 4.5	8.3E+03	3.9
Correction for Depletion		4.2
Depletion UVc on		5.3

Overall Results

Table 5 Summary for all Virus Particles

Corrected mean log reduction of virus over 4.5 hours

Virus	Measured continuous* mean log reduction of virus particles
E.coli T4 Phage	6.1
FCoV[A]	4.4
Saccaharomyces virus ScV-L-BC	4.7
Vibrio phage fs1	5.3

FCoV[A] attenuated non-transmissible variant

* Every 30 minutes over a 4.5 hour period

5.0 Conclusions

During the experiment and subsequent analysis we have been able to demonstrate that inactivation levels across the range of virus particles *not* attributable to UVc irradiation was between 3 and 4.5 log cycles on a mean continuous basis for all virus particles examined.

Such an effect would be anticipated with virus particles *in vitro* and might be due to physiochemical factors operating as a result of aspiration and physical factors within the device considered as a whole. The occurrence and effects of such factors are considered inevitable in laboratory models of environments.

However, our data does demonstrate with a high degree of significance that the Medixair UVc air sterilisation unit was effective in reducing continuous doses of each virus over a 4.5-hour period. The corrected log inactivation data per 30 minute cycle in table 5 clearly illustrates a high and sustained level of inactivation for each viral target, with the range being measured at between 4.4 to 6.1 log reductions of challenge per 30 minutes with dosing at rates described above.

Taking into account the sensitivity of the techniques currently employed for enumerating viral particles it is accurate to state that in this trial, our corrected estimates for kill due to UVc doses in the Medixair device evidences a robust viral inactivation quotient.

" it is apparent that all viable viral targets were inactivated by a greater than 99.999 % efficiency"

Given the level of challenge and taking into account loss of recoverability not due to UVc doses, the significance of the actual inactivation rate attributable to the Medixair unit becomes clearer by considering the percentage kill for each viral target. Deriving this value from table 5 it is apparent that all viable viral targets were inactivated by a greater than 99.999 % efficiency when passed through the Medixair unit. Further this degree of efficiency was demonstrated on a continuous basis during this trial for each viral type.

With the demonstration of such veridical efficiency it is clear that the Medixair unit has immediate application in the sterilisation of atmospheres in environments where airborne viral particles represent a risk of contagion to humans or animals.

.....

D.O'Connor B.Sc. Ci.Biol M.I.F.S.T.
Managing Director
Microsearch Laboratories
June 2003

6.0 References

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ii) Jensen, M. M. (1964). "Inactivation of airborne viruses by ultraviolet irradiation." Applied Microbiology 12(5): 418-420.

iii) Hill, W. F., F. E. Hamblet, et al. (1970). "Ultraviolet devitalization of eight selected enteric viruses in estuarine water." Appl. Microb. 19(5): 805-812.

MEDIXAIR™

CONTROL OF AIRBORNE PATHOGENS USING ULTRAVIOLET LIGHT

An innovative device for the disinfection of indoor air utilizing proven Ultraviolet Light technology

Medixair™ is engineered to ensure critical UV Light disinfection doses are achieved, creating a medically significant reduction of disease transmission by airborne bacterial, viral and fungal pathogens, and has been thoroughly tested in laboratory and clinical trials.

Medixair™ is safe for use in occupied areas, small, quiet and none invasive, and provides continuous operation without interruption of normal activities.

Medixair™ does not require dedicated operating staff, and does not require additions or alterations to existing HVAC equipment. Units are low cost, allowing flexible placement to meet varying needs, have small service times with low cost consumables, and do not require dedicated maintenance specialists.

Brandenburg
CREATING BETTER

Indoor Air Quality

Studies have found that bioaerosols (airborne microbes, their fragments, toxins and waste products) may account for up to one third of indoor airborne particulates. According to the American Medical Association, 50% of all illness is caused or aggravated by polluted indoor air. For example, the US Environmental Protection Agency (EPA) estimates that only 10% of all colds are caught outdoors, and 90% are caught indoors.

Activity	Approximate particle count	Units
Sneezing	40,000	Per sneeze
Bowel evacuation	20,000	Per event
Vomiting	1,000	Per event
Coughing	710	Per cough
Talking	36	Per 100 words

Droplet or airborne microorganisms released from various activities
Aerobiology and Its Role in the Transmission of Infectious Diseases

While the common cold may be considered mostly an inconvenience, colds and influenza outbreaks in commercial, professional sports and industrial facilities cause significant losses in performance and employee productivity, and have a major economic impact.

In healthcare environments, where there is significant potential for airborne transmission of nosocomial infection (sometimes referred to as "Health Care Associated Infection"), the effects are much more serious.

Medical Implications

All modern medical facilities employ extensive and rigorously enforced procedures for the microbial decontamination of contact surfaces and the prevention of microbial transfer through human interface. Other than personal protection (face masks), decontamination of airborne microorganisms is often implemented as a distant third.

Indoor air in a healthcare environment often contains a significant load of particulate matter, including microorganisms, dust, lint (from hospital linens and fabrics), and even pollen and animal dander brought in on the clothes of staff, patients and visitors.

Bacteria and viruses may float freely in the air, or are suspended on minute dust particles, and are continuously being disturbed by everyday activities such as:

- **Bed-making**
- **Cleaning**
- **The movement of equipment**
- **The movement of patients, medical staff, and visitors**
- **The delivery of food**
- **Air-conditioning**

Mortality in patients with a Health Care Associated Infection is estimated to be around seven times higher than in uninfected patients. According to the Centers for Disease Control (CDC), institution-acquired infections impact 99,000 lives and cost hospitals and nursing homes $30 billion a year.

A 2008 study carried out by Penn State University through the NIST CONTAM program suggests that an airborne pathogen such as tuberculosis will be carried through a typical office building ventilation system (conforming to the ASHRAE Standard 62-89 guidelines) and result in a person ten floors away from the source having a 33% risk of accumulating enough exposure to contract the disease after only 8 hours.

Medical practitioners agree that the airborne transmission of infectious diseases is a problem. However, the extent of the problem continues to be debated.

Currently, there is a wide range in the reported frequencies of airborne transmission in hospital acquired infections, from 10% to 33%.

Unfortunately, those responsible for infection control have been forced to use suboptimal, dated technologies to contain and eliminate airborne infection transmission - such as HEPA filtration systems, which were first developed in the 1940s.

Ultraviolet Light for Disinfection

The potential for interrupting transmission of airborne infection with ultraviolet light was first demonstrated by William F. Wells in the 1940s and 1950s. Wells showed that airborne droplet nuclei of tuberculosis and measles were the vehicles of airborne transmission, and that they were highly susceptible to inactivation by exposure to UV light. While most of the early attention was focused on measles and tuberculosis (because of their importance as airborne infections), many other infectious organisms were also found to be susceptible. However, difficulties in standardizing UV doses and repeating Wells' results, coupled with the growing availability and success of antibiotics that coincided with Wells' work, lead to the near abandonment of UV for air disinfection for many years.

Ultraviolet light has now become commonly used for many disinfection processes:

Drinking Water

UV light for drinking water disinfection dates back to the early part of the last century. Unlike chemical treatment, UV disinfection of water consists of a purely physical, non-corrosive process, and produces no known disinfection byproducts. Additionally, UV treatment is rapid and, in terms of primary energy use, approximately 20,000 times more efficient than boiling.

Wastewater Treatment

UV light is replacing chlorination in the treatment of wastewater due to the chemical's toxic by-products. UV treatment compares favorably with other water disinfection systems in terms of cost, labor and the need for technically trained personnel for operation. Chlorine disinfection systems are expensive because of the need for special operator training and a steady supply of a potentially hazardous material.

Food, Drugs and Equipment

UV light surface disinfection systems are used to reduce microbial counts on all kinds of equipment and packaging, including glass and plastic bottles, cans, lids and foils. By treating the surfaces with UV prior to filling, spoilage organisms are eliminated, extending the shelf life of the product and reducing the risk of contamination.

Ultraviolet light is a range of the electromagnetic spectrum that is shorter in wavelength than visible light. Within the electromagnetic spectrum, photons (packets of light) of shorter wavelengths have more energy than those of longer wavelengths, and therefore have more potential to damage or disrupt microorganisms.

UVC light (in the 100-280 nm range) kills microorganisms by damaging their DNA. The UV light is absorbed by the DNA molecules and breaks the chemical bonds that hold them together.

The corrupted DNA causes the death of bacteria and fungi by interrupting vital cell functions, and renders viruses unable to replicate.

The effectiveness of germicidal UV depends on two primary factors: the dose of UV and the ability of the micro-organism to tolerate it. The dose is a product of the intensity of the light and the length of exposure.

Medixair™ Technology

Medixair™ offers a simple, compact, non-intrusive and cost effective solution to air disinfection, backed by both laboratory research and clinical trials. The patented design uses an enclosed chamber to contain the germicidal ultraviolet light (UVC) source, removing the potential for exposure by humans and animals present in the treated areas, and allowing continuous uninterrupted and unattended operation.

Each operating Medixair™ unit will disinfect 880 ft^3 (25 m^3) of air per hour continuously, enough to completely treat the air in an average hospital room over nine times every 24 hours.

Rigorous testing has demonstrated that Medixair™ is capable of achieving between 6.6 and 7.2 log cycles of kill over an eight hour period.

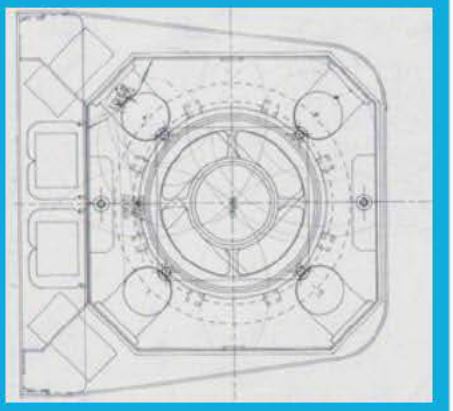
Safety

The ultraviolet light used by Medixair™ is non-ionizing and creates no ozone. No ultraviolet light is exposed outside the Medixair™ unit while it is in operation. Opening the unit's service access door, even while operating, will cause the unit to switch off.

The Environment

Medixair™ uses standard low pressure UV tubes that are manufactured with the same basic materials used in all commercially available fluorescent lights, and the units use electronic starters to minimize energy consumption and ensure high efficiency. As with all fluorescent lights, recycling of spent tubes is highly recommended.

Medixair™ Blueprint



The effectiveness of germicidal UV light depends on the "dose" or amount of energy absorbed by the microorganism. As the intensity of light is reduced exponentially with the distance from the source, air sanitization can only be achieved by a carefully managing this exposure.

The light chamber in the Medixair™ units is engineered to ensure that all the air passing through must pass within a defined maximum distance from the light source.

Coupled with the managed air flow rate, this ensures that all microorganisms present in the air will receive at least the target dose.

Medixair™ Results : Laboratory Trials

Laboratory Trials Carried out by Microsearch Laboratories Ltd. - an independent UKAS Accredited, DEFRA authorized contract laboratory, capable of handling up to Class II pathogens.

Contaminated Laboratory Waste Room

Organisms employed:

E.coli
S.areus
S.typhimurium
B.globigii
B.subtilus
B.megaterium

A reduction of 99.999 % with respect to each target organism was achieved over a 24 hour period in a real use situation.

Effectiveness Against Anthrax

Organisms employed:

Bacillus globigii (recommended anthrax spore surrogate)

Greater than 99.999 % kill rates with a 5 log reduction of contaminants over an 8 hour period.

Effectiveness Against MRSA

Organisms employed:

Staphylococcus aureus; NCTC 11939 (Epidemic methicillin resistant strain)
Staphylococcus aureus; NCTC 11940 (Epidemic methicillin resistant strain)
Staphylococcus aureus; NCTC 11962 (Associated with post operative toxic shock)

Achieved between 6.6 and 7.2 log cycles of kill over an 8 hour period.

Medixair™ Results : Clinical Trials

Clinical Trials Carried Out at Northwick Park Hospital, London, UK

Acute Ward MRSA Contamination (Meticillin-resistant Staphylococcus aureus)

MRSA hot-spots continued to prevail despite regular surface cleaning. In these areas, one in five patients became colonized with MRSA. Of that cohort, one in thirty further developed a blood stream infection (bacteraemia). In this group there was a mortality rate of 40%.

The replicated, controlled, and ethics committee approved trial aimed to intervene in the environmental transmission cycle of MRSA. Two identical side wards were employed in the trial to provide a control group and to permit replication of results.

Conclusions:

Medixair™ air sterilization made a positive impact, producing a significant reduction in the levels of environmental MRSA and colonization of patients within five days of implementation. A direct line correlation was identified between environmental MRSA contamination to patient colonization, wound infection and mortality.

Acute Orthopedic Trauma Ward **Clostridium difficile** Outbreak

Following the successful MRSA Study, Medixair™ units were successfully used as an intervention against an outbreak of **Clostridium difficile** in a trauma ward.

This trial achieved an 80% reduction over a period of 15 months, with almost all the subsequent infections occurring within the first quarter after the Medixair™ units were installed (with the last four quarters reporting either none or only one new case of CDI).

Conclusions:

During the study period the hospital had an active program against CDI. The program for the trauma ward was not distinct from the rest of the hospital apart from the installation of the air sterilization units. The hospital as a whole demonstrated a modest reduction of the total number of CDI cases, but not to the same degree as in the acute orthopedic trauma ward. Ultraviolet air sterilization seems to reduce the number of CDI outbreaks and the number of cases. It is hypothesized that the airborne mode of transmission plays a role in transmission of **Clostridium difficile.**

Medixair™ Results : Intervention Trial

Intervention Trial Carried Out at National Hospital for Neurology and Neurosurgery, University College London Hospitals, NHS Foundation Trust

Acute Ward MRSA Outbreak (Norovirus)

A serious infection outbreak caused the closure of several wards for two weeks. The outbreak was controlled within days of the installation of Medixair™ units.

Note: While the efficacy of Medixair™ has been demonstrated against all viral particles, this intervention was not a clinical study. Further managed hospital trials are currently in process.

Medixair™ - Clearing the Air

"The ongoing need for improved control of person-to-person airborne transmission of some respiratory infections, our increasing reliance on re-circulated air, and our growing understanding of where UV air disinfection is likely to work have prompted this review."

Richard L. Riley and Edward A. Nardell

Clearing the Air:
The Theory and Application of Ultraviolet Air Disinfection

Medixair™ has been selected as a breakthrough product by the British National Health Service, and is being implemented in showcase hospitals as part of its "Smart Solutions for HCAI" program.

How to Learn More

MEDIXAIR™

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3780 Rider Trail South
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Phone: 314-567-4101
Email: sales@b-onena.com
Web: www.b-onena.com

Appendices

Medixair™ Specifications:

- Height: 27.3" (694 mm)
- Width: 7.9" (202 mm)
- Depth: 7.9" (202 mm)
- Weight: 17.6 lb (8 kg)
- Power Supply: 110-120 volt - 100 watts (230 volt version also available)
- Air Volume: 14.7 ft^3/min (25 m^3 per hour)
- UV Exposure Energy: 23,000 µW.sec/cm^2
- Noise: 35 dB @ 1metre (3.28ft)

Medixair™ Maintenance:

- The germicidal UVC tubes should be replaced every 6 months
- The germicidal UVC tubes should be cleaned quarterly (in the 2 quarters without tube replacement) following the bulb cleaning and handling instructions
- The air filter should be replaced quarterly (monthly in high dust environments)

Consumables are all low cost items. Service does not require specialist tools, equipment, or training, and the average service time per unit is less than 10 minutes.

Medixair™ Benefits:

- Medixair™ units provide continuous unattended operation without the need for dedicated specialist staff
- Medixair™ units are discreet, non-intrusive, and whisper quiet, allowing all normal activities to proceed without interruption
- Medixair™ units are available as fixed wall-mounted for permanent locations, or free standing to allow for more flexible response to changing conditions
- Medixair™ units offer a very affordable, proven solution for controlling airborne pathogens, allowing more widespread usage within the same budgetary constraints

UV Energy Required to Destroy Bacteria and Viruses (as μW.s/cm²)

Bacteria	Energy	Medixair™ %	Bacteria	Energy	Medixair™ %
Agrobacterium tumefaciens	4,200	547 %	Phytomonas tumefaciens	4,400	522 %
Bacillus anthracis	4,500	511 %	Proteus vulgaris	3,000	766 %
Bacillus aegaterium (spore)	9,070	253 %	Pseudomonas aeruginosa	5,500	418 %
Bacillus aegaterium	3,750	613 %	Pseudomonas fluorescens	3,500	657 %
Bacillus subtilis (spore)	12,000	191 %	Salmonella enteritidis	7,600	303 %
Bacillus subtilis	7,100	323 %	Salmonella paratyphi	6,100	377 %
Bacillus paratyphosus	3,200	718 %	Salmonella typhimurium	8,000	287 %
Bacillus enteritidis	4,000	575 %	Samonella typhosa	6,000	383 %
Coryneb acterium diphteriae	3,750	613 %	Sarcina lutea	19,700	116 %
Clostridium tetani	4,900	469 %	Serratia marcesens	2,420	950 %
Clostridium botulinium	12,000	191 %	Salmonella paratyphi	6,100	377 %
Dysentery bacilli	2,200	1045 %	Salmonella typhimurium	8,000	287 %
Eberthella typhosa	2,140	1074 %	Samonella typhosa	6,000	383 %
Escherichia coli	5,400	425 %	Sarcina lutea	19,700	116 %
Leptospira spp (Infectious Jaundice)	3,000	766 %	Serratia marcesens	2,420	950 %
Legionella pneumophila	2,040	1127 %	Shighella dysenteriae	4,200	547 %
Legionella bozemanii	1,800	1277 %	Shigella paradysenterea	1,680	1369 %
Legionella dumoffii	3,000	766 %	Shigella flexneri	1,700	1352 %
Legionella gormanii	2,500	920 %	Shigella sonnei	2,100	1095 %
Legionella micdadei	1,500	1533 %	Spirillium rubsum	4,400	522 %
Legionella longbeachae	1,500	1533 %	Staphylococcus albus	1,840	1250 %
Listeria monocytogenes	3,400	676 %	Staphylococcus aureus	2,600	884 %
Listeria monocytogenes	3,400	676 %	Streptococcus haemolyticus(A)	6,700	343 %
Micrococcus candidus	6,050	380 %	Streptococcus haemolyticus(D)	9,500	242 %
Micrococcus sphaeroides	10,000	230 %	Streptococcus lactis	6,150	373 %
Mycobacterrium tuberculosis	6,200	370 %	Streptococcus viridans	2,000	1150 %
Neisseria catarrhalis	4,400	522 %	Streptococcus pyrogenes	2,160	1064 %

Virus	Energy	Medixair™ %	Virus	Energy	Medixair™ %
Adenovirus	1,500	1533 %	Infectious hepatitis virus	8,000	287 %
Bacteriophage (E.Coli virus)	3,000	766 %	Influenza	3,400	676 %
Coxsackie virus A9	12,000	191 %	Poliovirus 1	11,000	209 %
Coxsackie virus B1	15,500	148 %	Poliovirus 2	12,000	191 %
Echovirus 1	11,000	209 %	Poliovirus 3	10,000	230 %
Echovirus 2	12,000	191 %	Reovirus 1	15,400	149 %
Hepatitis A	11,000	209 %	Rotavirus SA11	7,800	294 %

References

Aerobiology and Its Role in the Transmission of Infectious Diseases

Aaron Fernstrom and Michael Goldblatt
Journal of Pathogens
Volume 2013 (2013), Article ID 493960

Spread of Disease in Office Buildings

The Pennsylvania State University
Indoor Environment Center

Managing water in the home: accelerated health gains from improved water supply

The World Health Organization
WHO/SDE/WSH/02.07
Prepared by Professor Mark D. Sobsey
School of Public Health
University of North Carolina
Chapel Hill
USA

Clearing the Air: The Theory and Application of Ultraviolet Air Disinfection

Richard L. Riley and Edward A. Nardell
American Review of Respiratory Disease, Vol. 139, No. 5 (1989), pp. 1286-1294.

International Ultraviolet Association

www.iuva.org

From: (b) (6)
Sent: Fri, 13 Mar 2020 06:31:13 -0400
To: Lerner, Andrea (NIH/NIAID) [E]
Subject: Fwd: Aerosolization of body fluids and increased Covid19 transmission in the dental office setting

Please handle

Begin forwarded message:

From: "Dr. Brian E. Blough" <Bblough@amdpi.com>
Date: March 13, 2020 at 2:17:45 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Aerosolization of body fluids and increased Covid19 transmission in the dental office setting

Dr. Fauci-
I will be brief:

- I think there are urgent best practices relative body fluid aerosolization and COVID19 that dental health providers must consider, at least in hotspots.
- I think time is of the essence, thus I am writing to several policy makers and experts. Nothing to lose.
- It is my belief that high speed dental handpieces and intra oral use of ultrasonic dental instrumentation on patients should be discouraged or prohibited in communities in which there are confirmed cases. These instruments aerosolize body fluids putting providers, patients and staff at higher and unnecessary risk of exposure. You might as well walk through the office spraying a bottle of virus containing body fluids.
- Aerosolization of body fluids is not a typical concern in other healthcare settings. I am uncertain of the awareness of this mode of transmission within crises management circles. I am concerned highly infectious mode of transmission could be overlooked when considering containment best practices. Universal precautions would be rendered ineffective to an unacceptable degree. No surface would be spared.
- I believe that dentistry is a subset of the healthcare system that should be considered and managed separately than "typical" healthcare settings. Different rules do apply.
- In rare cases, emergent treatment is necessary. In my opinion, in these instances providers should use head to toe disposable PPE, to include face shields. The use of

single tooth rubber dam isolation should be utilized when possible. Often times removal multi tooth rubber dam isolation can cause splattering of body fluids.

- Dental conditions that require the use of this aerosolizing instruments can often be postponed for many weeks with very minimal risk of detriment to the patient.

- In my view, dental procedures that are diagnostic in nature or disease states that can be treated with hand instrumentation are a relatively "safe" given full compliance with universal precaution protocols. *I have no evidence to support this claim*- this is just my professional opinion as an experienced dental operator.

- I am willing and able to serve in any way I can.

Thank you so much for your precious time.

Brian Blough DDS
President, Nexus Dental PC
704-763-2561

From: (b) (6)
Sent: Fri, 13 Mar 2020 06:48:37 -0400
To: Lerner, Andrea (NIH/NIAID) [E]
Subject: Fwd: Extremely important concern

Please handle

Begin forwarded message:

From: dyan billal (b) (6)
Date: March 13, 2020 at 1:56:44 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Fw: Extremely important concern
Reply-To: dyan billal (b) (6)

Hello Dr Fauci
I am a Registered Nurse in Orange County, CA.
I am writing to ask you why in light of all that is going on .....we are still doing elective surgeries and people are getting their teeth cleaned at the dental offices.

There are several concerns about this:

1. For elective surgeries we are putting people in the hospital that should not be exposed there to other illness. Not to mention they are taking up precious beds that patients who are very sick with this virus may need. We are using staff that could be used better for the issues we are facing now.
Also, these surgical patients will be in a weakened state to fight the virus if they contract it.
It is all around us. Why would we continue to do elective procedures in the middle of a pandemic?
Also.....these patients are not being tested before coming in and they can also pose a potential risk to doctors and nurses and other patients. It makes NO SENSE to me.

2. For dental hygienists, WHY would they be doing routine cleanings when it has been proven that the regular masks do not protect them from droplet infection with this virus???
You are aware of how many droplets SPRAY in the air during a cleaning? How can they be protected?
Those masks they wear will not suffice. The spray still goes on their necks...etc.....

PLEASE address these serious concerns ASAP.

I already read the guidelines posted on ADA, Dental Hygiene Association and the CDC on elective surgery.
Leaves A LOT to be desired.

Sincerely,
Dyan Billal

From: (b) (6)
Sent: Fri, 28 Feb 2020 16:54:13 -0500
To: Cassetti, Cristina (NIH/NIAID) [E]
Subject: Fwd: Urgent Email/Strategy to attack 2019-nCoV coronavirus
Attachments: Nucleotide_Analogues_as_Inhibitors of SARS-CoV Polymerase_2_28_2020.pdf, ATT00001.htm, Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro.pdf, ATT00002.htm

Pls handle

Sent from my iPhone

Begin forwarded message:

From: Jingyue Ju <dj222@columbia.edu>
Date: February 28, 2020 at 4:46:04 PM EST
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Cc: "Barasch, Kimberly (NIH/NIAID) [C]" (b) (6), (b) (6)" (b) (6), "Redfield, Robert R. (CDC/OD)" (b) (6), "Davis, Mindy (NIH/NIAID) [E]" (b) (6), "Eakin, Ann (NIH/NIAID) [E]" (b) (6), "Stemmy, Erik (NIH/NIAID) [E]" (b) (6), "Sciotti, Rick (NIH/NIAID) [E]" (b) (6) "Schiltz, Helen (NIH/NIAID) [E]" (b) (6) "Krafft, Amy (NIH/NIAID) [E]" (b) (6)
Subject: Re: Urgent Email/Strategy to attack 2019-nCoV coronavirus

Dear Dr. Fauci,

Following my previous email regarding our work on developing strategies to attack the 2019-nCoV coronavirus, I am attaching in this email our (b) (4)

(b) (4)

At this point, it is imperative that the prodrug forms (one is Sofosbuvir that is FDA approved for HepC) of these molecules begin immediate in vitro testing with infected cells (similar to the studies carried out for Remdesivir and chloroquine in the Cell Research article at the link, https://www.nature.com/articles/s41422-020-0282-0; PDF file of the article also attached) followed by animal testing trials ASAP. (b) (4)

(b) (4)

I can be reached any time at (b) (6).

All the best,

Jingyue Ju, Ph.D.
Samuel Ruben-Peter G. Viele Professor of Engineering
Professor of Chemical Engineering and Pharmacology
Director, Center for Genome Technology &Biomolecular Engineering
Columbia University
Northwest Corner Building, Room 1000M1
550 West 120th Street
New York, NY 10027
Phone:

<dj222@columbia.edu>wrote:
Dear Drs. Fauci and Redfield,

Scientists in my laboratory at Columbia University are actively engaged in design strategies to cope with the new strain of coronavirus, 2019-nCoV, which has caused a global public health emergency. We have embarked on a project entitled "Nucleotide Analogues as Inhibitors of Viral Polymerases". We provide a summary of this work below.

Coronaviruses such as the newly discovered virus from Wuhan, China, 2019-nCoV, and the viruses that cause SARS and MERS, have resulted in regional and global public health emergencies. Based on our molecular insight that the hepatitis C virus and the coronavirus use a similar viral genome replication mechanism, we reasoned that the FDA-approved drug EPCLUSA (Sofosbuvir/Velpatasvir) for the treatment of hepatitis C will also inhibit the above coronaviruses, including 2019-nCoV. To develop broad spectrum anti-viral agents, we further describe a novel strategy to design and synthesize viral polymerase inhibitors, by combining the ProTide Prodrug approach used in the development of Sofosbuvir with the use of 3'-blocking groups that we have previously built into nucleotide analogues that function as polymerase terminators.

Please let me know if you would like to receive the full manuscript.

Thank you very much for your consideration.

Sincerely,

Jingyue

Jingyue Ju, Ph.D.
Samuel Ruben-Peter G. Viele Professor of Engineering

Professor of Chemical Engineering and Pharmacology
Director, Center for Genome Technology &Biomolecular Engineering
Columbia University
Northwest Corner Building, Room 1000M1
Phone:

Nucleotide Analogues as Inhibitors of SARS-CoV Polymerase

Jingyue Ju Columbia University 2/28/2020

This document concerns the use of nucleotide analogues as inhibitors of SARS-CoV RNA-dependent RNA polymerase. We tested the ability of the activated (triphosphate) form of Sofosbuvir, 2'-F,Me-UTP, and a different nucleotide analogue, 3'-fluoro-3'-deoxythymidine triphosphate (3'-F-dTTP), to be incorporated by an RNA-dependent RNA polymerase (RdRp). We used the RdRp of SARS-CoV (responsible for the 2003 SARS outbreak), referred to as nsp12, and its two cofactors, nsp7 and nsp8, shown to be required for the processive polymerase activity of nsp12 (1, 2). These three viral gene products have high homology at the amino acid level (e.g., 96% identity and 98% similarity for nsp12, with similar homology levels for nsp7 and nsp8) to the equivalent gene products from SARS-CoV-2 (the causative agent of the recent COVID-19 outbreak).

Like Sofosbuvir, the prodrug form of 2'-F,Me-UTP (**Fig. 1A)**, 3'-F-dTTP can also be synthesized in prodrug form (**Fig. 1B**). Synthesis of 5'-*O*-phosphoramidate nucleoside prodrugs can be carried out starting from 2' or 3'-modified nucleosides, respectively. In a typical approach, the 5'-OH is derivatized to afford the corresponding phosphoramidates by treatment with freshly prepared chlorophosphoramidate reagent in the presence of N-methyl imidazole (3, 4).

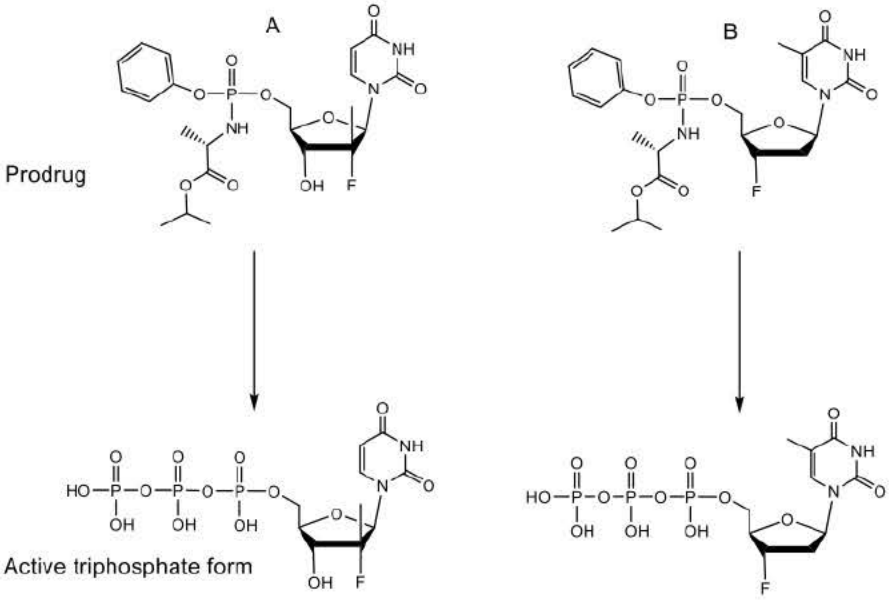
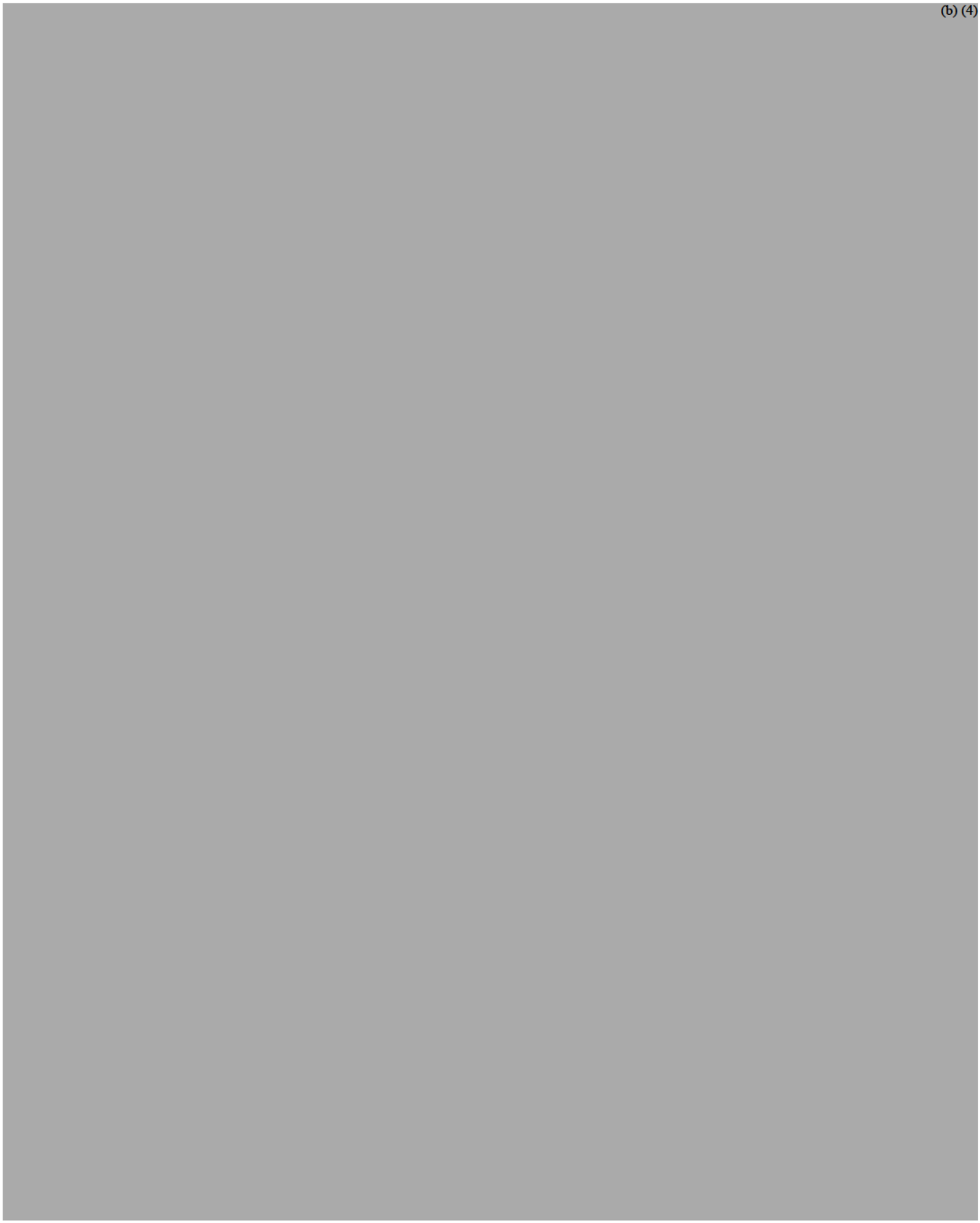


Fig. 1: (**A**) Conversion of Sofosbuvir to active 2'-F,Me-UTP drug, and (**B**) conversion of parent prodrug 3'-F-5'-*O*-phosphoramidate dT nucleoside to the activated 3'-fluoro-3'-deoxythymidine triphosphate (3'-F-dTTP) *in vivo*. We have evaluated their performance as inhibitors of the SARS-CoV RNA dependent RNA polymerase, as shown in **Fig. 2**.


(b) (4)

(b) (4)


(b) (4)

Cell Research

www.nature.com/cr
www.cell-research.com

LETTER TO THE EDITOR OPEN

Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro

Cell Research (2020) 0:1–3; https://doi.org/10.1038/s41422-020-0282-0

Dear Editor,

In December 2019, a novel pneumonia caused by a previously unknown pathogen emerged in Wuhan, a city of 11 million people in central China. The initial cases were linked to exposures in a seafood market in Wuhan.[1] As of January 27, 2020, the Chinese authorities reported 2835 confirmed cases in mainland China, including 81 deaths. Additionally, 19 confirmed cases were identified in Hong Kong, Macao and Taiwan, and 39 imported cases were identified in Thailand, Japan, South Korea, United States, Vietnam, Singapore, Nepal, France, Australia and Canada. The pathogen was soon identified as a novel coronavirus (2019-nCoV), which is closely related to sever acute respiratory syndrome CoV (SARS-CoV).[2] Currently, there is no specific treatment against the new virus. Therefore, identifying effective antiviral agents to combat the disease is urgently needed.

An efficient approach to drug discovery is to test whether the existing antiviral drugs are effective in treating related viral infections. The 2019-nCoV belongs to *Betacoronavirus* which also contains SARS-CoV and Middle East respiratory syndrome CoV (MERS-CoV). Several drugs, such as ribavirin, interferon, lopinavir-ritonavir, corticosteroids, have been used in patients with SARS or MERS, although the efficacy of some drugs remains controversial.[3] In this study, we evaluated the antiviral efficiency of five FAD-approved drugs including ribavirin, penciclovir, nitazoxanide, nafamostat, chloroquine and two well-known broad-spectrum antiviral drugs remdesivir (GS-5734) and favipiravir (T-705) against a clinical isolate of 2019-nCoV in vitro.

Standard assays were carried out to measure the effects of these compounds on the cytotoxicity, virus yield and infection rates of 2019-nCoVs. Firstly, the cytotoxicity of the candidate compounds in Vero E6 cells (ATCC-1586) was determined by the CCK8 assay. Then, Vero E6 cells were infected with nCoV-2019BetaCoV/Wuhan/WIV04/2019[2] at a multiplicity of infection (MOI) of 0.05 in the presence of varying concentrations of the test drugs. DMSO was used in the controls. Efficacies were evaluated by quantification of viral copy numbers in the cell supernatant via quantitative real-time RT-PCR (qRT-PCR) and confirmed with visualization of virus nucleoprotein (NP) expression through immunofluorescence microscopy at 48 h post infection (p.i.) (cytopathic effect was not obvious at this time point of infection). Among the seven tested drugs, high concentrations of three nucleoside analogs including ribavirin (half-maximal effective concentration (EC_{50}) = 109.50 μM, half-cytotoxic concentration (CC_{50}) > 400 μM, selectivity index (SI) > 3.65), penciclovir (EC_{50} = 95.96 μM, CC_{50} > 400 μM, SI > 4.17) and favipiravir (EC_{50} = 61.88 μM, CC_{50} > 400 μM, SI > 6.46) were required to reduce the viral infection (Fig. 1a and Supplementary information, Fig. S1). However, favipiravir has been shown to be 100% effective in protecting mice against Ebola virus challenge, although its EC_{50} value in Vero E6 cells was as high as 67 μM,[4] suggesting further in vivo studies are recommended to evaluate this antiviral nucleoside. Nafamostat, a potent inhibitor of MERS-CoV, which prevents membrane fusion, was inhibitive against the 2019-nCoV infection (EC_{50} = 22.50 μM, CC_{50} > 100 μM, SI > 4.44). Nitazoxanide, a commercial antiprotozoal agent with an antiviral potential against a broad range of viruses including human and animal coronaviruses, inhibited the 2019-nCoV at a low-micromolar concentration (EC_{50} = 2.12 μM; CC_{50} > 35.53 μM; SI > 16.76). Further in vivo evaluation of this drug against 2019-nCoV infection is recommended. Notably, two compounds remdesivir (EC_{50} = 0.77 μM; CC_{50} > 100 μM; SI > 129.87) and chloroquine (EC_{50} = 1.13 μM; CC_{50} > 100 μM, SI > 88.50) potently blocked virus infection at low-micromolar concentration and showed high SI (Fig. 1a, b).

Remdesivir has been recently recognized as a promising antiviral drug against a wide array of RNA viruses (including SARS/MERS-CoV[5]) infection in cultured cells, mice and nonhuman primate (NHP) models. It is currently under clinical development for the treatment of Ebola virus infection.[6] Remdesivir is an adenosine analogue, which incorporates into nascent viral RNA chains and results in pre-mature termination.[7] Our time-of-addition assay showed remdesivir functioned at a stage post virus entry (Fig. 1c, d), which is in agreement with its putative antiviral mechanism as a nucleotide analogue. Warren et al. showed that in NHP model, intravenous administration of 10 mg/kg dose of remdesivir resulted in concomitant persistent levels of its active form in the blood (10 μM) and conferred 100% protection against Ebola virus infection.[7] Our data showed that EC_{90} value of remdesivir against 2019-nCoV in Vero E6 cells was 1.76 μM, suggesting its working concentration is likely to be achieved in NHP. Our preliminary data (Supplementary information, Fig. S2) showed that remdesivir also inhibited virus infection efficiently in a human cell line (human liver cancer Huh-7 cells), which is sensitive to 2019-nCoV.[2]

Chloroquine, a widely-used anti-malarial and autoimmune disease drug, has recently been reported as a potential broad-spectrum antiviral drug.[8,9] Chloroquine is known to block virus infection by increasing endosomal pH required for virus/cell fusion, as well as interfering with the glycosylation of cellular receptors of SARS-CoV.[10] Our time-of-addition assay demonstrated that chloroquine functioned at both entry, and at post-entry stages of the 2019-nCoV infection in Vero E6 cells (Fig. 1c, d). Besides its antiviral activity, chloroquine has an immune-modulating activity, which may synergistically enhance its antiviral effect in vivo. Chloroquine is widely distributed in the whole body, including lung, after oral administration. The EC_{90} value of chloroquine against the 2019-nCoV in Vero

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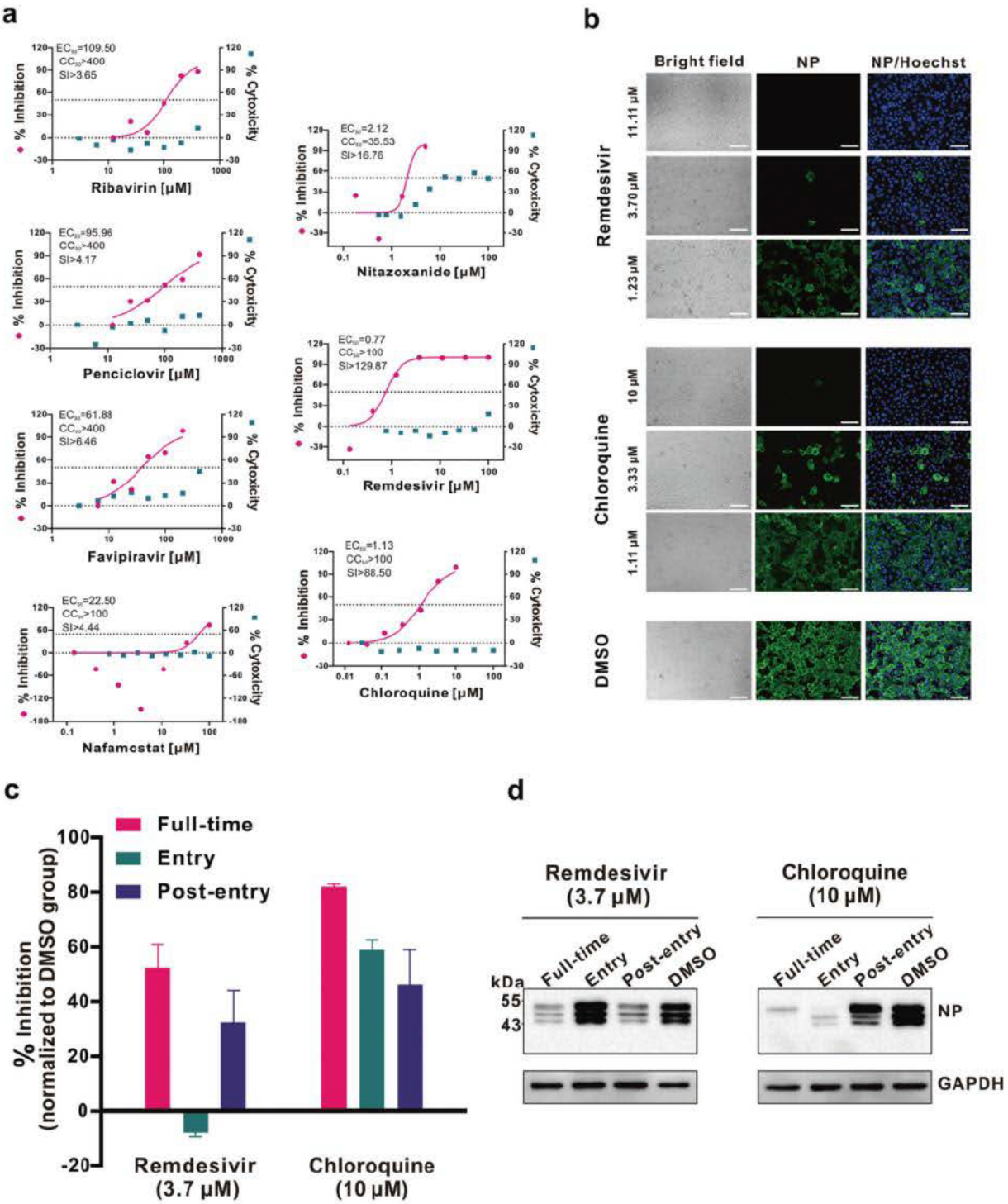

Fig. 1 The antiviral activities of the test drugs against 2019-nCoV in vitro. a Vero E6 cells were infected with 2019-nCoV at an MOI of 0.05 in the treatment of different doses of the indicated antivirals for 48 h. The viral yield in the cell supernatant was then quantified by qRT-PCR. Cytotoxicity of these drugs to Vero E6 cells was measured by CCK-8 assays. The left and right *Y*-axis of the graphs represent mean % inhibition of virus yield and cytotoxicity of the drugs, respectively. The experiments were done in triplicates. **b** Immunofluorescence microscopy of virus infection upon treatment of remdesivir and chloroquine. Virus infection and drug treatment were performed as mentioned above. At 48 h p.i., the infected cells were fixed, and then probed with rabbit sera against the NP of a bat SARS-related CoV[2] as the primary antibody and Alexa 488-labeled goat anti-rabbit IgG (1:500; Abcam) as the secondary antibody, respectively. The nuclei were stained with Hoechst dye. Bars, 100 μm. **c** and **d** Time-of-addition experiment of remdesivir and chloroquine. For "Full-time" treatment, Vero E6 cells were pre-treated with the drugs for 1 h, and virus was then added to allow attachment for 2 h. Afterwards, the virus–drug mixture was removed, and the cells were cultured with drug-containing medium until the end of the experiment. For "Entry" treatment, the drugs were added to the cells for 1 h before viral attachment, and at 2 h p.i., the virus–drug mixture was replaced with fresh culture medium and maintained till the end of the experiment. For "Post-entry" experiment, drugs were added at 2 h p.i., and maintained until the end of the experiment. For all the experimental groups, cells were infected with 2019-nCoV at an MOI of 0.05, and virus yield in the infected cell supernatants was quantified by qRT-PCR **c** and NP expression in infected cells was analyzed by Western blot **d** at 14 h p.i.

E6 cells was 6.90 μM, which can be clinically achievable as demonstrated in the plasma of rheumatoid arthritis patients who received 500 mg administration.[11] Chloroquine is a cheap and a safe drug that has been used for more than 70 years and, therefore, it is potentially clinically applicable against the 2019-nCoV.

Our findings reveal that remdesivir and chloroquine are highly effective in the control of 2019-nCoV infection in vitro. Since these compounds have been used in human patients with a safety track record and shown to be effective against various ailments, we suggest that they should be assessed in human patients suffering from the novel coronavirus disease.

ACKNOWLEDGEMENTS

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AUTHOR CONTRIBUTIONS

G.X., W.Z., Z.H., M.W., R.C., and L.Z. conceived and designed the experiments. X.Y., J.L., M.X., M.W., R.C., and L.Z. participated in multiple experiments; G.X., W.Z., Z.H., Z.S., M.W., R.C., and L.Z. analyzed the data. M.W., L.Z., R.C., and Z.H. wrote the manuscript. G.X., W.Z., and Z.H. provided the final approval of the manuscript.

ADDITIONAL INFORMATION

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Competing interests: The authors declare no competing interests.

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From: (b) (6)
Sent: Mon, 2 Mar 2020 09:10:54 -0500
To: Cassetti, Cristina (NIH/NIAID) [E]
Subject: Fwd: lay info for people who are at risk for COVID-19
Attachments: Wuhan Coronavirus for Mama.20020301.pdf, ATT00001.htm

Please take a look at this and respond.

Begin forwarded message:

From: Cynthia Bristow <cynthia.bristow@stonybrook.edu>
Date: March 1, 2020 at 10:12:22 PM EST
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: lay info for people who are at risk for COVID-19

Dear Tony,

I would like to respectfully ask if someone in your Institute could kindly review the attached précis regarding the current COVID-19 situation and recommend any revisions prior to my disseminating this to (b) (6) and others in retirement communities who are concerned.

I appreciate that this would not be an official endorsement by you. I am only asking if there is anything that you or others think I could add or subtract from this précis to give solace to those who are in need of knowledge and comfort.

Thank you kindly for your attention to this matter.

Best wishes,

Cynthia L. Bristow, PhD
Chief Executive Officer
Alpha-1 Biologics
25 Health Sciences Drive, Suite 110
Stony Brook, NY 11790-3383
Office: 631 444 6238
Cell phone: (b) (6)
cynthia.bristow@alpha1biologics.com
cynthia.bristow@stonybrook.edu
www.alpha1biologics.com


(b) (4)

From: (b) (6)
Sent: Fri, 13 Mar 2020 07:18:58 -0400
To: Lerner, Andrea (NIH/NIAID) [E]
Subject: Fwd: Trial by fire?

Please handle

Begin forwarded message:

From: Aaron Harber (b) (6)
Date: March 13, 2020 at 6:52:52 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Trial by fire?

Dear Tony,

You're doing a great job under terrible circumstances so I hope you hang in there. I'm sure the President is driving you nuts at times.

I know you're probably far too busy to do yet another program with me (**HarberTV.com/Fauci**) but, if you can send me a couple of quick answers this morning, that would be great.

1. Do you think it's realistic we could have an effective vaccine for the COVID-19 virus by this Fall? My guess is it will be more like the Fall of 2021 but tell me if I might be wrong.

2. Given that we've known about the probability of a pandemic, why are we so poorly prepared to address it (e.g., masks, testing kits, medical staffing et cetera)? I realize most of the needs rarely occur and when they do, there are extraordinary spikes in demand for certain products and expertise but one would think there are ways to address this far better than we have.

3. Is there anything people should know that is not being emphasized?

Thanks for any response you can send, even if it's a few words. And keep up the good work. You are greatly appreciated.

Best wishes,

Aaron

Aaron@HarberTV.com
P: 303-666-6161 (+voicemail) C: (b) (6) (+texts)
HarberTV.com/Info + HarberTV.com/Award

From: (b) (6)
Sent: Sat, 14 Mar 2020 13:15:38 -0400
To: Mike Betts
Subject: Re: Coronavirus response

Thank you for your note.
A.S. Fauci

Sent from my iPhone

On Mar 14, 2020, at 12:19 PM, Mike Betts (b) (6) >wrote:

I wanted to convey an idea I had with regard to the coronavirus. It seems to me that trying to contain the virus as we are doing at present will be futile. Since the virus can be present for many days without a person having any symptoms, you would literally need to test everyone at the same time to determine who has it--an impossible task.

I have a different thought. We know that the virus is especially dangerous for the old and/or immunosuppressed. IMO we should be focusing all of our efforts on keeping that group from becoming infected. To do so that group should be encouraged to self-isolate, to limit their social interactions and other groups should be instructed to avoid them. Sort of a reverse-quarantine idea. All testing would be done within those groups and all groups would also be encouraged to continue with the hygienic suggestions they've already received.

The problem right now is that the media has created a panic. Last night my wife and I went to the local Whole Foods and many of the shelves were empty and healthy younger people were wearing masks.

The message is not getting out that the virus is almost solely dangerous to the elderly and immunosuppressed. [Why aren't the demographics being released? That in itself could calm many people.] With my suggestion, exposures to them would be diminished, significantly reducing the number of deaths, as well as the potential impact on hospitals. Any person outside of that group that was severely affected could be identified and treated. Quarantining otherwise healthy people outside of those groups who finally demonstrate symptoms--like the NBA players--is ridiculous. They are likely to get the sniffles and have also already spread the virus. As long as

they're not spreading it to the endangered group we should not worry about it.

In sum, we need to isolate the vulnerable and realize that the mortality rate for people outside of that group is likely lower than the flu.

Of course, while this occurs we are working on finding treatments and vaccines. But sending home workers who have next to no likelihood of being significantly impacted by this virus is ridiculous. The virus hits hardest the old and infirm, two groups that are most likely NOT to even be in the workforce!

To me, this solution is a lot simpler than what is being tried right now and is much more likely of success. To everyone besides the endangered group this virus is literally less dangerous than the flu. There is no reason that anyone outside of the endangered group should have any concern at all and we need to make that clear. Please let me know what you think.

Sincerely,

Michael Betts
(b) (6)

From: (b) (6)
Sent: Sun, 15 Mar 2020 11:55:50 -0400
To: Irene Roberts
Subject: Re: Why are dental clinics still open?

Thank you for your note.
A.S. Fauci

Sent from my iPhone

On Mar 15, 2020, at 11:52 AM, Irene Roberts (b) (6) wrote:

Please read the linked article below from NATURE journal and tell me WHY DENTAL CLINICS ARE STILL OPEN?

I have contacted the CDC, WHO, OSHA, Dept. of Health, WDA and American Dental Association. Every response just refers me back to ADA guidelines.

Please, please read the article below and tell me why dental clinics are still open when we are trying to prevent/control the spread of COVID19?

No matter how well CDC guidelines are followed, airborne spread of infectious respiratory viruses in a dental clinic are at higher risk than any other medical facility. This may even be the main source of spread of COVID19 to nursing homes. Teeth cleanings are NEVER an emergency and dental hygiene services should have been shut down immediately, way before schools were closed. Most dental clinics have a high population of nursing home clients, immunocompromised and elderly patients.

Due to loss of revenue to dentists (business owners), patients are NOT encouraged to reschedule their appointments when they have flu symptoms! Very few dentists are following the CDC guidelines that prevent sick patients from entering the dental clinic in the first place.

I have heard from several dental hygienists nationwide. Many are deeply concerned for the health and safety of their patients and themselves. There is already a shortage of dental hygienists and many are wanting to leave the dental profession due to feeling unsafe and unprotected! Not only are they being asked to re-use contaminated masks but they are not wearing the proper-level protection mask in the first place! And it is impossible to not be exposed to the direct transmission of COVID19.

The article linked below explains the dangers to dental patients, employees, and how easily COVID19 is spread in a dental office. Dental hygienists cannot practice social distancing when they are forced to work within 6 inches of a patient's mouth and nose, wearing masks that do not protect them (or subsequent patients) from inhaling direct exhale from infected patients.

There is absolutely no way to prevent the spread of COVID19 in a dental setting! And with the shortage of masks and safety supplies, why aren't these being saved for the hospital workers instead of non-essential dental procedures?

It is a huge oversight that dental hygiene services were not shut down immediately! Please read article below to understand the direct transmission!

https://www.nature.com/articles/s41368-020-0075-9

From: (b) (6)
Sent: Sun, 15 Mar 2020 13:15:06 -0400
To: CLuser Seller
Subject: Re: A perspective from an American citizen.

Thank you for your note
A.S. Fauci.

Sent from my iPhone

On Mar 15, 2020, at 1:09 PM, CLuser Seller (b) (6) wrote:

Hello,

I realize you are between a rock and a hard place. You have to please Trump so he doesn't silence you. That said, I think you are the voice the AMERICAN PEOPLE turn to for reason. People are freaked out and in all honesty, we see the train coming and not much being done to stop it. Trump is WAY over his head. It is, once again, all about him. All about how it looks on him. Please, and I know you are, do EVERYTHING you can to get through to him that he needs to stop talking and let the experts (not the VP) run this thing. The balance you have to hold between Trump and the TRUTH is a bit of a danger to us, the public.

My family is scared. I am scared. (b) (6). Will I be one of those doctors choose to let die because of my age? Will you be one of those? I am healthy as an ox as are you, I love my kids and grandkids as much as the next person and WANT to live for them. Now though I wonder if I will get to do that. Worse, I now fear them when they come over directly from the school twice a week. I know I am not alone in this feeling. WHY are we not doing a nationwide shut down of schools, bars, restaurants? Italy, Washington state is a map of things to come, CA next. I live in CA and it is business as usual. Concerts, schools, events...still happening. People are NOT listening - it doesn't apply to 'them'. "Won't happen here" attitude. I keep hearing 'every option is on the table', how real this virus is, how bad it will be but I don't see anyone actually acting on it. We don't have the tests we need, we don't have the hospital beds, masks, ventilators. How can this be in the 'greatest nation on earth'?? It is time for the Federal Government to ACT and shut things down, get everything in place. Painful as it will be. People are ALREADY scared. ALREADY hoarding. ALREADY panicked. Do you know this?? On the street - this is how it is.

Look at the images of the travelers coming home from Europe due to the ban on travel. We are supposed to be social distancing and yet they are crammed together for HOURS, then asked a few questions, temperature taken and if no symptoms are let go to disperse into their communities. They COULD be carriers. They are not being quarantined. How in the world does that help us? It is crazy, disorganized and dangerous. Create a ban, freak Americans in Europe out, everyone flies home and then there is nothing done when they arrive? They are allowed to move freely into the communities they live in? UNTESTED?? That is so crazy and adds to the panic people are feeling because if THIS is how Trump's admin 'prepare' for the return of travelers after they set the ban...we are truly in for a horror show in the coming weeks.

I know I am preaching to the choir, and you know a zillion times more than I do. I am just a citizen. I trust you, but I do not trust this President or his 'task force'. I am a level headed, pragmatic person. I plan for everything, I make lists and check them twice. Trump doesn't read, doesn't educate himself, doesn't make lists. I hope he is learning through this, from people like you. I want him to step up. I have doubts he is

even able to. So....it is up to you. It may come to a point where you need to leave his team and take care of the public. Talk the truth to the public through Governors and Mayors.

Trump will demonize you, he does that with everyone who crosses him. But he is woefully ignorant on this topic. He has money to live on, no fear of being evicted, gets tested immediately -just because he shook hands with someone yet we, the PEOPLE, have to wait until we are sick. He is privileged. We, the people, are left to our own devices and decisions made in our local communities. That is nuts. Trump needs to step up, get tests going - for all citizens regardless of symptoms. Truly have tests so that "everyone who wants one can get one" (a lie). Unfortunately, at some point, you are going to have to make a choice - back up the liar in Chief, or take care of the public.

I know this is a very politically charged letter - I don't mean for it to be. I WANT the President to succeed. I support the office. But this is now different. Up to now, we've had the luxury to roll our eyes and say 'that is Trump being Trump'. No more. NOW, he could ACTUALLY cause my death, the death of my loved ones and my community. It is time to force him to listen, if you can, and more importantly to act or get him out of the way. Use the Congress if you have to. He needs to get out of the way.

A concerned Citizen,
Thank you for reading my thoughts.

CL

From: (b) (6)
Sent: Sun, 15 Mar 2020 15:33:20 -0400
To: Xiaoyang Hua, M.D., Ph.D.
Subject: Re: COVID-19 some suggestions

Thank you for your note

Sent from my iPhone

> On Mar 15, 2020, at 3:17 PM, Xiaoyang Hua, M.D., Ph.D. <xiaoyang.hua@duke.edu> wrote:
>
> Dear Dr. Fauci:
> I am writing to you to express my deepest concerns on the COVID-19 outbreak in the USA and would like to share some thoughts with you.
>

(b) (6)

(b) (6) I truly appreciate what you have done to wake the Americans and warn them about this dangerous virus outbreak. I hope we are not repeating the mistakes that the Chinese and Italians have made earlier.
>
> I know many physicians and nurses who have been on the frontlines against this coronavirus outbreak in Wuhan China. Over the past a couple of months, I have been communicating with them about the COVID-19 outbreak. I have obtained much firsthand information about this virus from medical professionals, including the ICU directors of major hospitals in Wuhan. Here I want to share some thoughts with you and hope that I can help prevent the worst in the USA.
>
> For the government:
>
> 1. Close all public schools immediately. My family is in Iowa City, IA. They are yet to decide if they should close the schools after the spring break. This is one example that has concerned me a lot. In the email from the Iowa City School District, quote: "there are many factors to be considered any time a decision is made to close schools. These factors range from evaluating the consequences of missed instruction to providing meals to students who rely on the school's food service program", this is extremely short-sighted. These factors, as quoted above, will be very minor issues and easier to handle, compared with the potential catastrophic consequences should the virus outbreak be out of control and have paralyzed our already-overwhelmed medical system in the USA. I hope the federal government can issue an administrative order to close the public schools.
>
> 2. Cancel or postpone any large gathering events more than 20 people. Use tele-conference if necessary.
>
> 3. Every county in this country should have contingent plan in place and have one or several isolation facilities/temporary shelters in the remote areas using college dorms or hotels, in preparation of future large outbreaks of COVID-19 in the community.
>
> 4. Work with local or state media to inform the public of the status of basic life necessity (e.g. food, water, tissue paper) and essential medical supplies (including PPE). If there is a shortage, the estimated back-to-stock timeline should be provided. For PPEs, if the shortage cannot be solved within a short period of time, they should be saved for those who truly need them including medical professionals treating patients with COVID-19. All local medical supply businesses should turn in their inventories since the State Emergency has been declared. These timely updates will provide assurance to the public to avoid panic and chaos.

>
> 5. Encourage online shopping and drive-thru pick-up including groceries. Help the local businesses to expand their delivering capacities.
>
> 6. Provide the public live updates on the outbreak, including the number of confirmed cases, their current clinical status, strategies of tracing their close contacts, as well as the number of total cases being tested. From what I have learned, the more transparent the government is, the less panic the public will be.
>
> 7. Issue laws that prohibit intentional spread of COVID-19, irresponsible behaviors that put other innocent people or medical professionals at risk of contracting the virus.
>
>
>
> For medical professionals:
>
> Early January in Wuhan, many patients very likely contracted COVID-19 in the local hospitals when they visited their physicians for other medical conditions. In addition, the medical system in Wuhan China was almost paralyzed at that time. One of major reasons is that many medical professionals were infected and sick. The medical professionals are the backbone in the fight against this virus outbreak. We need to prepare for the worst scenario that this outbreak can last for a few or several months. We need to protect our medical professionals first.
>
> 1. Set up a centralized Fever/COVID-19 hotline operated by trained provider/nursing staff. This telephone line can use the current available state information hotline, with expanded functions serving as a gatekeeper and triage mechanism for potential COVID-19 patients to receive guidance on where to seek help before visiting a busy clinic, an urgent care, or a hospital emergency room to minimize the chances of cross-infection and over-whelming large medical centers.
>
> 2. Establish designated Fever/COVID-19 clinics or hospitals led by well-trained ID teams (MD, NP), especially in highly populated areas. These clinics will serve as the secondary triage and referral centers for the aforementioned Fever/COVID-19 hotline, plus for primary care clinics that are not equipped with adequate staff and testing tools. These clinics should have adequate staff including physicians and middle level providers, equipped with testing kits to perform COVID-19 test onsite. They should have the capacity of testing drive-through patients, securing airway for ventilation if needed before transferring severe patients to tertiary medical facilities. They should be operated collaboratively with larger healthcare systems like U Iowa, Unity Point, and Mercy who are setting up their own isolated COVID-19 centers for more severe cases.
>
> 3. Establish a clear communication and transfer protocol between Fever/COVID-19 hotlines, clinics and treating hospitals for management of suspicious and confirmed cases. For those with mild COVID-19 infection, they should be self-quarantined at home and monitored closely and remotely. If they cannot perform self-quarantine safely, such as living by themselves or in nursing homes, they should be kept in the county isolation facilities (as mentioned above), being monitored there.
>
> 4. If drive-through testing is available at CVS or Walgreen, patients with positive results should call the hotline or their PCPs first if clinically stable to receive guidance for self-quarantine, monitoring and follow-up. If they cannot perform self-quarantine safely, they should be kept in the county isolation facilities as mentioned above.
>
> 5. Inform the public and other healthcare providers of the availability of these Fever/COVID-19 hotline and clinics, encouraging patients with symptoms to utilize these resources first before visiting clinics, emergency rooms to reduce the chances of cross-infection, and the burden on large medical centers.
>
> 6. Encourage medical professionals to call their clinic patients for screening. Allow the medical providers to postpone all non-urgent medical visits for annual checkups, stable and non-urgent chronic conditions et al.
>
> 7. Encourage all physicians and healthcare professionals who provide direct patient care to wear personal protective equipment (PPE) such as masks, eye shields and gloves to protect themselves and to minimize the chances of spreading the virus to other patients, if necessary or based on their screening phone calls.

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>
> Sincerely,
>
>
>
> Kind regards,
> ---
> Xiaoyang Hua, MD/PhD
> Duke Head and Neck Surgery
>
>
>
>
>
>
>

From: (b) (6)
Sent: Sun, 15 Mar 2020 19:07:42 -0400
To: Nancy Alvarez
Subject: Re: N 95 masks

Thank you for your note.
A.S. Fauci.

Sent from my iPhone

> On Mar 15, 2020, at 4:46 PM, Nancy Alvarez (b) (6) wrote:
>
> Dr Fauci,
> I am an RN in NJ. My organization does not have enough masks. They are running scared and passing the risk to the staff by touting the new standard of not needing to wear a N 95. This is scary. We deserve the right equipment and we need people like you to advocate for us.
>
> -Nancy

From: (b) (6)
Sent: Sun, 15 Mar 2020 19:08:42 -0400
To: Kaufman, Daniel
Subject: Re: Cov19

Thank you for your note.
A.S. Fauci.

Sent from my iPhone

On Mar 15, 2020, at 4:16 PM, Kaufman, Daniel <DKaufman@mednet.ucla.edu>wrote:

Dear Dr. Fauci,

Thank you for your leadership in these difficult times.

Id like to suggest that you advocate for it to become social etiquette for everyone to wear a home-made face mask when outside.
This will cut down of the spread of COV19 from **asymptomatic** individuals.
Although surgical masks are in short supply, masks can be made at home from cotton T-shirts, towels, linen, paper towels/rubber bands etc.
(see https://smartairfilters.com/en/blog/best-materials-make-diy-face-mask-virus).
Thank you for considering this suggestion.
Sincerely,
Daniel Kaufman, PhD
Professor
Dept. Molecular and Medical Pharmacology
UCLA School of Medicine
Center for Health Sciences Rm 23-167
Los Angeles, CA
90024-1735

From: [redacted]
Sent: Sun, 15 Mar 2020 19:37:43 -0400
To: Lei Wu
Subject: Re: Please shut down the country NOW

Thank you for your note.
A.S. Fauci.

Sent from my iPhone

On Mar 15, 2020, at 7:35 PM, Lei Wu [redacted] wrote:

Dr. Fauci. This is Lei Harrison. In the coronavirus crisis, [redacted] I have been calm until now. No one can anymore after seeing the photos of the international airports today where hundreds if not thousands of people standing in line for 5-6 hours and realizing immediately the virus transmission will explode exponentially because of this. I strongly request:

1. Shut down the country NOW. Mobility has to be as low as possible. We have to do the very best RIGHT NOW to break the transmission chain.

2. Please talk to Dr. Zhong Nanshan (钟南山）, the Chiense doctor and advisor during the coronavirus crisis. His advice and experience would be of tremendous value for the U.S. now.

3. Sofar, we've been acting in a reactive instead of proactive fashion. Not anymore. People need to realize that we are entering war time. We need to act fast, in light speed to beat the virus.

4. Healthcare workers need to most strongly protected- treat it as airborne if needed at the hospitals and pharmacies. Supplies of essential protective medical supplies for healthcare workers are equally important as supplies needed for the patients. Make sure supply chain from China is uninterrupted; and have American companies to start making masks, ventilators etc. Plan ahead.

5. Grocery store and restaurants can potentially become a hub too. They need to have high level of hygiene, and ideally no contact with the customers.

6. Garbage and belongs and bodies need to be burned.

7. Safety protocol at the labs, public and private labs that have access to the virus or experimental animals with the virus.

8. Plan ahead. Instruct patient to self-treat or be treated by family at home. If we ever come to it, recruit and train volunteers (how and whom?) to help taking care of patients.

Dr. Fauci. Clock is ticking. It's a race against time. And it's time that every single American takes responsibility. Please lead us through the crisis.

Respectfully,
Lei Harrison

From: (b) (6)
Sent: Mon, 16 Mar 2020 06:09:17 -0400
To: Lerner, Andrea (NIH/NIAID) [E]
Subject: Fwd: Dental

Respond

Sent from my iPad

Begin forwarded message:

From: aliciabigelow22 (b) (6)
Date: March 16, 2020 at 5:54:34 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Dental

I ask you to address the explosion of concerns among the dental community in regards to COVID-19. We, the dental community, already high risk personnel, are at an even higher risk at this point and time. Many of those who do not work in the dental community are not aware of how high risk our current situation is. For 8-12 hours a day we are creating aerosols while sitting 8-12 inches from a persons open mouth. These aerosols contain saliva and blood droplets, along with billions of other bacteria and materials. In dentistry, saliva is considered a blood borne pathogen. Although OSHA requires Level 3 masks for all aerosol producing procedures, not all offices are complying. This DOES NOT matter anyway as we know SURGICAL MASKS DO NOT FILTER OUT THE COVID-19 virus. I ask that you suspend non essential dental procedures such as dental cleanings and other procedures that are non-emergent. That we triage patients and accept EMERGENCIES ONLY. We are at such a HIGH risk, not only to ourselves and our families, but a HIGH RISK to spreading this virus COMMUNITY wide. Many of us are taking extra precautions but screening patients, but with a up-to-14 day incubation period, that obviously does not matter.
Please hear our plea to address our concerns. The American Dental Association and the American Dental Hygienists Association has failed us.

Thank you
Alicia Jewell

Sent from my Verizon, Samsung Galaxy smartphone

From: (b) (6)
Sent: Wed, 18 Mar 2020 19:51:14 -0400
To: dalt222
Subject: Re: Plaquenil for Covid 19

Thank you for your note.
A.S. Fauci

Sent from my iPhone

On Mar 18, 2020, at 7:41 PM, dalt222 (b) (6) wrote:

Dr Fauci,

I hope all is well with you. I am a Dermatologist practicing in the Metropolitan Detroit area. I have done some literature searching on potential treatments for the novel coronavirus and stumbled across a few case case reports from China in 2005 at the time of the SARS outbreak. They detailed some successes in treatment of severe cases with chloroquine. I saw a more recent study showing hydroxychloroquine had better in vitro efficacy than chloroquine. Have you heard of this? Plaquenil is so innocuous, I wonder if we shouldn't just try it.

I think you are doing phenomenal work and really presenting a level, measured and realistic view of this epidemic to the world. Please keep up the great work. It is much appreciated

David A. Altman MD FAAD
Assistant Clinical Professor
Division of Internal Medicine
Michigan State University College
Of Human Medicine

Sent from my Verizon, Samsung Galaxy smartphone

From: (b) (6)
Sent: Wed, 18 Mar 2020 19:56:42 -0400
To: John Brouse
Subject: Re: Covid19 treatment

Thank you for your note.
A.S. Fauci

Sent from my iPhone

On Mar 18, 2020, at 7:02 PM, John Brouse (b) (6) wrote:

Sent from Mail for Windows 10
Dear Dr. Fauci

I understand that South Korea has been administering Hydroxl Chloroquine, a treatment for Malaria, to her citizens that have contracted Coronavirus. Is America considering this drug to help lessen the symptoms of this virus? This drug may not prevent anyone from getting ill, but may be a viable treatment to speed the recovery of individual afflicted with this disease.

Respectfully,

John Brouse

From: (b) (6)
Sent: Sat, 21 Mar 2020 07:35:58 -0400
To: DMID Word Nerds
Subject: Fwd: Note from a NIH "alumnus" re. SARS-CoV-2

Sent from my iPhone

Begin forwarded message:

From: Robert Wiskocil (b) (6)
Date: March 21, 2020 at 4:30:43 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Note from a NIH "alumnus" re. SARS-CoV-2

Dear Dr. Fauci,
I used to work in Bob Goldberg's division at the NCI (Blgd 37) from '78-'80. I'm now a rheumatologist in the SF Bay Area.
I'm including a Letter to the Editor (submitted 3.19.20) for the (b) (6) that proposes a cost-effective therapy for COVID-19. (I've included a slightly longer version with more references):

(b) (6)

I hope you find this helpful!

Sincerely,

(b) (6)

Robert Wiskocil, MD

(b) (6)

From: (b) (6)
Sent: Sat, 21 Mar 2020 07:38:39 -0400
To: Friedmann, Theodore
Subject: Re: COVID-19 information for the public

Thank you for your note.
AS Fauci

Sent from my iPhone

> On Mar 21, 2020, at 2:01 AM, Friedmann, Theodore <tfriedmann@health.ucsd.edu> wrote:
>
> Dear Tony: I'm sure that you realize how dismayed and saddened many of us are at the inaccurate and harmful comments coming from our political leaders regarding the COVID-19 pandemic. That feeling hit a new height today with the irresponsible and nonsensical announcement from President Trump regarding his claimed effectiveness of chloroquine and hydroxychloroquine. This announcement and many other untruths were delusional, irrational, un-scientific and revealed a profoundly harmful and unethical betrayal by President Trump his responsibility to protect the health of the public that pus th republic in sever danger. I was very glad to hear your public comments that countered this horribly dangerous misinformation. I hope that your message falls on receptive ears in the public and leads to a major change in the kind of public announcements that are currently being foisted on the desperate public who depend on knowing and acting based on the truth. Please continue and even expand your role as the truth teller in the who crowded collection of muzzled officials and sycophants who seem to be more devoted to deceiving the public rather than preparing the public for hard truths and solving the logistics failures of masks, availability of testing its. Please continue your brave and essential role as honest broker that you play valiantly privately during your policy discussions that the public also deserves to know about the wrong and unethical self-serving propaganda that the public is fed by President Trump and some other members of the Corona Virus task force. It is a deadly governmental game. I wish you good luck in alerting the public to this immoral, unethical and deadly plague of governmental misinformation designed to shape political quandaries rather than public welfare. Please continue speaking out about public misinformation.
>
> Ted Friedmann, MD
>

From: (b) (6)
Sent: Sat, 21 Mar 2020 07:42:47 -0400
To: info@thepoetryloft.org
Subject: Re: Research Study on the efficacy of cloth masks

Thank you for your note.
AS Fauci

Sent from my iPhone

On Mar 20, 2020, at 8:42 PM, "info@thepoetryloft.org" <info@thepoetryloft.org>wrote:

Dear Dr. Fauci,

I've attached a study for your review on the efficacy of cloth masks. In desperation, many hospitals workers are considering making and using cloth masks which is very concerning. The CDC has recently recommended using cloth masks such as bandanas if N95 masks are not available.

Thank you very much.

Most gratefully,

Beatrice Lazarus
<cloth masks safety.pdf>

From: (b) (6)
Sent: Tue, 24 Mar 2020 07:47:49 -0400
To: Pottinger, Matthew F. EOP/WHO
Subject: Re: regarding masks and Covid-19

Very good point.

On Mar 24, 2020, at 6:38 AM, Pottinger, Matthew F. EOP/WHO (b) (6) wrote:

(b) (5)

Matt

Sent from my iPhone

On Mar 24, 2020, at 6:27 AM, Pottinger, Matthew F. EOP/WHO (b) (6) >wrote:

Dr. KY Yuen, a leading member of the COVID response in Hong Kong, bcc'ed me on his response to a reporter's query. His viewpoint is worth considering. (b) (5)

(b) (5)

Best
Matt Pottinger
Deputy National Security Advisor.
Sent from my iPhone

Begin forwarded message:

From: KY Yuen <kyyuen@hku.hk>
Date: March 23, 2020 at 10:39:53 PM EDT
To: "Lyons, John" <john.lyons@wsj.com>
Subject: [EXTERNAL] Wall Street Journal question regarding masks and Covid-19

Dear John,

Thanks for your message.

i. Studies have shown that wearing a mask with frequent hand hygiene significantly reduced transmission of influenza virus (also an enveloped respiratory virus with high transmissibility) in a community setting. But once the use of surgical mask is removed, the effect of hand hygiene becomes insignificant. (see attached)

ii. Moreover, besides protecting yourself from this novel coronavirus or other respiratory viruses by wearing a mask, for those who are infected with this novel coronavirus asymptomatically (subclinical) or symptomatically, this will markedly reduce the amount of virus shedding in the saliva and respiratory droplet. This will therefore markedly reduce the community transmission. But the wearers must wear it correctly, learn to avoid touching the mask involuntarily and still observe good hand hygiene. This is not easy.

iii. Except for the rich people, millions of HK people are living in very small housing estate or subdivided flat of 60 square feet. Advice has to be pragmatic. We go out to work, exercise or hiking. The first thing is to go into a VERY crowded elevator, then into very crowded MTR or bus, then going up a crowded elevator to our office OR to the place of hiking and exercise, and the reverse order happens when we go home. If we take off a mask and throw it away every time when not in a crowded environment and put up a new mask when entering a crowded environment, we need to use at least 8 mask per day when lunch and dinner outside are counted. Thus all these advice by many authorities may not be pragmatic.

HK is the most densely populated city in the world. Before the epidemic, at least 0.1 million HK residents or tourists cross our mainland border every day carrying the virus with them into HK. If not for universal masking once we depart from our home every day and wearing it correctly with hand hygiene, HK would be like Korea and Italy LONG ago. We now achieve 250 confirmed cases per 7.5 million population. This is really a record and is BETTER than other countries with a HOT weather and much less epidemic pressure from Chinese mainlanders.

Hope that this message will explain clearly why most medical colleagues in HK advocate universal masking once leaving their home. Note that the logistic of mask availability is another issue that requires other ways to work on.

Warm regards.
KY

From: Lyons, John [mailto:john.lyons@wsj.com]
Sent: Tuesday, March 24, 2020 10:16 AM
To: (b) (6)
Subject: Wall Street Journal question regarding masks and Covid-19

Dear Professor Yuen,

I am a senior reporter at the WSJ based here in Hong Kong.

I am interested in your perspective for a story I am writing on whether "to mask or not to mask" in the fight against the new Coronavirus.

On the one hand, the WHO has said healthy people need not wear masks on the grounds that they are not effective if not properly used; may lead to a false sense of security; and could use up scarce supplies.
On the other hand, many people, especially in Asia, see it as common sense a barrier will help contain the spread, especially when some carriers are asymptomatic. In Hong Kong, the experience of successfully fighting SARS seems to add evidence that masks are a good idea.

I can be reached at (b) (6). I am trying to finish the story today. It will run in the newspaper and on our website globally.

Best,

John

--

John Lyons
The Wall Street Journal.
Hong Kong Cell: (b) (6)

<hand_hygiene_and_risk_of_influenza_virus_infections_in_the_community_a_systematic_review_and_metaanalysis.pdf>

From: (b) (6)
Sent: Sat, 28 Mar 2020 17:58:32 -0400
To: Hallett, Adrienne (NIH/OD) [E]
Cc: Collins, Francis (NIH/OD) [E];Tabak, Lawrence (NIH/OD) [E];Wolinetz, Carrie (NIH/OD) [E];Shapiro, Neil (NIH/OD) [E];Lauer, Michael (NIH/OD) [E]
Subject: Re: Brad Sherman

Thanks to everyone.

On Mar 28, 2020, at 5:32 PM, Hallett, Adrienne (NIH/OD) [E] (b) (6) >wrote:

Thanks Francis. I just spoke to his Deputy Chief of Staff (b) (6)
She's asking for advice on the letter to NIH. I told her not to try to get us to agree to a funding amount because that will get shot down in clearance. I told her to ask open ended questions about the scientific questions that need to be answered and programs at NIH that might help.
She said Sherman intends to introduce legislation that she has already drafted and she has already drafted a Dear Colleague letter asking for CoSponsors. The bill has 3 parts:
1) refundable R&D tax credit to companies working on Coronavirus;
2) 7 year patent exclusivity for any drug developed;
3) $5 billion for NIAID and $1 billion for FDA.
I suggested she give NIAID flexibility - please don't specify the mechanism (grants vs contracts) or the phase (preclinical vs trials); long availability; and perhaps transfer authority.
She mentioned that the Congressman wants NIAID to screen generics on the market to see if any might work for COVID-19.
I'm hoping I may get to see the bill before he introduces. (b) (5)
I'll share what I see when I see it.
Adrienne

On Mar 28, 2020, at 2:27 PM, Collins, Francis (NIH/OD) [E] (b) (6) wrote:

Hi Adrienne,

I spoke with Brad Sherman (D-CA) yesterday. He had originally reached out to Tony, and Cliff Lane spoke to him Thursday, but I stepped in to try to lift one task off of Tony's plate.

He believes that the $2.2T government COVID-19 bill massively underinvested in efforts that could actually stop or slow the pandemic – choosing instead to try to help the victims. He thinks the private sector will only go after projects that generate IP, so the possible role of repurposing generics will be ignored. He has some other ideas about how best to prevent spread of coronavirus on surfaces, and how to re-use masks, but those are not particularly well formed, and he is quick to say he's not a scientist.

But he wants to see another $5B given to NIH right away (even before the 4th supplemental package) – so that we could solicit dozens of ideas about therapeutics and invest in most of them, not worrying that most will fail. He is planning to introduce legislation to this effect, and said that a signal from Tony or me would be really helpful. I reminded him that we are not allowed to speak in favor of legislation unless the administration has taken a position.

He said he is sending a letter to Tony and me, asking what we need to go flat out against COVID-19. He wanted to know who from my office his staff could work with. I said you!

Francis

From: (b) (6)
Sent: Mon, 30 Mar 2020 06:05:28 -0400
To: DMID Word Nerds
Subject: Fwd: Chloroquine is a thromboxane inhibitor: there is a readily available analog

Sent from my iPhone

Begin forwarded message:

From: "Dr. Josh Backon" <backon@mail.huji.ac.il>
Date: March 30, 2020 at 5:52:32 AM EDT
To: "Fauci, Anthony (NIH/NIAID) [E]" (b) (6)
Subject: Chloroquine is a thromboxane inhibitor: there is a readily available analog

Dear Dr. Fauci,

I'm a (b) (6) internist.

I have a suggestion for 2 potent antiviral agents, cheap and readily available, that may prevent viral shedding. No viral shedding? No infectivity. The concept is that EVERYONE should take these items.

First a short bio:

Dr. Josh Backon was affiliated with the Hebrew University Faculty of Medicine for over 33 years. He has a good track record (84+ publications quoted by over 750 other researchers in journal articles
https://scholar.google.com/scholar?start=0&q=%22backon++j.%22&hl=en&as_sdt=0,5
and in over 250-300 texts as per
https://www.google.com/search?tbo=p&tbm=bks&q=%22backon+j.+%22&num=100).
In the 1980's he was Consulting Editor of the Journal of Pediatric Endocrinology, Editor of Reviews in Pure and Applied Pharmacological Sciences, and Associate Editor of the International Journal of Adolescent Medicine and Health. From 1990-2004, he was a consultant on emergency planning and management at Israel's National Police Headquarters with Nitzav Mishneh Dannny Fisher.
==========

Chloroquine, an antimalarial drug, is now being used to treat Covid-19. Its mechanism was found in the 1970's to inhibit thromboxane https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=chloroquine+thromboxane&btnG= The problem with chloroquine was that it also elevated levels of prostaglandin F2alpha. In 1980, Srivastava, an Indian biochemist working in Denmark found that GINGER is a potent inhibitor of thromboxane synthetase. I wrote a number of papers in the 1980's on use of ginger: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=backon+ginger&btnG=

-

GINGER IS A POTENT ANTIVIRAL

-

https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=ginger+antiviral&oq=gin

-

THE SECOND ANTIVIRAL AGENT IS TURMERIC [add black pepper since piperine dramatically increases oral bioavailability of turmeric]
https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=turmeric+antiviral&oq=tur

Multisite inhibitors for enteric **coronavirus**: antiviral cationic carbon dots based on curcumin
D Ting, N Dong, L Fang, J Lu, J Bi… - ACS Applied Nano …, 2018 - ACS Publications
… These results offer theoretical support for the development of CCM-CDs as a hopeful antiviral drug for the treatment of **coronavirus** infections, including PEDV … Curcumin (CCM) is a polyphenol compound obtained from **turmeric** roots…

NAC AND PIPERINE TO INHIBIT INFLAMMATORY CYTOKINES (iNOS, NF KappaB, TNFalpha) INVOLVED IN ARDS

-

Mortality in COVID-19 patients is usually from ARDS (acute respiratory distress syndrome) via inflammatory cytokines. Apart from N-acetylcysteine which was found 3 years ago to elevate atrial natriuretic factor [found by Kiemer in 2001 to zap inflammatory cytokines: iNOS, NF KappaB, and TNFalpha) now piperine in black pepper was found to inhibit inflammatory cytokines [piperine also dramatically increases oral bioavailability of turmeric [which has been used as a potent antiviral]:

N-ACETYLCYSTEINE

https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=n-acetylcysteine+%22inflammatory+cytokines%22&btnG=

PIPERINE
https://scholar.google.com/scholar?hl=en&as_sdt=0,5&q=piperine%20inflammatory%20cytokines&btnG=&fbclid=IwAR0kXZxI66JPLFPry2MDTDxOAelgGnmBZdKBw7c1v78Hfi7t0JJnx0Y2zuE
==========

BTW the thromboxane hypothesis explains the increased male to female ratio in infectivity as well as the low incidence in younger people.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1433448/

Gut. 1987 Oct; 28(10): 1323.
doi: 10.1136/gut.28.10.1323

PMCID: PMC1433448
PMID: 18668886

Ginger and carbon dioxide as thromboxane synthetase inhibitors: potential utility in treating peptic ulceration

Josh Backon

From: (b) (6)
Sent: Tue, 31 Mar 2020 13:38:07 -0400
To: Pottinger, Matthew F. EOP/WHO
Cc: Bax, Adriaan (NIH/NIDDK) [E]
Subject: Re: Article

The scientist's name is Adriaan Bax. He is at NIH at NIDDK. I am copying him on this email

On Mar 31, 2020, at 12:15 PM, Pottinger, Matthew F. EOP/WHO (b) (6) wrote:

Tony,
Do you have any info about the forthcoming NEJM article you mentioned in the TF meeting yesterday? The author or title, or any preview of the synopsis? I think you mentioned it had to do with aerosolization of the virus through speaking by asymptomatic and pre-symptomatic people (which masks could help mitigate).
Best,
Matt

From: Droegemeier, Kelvin K. EOP/OSTP (b) (6)
Sent: Tuesday, March 31, 2020 10:29 AM
To: Pottinger, Matthew F. EOP/WHO (b) (6); Carter, Hillary H. EOP/NSC (b) (6)
Subject: Article

Hi Matt and Hillary,

I chatted with the NE Journal of Medicine Editorial Office and without at least the name of an author or some sense of the title, they can't track down the article. Can you reach out to Tony and see if he has more info, or if he just heard about this and doesn't know more?

Thanks!

Kelvin

Dr. Kelvin K. Droegemeier, Director
Office of Science and Technology Policy
The White House
Washington, DC 20502
(b) (6)
http://www.ostp.gov
@WHOSTP

From: (b) (6)
Sent: Mon, 6 Apr 2020 21:00:59 -0400
To: (b) (6);Deborah Birx
Subject: Fwd: Toward the new normal with COVID-19

Deb:
Should we consider inviting Tom down for the meeting tomorrow evening?
Tony's

Begin forwarded message:

From: "Thomas R. Frieden" <trfrieden@resolvetosavelives.org>
Date: April 6, 2020 at 8:19:05 PM EDT
To: "Thomas R. Frieden" <trfrieden@resolvetosavelives.org>
Subject: Toward the new normal with COVID-19

Dear Colleague,

Until there's a COVID-19 vaccine, we won't be able to return to the way things were. Reopening will have to be gradual—loosening a tap not opening a floodgate, and must be guided by data on specific benchmarks to be reached. Writing today for Think Global Health of CFR, I outlined the key steps we must take right now to re-open as soon and as safely as possible. This will require improving strategic intelligence, fortifying our health care system, and revolutionizing public health, including extensive testing and intensive contact tracing and support for people who are infected and their contacts.

Last week I shared simple but high-value COVID-19 interventions which require minimal cost and. The simple steps were adapted from a great paper from a team in Australia which we also summarized here.

Our team analyzes the latest COVID-19 data, including a hugely important review of syndromic surveillance and clear scientific analysis of topics such as face masks and blood type. See the latest below and in our Weekly Science Review.

If you would like to share, I've tweeted here, here, and here.

Thank you for what you do to fight COVID-19.
Tom

Tom Frieden, MD, MPH
President and CEO
www.DrTomFrieden.net
tfrieden@rtsl.org

RESOLVE TO SAVE LIVES
An initiative of Vital Strategies

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COVID-19 Weekly Science Review

Prevent Epidemics
RESOLVE TO SAVE LIVES
Vital Strategies

Science Update: April 6, 2020

Covering articles published March 28 - April 3, 2020

Dear Colleague,

This week we're focusing on 'what's next?' Opening up society is about data, not a date. It's about easing a faucet not opening the floodgates and we must prepare to test, isolate, contact trace, and quarantine to avoid future peaks. Our team at Resolve to Save Lives, an initiative of Vital Strategies, has been analyzing the latest COVID-19 data on pressing topics, providing helpful summaries and insight.

We're now on our second week of sharing our data summaries every Monday. I hope you find this resource useful, and are staying informed and safe.

All the best,

Tom

Dr. Tom Frieden
President and CEO of Resolve to Save Lives, an Initiative of Vital Strategies

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Download a PDF version of the Weekly Science Review

New Insights

Data insight: Syndromic surveillance should be explored as an early signal for COVID-19

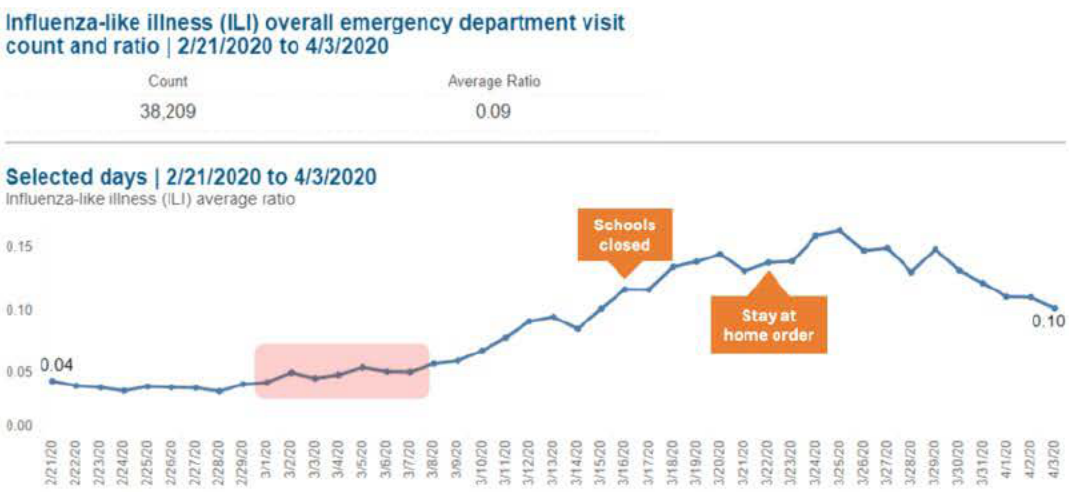
Syndromic surveillance is an innovative surveillance technique designed to detect illness clusters early, before diagnoses are confirmed and reported to public health agencies, and to mobilize a rapid response, thereby reducing morbidity and mortality.

Two syndromes could be used to detect an increase in complaints associated with COVID-19 in New York City:

- Influenza-like illness (ILI) syndrome includes mention of fever, flu and cough or sore throat
- Respiratory includes mention of bronchitis, chest cold, chest congestion, chest

pain, cough, difficulty breathing, pneumonia, shortness of breath, and upper respiratory

Data on the number and proportion of each syndrome is publicly available and updated daily. This type of information can be used as an early signal for COVID-19 if an increase in the number or proportion of visits due to ILI and Respiratory syndromes is driven by symptomatic COVID-19 patients.



Looking back at ILI data from NYC from March 2020, the proportion of ED visits due to both ILI and Respiratory syndromes started to rise in early March, which is atypical when compared to seasonal averages and occurred in the context of falling influenza rates.

Face Masks in the Community

Respirators and surgical masks should be reserved for medical professionals. For the general public, there is no strong scientific evidence that facial coverings prevent transmission of disease. Expert groups are currently examining the risks and benefits of face mask use by the public, primarily out of concern for asymptomatic transmission. Regardless, face masks should not replace other measures currently in place to reduce the spread of infection.

Click here for the latest guidance on cloth face coverings from the US CDC.

Latest Articles

Epidemiology

Detection of SARS-CoV-2 Among Residents and Staff Members of an Independent and Assisted Living Community for Older Adults — Seattle, Washington, 2020 (MMWR 3 April 2020)

Main message: It is possible to prevent an outbreak of COVID-19, even in a senior assisted living community. Screening for COVID-19 symptoms only is insufficient to identify all COVID-19 cases. In the absence of frequent testing, it is especially important to adhere to stringent SARS-CoV-2 mitigation measures in independent and assisted living communities.

Response

Impact of school closures for COVID-19 on the US health-care workforce and net mortality: a modeling study (Lancet Public Health, 3 April 2020)

Main message: The decision to close schools is a difficult trade-off between closing schools to reduce further transmission and potential health-care worker absenteeism due to additional childcare needs that could ultimately increase mortality from COVID-19. We don't yet have enough information to estimate the overall impact of current school closures.

Question of the Week

How does COVID-19 relate to blood type?

It has been reported that certain blood types may be associated with an increased risk of COVID-19. This is based on a non-peer reviewed study of 2,173 patients in Wuhan, China which showed that blood group A was associated with a higher risk for acquiring COVID-19 compared with non-A blood groups, whereas blood group O was associated with a lower risk for the infection compared with non-O blood groups. More specifically, the proportion of blood group A in patients with COVID-19 was significantly higher than that in a group of 3,694 controls from a recent survey in Wuhan. the general population, being 38% in the former vs 32% in the later (P <0.001) The observed higher risk for blood group A was not replicated in a similar comparison of 285 COVID-19 patients and 23,368 controls in Shenzen, China. The authors of this study acknowledge that this is an early study with limitations and should not guide clinical practice. Others note that the authors did not provide an explanation for this observation and the findings should not change the behavior of people with certain blood types. Those with Type A or Type O blood should continue to follow guidance to prevent infection (as should those of any blood type).

Read the full COVID-19 Weekly Science Review

News Highlights from Last Week

March 31, 2020 - A series of errors with lab testing delayed the U.S. response to the Covid-19 pandemic. We need to be clear about what went wrong and how we can get things right. Continue reading.

April 1, 2020 - Coronavirus live blog: Dr. Tom Frieden, former CDC director, answers your questions. Continue reading.

April 1, 2020 - Dr. Tom Frieden, who served as CDC Director during the Ebola and Zika outbreaks, weighs in on the latest pandemic models and how Americans can stay healthy during an appearance on "CBS This Morning." Watch here.

April 2, 2020 - "This is a world war, and the enemy is not people, states or countries but a dangerous microbe. It's us against the microbes," Frieden told reporters during a Wednesday news briefing. He led the response to the Ebola outbreak in 2014. Continue Reading.

Social Media Highlights

MIT Technology Review
@techreview

We're speaking with epidemiologist Dr. @CyrusShahpar about the "war" against covid-19. Join us for this live web show, and bring your questions.

Radio Corona: The War Against Covid-19
In this episode of Radio Corona, Gideon Lichfield, editor in chief of Technology Review, will speak with epidemiologist ...
youtube.com

4:12 PM · Apr 1, 2020 · Twitter Web App

17 Retweets **22** Likes

Dr. Tom Frieden
@DrTomFrieden

If you missed my virtual press briefing and public health update on the #COVID19 pandemic, you can watch it below on my YouTube channel #coronavirus

Resolve to Save Lives - Virtual Media Briefing on COVID-19 with Dr....
Resolve to Save Lives and Dr. Tom Frieden provide a Virtual Media Briefing and public health update on COVID-19, April 1, 2020
youtube.com

For more insights and updates, and to read this week's Science Review, visit:
www.preventepidemics.org

Our mailing address is:

preventepidemics@resolvetosavelives.org

From: Conrad, Patricia (NIH/NIAID) [E] on behalf of Fauci, Anthony (NIH/NIAID) [E]
Sent: Tue, 31 Mar 2020 21:07:00 +0000
To: (b) (6)
Subject: FW: Additional data on masks
Attachments: MacIntyre BMJ.pdf, Figure 3.jpg

Adding everyone since it was discussed in am meeting. thx

From: Lerner, Andrea (NIH/NIAID) [E] (b) (6)
Sent: Tuesday, March 31, 2020 5:04 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Folkers, Greg (NIH/NIAID) [E] (b) (6) Marston, Hilary (NIH/NIAID) [E] (b) (6); Eisinger, Robert (NIH/NIAID) [E] (b) (6); Doepel, Laurie (NIH/NIAID) [E] (b) (6)
Subject: Additional data on masks

Dr. Fauci,

In addition, I found the attachedd review on masks that addresses use in the community settings. Attached are the paper and figure 3, which summarizes the data from 9 very diverse RCTs (overlapping with what I had sent earlier).

Bottom line: generally there were not differences in ILI/URI/or flu rates when masks were used, although when early use and compliance was taken into account, a few times a difference was seen.

In addition:
This case control study noted that, among SARS patients in Hong Kong without a known source of infection, cases (27.9%) were less likely than uninfected controls (58.7%) to report wearing a mask frequently in public, for what that's worth.
https://wwwnc.cdc.gov/eid/article/10/4/03-0628_article

Overall, this doesn't change my opinion that I can see an argument for a theoretical benefit but that data is scarce and studies have many flaws but passing on the additional information.

Andrea

Study, year of publication	Design, participants	Mask type, intervention	Outcome	Results	Comments, limitations, biases
Cowling[11] 2008	• Cluster RCT • 198 index cases and household contacts • Hong Kong	• Medical masks • Hand hygiene • Control	• Self-reported influenza symptoms • Laboratory confirmed influenza (by culture or RT-PCR) in household	• No significant difference in rates of laboratory confirmed influenza (OR 1.16, 95% CI 0.31 to 4.34) and ILI (0.88, 0.34 to 2.27) in the medical masks arm versus control arm	• Both index cases and household contacts used medical masks • This pilot study was small and underpowered • Compliance 45% in index cases and 21% in household contacts • Compliance data showed that some index cases in the control and hand hygiene arms used medical masks
Cowling[12] 2009	• Cluster RCT • 407 index cases and 794 household contacts • Hong Kong	• Hand hygiene • Masks + hand hygiene • Control (education)	• Self-reported influenza symptoms • Laboratory confirmed influenza (by RT-PCR) in household	• No significant difference in rate of laboratory confirmed influenza in three arms • Significant difference if masks + hand hygiene together applied within 36 hours of illness (OR 0.33, 0.13 to 0.87) • Hand hygiene alone was not significant	• No separate medical mask arm, making it difficult to evaluate the efficacy of masks • Both index cases and household contacts used masks • Compliance 49% in index cases and 26% in household contacts using masks • Compliance data showed that some index cases in the control and hand hygiene arms used medical masks
MacIntyre[13] 2009	• Cluster RCT • 145 child index cases and well adult household contacts • Australia	• Medical masks for contacts • P2 respirators (equivalent to N95) for contacts • Control	• Self-reported ILI • Laboratory confirmed respiratory infection	• No significant difference in ILI and laboratory confirmed respiratory infections in all three arms • Adherent use of P2 or medical masks significantly reduced the risk of LI (HR 0.26, 0.09 to 0.77)	• Only household contacts used medical masks • Low compliance: 21% of household contacts wore masks often/always
Aiello[14] 2010	• Cluster RCT • 1437 well university residents • Michigan, USA	• Medical masks • Medical masks + hand hygiene • Control	• Self-reported ILI • Laboratory confirmed influenza (by culture or RT-PCR)	• No significant difference in ILI in three arms • Significant reduction in ILI in the medical masks + hand hygiene arm over 4-6 weeks (P=0.05)	• Self reported ILI • Not all ILI cases (n=368) were laboratory tested (n=94) • No data on compliance
Larson[15] 2010	• Block RCT • 617 households • Manhattan, USA	• HE • HE + hand sanitiser • HE + hand sanitiser + medical masks	• Self-reported ILI • Self-reported URI • Laboratory confirmed influenza through culture or PCR	• No significant difference in rates of URI, ILI, or laboratory confirmed influenza between the three arms • Significantly lower secondary attack rates of URI/ILI/influenza in the HE + hand sanitiser + medical mask arm (OR 0.82, 0.70 to 0.97).	• No separate medical masks group • Household contacts used medical masks • Low compliance and around half of household in the masks arm used masks within 48 hours • There was no index case at home
Canini[16] 2010	• Cluster RCT • 105 index cases and 306 households • France	• Medical mask (as source control to be used by index case) • Control	• Self-reported ILI in household	• No significant difference in the rates of ILI between the two arms (OR 0.91, 0.44 to 2.05)	• Trial stopped early owing to low recruitment and influenza A/H1N1-pdm09 in subsequent year
Simmerman[17] 2011	• Cluster RCT • 465 index patients and their families • Thailand	• Hand hygiene • Hand hygiene + medical masks • Control	• Self-reported ILI • Laboratory confirmed influenza by PCR and serology in family members	• No significant difference in secondary influenza infection rates between hand hygiene arm (OR 1.20, 0.76 to 1.88) and hand hygiene plus medial masks arm (1.16, 0.74 to 1.82)	• No separate medical mask group • Owing to H1N1 pandemic, hand and respiratory hygiene campaigns and mask use substantially increased among the index cases (from 4% to 52%) and families (from 17.6% to 67.7%) in control arm
Aiello[18] 2012	• Cluster RCT • 1178 university residents • Michigan, USA	• Medical masks • Medical masks + hand hygiene • Control	• Clinically diagnosed and laboratory confirmed influenza (by RT-PCR)	• No overall difference in ILI and laboratory confirmed influenza in three arms • Significant reduction in ILI in the medical masks + hand hygiene arm over 3-6 weeks (P=0.05)	• Good compliance: medical mask + hand hygiene group used masks for 5.08 h/day SD 2.23) and medical mask group used masks for 5.04 h/day (SD 2.20) • Self reported ILI • Effect may have been due to hand hygiene because medical masks alone not significant
Suess[19] 2012	• Cluster RCT • 84 index cases and 218 household contacts • Berlin, Germany	• Masks • Masks + hand hygiene • Control	• Laboratory confirmed influenza infection and ILI	• No significant difference in rates of laboratory confirmed influenza and ILI in all arms by intention to treat analysis • The risk of influenza was significantly lower if data from two intervention arms (masks and masks + hand hygiene) were pooled and intervention was applied within 36 hours of the onset of symptoms (OR 0.16, 0.03 to 0.92)	• Around 50% participants wore masks "monthly" or "always" • Participants paid to provide respiratory samples

CI=confidence interval; CRI=clinical respiratory infection; HCW=healthcare worker; HE=health education; HR=hazard ratio; ILI=influenza-like illness; OR=odds ratio; PCR=polymerase chain reaction; RCT=randomised controlled trial; RR=relative risk; RT=reverse transcriptase; SD=standard deviation; URI=upper respiratory tract infection.

thebmj

STATE OF THE ART REVIEW

Facemasks for the prevention of infection in healthcare and community settings

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ABSTRACT

Facemasks are recommended for diseases transmitted through droplets and respirators for respiratory aerosols, yet recommendations and terminology vary between guidelines. The concepts of droplet and airborne transmission that are entrenched in clinical practice have recently been shown to be more complex than previously thought. Several randomised clinical trials of facemasks have been conducted in community and healthcare settings, using widely varying interventions, including mixed interventions (such as masks and handwashing), and diverse outcomes. Of the nine trials of facemasks identified in community settings, in all but one, facemasks were used for respiratory protection of well people. They found that facemasks and facemasks plus hand hygiene may prevent infection in community settings, subject to early use and compliance. Two trials in healthcare workers favoured respirators for clinical respiratory illness. The use of reusable cloth masks is widespread globally, particularly in Asia, which is an important region for emerging infections, but there is no clinical research to inform their use and most policies offer no guidance on them. Health economic analyses of facemasks are scarce and the few published cost effectiveness models do not use clinical efficacy data. The lack of research on facemasks and respirators is reflected in varied and sometimes conflicting policies and guidelines. Further research should focus on examining the efficacy of facemasks against specific infectious threats such as influenza and tuberculosis, assessing the efficacy of cloth masks, investigating common practices such as reuse of masks, assessing compliance, filling in policy gaps, and obtaining cost effectiveness data using clinical efficacy estimates.

thebmj.com

To find out which equipment is recommended for different diseases and settings view the interactive graphic: http://www.bmj.com/content/350/bmj.h694/infographic

Introduction

Most efforts on the prevention of respiratory infections have focused on drug based interventions. In an emerging outbreak of infectious disease, non-pharmaceutical measures including facemasks and respirators may be the only available protection.

Various devices are used in healthcare and community settings worldwide, ranging from cloth, cotton, or gauze masks (cloth masks); medical, surgical, or procedure mask (medical masks); and N95, N99, N100, P2, P3, FFP2, and FFP3 respirators (respirators). The difference between the products arises from their design and intended use. Medical masks and cloth masks (hereafter "facemasks") were designed to prevent the spread of infection from wearers to others, but are commonly used to protect the wearer from splashes or sprays of blood or body fluids. Facemasks are not subject to regulation, do not provide a seal around the face, and vary widely in type and quality.[1 2] A respirator is a fitted device designed to protect the wearer from respiratory infections, which provides a seal around the face and is defined and regulated by its filtration capacity.[1 2]

No consensus exists around the choice between facemasks and respirators for respiratory protection, as is starkly illustrated by the widely discrepant guidelines for protection against the Ebola virus in the midst of the worst epidemic in history.[3] Although the efficacy of hand washing against respiratory and gastrointestinal infection has long been established in randomised clinical trials (RCTs),[4-6] evidence for facemasks has lagged behind. The threat of pandemic A/H5N1 influenza and resultant pandemic planning drove the first RCTs of facemasks in various settings.[7-19] The aim of this review is to inform policy makers and stakeholders by examining and summarising the available evidence related to the efficacy of facemasks and respirators, current practice, and guidelines, as well as highlighting the gaps in evidence.

Sources and selection criteria

We searched for evidence on facemasks and respirators in community and healthcare settings related to efficacy, policies, guidelines, clinical practice (including compliance and non-standard practices), organisational matters, regulation and fit testing, and cost effectiveness.

The following databases were searched: Medline (January 1950 to 31 July 2014), Embase (1988 to 31 July 2014), the Cochrane Library, Web of Science, and Google scholar. We also searched the Australian New Zealand Clinical Trials Registry (ANZCTR) and the US National Institutes of Health Clinical trial registry.

We used the following keywords: "facemask", "mask", "surgical mask", "medical mask", "cotton/cloth mask", "respirator", "N95/N97, N99 respirator", "FFP2/FFP3 respirator", "P2/P3 respirator" "respiratory protection", "respiratory protective device", "infection control", "respiratory infections and facemasks/mask/respirator", "influenza and facemasks/mask/respirator", "flu and facemasks/mask/respirator", "pandemic influenza and facemasks/mask/respirator", "SARS and facemasks/mask/respirator" "tuberculosis and facemasks/mask/respirator", "TB and facemasks/mask/respirator" and emerging infections and facemasks/mask/respirator". The GRADE (grading of recommendations assessment, development and evaluation) approach was used to examine the type of evidence.[20] RCTs were considered as level 1 (high) evidence, observational studies (cohort, case control, before after, time series, case series, and case reports) as level 2 (low) evidence, and any other evidence as level 3 (very low) evidence.[20] Only high level evidence (from RCTs) is summarised in the tables and figures. Because this article is not a systematic review, we did not further grade individual RCTs into high, moderate, low, and very low quality evidence but summarised each RCT's specific limitations. AAC reviewed the titles of the search articles and prepared an initial list of articles to be included in the study. Both authors then independently reviewed the abstracts included in the list and selected studies to be included in the figures.

We examined infection control policies and guidelines from the World Health Organization, US Centres for Disease Prevention and Control (CDC), European Centre for Disease Prevention and Control (ECDC), and other health organisations for recommendations on the use of facemasks and respirators. We also did a Google search and searched the websites of other health related organisations. Policies and guidelines on the use of facemasks were also searched using the following keywords: "infection control guideline/policy/plan", "pandemic influenza guideline/policy/plan", "personal protective equipment use/guideline", "personal protective equipment use/guideline for infection control", "masks use/guideline for infection control", "respirator use/guideline for infection control". Only English language articles were reviewed.

Use of facemasks and respirators in healthcare settings

Studies in the late 19th century first examined cloth masks for the prevention of the spread of infection from surgeons to patients in the operating theatre.[21 22] Cloth masks have been used for respiratory protection since the early 20th century.[23] The first study of the use of facemasks by healthcare workers in 1918 found low rates of infection in those who used a cloth mask.[24] Masks were also used to protect healthcare workers from scarlet fever, measles,[25] influenza,[26 27] plague,[28] and tuberculosis.[29]

The use of disposable medical masks became common in the mid-20th century,[30 31] with very little research on cloth masks since, despite their continued widespread use in developing countries.[23] Respirators were later specifically designed for respiratory protection. We identified 13 RCTs on face masks and respirators, which studied a diverse range of interventions and outcomes. Of these, four were conducted in the healthcare setting and nine in various community and household settings.[7-19] Three unpublished RCTs were identified from clinical trial registries, two of which were carried out in healthcare settings and one in the Hajj.[32-34] We also found systematic reviews of some RCTs, and several observational studies.[35-43]

Efficacy of facemasks and respirators in healthcare settings

Randomised controlled trials

In line with GRADE, we considered RCTs as the best available evidence. We identified only four RCTs of the clinical efficacy of facemasks or respirators in healthcare workers, which studied a diverse range of interventions and outcomes (fig 1).[7-10] The updated 2014 WHO guidelines on personal protective equipment (PPE) cite two of these four trials,[44] but exclude the larger two.[9 10]

The first trial, which was carried out in healthcare workers in Japan, randomised 32 workers to a medical mask group or a control arm. It found no significant difference in respiratory illnesses (P=0.81) but was underpowered to examine efficacy.[7] The second trial compared targeted use of medical masks and N95 respirators in 446 nurses in Canada and reported equal efficacy in preventing influenza (23.6% with medical masks *v* 22.9% with respirators; absolute risk difference, −0.73%, 95% confidence interval −8.8% to 7.3%).[8] However, because the study did not have a control group it technically cannot determine efficacy—both arms may have been equally ineffective, as suggested by the high rate of influenza in both groups. Similar rates of influenza of 23% have been described in unprotected healthcare workers during hospital influenza outbreaks.[46] Studies of nosocomial influenza generally describe lower attack rates than this second study, which suggests that targeted masks and respirators are equally inefficacious (rather than equally efficacious).[47]

The third trial, which investigated 1922 healthcare workers in China, compared continuous use of medical masks, N95 respirators (fit tested and not fit tested), and a control group.[9] N95 respirators protected against clinical respiratory infection (odds ratio 0.38, 0.17 to 0.86 but not against polymerase chain reaction (PCR) confirmed influenza.[9] Trends for all outcomes, including influenza, showed the highest infection rates in the control arm and the lowest in the N95 arm.

The fourth RCT, which looked at 1669 healthcare workers in China, compared continuous use of N95 respirators, targeted use of N95 respirators while doing high risk procedures, and continuous use of medical masks. The study showed efficacy of continuous N95 use against clinical respiratory infection (hazard ratio 0.39, 0.21 to 0.71) and bacterial colonisation (0.40, 0.21 to 0.73). No difference was seen between targeted N95 use and medical mask use, which suggests that a N95 respirator

Study, year of publication	Design, methods	Mask type, intervention	Outcome	Results	Comments, limitations, biases
Jacobs[7] 2009	• Block RCT • Tertiary care hospitals in Tokyo Japan, 2007 • 32 HCWs (2464 subject days)	• Medical masks • Control group	• Self reported cold symptoms	• No difference in outcome (cold symptoms) in intervention *v* control arm (P=0.81)	• Self reported compliance 84.3% • Small study • Underpowered • Symptoms self reported—not laboratory confirmed
Loeb et al[8] 2009	• Non-inferiority randomised clinical trial, no controls • 8 tertiary care hospitals in Ontario, Canada 2008-09 • 446 nurses	• Targeted use of medical masks • Fit tested N95 respirators	• Laboratory confirmed influenza infection assessed by PCR or seroconversion during 2008-09	• No difference in the outcome • Rate of mostly serologically defined influenza in the medical mask group 23.6% *v* 22.9% in the respirator group (absolute risk difference −0.73%, 95% CI −8.8% to −7.3%)	• No data on compliance • No control arm, no information on training or fit testing • Despite statement to the contrary, reported numerator and denominator data show that seropositive vaccinated subjects included in definition of "influenza" • Study was stopped early owing to influenza A/H1N1-pdm09, as respirator use became mandatory • Stated as "non-inferiority" but superiority of any tested intervention not previously proved in any RCT
MacIntyre[9] 2011	• Cluster RCT • 15 hospitals in Beijing China, 2008-09 • 1441 HCWs, 481 convenience controls	• Medical masks • N95 respirators (fit tested) • N95 respirators (not fit tested) • Convenience control group	• Self reported CRI • Self reported ILI • Laboratory confirmed viral infection and influenza by PCR	• Compared with medical masks, all outcomes were consistently lower for the N95 group • CRI (OR 0.38, 0.17 to 0.86) and laboratory confirmed viral infection (0.19, 0.05 to 0.67) significantly lower in N95 group	• Self reported compliance 68-86% • Use of convenience control group • N95 protective compared with medical masks (excluding controls) • Lack of power for PCR confirmed influenza
MacIntyre[10] 2013	• Cluster RCT, no controls • Beijing China 2010-11 • 1669 HCWs in 68 wards (19 hospitals)	• Continuous use of N95 respirators • Targeted use of N95 respirators for high risk situations • Continuous use of medical masks	• Self reported CRI • Self reported ILI • Laboratory confirmed viral infection and influenza by PCR	• Rates of CRI (HR 0.39, 0.21 to 0.71) and bacterial colonisation (0.40, 0.21 to 0.73) significantly lower in the continuous N95 respirator use arm	• Self reported compliance 57-82% • Lack of power for PCR confirmed influenza
MacIntyre[45] 2014*	• Cluster RCT • 15 hospitals in Beijing China, 2008-09 • 1441 HCWs	• Medical masks • N95 respirators (fit tested and not fit tested) • Convenience control group	• Laboratory confirmed bacterial colonisation	• Bacterial colonisation was significantly lower among HCWs who used N95 respirators (RR 0.34, 0.21 to 0.56) • Dual infections significantly lower in N95 arm	• Analysis of bacterial outcomes from previous RCT • Bacterial testing was done on symptomatic subjects only, so cannot determine if bacterial colonisation higher in symptomatic versus asymptomatic subjects

*Same as the RCT by MacIntyre,[9] but reports the outcome of bacterial infection.
CI=confidence interval; CRI=clinical respiratory infection; HCW=healthcare worker; HR=hazard ratio; ILI=influenza-like illness; OR=odds ratio; PCR=polymerase chain reaction; RCT=randomised controlled trial; RR=relative risk

Fig 1| Summary of high level evidence (GRADE guidelines) on facemasks and respirators in the healthcare setting

needs to be worn throughout the shift to be protective.[10] None of the four RCTs showed that medical masks were efficacious, although efficacy might have been at a lower level than the trials were able to detect.[9 10]

Bacterial colonisation

An analysis published in 2014 showed that laboratory confirmed bacterial colonisation (mainly *Streptococcus pneumoniae* and *Haemophilus influenzae*) is common in healthcare workers with symptoms of respiratory illness.[45] Importantly, N95 respirators significantly reduced the risk of bacterial colonisation by 62% compared with no mask and by 46% compared with medical masks, which were not efficacious. These findings may have important implications for policy and practice, but the role of respirators to help combat antibiotic resistant bacteria has not been tested in an RCT. The analysis also found that simultaneous infection of healthcare workers with two bacteria and a virus, or a bacterium and two viruses was common,[45] and that an N95 respirator significantly protected against dual infections.

Non-randomised studies

Lower levels of evidence are available from cohort,[48] case-control,[49-55] cross sectional,[56-61] laboratory experimental,[62-68] and observational (including time series and case series) studies.[69-78] Most were conducted during the severe acute respiratory syndrome (SARS) outbreak,[50-55 59-61 69 72-75 79] but others examined tuberculosis,[77 80 81] respiratory syncytial virus (RSV),[48] and pertussis.[58]

With a few exceptions,[53 60 74] evidence from SARS favoured the use of facemasks or respirators (or both) in healthcare workers. Respirators are generally recommended for tuberculosis, although most of these studies examined a combination of simultaneous infection control practices (environmental and source control measures).[77 80 81] No study has measured the efficacy of facemasks or respirators in preventing tuberculosis (either asymptomatic infection or disease) in healthcare workers. A small study found no significant difference in the rate of RSV between hand hygiene versus mask wearing or hand hygiene versus gown wearing.[48] An observational study showed that medical masks protected against nosocomial transmission of pertussis in staff and patients.[58]

In vivo studies report varying levels of filtration performance and protection for different types of barrier, with the degree of protection increasing from cloth masks, to medical masks, and finally to respirators.[37 64 68] Conflicting advice is given by different agencies for other infections such as Middle East respiratory syndrome coronavirus (MERS-CoV) and Ebola virus disease.[3 82]

Study, year of publication	Design, participants	Mask type, intervention	Outcome	Results	Comments, limitations, biases
Cowling[11] 2008	• Cluster RCT • 198 index cases and household contacts • Hong Kong	• Medical masks • Hand hygiene • Control	• Self reported influenza symptoms • Laboratory confirmed influenza (by culture or RT-PCR) in household	• No significant difference in rates of laboratory confirmed influenza (OR 1.16, 95% CI 0.31 to 4.34) and ILI (0.88, 0.34 to 2.27) in the medical masks arm versus control arm	• Both index cases and household contacts used medical masks • This pilot study was small and underpowered • Compliance 45% in index cases and 21% in household contacts • Compliance data showed that some index cases in the control and hand hygiene arms used medical masks
Cowling[12] 2009	• Cluster RCT • 407 index cases and 794 household contacts • Hong Kong	• Hand hygiene • Masks + hand hygiene • Control (education)	• Self reported influenza symptoms • Laboratory confirmed influenza (by RT-PCR) in household	• No significant difference in rate of laboratory confirmed influenza in three arms • Significant difference if masks + hand hygiene together applied within 36 hours of illness (OR 0.33, 0.13 to 0.87) • Hand hygiene alone was not significant	• No separate medical mask arm, making it difficult to evaluate the efficacy of masks • Both index cases and household contacts used masks • Compliance 49% in index cases and 26% in household contacts using masks • Compliance data showed that some index cases in the control and hand hygiene arms used medical masks
MacIntyre[13] 2009	• Cluster RCT • 145 child index cases and well adult household contacts • Australia	• Medical masks for contacts • P2 respirators (equivalent to N95) for contacts • Control	• Self reported ILI • Laboratory confirmed respiratory infection	• No significant difference in ILI and laboratory confirmed respiratory infections in all three arms • Adherent use of P2 or medical masks significantly reduced the risk of ILI (HR 0.26, 0.09 to 0.77)	• Only household contacts used medical masks • Low compliance: 21% of household contacts wore masks often/always
Aiello[14] 2010	• Cluster RCT • 1437 well university residents • Michigan, USA	• Medical masks • Medical masks + hand hygiene • Control	• Self reported ILI • Laboratory confirmed influenza (by culture or RT-PCR)	• No significant difference in ILI in three arms • Significant reduction in ILI in the medical masks + hand hygiene arm over 4-6 weeks (P<0.05)	• Self reported ILI • Not all ILI cases (n=368) were laboratory tested (n=94) • No data on compliance
Larson[15] 2010	• Block RCT • 617 households • Manhattan, USA	• HE • HE + hand sanitiser • HE + hand sanitiser + medical masks	• Self reported ILI • Self reported URI • Laboratory confirmed influenza through culture or PCR	• No significant difference in rates of URI, ILI, or laboratory confirmed influenza between the three arms • Significantly lower secondary attack rates of URI/ILI/influenza in the HE + hand sanitiser + medical mask arm (OR 0.82, 0.70 to 0.97).	• No separate medical masks group • Household contacts used medical masks • Low compliance and around half of household in the masks arm used masks within 48 hours • There was no index case at home
Canini[16] 2010	• Cluster RCT • 105 index cases and 306 households • France	• Medical mask (as source control to be used by index case) • Control	• Self reported ILI in household	• No significant difference in the rates of ILI between the two arms (OR 0.95, 0.44 to 2.05)	• Trial stopped early owing to low recruitment and influenza A/H1N1-pdm09 in subsequent year
Simmerman[17] 2011	• Cluster RCT • 465 index patients and their families • Thailand	• Hand hygiene • Hand hygiene + medical masks • Control	• Self reported ILI • Laboratory confirmed influenza by PCR and serology in family members	• No significant difference in secondary influenza infection rates between hand hygiene arm (OR 1.20, 0.76 to 1.88) and hand hygiene plus medial masks arm (1.16, 0.74 to 1.82)	• No separate medical mask group • Owing to H1N1 pandemic, hand and respiratory hygiene campaigns and mask use substantially increased among the index cases (from 4% to 52%) and families (from 17.6% to 67.7%) in control arm
Aiello[18] 2012	• Cluster RCT • 1178 university residents • Michigan, USA	• Medical masks • Medical masks + hand hygiene • Control	• Clinically diagnosed and laboratory confirmed influenza (by RT-PCR)	• No overall difference in ILI and laboratory confirmed influenza in three arms • Significant reduction in ILI in the medical masks + hand hygiene arm over 3-6 weeks (P<0.05)	• Good compliance: medical mask + hand hygiene group used masks for 5.08 h/day (SD 2.23) and medical mask group used masks for 5.04 h/day (SD 2.20) • Self reported ILI • Effect may have been due to hand hygiene because medical masks alone not significant
Suess[19] 2012	• Cluster RCT • 84 index cases and 218 household contacts • Berlin, Germany	• Masks • Masks + hand hygiene • Control	• Laboratory confirmed influenza infection and ILI	• No significant difference in rates of laboratory confirmed influenza and ILI in all arms by intention to treat analysis • The risk of influenza was significantly lower if data from two intervention arms (masks and masks + hand hygiene) were pooled and intervention was applied within 36 hours of the onset of symptoms (OR 0.16, 0.03 to 0.92)	• Around 50% participants wore masks "mostly" or "always" • Participants paid to provide respiratory samples

CI=confidence interval; CRI=clinical respiratory infection; HCW=healthcare worker; HE=health education; HR=hazard ratio; ILI=influenza-like illness; OR=odds ratio; PCR=polymerase chain reaction; RCT=randomised controlled trial; RR=relative risk. RT=reverse transcriptase; SD=standard deviation; URI=upper respiratory tract infection.

Fig 2| Summary of high level evidence (GRADE guidelines) on facemasks in the household setting

Role of cloth masks

Cloth masks are commonly used in developing countries and many non-standard practices around cleaning and reuse have evolved. However, no RCTs of cloth masks have been published. Most studies were conducted before the development of disposable masks.[23] Data on the use of cloth masks for the prevention of diphtheria, measles, and tuberculosis are limited and outdated.[24 25 29] The penetration through cloth is reported to be high—40-90% of particles penetrated in one study.[63] Without an RCT it is unclear whether cloth masks provide clinical protection. Given their widespread use in developing countries, including Asia, where the risk of emerging infectious diseases is high, research on the clinical efficacy of cloth masks is needed. Healthcare workers in the west African Ebola outbreak use cloth masks when other supplies are not available (personal communication, W Beckley, 2014). Guidelines make cautious recommendations about the use of such masks when medical masks and respirators are in high demand and supplies are exhausted.[83 84]

Facemasks as source control

Facemasks were first used in operating theatres to maintain a sterile operating field and to prevent transmission of infection from surgeons to patients. However, studies fail to show any efficacy for this indication.[85-87] Only one randomly controlled clinical trial reported high infection rates after gynaecological and abdominal surgery—three of five women developed infection in the "no mask" group compared with no infections in the four women operated on by a masked surgeon.[88] Guidelines have recommended medical masks for use in operating theatres to protect staff from the splash and spray of blood and body fluids.[89] A visor or protective face shield may be used, subject to adequate air circulation and ventilation,[90] but no studies have directly compared these options. Although the use of facemasks for source control has not been proved in the operating theatre setting, their use is standard across most healthcare sites.

As source control, facemasks are also used by sick people to prevent the spread of infection to others. An experimental study showed that the spread of influenza virus from a sick patient may be reduced by the patient wearing a facemask or a respirator.[91] A study on volunteers with influenza-like illnesses symptoms reported a more than threefold reduction of viral particles in exhaled samples with use of medical masks.[92] During the SARS outbreak, medical and cloth masks were used as source control and were reported to be effective.[61] Evidence shows that the use of facemasks by infective patients with tuberculosis reduces the risk of tuberculosis transmission.[93] Despite the lack of data from human clinical trials, medical masks are highly recommended by WHO, the CDC, and the ECDC for source control in tuberculosis.[44 94 95]

The use of facemasks in the community setting

Facemasks are used in the community in Asian countries, not only to protect people from acquiring respiratory infections but also to minimise spread of infection from the wearer. Such use often increases during outbreaks and pandemics. Cloth masks were reportedly used by the general public during the 1918 influenza pandemic.[26 27] During the SARS outbreaks, masks were widely used in diverse community settings.[96 97]

Efficacy of facemasks in the community

We identified nine RCTs of facemasks in various household and community settings,[11-19] and in all but one they were used for respiratory protection. In one household trial the use of facemasks was tested as source control to prevent the spread of infections from the wearer.[16] These RCTs had diverse settings, designs, and interventions—many of which were mixed, such as hand washing and facemasks (fig 2).

An RCT in Hong Kong randomised index cases (198 laboratory confirmed influenza cases) and their households into medical masks, hand hygiene, or a control arm. Rates of laboratory confirmed influenza and influenza-like illness were not significantly different in the medical mask arm versus the control arm (influenza: odds ratio 1.16, 0.31 to 4.34; influenza-like illness: 0.88, 0.34 to 2.27).[11] In a second trial by the same group, medical masks plus hand hygiene and hand hygiene alone groups were compared with a control group (total 407 index cases). There was no significant difference across the three arms, although medical masks plus hand hygiene were protective when the intervention was implemented early (within 36 hours of onset of symptoms in the index case, adjusted odds ratio 0.33, 0.13 to 0.87).[12]

An Australian study randomised 145 index cases and their household members to one of three arms—medical masks, P2 respirators (equivalent to N95), or control.[13] In contrast to the second trial above, where both index cases and household members used a mask,[12] only household contacts used a medical mask in this study. No significant difference in the risk of influenza-like illness was seen between the three arms in the per protocol analysis, but risk was significantly lower with the adherent use of P2 or medical masks (hazard ratio 0.26, 0.09 to 0.77).[13]

Two RCTs in university residence halls in the United States over two influenza seasons randomised well students into medical masks plus hand hygiene, medical masks alone, or control.[14 18] Influenza-like illness and laboratory confirmed influenza were not significantly reduced after either intervention, although during the first four to six weeks, influenza-like illness was significantly lower in the medical masks plus hand hygiene arm in both trials ($P<0.05$).[14 18] This suggests that hand hygiene might have been the major contributor to protection.

An RCT in the US randomised 617 households to education, hand sanitiser alone, or hand sanitiser plus medical masks. Although the rates of upper respiratory tract infections, influenza-like illness, and laboratory confirmed influenza were low in the hand sanitiser and hand sanitiser plus medical masks groups, the difference was not significant after adjusting for other factors. However, the hand sanitiser plus medical masks group had significantly lower secondary attack rates for influenza, influenza-like illness, and upper respiratory tract infections (odds ratio 0.82, 0.70 to 0.97) compared with the education group. Results for the hand sanitiser only group were not significant (1.01, 0.85 to 1.21).[15]

Table 1 | Summary indications for use of masks and respirators for selected infectious diseases

	Healthcare setting*		Community setting†	
Disease	Low risk	High risk	Low risk	High risk
Seasonal influenza	First choice: medical mask‡§; Second choice: cloth mask**	First choice: respirator‡§; Second choice: medical mask**; Third choice: cloth mask**	Not recommended‡§	Not recommended‡§
Pandemic influenza	First choice: respirator‡ or medical mask§; Second choice: cloth mask**	First choice: respirator‡§; Second choice: medical mask**; Third choice: cloth mask**	Not recommended‡§	First choice: medical mask‡§; Second choice: cloth masks**
MERS-CoV	First choice: respirator‡ or medical mask§	First choice: respirator‡§	Not recommended	Not recommended
Tuberculosis	First choice: respirator‡§	First choice: respirator‡§	Not recommended‡§	Not recommended*†
Ebola virus	First choice: respirator‡ or medical mask§; Second choice: cloth mask**	First choice: respirator‡§; Second choice: medical mask**; Third choice: cloth mask**	Not recommended§	First choice: medical mask§; Second choice: cloth masks**

*Low risk: routine patient care, not within 1-2 m of infective patient; High risk: high risk procedures such as aerosol generating procedures, new or drug resistance organism.
†Low risk: home, non-crowded settings; high risk: crowded settings (such as public transport), pre-existing illness, pregnancy, older age (pandemic influenza), contact with human remains or infected animals (Ebola virus).
‡Centres for Disease Control and Prevention (CDC).
§World Health Organization.
**Not stated explicitly—inference drawn from Institute of Medicine (IOM) guidelines and other policy documents prepared for low recourse settings (As efficacy data is not available, cloth masks should be used only when no other option is available).
MERS-CoV=Middle East respiratory syndrome coronavirus.

An RCT in Thailand randomised 465 index patients and their families to hand hygiene, hand hygiene plus medical masks, and a control arm. No significant difference between secondary influenza rate was seen.[17]

In a cluster randomised controlled trial in Germany, 84 index cases and 218 household contacts were randomised into a mask arm, masks plus hand hygiene arm, and a control arm. There was no significant difference in rates of laboratory confirmed influenza and influenza-like illness in all arms by intention to treat analysis. However, the risk of influenza was significantly lower if the data from two intervention arms were pooled and the intervention was applied within 36 hours of the onset of symptoms (odds ratio 0.16, 0.03 to 0.92).[19]

A household trial in France examined the role of medical masks as source control—index patients were randomised into medical mask (52 household and 148 contacts) and control groups (53 household and 158 contacts). There was no difference between the groups (0.95, 0.44 to 2.05), and the trial was finished early owing to low recruitment and subsequent H1N1-pdm09 infection.[16]

Community use of facemasks during outbreaks and pandemics

The routine use of facemasks is not recommended by WHO, the CDC, or the ECDC in the community setting.[98-100] However, the use of facemasks is recommended in crowded settings (such as public transport) and for those at high risk (older people, pregnant women, and those with a medical condition) during an outbreak or pandemic.[98 99]

A modelling study suggests that the use of facemasks in the community may help delay and contain a pandemic, although efficacy estimates were not based on RCT data.[101] Community masks were protective during the SARS outbreaks, and about 76% of the population used a facemask in Hong Kong.[102] There is evidence that masks have efficacy in the community setting, subject to compliance[13] and early use.[12 18 19] It has been shown that compliance in the household setting decreases with each day of mask use, however, which makes long term use over weeks or months a challenge.[13]

The statistical power of each individual RCT may have been too low to determine efficacy by intention to treat, and larger trials may be needed. A meta-analysis of the existing community trials would be difficult because of the diverse settings, interventions, outcomes, and measurements. The study designs of all but one of the RCTs used mixed interventions, where one intervention was present in both intervention arms (such as hand hygiene alone compared with masks plus hand hygiene; fig 2), which makes it more difficult to determine the efficacy of masks alone.

Choice of facemask versus respirator

In communities where facemasks are commonly used, such as in Asia, the choice is between medical masks and cloth masks. In the healthcare setting, the choice is between respirators or medical masks in developed countries, and between respirators, medical masks, or cloth masks in developing countries (table 1). In the healthcare sector the purpose of PPE is the occupational health and safety of healthcare workers, and the choice should be made using a risk analysis framework.[3] The framework should be based on expected mode of transmission, level of exposure or risk, severity of the disease in question, availability of other preventive or therapeutic agents, and uncertainty about transmission. Cost considerations, organisational factors, and individual factors (such as compliance) may affect implementation but should not drive best practice guidelines. In developing countries, the cost of N95 respirators may limit their use, and cloth masks are popular because they can be cleaned and reused.

Table 2 | Primary modes of transmission of respiratory infections

Presumed main mode of transmission	Examples of virus	Examples of bacteria
Droplet	Influenza virus A and B*, coronavirus*	*Streptococcus pneumoniae*, *Haemophilus influenzae*
Airborne	Rhinovirus A and B	Tuberculosis, *Bordetella pertussis**
Contact	Adenovirus, parainfluenza virus, respiratory syncytial virus, Middle East respiratory syndrome coronavirus*	

*Primary mode is by droplet transmission, but airborne transmission may occur in high risk situations.

Transmission modes

Infectious diseases can spread though droplets, respiratory aerosols, or direct and indirect contact with contaminated surfaces (table 2). Droplets are large

particles (>5 μm), generally emitted while coughing or sneezing, which do not remain suspended in the air, whereas aerosols are small particles (<5 μm), which can remain suspended in the air for several hours and transmit infection over long distances.[2 103]

A medical mask is theoretically sufficient to prevent droplet infection, whereas a respirator is needed to prevent airborne infection. In terms of facemask use, the physical barrier may also prevent contact transmission such as hand to face, mouth, or nose. A facemask or a respirator may provide protection against multiple modes of transmission, including droplet, airborne, and hand to mouth (or nose) transmission.

The relative contribution of each mode is difficult to quantify and is controversial,[104 105] but the debate about mode of transmission is academic if an intervention is shown to prevent infection in a clinical trial. Clinical efficacy data should take precedence over theoretical debates about modes of transmission, which have long dominated the discourse on PPE.

The current paradigm of droplet and airborne transmission is based on outmoded experiments from the 1950s, done using outdated equipment, and it oversimplifies the complexity of pathogen transmission.[106] Enough evidence exists for us to know that pathogens are not transmitted by three mutually exclusive routes, and that the term "aerosol transmissible" is preferable to droplet or airborne.[106] For example, evidence exists that influenza, which has been thought of as predominantly droplet spread,[104] can also be spread by the airborne route.[103 105 107] Pathogens that are spread predominantly through droplets do not need to travel long distances in air currents (as in the current definition of airborne) to be inhaled and cause infection. They can be transmitted in short range aerosols, for which a facemask does not offer sufficient protection.[106]

It is further argued that aerosol transmission and airborne transmission are not the same. Airborne transmission can occur through inhalation of small infectious particles at long or short distances from the infectious person, even in the absence of aerosols or aerosol generating procedures owing to evaporation of larger droplets.[106] Diseases transmitted mainly through the airborne route, such as tuberculosis, require a properly fitted N95 or higher respirator. Aerosol transmission may also occur during high risk procedures with organisms that are normally transmitted by other routes. Similarly, evidence suggests that infective aerosols may be generated from vomitus and faecal matter in people infected with norovirus and SARS.[108-111] Respirators have also been shown to be more effective against aerosol transmission.[112]

When the transmission dynamics of a newly emergent infection are unknown, a respirator should be used as a precaution.[44] For example, respirators were initially recommended for SARS and H1N1-pdm09,[99 113] but recommendations were later changed in favour of masks.[44 114] It is unclear what evidence underpinned this change.

High risk situations

Healthcare workers who undertake high risk aerosol generating procedures have a threefold higher risk of acquiring nosocomial respiratory infections than those who do not.[112] WHO and the CDC recommend medical masks to protect from seasonal influenza; however, a respirator is recommended when high risk procedures are performed.[44 115] Recent debate about "surgical smoke" (aerosols generated during surgery that uses lasers or diathermy) indicates that superior respiratory protection is needed for operating theatre staff.[116]

During the SARS epidemic, high risk procedures put healthcare workers at high risk of acquiring infection.[117] In a study in Hong Kong, none of the staff who wore medical masks or respirators became infected. However, the study excluded one hospital in which cases occurred as a result of a high risk procedure (drug nebulisation), and the authors concluded that medical masks are sufficient to protect against SARS if there is no risk of aerosol transmission.[50] Inconsistent use of N95 respirators was not associated with the acquisition of infection during the SARS outbreak in the US, and this was attributed to low rates of aerosol generating procedures.[60] In the Ebola virus outbreak of 2014, the CDC and other agencies changed their guidelines from surgical masks to respirators after nurses became infected.[118]

Organisational and individual factors

Organisational and individual factors play a role in use of respiratory protection. Healthcare workers may be limited by what is available in the workplace. Availability, cost, and the ability to conduct annual fit testing are important.

Few options are available in most low resource settings, and healthcare workers may have to buy their own masks.[119] During the H1N1-pdm09 pandemic, the supply of respirators was exhausted in many hospitals, and healthcare workers had to reuse respirators or rely on other types of facemask.[120 121]

Current stockpiling guidelines are based on assumptions about the size and duration of a pandemic, hospital stay, number of healthcare workers, and length of shifts,[122] but these may be inaccurate.[123 124] It has been documented that non-standard practices occur during outbreaks, especially when there is a shortage of supplies.[119] There is very little research on such practices, which include reuse, cleaning of facemasks, and double masking.[125]

The balance between risk perception and discomfort affects individual decisions to use facemasks and respirators. When the risk of infection is thought to be high, acceptance and compliance with interventions to prevent infection are generally higher.[126] Compliance was reported to be high during the initial phase of the H1N1-pdm09 pandemic, when risk perception was high, but it later decreased when healthcare workers thought that the pandemic was less severe than initially estimated.[121]

In countries that have experienced epidemics such as SARS, mask wearing is more acceptable, but it is not commonplace in countries such as the UK, US, and Australia.[127] Compliance with the wearing of facemasks is lower than for other PPE,[128 129] and it decreases with increased duration of use.[9] Compared with medical masks, respirators are associated with more adverse effects, such as discomfort, headache, skin irritation,

and pressure on the nose.[9 10] However, in China, despite healthcare workers reporting the same level of discomfort with respirators as in Western countries, compliance remains high.[9 10 127] Discomfort is therefore not the sole determinant of compliance, which is also influenced by cultural factors, risk perception, and experience of serious outbreaks such as SARS.

Healthcare workers are known to be poorly compliant with other infection control interventions, such as hand hygiene and vaccination, which points to a particularly challenging organisational culture.[130 131] A supportive organisational environment, promotion of a safety culture, regular communication, availability of respiratory protective equipment, and training programmes improve compliance.[56 132-134] Legislation may also work—New York State recently passed legislation that compels all frontline healthcare workers to either receive influenza vaccination or use a facemask.[135]

Regulations, training, and fit testing of respirators

The optimal use of respirators requires selection of certified respirators, training and fit testing, and inspection, as well as suitable maintenance and storage of the equipment.[136] Certified respirators should be used in the healthcare setting, and the certification process should be managed by a regulatory body, such as the US National Institute for Occupational Safety and Health (NIOSH).[137] In Europe, European Norm (EN) standards and in Australia, AS/NZS 1716 standards regulate the use of respirators.[138 139]

Low resource countries may lack the resources to manage the regulation and certification process. A recent survey of 89 hospital in low to middle income countries showed that very few hospitals used certified respirators, and where used the various types of respirators were of unknown quality (unpublished data).

Training, fit checking (previously known as user seal checking), and fit testing are vital components of any respiratory protection programme, which must ensure a seal between the respirator and the face so that air does not leak out. Healthcare workers should be trained in donning (order and methods of putting on facemasks and respirators) and doffing (order and methods of removing facemasks and respirators) techniques so that they do not contaminate themselves. Fit checking is a qualitative process and not a substitute for fit testing; it should be done every time a respirator is donned to ensure that it is sealed to the face, with no gap between the face and the respirator.[140]

Fit testing ensures that the specific type (for example, model and size) of respirator is suitable for the wearer. Fit testing can be quantitative or qualitative, with the second option being cheaper for most workplaces.[141] Qualitative fit test is performed by releasing a bitter or sweet agent into an exposure chamber to test whether the wearer can taste the agent.[141] This test is easy to perform but indicates lack of fit only and does not measure leakage around the respirator.

In the quantitative test, air sampling is performed from inside the respirator through a fit testing instrument and the amount of leakage is calculated.[141] No clinical data are available to support the use of fit testing—the recommendation to fit test is based on laboratory evidence. The efficacy of a respirator is thought to improve with fit testing,[142] but the only trial to compare fit tested and non-fit tested respirators showed no difference in efficacy with fit testing.[9] These results are specific to the respirator used in that trial and cannot be generalised to other respirators because respirators are regulated for filtration only and not for fit, which varies widely between products.

In vivo studies showed that properly fitted respirators decrease the risk of infection transmission and block most viral particles.[142] Fit testing is recommended annually, because weight gain or changes in facial shape or size can change the adequacy of fit.

Current data suggest that rates of fit checking and fit testing are low among healthcare workers.[143 144] Surveys of health professionals and home based healthcare workers in the US showed that respirators were supplied to most during the H1N1-pdm09 pandemic, but that less than a third were fit tested.[145 146] Various types of respirators were fit tested in an Australian study and 28% of healthcare workers were unable to fit any available respirator owing to variations in face shape.[147]

Policies and guidelines around the use of facemasks and respirators

Different health organisations and countries have diverse policies and guidelines on the use of facemasks and respirators.[3 148] WHO and the CDC have consistent policies for the use of facemasks and respirators to protect against seasonal influenza and tuberculosis,[44 94 115 149] but policies for pandemic influenza are inconsistent.[44 150]

For seasonal influenza, both organisations recommend medical masks in low risk situations and N95 respirators in high risk situations, such as aerosol generating procedures. For some other infections, such as Ebola virus, MERS-CoV, and during an influenza pandemic, WHO recommends the use of medical masks in low risk situations and N95 respirators in high risk situations,[44 151 152] whereas, the CDC now recommends respirators in both situations.[82 118 150] Respirators are recommended by both organisations to protect healthcare workers from tuberculosis.[94 149]

High, middle, and low income countries also have diverse policies on the use of facemasks and adopt variations on WHO or CDC guidelines depending on resources and occupational health and safety legislation.[148 153] For Ebola virus, which is mostly spread by contact, WHO and many countries recommend a medical mask, but this recommendation has been challenged on multiple grounds.[3] No RCTs have compared respirators with facemasks for Ebola, but several healthcare workers have contracted Ebola while using PPE.[154] Many countries look to the WHO and CDC guidelines to model their own guidelines. The CDC remains highly influential for developed countries, Australia being an example.

Different policy recommendations may reflect the paucity of evidence and varying results of the few available RCTs of facemasks in the healthcare setting. However, for end users in the hospital setting, the conflicting guidance from different sources (such as WHO and the CDC)

RESEARCH QUESTIONS

How efficacious are various types of facemasks and respirators to protect against specific infections such as influenza, tuberculosis, and Ebola virus?

What research exists on common clinical practices such as cloth mask use, mask reuse, extended use, and double masking?

What strategies can help improve compliance and use?

What is the comparative cost effectiveness of respirators versus facemasks?

is not ideal. A US study showed that healthcare workers used various types of facemasks and respirators during the H1N1-pdm09 pandemic as a result of the conflicting guidance from WHO and the CDC.[121]

Despite widespread use in low resource settings, most guidelines do not cover or only briefly mention cloth masks.[23] In addition, most policy documents do not discuss recommendations on the extended use and reuse of facemasks and respirators.[148]

Research gaps

Limitations of existing evidence

Clinical trials of facemasks report a range of outcomes from self reported clinical syndromes to laboratory confirmed viruses,[7-13 15-19] which might not be generalisable to other specific infectious diseases. Cross sectional and observational studies of masks largely draw from the SARS outbreak, and may not be applicable to other pathogens,[36] because SARS was less infectious than many other respiratory infections and was mostly nosocomial.[155]

Laboratory based studies of masks are mostly simulated and so have limited clinical application because they cannot account for events such as compliance, coughing, talking, and other subtle actions by the wearer. Although masks and respirators are commonly used to protect the wearer against tuberculosis, no clinical trial data are available to prove their efficacy, and a trial of respirators versus a "no mask" group is unlikely to be conducted. Elastomeric respirators (reusable full face respirators with a changeable cartridge) and powered air purifying respirators are increasingly recommended in the healthcare setting but have not been tested in an RCT.[148]

Another limitation of the available facemask studies is the mixing of interventions. In four trials in the community setting facemasks were combined with hand hygiene as an intervention, which makes it difficult to ascertain the efficacy of masks alone.[12 15 17 18]

Most studies failed to control for other infection control measures (administrative and environmental controls) and the use of other types of PPE, and compliance was variably accounted for.

Many observational and cross sectional studies also examined facemasks together with other forms of PPE and hand hygiene, so the observed effect might be due to the combined effect of hand hygiene or use of other types of PPE (or both).[48 58 70 73 75] Similarly, in some community based trials both index cases and household members used a mask,[12] whereas in others only household members used a mask.[13] In the first case, it may be difficult to ascertain whether efficacy is due to mask use by the index case, by a household member, or by both.

RCTS of facemasks are difficult to design and conduct owing to the complexity of follow-up and measurement of infection outcomes, the statistical power needed to examine outcomes such as influenza, and the difficulty in identifying settings where adequate compliance can be achieved to make a trial feasible. In most clinical trials, controls followed routine practice, and trials without a control arm cannot determine efficacy if no difference is found between interventions. The use of facemasks and respirators in the non-hospital healthcare setting (for example, in home based healthcare workers, nursing homes, paramedics, and ambulatory clinics) has not been studied.

New research

For influenza, further study is needed on the role of facemasks and other types of PPE in the hierarchy of other interventions such as vaccines, antivirals, and social distancing in pandemic planning. In general, a matched pandemic vaccine will not be available for three to six months after the emergence of a new pandemic influenza strain, so masks and respirators—along with other non-pharmaceutical measures and antivirals—will be particularly important in the early phase of a pandemic. The type of product used, estimated stockpiling, and role of extended use and reuse are important factors to consider. Cloth masks may be the only option for some countries, and their role in healthcare and community settings needs also to be further explored.

Studies should also be conducted on the storage of facemasks and respirators and stockpiling for pandemics. The shelf life of respirators is around three years, whereas medical masks have no specified shelf life.[123]

Given the large cost differential between respirators and masks, health economic studies that incorporate clinical efficacy data are needed to determine cost effectiveness.

Finally, more education and research are needed on modes of transmission to supersede the blunt experiments of the 1950s, the findings of which have become entrenched in the dogma on hospital infection control.[106] Old paradigms around droplet, airborne, and contact spread need to be reviewed when formulating guidelines to take into account clinical data that prove multi-modal spread for many pathogens.[103 105 107]

Conclusion

Facemasks and respirators are important but under-studied forms of PPE, which offer protection against respiratory infections. They may be the only available protection for healthcare workers when no drugs or vaccines are available and the mode of transmission is unknown.

Community RCTs suggest that facemasks provide protection against infection in various community settings, subject to compliance and early use. For healthcare workers, the evidence suggests that respirators offer superior protection to facemasks. During pandemics and outbreaks these form part of a suite of protection offered to frontline workers to ensure occupational health and

safety. Respirators are also preferable when the disease is severe, with a high case fatality rate, and no drug treatment or vaccine is available.[3]

In developed countries, the choice for healthcare workers is between disposable masks and respirators, whereas in developing countries reusable cloth masks are also widely used in hospitals. RCTs on cloth masks are lacking, and policy guidance on their use is sparse.

Compliance is a determinant of protection, and it decreases with increasing duration of continuous mask use. Policies and guidelines on mask use worldwide are inconsistent, perhaps reflecting the relatively small number of RCTs available to inform them.

Ultimately the greatest priority is to provide evidence based choices for healthcare workers, whose occupational health and safety must be protected to ensure integrity and an effective response during an epidemic.

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Study, year of publication	Design, participants	Mask type, intervention	Outcome	Results	Comments, limitations, biases
Cowling[11] 2008	• Cluster RCT • 198 index cases and household contacts • Hong Kong	• Medical masks • Hand hygiene • Control	• Self reported influenza symptoms • Laboratory confirmed influenza (by culture or RT-PCR) in household	• No significant difference in rates of laboratory confirmed influenza (OR 1.16, 95% CI 0.31 to 4.34) and ILI (0.88, 0.34 to 2.27) in the medical masks arm versus control arm	• Both index cases and household contacts used medical masks • This pilot study was small and underpowered • Compliance 45% in index cases and 21% in household contacts • Compliance data showed that some index cases in the control and hand hygiene arms used medical masks
Cowling[12] 2009	• Cluster RCT • 407 index cases and 794 household contacts • Hong Kong	• Hand hygiene • Masks + hand hygiene • Control (education)	• Self reported influenza symptoms • Laboratory confirmed influenza (by RT-PCR) in household	• No significant difference in rate of laboratory confirmed influenza in three arms • Significant difference if masks + hand hygiene together applied within 36 hours of illness (OR 0.33, 0.13 to 0.87) • Hand hygiene alone was not significant	• No separate medical mask arm, making it difficult to evaluate the efficacy of masks • Both index cases and household contacts used masks • Compliance 49% in index cases and 26% in household contacts using masks • Compliance data showed that some index cases in the control and hand hygiene arms used medical masks
MacIntyre[13] 2009	• Cluster RCT • 145 child index cases and well adult household contacts • Australia	• Medical masks for contacts • P2 respirators (equivalent to N95) for contacts • Control	• Self reported ILI • Laboratory confirmed respiratory infection	• No significant difference in ILI and laboratory confirmed respiratory infections in all three arms • Adherent use of P2 or medical masks significantly reduced the risk of ILI (HR 0.26, 0.09 to 0.77)	• Only household contacts used medical masks • Low compliance: 11% of household contacts wore masks often/always
Aiello[14] 2010	• Cluster RCT • 1437 well university residents • Michigan, USA	• Medical masks • Medical masks + hand hygiene • Control	• Self reported ILI • Laboratory confirmed influenza (by culture or RT-PCR)	• No significant difference in ILI in three arms • Significant reduction in ILI in the medical masks + hand hygiene arm over 4-6 weeks (P<0.05)	• Self reported ILI • Not all ILI cases (n=368) were laboratory tested (n=94) • No data on compliance
Larson[15] 2010	• Block RCT • 617 households • Manhattan, USA	• HE • HE + hand sanitiser • HE + hand sanitiser + medical masks	• Self reported ILI • Self reported URI • Laboratory confirmed influenza through culture or PCR	• No significant difference in rates of URI, ILI, or laboratory confirmed influenza between the three arms • Significantly lower secondary attack rates of URI/ILI/influenza in the HE + hand sanitiser + medical mask arm (OR 0.82, 0.70 to 0.97).	• No separate medical masks group • Household contacts used medical masks • Low compliance and around half of household in the masks arm used masks within 48 hours • There was no index case at home
Cowling[16] 2010	• Cluster RCT • 105 index cases and 336 households • France	• Medical mask (as source control to be used by index case) • Control	• Self reported ILI in household	• No significant difference in the rates of ILI between the two arms (OR 0.95, 0.44 to 2.05)	• Trial stopped early owing to low recruitment and influenza A/H1N1-pdm09 in subsequent year
Simmerman[17] 2011	• Cluster RCT • 465 index patients and their families • Thailand	• Hand hygiene • Hand hygiene + medical masks • Control	• Self reported ILI • Laboratory confirmed influenza by PCR and serology in family members	• No significant difference in secondary influenza infection rates between hand hygiene arm (OR 1.20, 0.76 to 1.88) and hand hygiene plus medal masks arm (1.16, 0.74 to 1.82)	• No separate medical mask group • Owing to H1N1 pandemic, hand and respiratory hygiene campaigns and mask use substantially increased among the index cases (from 4% to 52%) and families (from 17.6% to 67.7%) in control arm
Aiello[18] 2012	• Cluster RCT • 1178 university residents • Michigan, USA	• Medical masks • Medical masks + hand hygiene • Control	• Clinically diagnosed and laboratory confirmed influenza (by RT-PCR)	• No overall difference in ILI and laboratory confirmed influenza in three arms • Significant reduction in ILI in the medical masks + hand hygiene arm over 3-6 weeks (P<0.05)	• Good compliance: medical mask + hand hygiene group used masks for 5.08 h/day (SD 2.13) and medical mask group used masks for 5.04 h/day (SD 2.20) • Self reported ILI • Effect may have been due to hand hygiene because medical masks alone not significant
Suess[19] 2012	• Cluster RCT • 84 index cases and 218 household contacts • Berlin, Germany	• Masks • Masks + hand hygiene • Control	• Laboratory confirmed influenza infection and ILI	• No significant difference in rates of laboratory confirmed influenza and ILI in all arms by intention to treat analysis • The risk of influenza was significantly lower if data from two intervention arms (masks and masks + hand hygiene) were pooled and intervention was applied within 36 hours of the onset of symptoms (OR 0.16, 0.03 to 0.92)	• Around 50% participants wore masks "mostly" or "always" • Participants paid to provide respiratory samples

CI=confidence interval; CRI=clinical respiratory infection; HCW=healthcare worker; HE=health education; HR=hazard ratio; ILI=influenza-like illness; OR=odds ratio; PCR=polymerase chain reaction; RCT=randomised controlled trial; RR=relative risk. RT=reverse transcriptase; SD=standard deviation; URI=upper respiratory tract infection.

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Sun, 12 Jul 2020 15:16:44 +0000
To: (b) (6)
Subject: FW: NIH-Wide Strategic Plan for COVID-19 Research
Attachments: 2020-07-10_COVID-StratPlan_508_final_final_2.pdf

What level of involvement di we (NIAID) have in the formulation of the NIH-wide Strategic Plan?

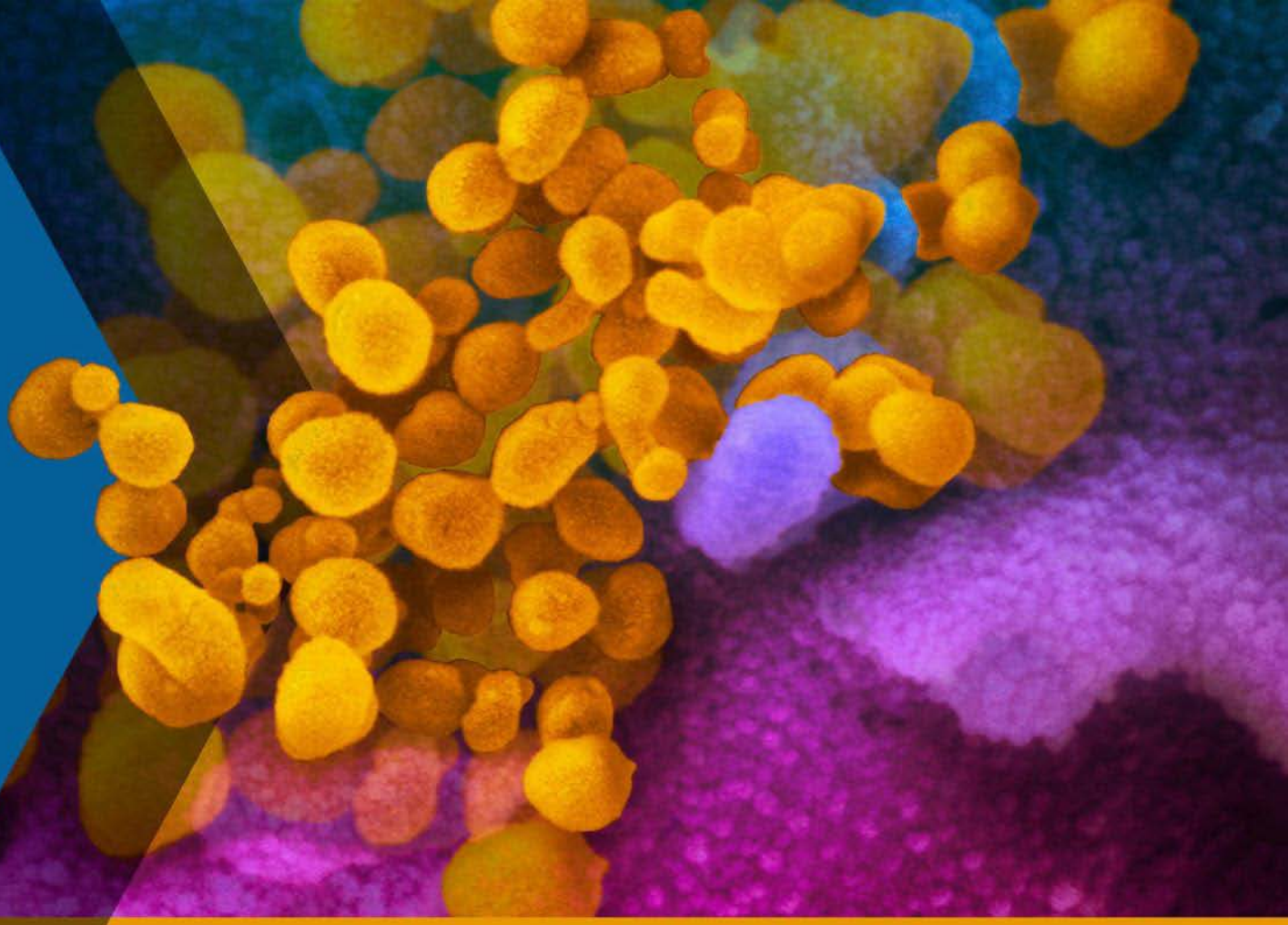
From: Schwetz, Tara (NIH/OD) [E] (b) (6)
Sent: Saturday, July 11, 2020 11:15 PM
To: ICDDIR-L@list.nih.gov; NIH Director's Executive Committee <OD-SmallStaff@mail.nih.gov>; List DEPDIR-L <DEPDIR-L@list.nih.gov>
Cc: Walsh, Elizabeth (NIH/OD) [E] (b) (6); Volkov, Marina (NIH/OD) [E] (b) (6)
Subject: NIH-Wide Strategic Plan for COVID-19 Research

Good morning,

Please find attached a copy of the finalized NIH-Wide Strategic Plan for COVID-19 Research. The plan will be announced and made available on the main NIH COVID-19 site tomorrow, Monday, July 13. A link to the plan will be available on OER's Strategic Plan page later in the week. Many thanks to everyone across NIH who contributed to drafting the plan!

Best,

Tara A. Schwetz, PhD
Associate Deputy Director, NIH
Acting Director, NINR
A: Building 1, Room 138
P: (b) (6) | **M:** (b) (6)



NIH-Wide Strategic Plan for

COVID-19 Research

July 2020

National Institutes of Health

Cover Image

Novel Coronavirus SARS-CoV-2

This scanning electron microscope image shows SARS-CoV-2 (yellow)—also known as 2019-nCoV, the virus that causes COVID-19—isolated from a patient in the United States, emerging from the surface of cells (blue/pink) cultured in the laboratory.

Credit: Rocky Mountain Laboratories, National Institute of Allergy and Infectious Diseases, NIH

FOREWORD

To the American People,

With the aim of turning discovery into better health for all, the National Institutes of Health (NIH) invests in biomedical research that spurs innovations in science and technology. NIH research has proven its value to the United States and the world over the years by rising to meet the challenges of polio, AIDS, and many other formidable health foes. Now, we face what may be the greatest public health crisis of our generation: coronavirus disease 2019 (COVID-19).

To address the unprecedented challenge that the COVID-19 pandemic poses to our health and economy, it is imperative that NIH and all sectors of society work together in unprecedented ways with unprecedented speed. Enabled by the strong support of Congress and other partners in the public and private sectors, NIH has mounted a vigorous research response against COVID-19 since the beginning of the pandemic. The breathtaking pace and scope of this response has been made possible by decades of NIH-funded basic research, which built a priceless foundation for the current efforts to combat COVID-19.

In this strategic plan for COVID-19 research, NIH shares its framework for funding work across the scientific spectrum. Our mission is to ensure that no stone goes unturned in the scientific response to COVID-19, as well as to inspire the collective efforts of NIH's researchers, collaborators, and diverse stakeholders. We will carry out this mission by improving, advancing, and optimizing COVID-19-related research in five key areas: fundamental knowledge, detection and diagnosis, treatment, prevention, and health disparities. Given the urgency of this health threat and the pressing need to develop tools to help people return to their daily routines safely, our mindsets must go far beyond "business as usual." Among the out-of-the-box initiatives now underway under NIH's leadership is a highly innovative, competitive effort to expand capacity and accuracy of testing and an unprecedented public-private partnership to accelerate development of therapeutics and vaccines. NIH research also will tackle the disturbing disparities seen in the COVID-19 response, with the aim of developing effective, evidence-based methods to ensure that diagnostics, treatments, and vaccines reach all populations, particularly those disproportionately affected by this devastating disease.

NIH acknowledges that the goals set forth in this plan are very ambitious and the scientific and logistical challenges truly daunting. Yet, we remain optimistic because of our agency's strong track record of encouraging ingenuity, even in the most difficult of times. We are convinced that pulling together the best minds in science is the best way to meet the twin challenges of curtailing the COVID-19 pandemic and preparing us to respond far better to future pandemics.

Sincerely,

Francis S. Collins, M.D., Ph.D.
Director, National Institutes of Health

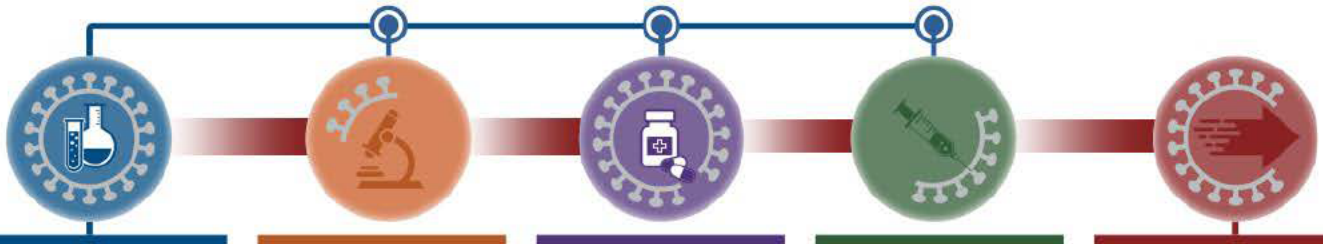
NIH-Wide Strategic Plan for COVID-19 Research

A BOLD COMMITMENT TO AN UNPRECEDENTED HEALTH CHALLENGE

GOALS

- **UNDERSTAND** SARS-CoV-2 and COVID-19
- **PREVENT** SARS-CoV-2 infection
- **DETECT and TREAT** COVID-19
- **MITIGATE** the threat of COVID-19

Guided by FIVE STRATEGIC PRIORITIES



PRIORITY 1

Improve Fundamental Knowledge

of SARS-CoV-2 and COVID-19 disease progression, outcomes, and recovery

PRIORITY 2

Advance Research To Improve Detection

by developing and validating new assays and retooling existing diagnostic platforms

PRIORITY 3

Support Research To Advance Treatment

by evaluating new or repurposing existing treatments and defining implementation strategies

PRIORITY 4

Accelerate Research To Improve Prevention

by developing vaccines, other methods to prevent transmission, and implementation models

PRIORITY 5

Prevent and Redress Poor COVID-19 Outcomes

in health disparity and vulnerable populations

CROSSCUTTING STRATEGIES

PARTNERING
to promote collaborative science

SUPPORTING
the research workforce and infrastructure

INVESTING
in data science

National Institutes of Health

GOAL

Improve basic understanding of SARS-CoV-2 and COVID-19 and develop the necessary tools and approaches to better diagnose, prevent, and treat this disease.

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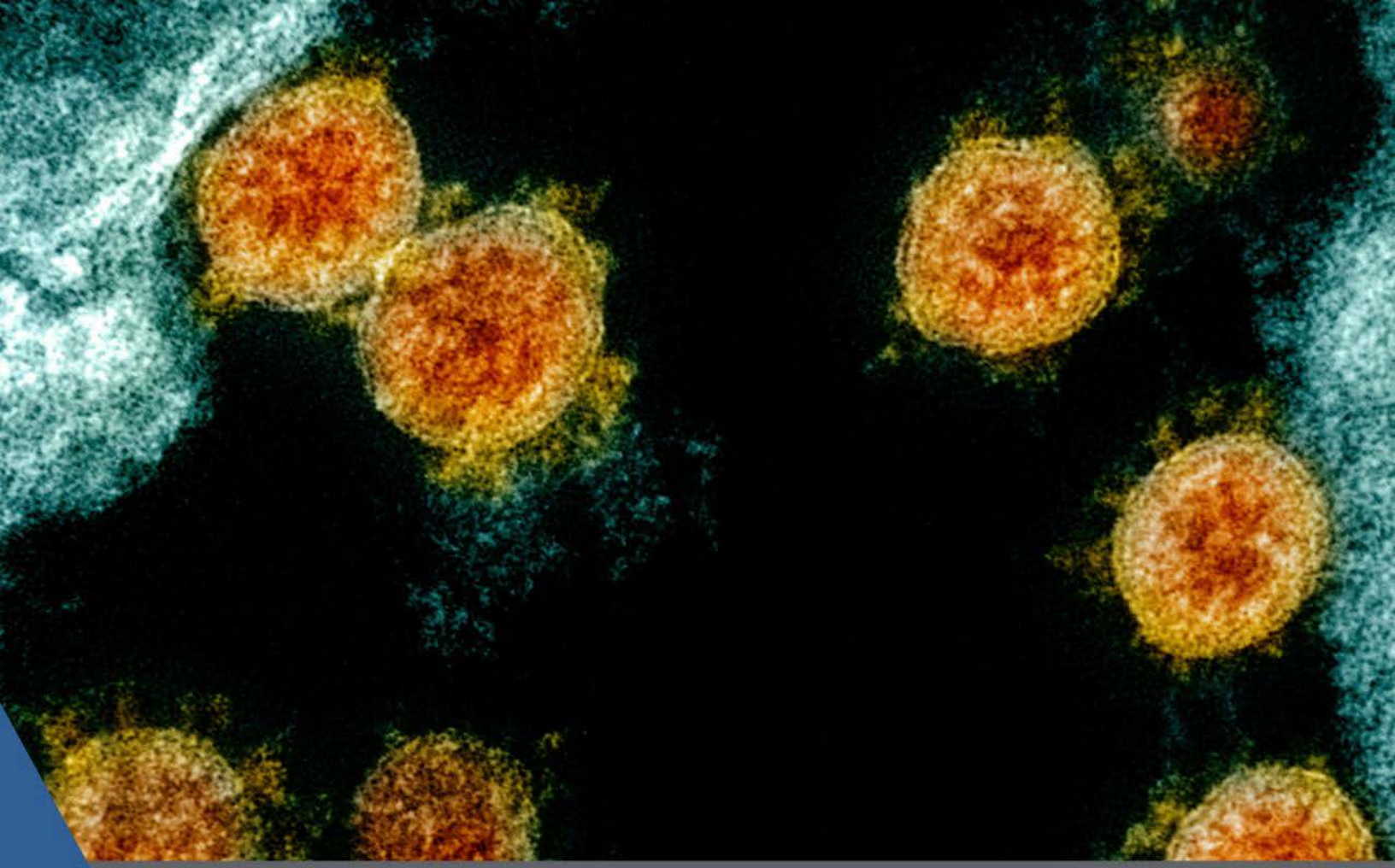
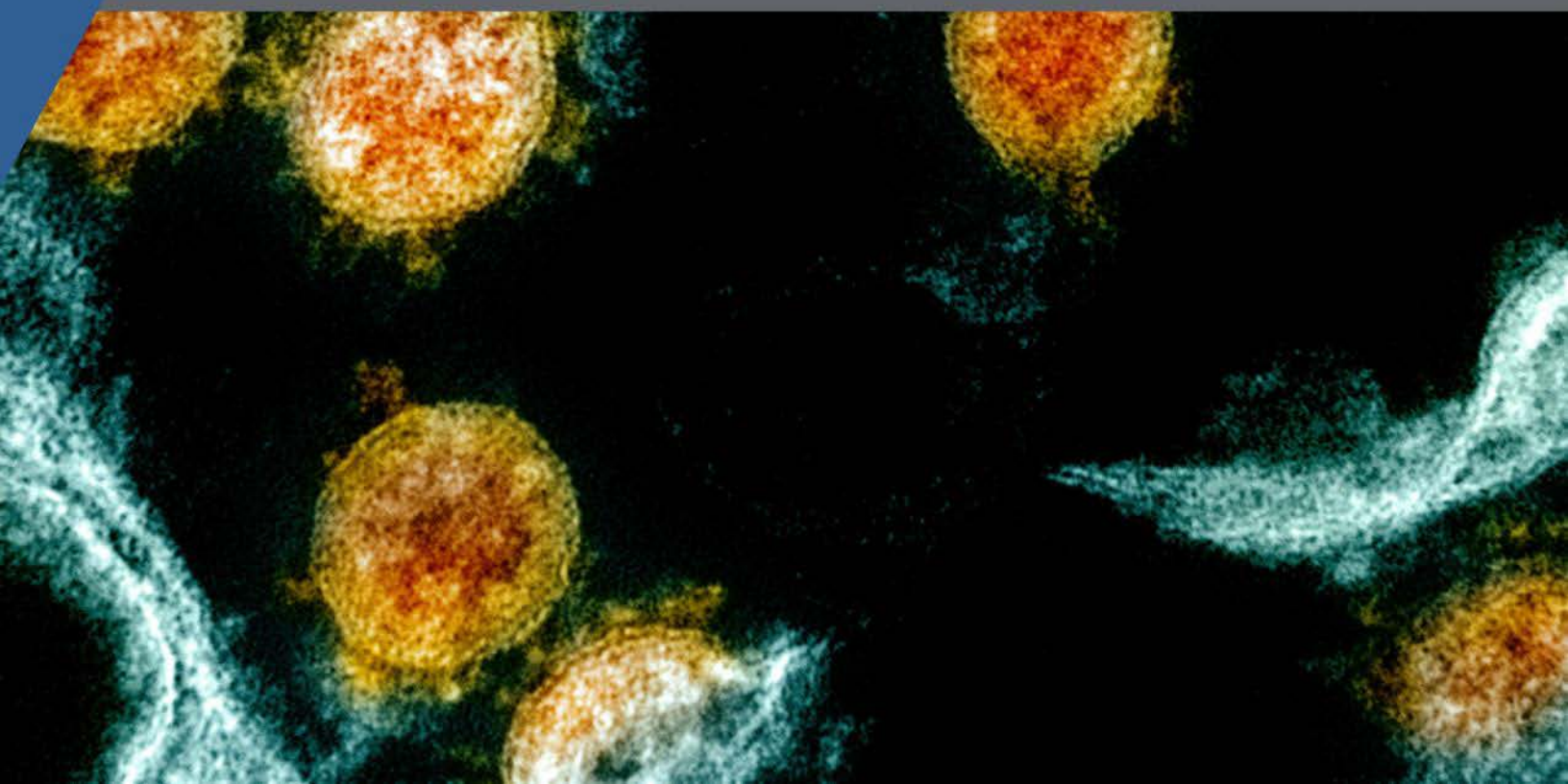


Goal: Improve basic understanding of SARS-CoV-2 and COVID-19 and develop the necessary tools and approaches to better diagnose, prevent, and treat this disease.



INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a newly emergent human disease caused by a naturally arising, novel coronavirus—the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus spreads easily from person to person through respiratory droplets, and infection typically causes fever, loss of taste or smell, shortness of breath, a dry cough, and/or other symptoms and complications associated with COVID-19. The ease with which the virus spreads and the virus's ability to be transmitted by asymptomatic individuals have caused possibly the most severe worldwide infectious disease pandemic of the modern age. More than 100,000 Americans died from COVID-19 within the first four months of the pandemic, contributing to more than 350,000 deaths worldwide in the same time period.

NIH is uniquely positioned to lead a swift, coordinated research response to this public health crisis. By leveraging existing funding mechanisms and establishing new programs, NIH is rapidly mobilizing the disbursement of emergency government funding to the biomedical research community while still maintaining a scientifically rigorous review process and strong

scientific stewardship to support the most promising and meritorious science in the face of a public health emergency.

Researchers have already established—and will continue to build on—an immense fundamental knowledge base on viruses and their effects on humans built from decades of NIH-supported research. Leveraging the most modern technologies and techniques—as well as a rich reservoir of existing diagnostics, prevention strategies, and treatment options used to combat viruses—researchers are rapidly identifying characteristics of SARS-CoV-2 and human responses to infection to speed the development of sorely needed interventions for COVID-19.

To hasten the development of interventions, NIH is capitalizing on the strengths of its intramural and extramural (domestic and international) research infrastructure and working in close collaboration with its partners in industry, academia, nonprofit organizations, and other government agencies and offices. NIH's intramural scientists are engaging in foundational studies, creating models, and identifying or screening existing therapeutic drugs against SARS-CoV-2, as well as modifying existing vaccine and diagnostic platforms to prevent and detect the virus. Likewise, NIH's leadership role in the Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) public-private partnership (Box 1) and its participation in the trans-government

Box 1 – ACTIV: An Unprecedented Partnership for Unprecedented Times

The rapid spread of COVID-19 and limited resources highlight the need to coordinate and streamline research processes to optimize biomedical research and testing of potential therapeutic and vaccine candidates. In April 2020, NIH launched the Accelerating COVID-19 Therapeutic Interventions and Vaccines (**ACTIV**) public-private partnership to develop a coordinated research strategy for prioritizing and speeding the clinical evaluation of the most promising treatments and vaccines. Through ACTIV, NIH has partnered with more than 15 biopharmaceutical companies; NIH's sibling agencies and offices within the Department of Health and Human Services, including the Biomedical Advanced Research and Development Authority, Centers for Disease Control and Prevention, and U.S. Food and Drug Administration; other government agencies, including the Department of Defense and Department of Veterans Affairs; European Medicines Agency; and representatives from academia and philanthropic organizations. Through the ACTIV partnership, NIH is pursuing four fast-track focus areas most ripe for opportunity, each led by a working group of senior scientists representing government, industry, nonprofit, philanthropic, and academic organizations. The **four areas** include (1) develop a collaborative, streamlined forum to identify preclinical treatments, (2) accelerate clinical testing of the most promising vaccines and treatments, (3) improve clinical trial capacity and effectiveness, and (4) accelerate the evaluation of vaccine candidates to enable rapid authorization or approval.

partnership called Operation Warp Speed (Box 3) are forging groundbreaking approaches to ramp up the identification, development, evaluation, and manufacturing of promising candidate therapeutics and vaccines.

Recognizing the disproportionate impact of COVID-19 on health disparity and specific vulnerable populations, NIH-funded researchers are working to identify the underlying factors and barriers that contribute to the staggering losses in these communities. Inclusion of these populations in clinical trials for diagnostics and interventions will be a critical part of NIH's pandemic response, as will exploring communication strategies and ways to improve access to care and interventions for at-risk populations.

In keeping with the urgency of the pandemic, NIH will rapidly communicate findings to the scientific community, health care providers, and the public. For the scientific community, NIH is moving as quickly as possible to disseminate data in multiple data-sharing platforms. Preprint and peer-reviewed publications relevant to all aspects of the research effort now are available, including literature compendiums and analysis tools, such as the newly established LitCovid and *iSearch* COVID-19 Portfolio tools. For health care providers, NIH convened a panel of experts who developed treatment guidelines that will evolve as new data and clinical expertise become available. Last, NIH will strive to provide the latest scientific information to the public, investing in research to identify the best methods for disseminating scientific findings to the populations who need them most, especially underserved and vulnerable populations.

NIH aims to actualize the response to the COVID-19 pandemic by supporting research to understand SARS-CoV-2 and mitigate the threat of COVID-19 for the health of all people. NIH will build on existing research initiatives—and accelerate the development of new ones—that are focused on the five research priorities detailed in this strategic plan. Through its pursuit of research in these priority areas, NIH hopes to achieve the vision of a world safe from COVID-19 by improving basic understanding of SARS-CoV-2 and COVID-19 and developing the necessary tools and approaches to better diagnose, prevent, and treat this devastating disease.

PRIORITY 1

Improve Fundamental Knowledge of SARS-CoV-2 and COVID-19

NIH-supported researchers will continue to work together with their partners to understand the biology of SARS-CoV-2 infection and COVID-19 outcomes, as well as the impact that infection and disease have on individuals, communities, and public health. This fundamental knowledge will be used to identify novel approaches for developing effective diagnostics, prevention strategies, and treatments.

Objective 1.1: Advance fundamental research for SARS-CoV-2 and COVID-19

NIH-supported researchers will continue to build upon an already strong foundation of knowledge to understand SARS-CoV-2 infection and COVID-19, including the research

priorities outlined in the National Institute of Allergy and Infectious Diseases's *NIAID Strategic Plan for COVID-19 Research*. For example, researchers are working to understand essential SARS-CoV-2 proteins and host-virus protein interactions that mediate infection and disease to enable the development of effective treatment and prevention strategies.

Researchers also will seek to advance knowledge of the body's immune response to SARS-CoV-2 infection. The immune system plays a critical role in preventing and fighting off infection. Early studies have shown that patients with COVID-19 develop SARS-CoV-2–specific antibodies in their blood. Antibodies are blood proteins produced by the immune system to fight viruses and, in some cases, prevent future infection from the same virus. More follow-up work is needed to determine how protective SARS-CoV-2 antibodies are and for how long.

The immune system, although typically protective, sometimes can overreact and contribute to tissue and vascular damage, as observed in COVID-19. Thus, patients with severe COVID-19 may benefit from therapies that turn down the immune response or directly target the virus. NIH will support research to understand the mechanisms of infection and how the infection contributes to disease in different systems. Researchers have begun looking at changes in blood proteins, sugars, and fats to identify markers that may be signs of COVID-19 outcomes or protection from future infection.

Understanding SARS-CoV-2 transmission—how the virus spreads—and why some individuals are more susceptible to severe disease than others is an important piece of the COVID-19 response. To shed new insight on these topics, NIH will support research to identify potential animal reservoirs, understand animal-to-human and human-to-human transmission, and characterize the virus's genetic diversity. Studies to examine biological factors that influence individual susceptibility to infection—such as age, sex and gender, genetics, and environment—already are in progress. Researchers also are examining social factors related to COVID-19, such as health disparities based on race and ethnicity, including their influence on biological factors. This information will be critical to understanding infection and disease progression and outcomes, and it may inform the development of interventions and vaccines.

Objective 1.2: Support research to develop preclinical models of SARS-CoV-2 infection and COVID-19

Animal models, particularly those that replicate human disease, are essential to understanding the basic biology of coronaviruses, including transmission, incubation periods, and host immune responses to infection. They also are critical to testing potential preventive and therapeutic strategies. For example, researchers are using mice and nonhuman primates to study responses to experimental therapeutics and vaccines. NIH will leverage existing animal models of infection with other coronaviruses and develop preclinical models to study and understand SARS-CoV-2 infection and COVID-19.

Previous experience with related coronavirus diseases suggests that replicating COVID-19 in animal models may be challenging. Thus, researchers are exploring new ways to increase access to validated animal models and enhance comparison of approaches to identify informative assays. NIH plans to develop and validate human cell–based models of SARS-CoV-2 infection—such as tailoring tissue chips, which are three-dimensional (3D) platforms engineered to support living human tissues and cells—to study viral infections in relevant human tissues, such as the lung. Systems biology and computational techniques will be used to complement preclinical models of the tissue injury and immune system activation seen in patients with severe COVID-19, as well as therapeutic effects against SARS-CoV-2 and COVID-19.

Objective 1.3: Advance the understanding of SARS-CoV-2 transmission and COVID-19 dynamics at the population level

Researchers will continue work to understand the progression of COVID-19 through natural history studies exploring why some populations, such as children, generally may not exhibit symptoms of infection and how these factors contribute to the spread of SARS-CoV-2. NIH has launched studies to illuminate the extent to which SARS-CoV-2 has spread undetected in the United States and to provide insights into which communities and populations are most affected. For example, one study will determine how many adults in the United States without a confirmed history of infection with SARS-CoV-2 have antibodies to the virus, indicating a prior infection.

Gaps exist in our understanding of the dynamics of disease transmission in different populations over time and the factors that influence a population's susceptibility to severe disease. NIH will support research to understand and address the behavioral and social factors that impact the spread of the virus. NIH-supported clinical epidemiology programs will leverage existing clinical and community-based research platforms to characterize the clinical features

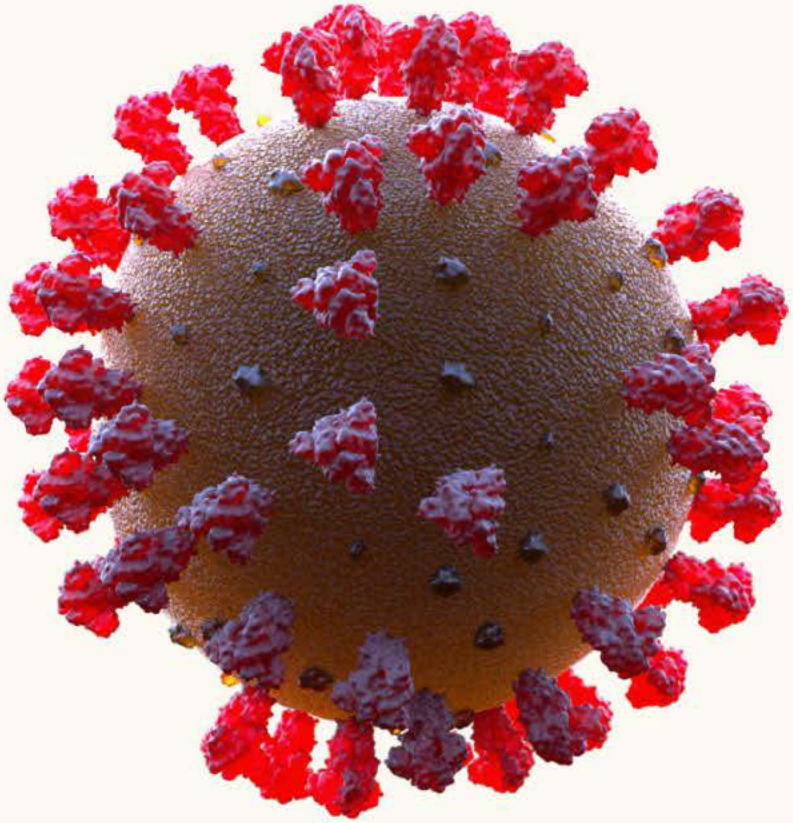
and disease course of COVID-19. Population-level studies will be used to explain the role of different factors in driving disease severity and outcomes, including but not limited to older age; sex; social determinants of health; and such comorbidities as diabetes, cancer, cardiovascular disease, kidney and digestive diseases, and pain and substance use disorders.

Objective 1.4: Understand COVID-19 disease progression, recovery, and psychosocial and behavioral health consequences

As people across the United States and around the world respond to the COVID-19 pandemic, the body of research from prior disasters and other stressful and traumatic events indicates that this experience likely will have a negative impact on people and their health through psychosocial, behavioral, and economic factors. NIH will support research to understand and address the impacts of the virus and the public health measures used to prevent its spread—such as physical distancing, shelter-in-place orders, and quarantining—on social epigenomic pathways (how social experiences affect genes and biology); mental and physical health; substance use; and well-being, illness, and recovery. In addition, studies will explore the health consequences from delayed care not only for COVID-19, but also for routine preventive practices (e.g., vaccinations) and detection and treatment of diseases and conditions (e.g., cancer).

These studies will focus on the effects of COVID-19 across the lifespan and in different populations, including vulnerable populations. Research also will investigate the long-term effects of recovering from COVID-19, as well as physical, environmental, neurobiological, social, and behavioral factors. Researchers, clinicians, and public health professionals across various disciplines will need to work together to understand which therapies work in specific populations, find any disparities in effectiveness, and understand why some individuals respond to available treatments differently than others.

PRIORITY 2



Advance Detection and Diagnosis of COVID-19

As Americans return to public spaces, a vital component of the Nation's strategy is detecting, diagnosing, and surveilling the population to identify and quarantine COVID-19 cases and track the spread of the virus. Despite an exponential increase, current testing capacity still is insufficient to meet the Nation's needs—both in terms of the number of tests available and their ability to deliver answers rapidly at the point of care. To develop more accurate, rapid, scalable, and accessible tests, NIH is committed to aggressively accelerating the development, validation, and commercialization of innovative COVID-19 testing technologies, focusing efforts both on viral tests—which indicate whether a person has a current infection—and on antibody, or serological, tests—which indicate if a person has had a previous infection. To this end, NIH will continue to advance a wide range of initiatives to improve or repurpose current technologies and advance new ones.

Objective 2.1: Support research to develop and validate new diagnostic technologies

NIH will support the development and validation of new diagnostics, including nucleic acid tests and viral antigen detection tests, that can identify the presence of the virus in biospecimens. Most current testing for the virus depends on detection of the viral RNA using a polymerase chain reaction test. These tests are accurate, but they generally require a central laboratory with expert technical staff and specialized equipment. Newer alternatives may be able to carry out this kind of nucleic acid detection with a simple point-of-care device. Another alternative that NIH-supported researchers are pursuing is called viral antigen testing, which detects the virus protein capsule. Antigen tests are traditionally less sensitive, but they can be modified for at-home use, enabling easier and more frequent testing.

To address the need for better diagnostics, NIH has launched the Rapid Acceleration of Diagnostics (RADx) initiative to speed innovation in COVID-19 testing technologies, with the potential of delivering rapid, widely accessible testing strategies to the public (Box 2). The RADx Tech arm of RADx aims to speed the development, validation, and commercialization of innovative point-of-care and home-based tests, as well as improve clinical laboratory tests that can detect the virus directly. RADx Tech will expand the existing Point-of-Care Technology Research Network and use a flexible approach to infuse funding and enhance technology designs at key stages of development. New technologies may employ less invasive sampling techniques, such as saliva collection, or other approaches, such as viral antigen testing to detect the virus protein capsule, and they will be designed to meet the needs of various settings, such as hospitals, schools, and places of business.

A range of additional NIH intramural and extramural activities will catalyze the development of other new diagnostic technologies. RADx Radical (RADx-rad) (Box 2) will support nontraditional approaches that address current gaps in COVID-19 testing, including breath detection of SARS-CoV-2, community wastewater detection, and changes in sensory functions (e.g., taste, smell). The program also will support new or nontraditional applications of existing approaches to make them more usable, accessible, or accurate. Other NIH intramural and extramural activities will focus on the development or adaptation of diagnostic approaches that include wearable, implantable, and remote sensors; medical imaging technologies combined with informatics solutions and artificial intelligence for detection and monitoring; and noncontact sensing and imaging for rapid mass screening and vital sign assessment.

Objective 2.2: Retool existing diagnostics for detection of SARS-CoV-2

In addition to catalyzing the development of novel COVID-19 diagnostic technologies, NIH will support efforts by scientists to repurpose, modify, or improve diagnostic tools currently available or under development. For example, researchers are developing microfluidic chip models of COVID-19 to enable rapid detection of SARS-CoV-2 infection. Researchers in the NIH intramural program are shifting their focus to repurpose diagnostic technologies and improve the speed, accuracy, and utility of tests that are available currently, including the use of imaging technologies for early detection of COVID-19 in the lungs and the use of artificial intelligence to improve diagnosis based on imaging.

As part of the repurposing effort, diagnostic technologies must be scaled up rapidly to increase access to and throughput of COVID-19 testing. Another component of the RADx initiative (Box 2), RADx Advanced Technology Platforms (RADx-ATP), seeks to scale up existing technologies (e.g., high-throughput platforms), expand the use of platforms suitable for testing centers providing access to underserved populations, and identify next-generation diagnostic testing platforms that could be scaled to population-level testing. NIH also will refocus efforts on research to alleviate potential supply chain issues. For example, to address potential shortages, researchers in the NIH intramural program are producing and evaluating the viability of several 3D-printed swabs.

Objective 2.3: Support research to develop and validate serological assays

Serology tests—also called antibody tests—detect the presence of antibodies in a person's blood. Someone who has antibodies to a virus, such as SARS-CoV-2, was infected at some point in time. However, because antibody tests do not look for pieces of the virus itself, they cannot be used to diagnose COVID-19 or determine if someone is infectious.

Currently, it is unclear whether the presence of SARS-CoV-2 antibodies correlates with lasting immunity and, if so, how durable and protective the antibodies are. However, if that correlation can be proven, serology tests will play an important role in facilitating the shift back to a more open and public environment and may help determine who can return to work or school safely. NIH's focus on accelerating the availability of high-quality serology tests is a key part of its participation in the interagency team to develop a national strategy for serology diagnostics to support return to work. Serology tests also are crucial for determining the efficacy of promising therapeutic or vaccine candidates and for studies of disease prevalence and

Box 2 – RADx: Rising to the Challenge of Widespread Testing

Over the last century, advances in biotechnology have improved medical treatment and saved lives. Now, as the United States fights a devastating public health threat, the Rapid Acceleration of Diagnostics (**RADx**) initiative is calling on scientists and engineers to put forward their most promising biomedical technologies and implementation strategies to answer the pressing need for SARS-CoV-2 testing. RADx is a nationwide program aimed at speeding the development and commercialization of rapid, easy-to-use diagnostic tests. The program also will support innovative approaches for implementation, expansion, accessibility, and acceptance of existing diagnostic testing. The RADx initiative consists of four key components:

- **RADx Tech** supports scientists and inventors through a nationwide competition to expand the type of access to testing technologies for point-of-care COVID-19 diagnostics and improved laboratory-based testing. NIH began the initiative with a call for innovative technologies that can be developed or repurposed to meet the pressing need for COVID-19 tests. Candidates are advancing through a phased review process, which will include appropriate funding for specific deadlines and deliverables and mentorship from experts in business, technical, and regulatory fields.
- **RADx Radical (RADx-rad)** will advance nontraditional, but potentially transformational, approaches and repurposing of existing approaches for COVID-19 testing. With longer development timelines, RADx-rad projects will address gaps in SARS-CoV-2 testing through technology platforms that can be used in future outbreaks of COVID-19 and that could be applicable to other, as yet unknown, infectious organisms.
- **RADx Advanced Technologies Platform (RADx-ATP)** will focus on reducing barriers for scaling up advanced technologies to increase the capacity for rapid, high-throughput testing infrastructure. Additionally, RADx-ATP will seek to identify next-generation diagnostic testing platforms that are reduced to practice at modest scale but could be scaled rapidly to population-level testing.
- **RADx Underserved Populations (RADx-UP)** will leverage existing community partnerships to build community-engaged demonstration projects focused on identifying effective implementation strategies to enable and enhance testing for underserved and vulnerable populations. This will include development of a Coordination and Data Collection Center, a collaborative network of clinical research centers across the country, and a program studying the social, ethical, and behavioral implications.

RADx aims to support innovative technologies to provide millions of additional rapid, easy-to-use, diagnostic tests for the United States by the fall of 2020 and identify and employ evidence-based implementation strategies to increase accessibility and acceptance in those populations most affected by this deadly pandemic. By calling on the ingenuity and inventiveness of U.S. scientists and engineers, NIH will advance diagnostic tools to prevent the spread of COVID-19, improve health, and save lives.

spread through communities. For example, NIH, in partnership with the Centers for Disease Control and Prevention (CDC) and U.S. Food and Drug Administration (FDA), is developing tests that identify antibodies to SARS-CoV-2 to determine how many people have been infected, including asymptomatic people. These efforts also could potentially be used to distinguish antibody responses in individuals receiving vaccines. To understand where and when COVID-19 arrived in the United States, the *All of Us* Research Program is performing serology testing on blood samples from its hundreds of thousands of participants, working backwards until the timepoint at which antibodies first show up in samples.

Serological tests are improving, and it is vital that the tests being developed and authorized for use are as accurate as possible. NIH is collaborating with the Biomedical Advanced Research and Development Authority (BARDA), CDC, and FDA to validate commercial and academically developed tests. Other validation efforts are leveraging NIH programs already in place. The Recipient Epidemiology and Donor Evaluation Study (REDS) Program, which works to protect the Nation's blood supply, will analyze blood samples from before and after the start of SARS-CoV-2 community transmission to validate serology tests. The REDS Program also will establish a repository for sharing data with government, academic, and industry scientists to advance serological testing and vaccine development.

PRIORITY 3

Advance the Treatment of COVID-19

When the COVID-19 pandemic began, FDA-approved treatments for coronaviruses did not exist. Normally, the discovery and development of a new therapeutic is a years-long process. The unprecedented need brought on by the COVID-19 pandemic has compelled a paradigm shift in that process to enhance the sharing of knowledge, resources, and infrastructure among academics, Federal agencies, and industry. Through such a shift, the goal is to compress the timeline for discovery and development of therapeutics to treat COVID-19 from years to months while continuing to apply rigorous standards to ensure safety and efficacy. To this end, NIH assembled the ACTIV partnership (Box 1) and will continue to work closely with other government agencies organized through Operation Warp Speed (Box 3).

Box 3 – Operation Warp Speed: Accelerating Delivery of Countermeasures to Americans

In response to the pandemic sweeping the United States and the world, the White House has launched a national program called **Operation Warp Speed**, whose marquee goal is to develop, produce, and distribute 300 million doses of safe and effective vaccines for COVID-19 by January 2021. This aim is part of a larger effort to develop diagnostics, therapeutics, and vaccines (collectively known as countermeasures) for COVID-19 and was undertaken by trans-governmental partners from the Department of Health and Human Services (HHS)—including NIH, Biomedical Advanced Research and Development Authority, Centers for Disease Control and Prevention, and U.S. Food and Drug Administration—and the Department of Defense. Operation Warp Speed will coordinate ongoing HHS-wide efforts—for example, NIH's ACTIV public-private partnership and the Rapid Acceleration of Diagnostics (RADx) initiative—and facilitate collaborations with private partners and other Federal agencies to accelerate the pace of countermeasures development without sacrificing safety or efficacy. This Federal collaboration is selecting the most promising candidates for evaluation, coordinating centralized clinical evaluation protocols for use by collaborators in evaluating candidate countermeasures, and jumpstarting the manufacturing process for promising candidates. This ambitious effort is made possible by simultaneously managing multiple steps, such as starting manufacturing of a vaccine candidate at industrial scale before the demonstration of vaccine efficacy and safety has concluded, as would happen normally. The program also will build the distribution infrastructure in advance of the approval and manufacturing of countermeasures, leveraging pandemic preparedness protocols developed during the 2009 H1N1 pandemic influenza response. Companies with candidates being tested in cooperation with Operation Warp Speed will provide the government with a portion of any countermeasures produced to ensure safe, affordable diagnostics and interventions for the American people.

Objective 3.1: Identify and develop new or repurposed treatments for SARS-CoV-2

NIH has established a multipronged approach to discover or repurpose promising candidate therapies for SARS-CoV-2 using advanced screening methods, such as human cell–based models, as well as animal models, to identify promising therapies that may interfere with the production of the virus or the ability of the virus to infect cells. NIH-supported researchers will continue to seek out and characterize candidate therapeutics that target viral and host proteins that play an important biological role in SARS-CoV-2 replication and infection. Data science tools will be critical to this endeavor; NIH intramural and NIH-supported researchers already are creating complex computer-generated models of SARS-CoV-2 and its biological processes to determine key interactions and pathways to target for therapeutics development.

Other therapeutic approaches involve passively boosting the immunity of people infected with SARS-CoV-2 by infusing convalescent plasma from patients recovered from COVID-19, pooling such blood products into hyperimmune globulin, or by developing monoclonal antibodies designed to target and neutralize the virus. NIH researchers and partners from across the globe have begun isolating, cloning, producing, and evaluating such protective, neutralizing antibodies from people who have recovered from COVID-19. Some of these monoclonal antibodies already are on a pathway to clinical testing.

In addition to new therapeutics, researchers are looking for ways to repurpose drugs approved for other indications to treat COVID-19. NIH-supported researchers, partners, and intramural staff are screening existing FDA-approved therapeutics for activity against SARS-CoV-2, strategically targeting pathways identified in fundamental coronavirus research studies as essential to virus production or infection. Within a few months of the pandemic's beginning, NIH collaborated with industry partners to show that the antiviral remdesivir, a drug formerly tested for the treatment of Ebola, accelerates the recovery of hospitalized, oxygen-supplemented patients with severe COVID-19. Additional clinical trials are planned or are underway to evaluate the efficacy of other repurposed drugs that have shown signs of antiviral activity in cell-based assays.

Objective 3.2: Evaluate new, repurposed, or existing treatments and treatment strategies for COVID-19

The multiorgan, multisystem involvement of severe COVID-19 prompts critical questions about its immediate and long-term impact, particularly in people with preexisting conditions. The severity of COVID-19 varies widely and can involve a number of different systems, including the cardiovascular, nervous, renal, and respiratory systems. It is unknown at this time if COVID-19 results in long-term health consequences, so continued evaluation of COVID-19 patients and the development of long-term treatment strategies may be necessary.

The multifaceted nature of COVID-19's impact on body systems necessitates evaluating a wide range of therapies that target disease processes resulting from SARS-CoV-2 infection. As part of this broad approach to therapy, NIH will evaluate treatment strategies that target the body's response to the virus, as well as evidence-based complementary health approaches. Treatment strategies could include approaches to address disease processes resulting from COVID-19, such as tissue injury, blood clotting, overreaction of the immune system, and inflammation. NIH also will evaluate medical care strategies that seek to improve COVID-19 outcomes, recognizing that individuals who receive critical care interventions, in particular, may require ongoing rehabilitation during recovery.

To facilitate the testing of both antiviral and disease process-targeted treatments for COVID-19 and its complications, NIH will create new research networks and leverage clinical trial networks supported by Institutes, Centers, and Offices across NIH, including the Clinical Center. These networks will be used to conduct a variety of flexible, adaptive clinical trials and support clinical trials designed in real-world hospital settings, called pragmatic clinical trials. NIH is collaborating with Federal, industry, and academic organizations through such partnerships as ACTIV (Box 1) to increase the capacity to conduct clinical trials across all phases, from pilot studies to large safety and efficacy trials. These partnerships will streamline recruitment and hasten the collection of data needed for FDA approval to ensure that new or repurposed interventions will be advanced as quickly as possible.

Interventions and treatment strategies will cover the breadth of populations affected by COVID-19, including populations with other medical conditions and diseases (e.g., HIV infection, diabetes, cancer). For example, the NIH intramural program is adapting clinical protocols to evaluate therapeutics, such as the inflammatory mediator tocilizumab, in cancer patients with COVID-19.

Objective 3.3: Investigate strategies for access to and implementation of COVID-19 treatment

The resolution of the COVID-19 pandemic will depend on the expeditious and broad dissemination of treatment strategies and care practices for use by health care practitioners while ensuring that all members of the public have access to COVID-19 treatment. Delays in the adoption of the updated clinical practices could result in unnecessary prolongation of the pandemic, additional lives lost, and increased economic burden.

NIH will build on existing dissemination and implementation science research, both by testing the adaptation of strategies that have been successful in other disease areas, such as HIV and tuberculosis treatment, and by supporting new studies that examine methods to disseminate, provide access to, and facilitate uptake of interventions for COVID-19. Community-engaged research strategies will be critical to the success of implementing interventions, particularly for underserved and vulnerable populations (e.g., African Americans). These populations are disproportionately affected by, have the highest infection rates of, or are the most at risk for complications or poor outcomes from COVID-19. Community-engaged research will provide access to local communication channels, resources, and social infrastructure that can aid the design of tailored, local strategies to mitigate implementation barriers for underserved and vulnerable populations, such as barriers resulting from social determinants of health.

Essential to these goals is the consideration of cultural, ethical, social, behavioral, historical, and economic factors associated with evaluating interventions, as well as the collection, storage, and dissemination of health-related data. NIH will support in-depth examinations of such topics as barriers to and implications of treatment; stigma and financial burden associated with COVID-19 treatment and follow-up care; and privacy, confidentiality, and data sharing.

PRIORITY 4

Improve Prevention of SARS-CoV-2 Infection

Critical to resolving the current COVID-19 pandemic and preventing future outbreaks is the development of countermeasures to stop transmission of the virus and prevent new infections. By supporting the development of new vaccines, behavioral and community interventions, and effective strategies for implementation of these countermeasures, NIH will create preventive interventions that have the potential to reduce the incidence of new SARS-CoV-2 infections across the country. The NIH approach will leverage existing knowledge, tools, networks, and infrastructure—in addition to developing and implementing novel approaches—to prevent new SARS-CoV-2 infections.

Objective 4.1: Develop novel vaccines for the prevention of COVID-19

To prevent future outbreaks of COVID-19, safe and effective vaccines for SARS-CoV-2 must be developed and distributed as quickly as possible. As soon as the SARS-CoV-2 genetic sequence became public in January 2020, NIH-funded scientists began working at an unprecedented pace to identify, develop, and test promising vaccine candidates, several of which are described in the *NIAID Strategic Plan for COVID-19 Research*. The NIH intramural program has played an important role in the early testing and development of several vaccine candidates, including those that showed potential for preventing infection from similar coronaviruses.

Advancing promising vaccine candidates through preclinical study, clinical testing, and regulatory approvals will require extraordinary coordination of Federal and industry partners via collaborations and partnerships. As is the case for therapeutics, the ACTIV public-private partnership (Box 1) is playing a critical role in coordinating research efforts between NIH, FDA, and industry. The multiple governmental roles and decisions about government funding are being coordinated by the Operation Warp Speed initiative (Box 3). For preclinical identi-fication of promising candidates, NIH and its partners are ensuring that needed resources, such as appropriate animal models, are available. Across the developmental spectrum, NIH and its partners also are ensuring the availability of vital vaccine supplies, including samples, adjuvants to increase the effectiveness of vaccines, and reagents. In addition, several vaccine formulations—which save time in development by using common, basic components that can be quickly adapted for new genetic targets—also are being studied for potential use against SARS-CoV-2 infection.

To coordinate and accelerate clinical testing, NIH and its partners are leveraging existing clinical trial networks, such as the HIV Vaccine Trials Network; HIV Prevention Trials Network; Infectious Diseases Clinical Research Consortium; and Prevention and Early Treatment of Acute Lung Injury Network (PETAL Network), which conducts trials to improve prevention and treatment of acute respiratory distress syndrome. NIH also has created the COVID-19 Prevention Network, which will provide centralized data coordination and integrated clinical site use and use novel epidemiological disease tracking tools to speed the evaluation of potential vaccines. Ensuring the participation of a broad range of populations in clinical testing, including high-risk groups, is a priority. Efficacy studies will be designed to include older individuals, people with comorbidities, and underserved populations. Once safety tests are completed, vaccines will be evaluated in pregnant women and children. With the strategy outlined here, NIH will work to end the pandemic by supporting research into multiple effective and broadly distributable SARS-CoV-2 vaccines.

Objective 4.2: Develop and study other methods to prevent SARS-CoV-2 transmission

Until a SARS-CoV-2 vaccine is developed, alternative methods to slow the spread of the virus will be necessary. NIH will support studies on preventive treatments, behavioral and community prevention practices, and policies to rigorously study and determine the most effective approaches to promote individual and community safety. NIH has worked to study and inform effective prevention practices through basic research into the mechanisms of viral survival, infection, and transmission.

Antibody treatments, in addition to their potential therapeutic use, hold promise as a method to prevent COVID-19 in individuals exposed to SARS-CoV-2 and those who are at high risk of serious illness, and they will be investigated as a potential prevention strategy. Research into the survival of SARS-CoV-2 in the environment and its transmission through respiratory droplets already has guided the understanding of how physical distancing and personal protective equipment (PPE) can be applied to prevent viral spread. Modifiable risk factors, such as environment and nutrition, and interactions with preexisting biological factors, such as epigenetics and metabolomics, that may contribute to a person's susceptibility to SARS-CoV-2 infection will be studied to better understand a broad range of prevention methods.

Some research results suggest that SARS-CoV-2 can be transmitted to an uninfected person through contact with an infected person who does not show signs of disease (i.e., is asymptomatic). In that case, traditional containment strategies (e.g., testing only people with symptoms, contact tracing, quarantining) may not be effective. NIH is supporting research into alternative tracing methods, including digital tracing via smartphones, to intervene and reduce transmission of SARS-CoV-2.

NIH also supports further research into effective practices for PPE use and reuse, as well as the development of new PPE, to protect health care workers, caregivers, and the public. NIH prioritizes the safety of health care workers and caregivers and will work to build scientific knowledge of the best decontamination methods and other safety measures specific to the needs of health care environments, such as nursing homes, dental practices, and hospitals. The National Institute of Environmental Health Sciences Worker Training Program will support grants to create virtual worker-based trainings for COVID-19 frontline responders and will serve as a clearinghouse for sharing training resources. NIH also is supporting research into the development of practices and innovative decontamination technologies and procedures, such as the use of ultraviolet light, heat, and chemical procedures to decontaminate and reuse N95 respirator masks.

Objective 4.3:
Develop effective implementation models for preventive measures

NIH and its funded scientists will leverage existing and new interagency collaborations to determine the best possible methods for developing, implementing, and distributing vaccines and behavioral prevention methods against SARS-CoV-2. Before vaccines are made available, rigorous research will be needed to ensure critical questions about the most effective distribution practices are answered. Ensuring vaccines are delivered to at-risk individuals, in high-need areas, and with proper administration techniques will be critical to preventing further outbreaks. Key to this research will be finding methods to address social, ethical, and behavioral factors likely to influence the use of vaccines and other prevention practices.

NIH will leverage its existing infrastructure and create new infrastructure to address and promote vaccine readiness and investigate effective communication strategies and implementation procedures for all prevention methods. Communities with limited access to technology and timely and accurate information will be a focus of the implementation of any studies on effective preventative measures. In addition, overcoming fears and addressing concerns about vaccine use will be an aspect of NIH's implementation research and communication efforts using community-engaged research methods. NIH will complete studies into the social and ethical implications of proposed approaches to prevent SARS-CoV-2 infection, from vaccines to community practices, and will create the opportunity to address ongoing health disparities and ensure adequate protection across diverse communities.

PRIORITY 5

Prevent and Redress Poor COVID-19 Outcomes in Health Disparity and Vulnerable Populations

The impact of COVID-19 on health disparity,[1] underserved, and vulnerable populations in the United States and abroad must be urgently addressed. Preliminary data show consistent differences in COVID-19 prevalence and mortality across different age, racial, and ethnic groups, and among specific populations (e.g., people with asthma or diabetes).[2] The underlying causes are complex and include social and structural determinants of health—such as social, economic, and political mechanisms that generate inequalities in society

[1] Health disparity populations include Blacks/African Americans, Hispanics/Latinos, American Indians/Alaska Natives, Asian Americans, Native Hawaiians and other Pacific Islanders, socioeconomically disadvantaged populations, underserved rural populations, and sexual and gender minorities.

[2] Populations with increased risk of COVID-19 include residents of chronic care and assisted living facilities; community-dwelling older adults; individuals with rare diseases; individuals with cognitive impairment or dementia; homeless populations; incarcerated populations and those involved with the criminal justice system; adults with medical comorbidities; pregnant women; children and adolescents; individuals with substance use disorders or severe mental illness; those living in congregate housing; persons who are deaf or with disabilities, including visual, hearing, communication, or mobility impairment; detainees in immigration centers; migrant communities; individuals living on tribal lands or reservations; and communities that are exposed to high rates of air pollution or other toxic exposures. Individuals who are on the frontlines of health care during the COVID-19 pandemic and those working in essential business operations also are at higher risk for COVID-19.

(e.g., discrimination, economic and educational disadvantages)—and differences in health care access and quality. These concerns are amplified in lower- and middle-income countries with fragile health care systems, densely populated urban areas where physical distancing is not possible, and communities with high rates of chronic health conditions. A deeper understanding of the underlying causes that may exacerbate the spread and morbidity or mortality of COVID-19 in the United States, as well as different countries around the globe, may allow the scientific, public health, and clinical communities to efficiently implement interventions to mitigate negative outcomes through better prevention, testing, and treatment of COVID-19. NIH aims to address key questions related to the differential impacts of the COVID-19 pandemic. These include understanding barriers to adherence to different mitigation strategies among populations and differences in risk and resilience based on biological factors, gender, race and ethnicity, socioeconomic status, ability, and other social and structural determinants of health. Ultimately, the United States will not be able to control the global pandemic alone. NIH will continue to collaborate with the global scientific community not only to understand the spread of COVID-19 but also to develop and distribute the diagnostics, treatments, and vaccines needed to control COVID-19 on a global scale.

Objective 5.1: Understand and address COVID-19 as it relates to health disparities and COVID-19–vulnerable populations in the United States

As part of the RADx initiative, NIH will fund a series of interlinked community-engaged projects to enhance testing of underserved, underresourced, and rural populations across the United States for COVID-19. This initiative will develop infrastructure to assess and expand evidence-based testing capacity for those populations that are most at risk for infection and adverse outcomes from contracting the virus. RADx Underserved Populations (RADx-UP) projects will establish pragmatic and other clinical trials at multiple sites across the country to investigate a variety of testing methods and approaches to better understand the uptake, acceptance, and effectiveness in specific populations (Box 2). RADx-UP projects will partner with community health centers (e.g., Tribal health centers, Health Resources and Services Administration community health centers, Federally Qualified Health Centers), medical libraries, houses of worship, homeless shelters, jails and prison systems, and other community resources to address the unique needs of different communities. The implementation and evaluation of new community interventions addressing the impact of mitigation strategies to prevent SARS-CoV-2 transmission—as well as the adverse psychosocial, behavioral, and socioeconomic consequences of the pandemic on health disparity populations—are crucial. Related efforts include holding an emergency consultation with Tribal leaders and others in the American Indian/Alaska Native community to discuss programs focused on enhancing testing capacity to better understand the best strategies for redressing the COVID-19 pandemic in these

populations. Importantly, NIH is committed to including individuals who have been traditionally underrepresented in biomedical research in clinical trials for treatments and vaccines to understand how interventions may affect these populations differently and ensure the applicability of findings to all. For example, the trans-NIH INCLUDE (INvestigation of Co-occurring conditions across the Lifespan to Understand Down syndromE) initiative will support research that explores the effects of COVID-19 on individuals with Down syndrome.

Objective 5.2: Understand and address COVID-19 maternal health and pregnancy outcomes

Pregnancy is associated with alterations in the immune system, resulting in increased susceptibility to certain viral, bacterial, and parasitic infections, which may adversely impact maternal morbidity, preterm birth, and infant health. More specifically, other respiratory viral infections, such as influenza, are associated with more severe disease outcomes in pregnant women and an increased risk of pregnancy and neonatal complications. Yet, there is a scarcity of information about SARS-CoV-2 infection and disease in pregnant women. Independent of COVID-19, women in the United States from underserved populations face substantially higher rates of pregnancy-related complications (i.e., severe maternal morbidity) and pregnancy-related death compared to non-Hispanic white women. Up to 60 percent of pregnancy-related deaths are preventable, highlighting inequities in health care access and quality-of-care factors that contribute to racial disparities in maternal mortality and severe morbidity. As such, NIH will leverage existing research on maternal morbidity and mortality to investigate questions related to pregnancy and COVID-19, including the effects of SARS-CoV-2 infection and treatment of COVID-19 on maternal and fetal health during pregnancy, as well as pregnancy outcomes. NIH has initiated large-scale studies to investigate the effects of COVID-19 on such factors as pre- and postnatal care, rate of Cesarean section delivery, and maternal health complications. Research also is needed to understand possible mother-to-fetus transmission, possible mother-to-child transmission at birth, and possible transmission via breastfeeding. NIH also will support research on the use of therapeutics to treat COVID-19 during pregnancy and breastfeeding.

Objective 5.3: Understand and address age-specific factors in COVID-19

Certain age groups are at higher risk for serious complications from SARS-CoV-2 infection, such as older adults (65 years and older). NIH will support studies of neurological and neurocognitive symptoms in COVID-19 and complications associated with SARS-CoV-2 infection in older adults. In addition, NIH will fund research to explore the role of inflammation in older populations with COVID-19 and subsequent progression to more severe disease, including lung pathology and acute respiratory distress syndrome. NIH also will seek to develop aged animal models (including nonhuman primates) or *in vitro* models suitable for studies on pathogenesis of the virus or preclinical testing of therapeutics and vaccines against SARS-CoV-2.

Although the majority of children and young adults have mild, moderate, or asymptomatic cases of COVID-19 compared to adults, new reports suggest that studies are needed to address the dynamics of the virus and the immune response in children and adolescents, as well as short- and long-term outcomes. For example, the NIH Human Epidemiology and Response to SARS-CoV-2 (HEROS) study will help determine what percentage of children infected with SARS-CoV-2 develop symptoms of the disease. Recent data also suggest that undiagnosed infections in children may present later as a pediatric inflammatory syndrome similar to Kawasaki disease called multisystem inflammatory syndrome in children (MIS-C). MIS-C is a condition in which different body parts—including the heart, lungs, kidneys, brain, skin, eyes, or gastrointestinal organs—can become inflamed. Although the causes of MIS-C are unknown, the weight of evidence supports a postinfectious inflammatory mechanism. It is known that many children with MIS-C either were infected with SARS-CoV-2 or were exposed to someone with COVID-19. A trans-NIH effort is underway, in coordination with other Federal partners, to implement a research plan to investigate MIS-C that will describe the spectrum of pediatric SARS-CoV-2 infection and identify MIS-C risk factors, natural history, long-term outcomes for patients, treatment response, potential therapies, and other critical research questions to impact patient health. NIH also will study the impact of the COVID-19 pandemic on brain development and other outcomes from birth through adolescence.

Furthermore, NIH will ensure that treatments and vaccines developed for COVID-19 are applicable for all, including children. To that end, the Pediatric Trials Network will use more than 50 established research sites to evaluate drugs given to children diagnosed with COVID-19. Researchers will analyze blood samples collected from routine medical procedures to under-stand how these drugs move through the bodies of children, as well as collect information on potential side effects and patient outcomes, such as the duration and type of respiratory support that may be needed. These studies are designed to refine dosing and improve safety for use in children. Researchers can expand the products to be tested as scientists learn more about the treatment needs of patients with COVID-19.

Objective 5.4: Address global health research needs from COVID-19

NIH recognizes that a global pandemic requires a global response and will work with international partners to improve fundamental knowledge of SARS-CoV-2 and COVID-19, as well as optimize the development and delivery of diagnostic tests, treatments, and vaccines to populations most in need. Much of the initial knowledge regarding the basic science, epidemiology, and disease characteristics of COVID-19 was gained from or developed in collaboration with the international scientific and medical communities. Collaborations with scientists around the globe have been essential to piecing together the emergence and spread of SARS-CoV-2, and they have helped identify the populations most severely affected. Critical to these efforts are open lines of communication and a collaborative, unified perspective among the international biomedical community. NIH will continue to foster international collaborations to address the COVID-19 public health response on a global level, drawing on a worldwide network of grantees and former trainees, many of whom have leadership roles in global and national responses.

Robust international scientific collaboration will be critical to the development and distribution of diagnostics, treatments, and vaccines needed to control COVID-19 on the global scale necessary for full social and economic recovery. NIH is coordinating efforts with other international COVID-19 product development accelerators to share best practices and information about clinical trials and the advancement of promising new medical countermeasures. Academic and industry collaborations outside the United States will provide critical perspective on SARS-CoV-2 transmission, track molecular changes in the virus, establish epidemiological tools to help monitor outbreaks and new infection patterns, and help develop countermeasures against the virus. By applying lessons learned from implementation and dissemination science studies in low- and middle-income countries, where health care providers do not have ready access to advanced technologies for infectious and other diseases, NIH will employ its international clinical infrastructure and academic relationships and create new collaborations to ensure swift distribution of these diagnostics and interventions to the populations that need them most.

Partnering to promote collaborative science

Supporting the research workforce and infrastructure

Investing in data science

CROSSCUTTING STRATEGIES

To support the five strategic priorities, NIH will pursue crosscutting strategies that build upon its existing strengths as the Nation's premier biomedical research agency. Specific examples of these strategies have been provided throughout this plan.

Partnering to promote collaborative science

NIH will continue current collaborative efforts and establish new ones, including training opportunities, to build a well-prepared academic workforce in the United States and internationally to accelerate research on COVID-19. By leveraging existing NIH-funded global research networks, coordinating closely with its Federal partners, and creating new public-private

partnerships, NIH will continue to employ every opportunity to deepen the understanding of and develop interventions for COVID-19. Many NIH-funded research networks already have been mobilized to address COVID-19—including those focused on specific practice areas, particular demographics, or otherwise at-risk populations—such as the PETAL Network managed by the National Heart, Lung, and Blood Institute.

NIH will both continue and expand collaborations with its fellow agencies and offices within the Department of Health and Human Services (HHS) (e.g., BARDA, CDC, FDA) and beyond (e.g., Department of Defense) to ensure efficient and rapid dissemination of diagnostics, treatments, and vaccines to the public. Furthermore, NIH and its Federal partners, including those involved in Operation Warp Speed (Box 3), will continue to work closely and recognize the importance of collaboration with the private sector, scientific societies, nonprofit organizations, patient communities, and health care providers.

Supporting the research workforce and infrastructure

Despite challenges presented by the pandemic and measures put in place to limit its spread, NIH has worked with the scientific community to advance COVID-19 research. By adapting its processes to work within the physical distancing constraints of the pandemic, NIH will continue to process proposals and fund research projects in a timely manner. For example, NIH has expanded its use of virtual meetings to conduct peer reviews to protect the health of reviewers and NIH staff while facilitating the funding of COVID-19 and other research. NIH also will continue to support researchers by providing validated biosamples and funding the expansion and retooling of research facilities. Furthermore, NIH will solicit innovative ideas to aid the COVID-19 response, potentially from investigators outside of infectious disease or virology research, through such mechanisms as the NIH Common Fund High-Risk, High-Reward Program. Ideas may relate to basic research, novel diagnostic strategies, vaccines, or therapeutics.

In addition to funding COVID-19 research in the extramural community, NIH will continue to mobilize its Intramural Research Program and the Clinical Center in support of COVID-19 research. Talented investigators will use NIH's specialized infrastructure that supports unique patient cohorts and clinical trials networks, as well as its state-of-the-art equipment, to deliver one-of-a-kind services relevant to COVID-19. These efforts will take advantage of a unique and wide range of research and technological expertise, as well as partnerships and collabo-rations with extramural investigators. Projects are underway to evaluate and validate serology tests, design and assess PPE, and complete onsite clinical trials and basic science research. NIH will maximize the capacity and use of its vaccine treatment and evaluation units to enroll participants rapidly and evaluate vaccine candidates in a safe and effective manner.

Investing in data science

To accelerate the pace of scientific discovery, NIH will support multiple data science efforts to ensure that COVID-19 research data are findable, accessible, interoperable, and reusable (the FAIR principles). By enhancing existing and creating new data science resources and analytical tools, NIH will facilitate the use of COVID-19 data to the greatest extent possible, both by those generating the data and by other researchers. These investments will support development of diagnostic tools, survey instruments, risk assessment models, public health surveillance tools, and portals to share data, among others (e.g., NIH Repository of COVID-19 Research Tools, OpenData Portal, PhenX, SHIELD [Systemic Harmonization and Interoperability Enhancement for Laboratory Data Collaborative], and SPHERES [SARS-CoV-2 Sequencing for Public Health Emergency Response, Epidemiology, and Surveillance]). NIH investments to develop shared metrics and terminologies across research projects will facilitate and maximize the use of a wide breadth of data, from chemical structures to clinical trial results.

Through these approaches, NIH will continue to explore and implement innovative ways to leverage its domestic and global infrastructure to address the needs of the COVID-19 pandemic and speed its resolution.

CONCLUSION

At the start of the COVID-19 pandemic, NIH and the biomedical community immediately began an unprecedented effort to diagnose, prevent, and treat this rapidly spreading disease. NIH has collected innovative and creative ideas from across the country, built new partnerships, and in alignment with interagency partners has designed a bold and ambitious plan for protecting the American people from the novel coronavirus. These efforts already have shed light on the virus, its biology, and promising approaches to mitigate the pandemic. Preparing for future epidemics and enhancing response capacity will be a vital legacy of this work.

The discoveries made by NIH scientists and NIH-funded investigators have built on countless technological advances to biomedical science. Genome sequencing, imaging technologies, data science and bioinformatics, and implementation science all have contributed to our knowledge of SARS-CoV-2 and COVID-19. To meet current needs, the approach to biomedical research has shifted in groundbreaking ways. By bringing together teams across a range of sectors and scientific disciplines and building on discoveries of the past, NIH will continue to take a crosscutting, integrative view of public health to put forward creative and bold strategies to end the COVID-19 pandemic.

The COVID-19 pandemic is the latest reminder of the constant threat of emerging and re-emerging infectious diseases to the health of the American people. These pathogens require constant surveillance as they evolve and adapt to environmental pressures. Likewise, NIH must maintain a flexible, adaptable infrastructure to support research programs that aim to understand the fundamental biology of new organisms and their potential impact on human health. These efforts will prepare scientific groundwork to protecting life through this and future public health threats. Under these extraordinary circumstances, NIH will continue to act swiftly to turn discoveries into health.


NIH
National Institutes of Health

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Tue, 21 Jul 2020 20:52:19 +0000
To: NIAID Announcements
Subject: Give Blood, Give Life at NIAID's Annual Blood Drive (7/20 – 7/31)
Attachments: Blood Drive 2020 8.5 by 11final.pdf

Dear Colleagues:

NIAID and the NIH Clinical Center are co-sponsoring our 10th annual two-week blood drive among NIAID employees from July 20 to July 31, 2020. For the past nine years, NIAID has held one of the most successful Institute/Center blood and platelet drives at NIH. NIAID employees have helped many NIH patients with their donations of blood components.

I encourage the participation of all employees who are eligible to donate blood components for NIH patients. Each donation benefits up to three patients and takes only one hour of your time. The blood you donate at the NIH Blood Bank is used to support the many patients who come here from all over the world to receive treatment. In appreciation of your dedication to helping others, NIAID will grant administrative leave to any NIAID federal employee who donates blood at the NIH Blood Bank for this blood drive. Specifically, you will be granted four hours of administrative leave to be used immediately following your blood donation appointment. As always, notify your supervisor for approval prior to donating at the NIH Blood Bank. Contractor employees should speak directly to their contract companies to determine what leave options are available.

If you would like to participate, please contact the NIH Blood Bank at **301-496-1048** and let them know that you are with the NIAID Blood Drive. Appointment times are between 7:30 am and 4:30 pm; the NIH Blood Bank will answer eligibility questions and provide information about the various types of donations. You should allow 90 minutes for your donation because of the additional cleaning that is necessary after each donation. The NIH Blood Bank is located at the NIH main campus, Building 10, Room 1C713. Masks are required to enter campus. The U.S. Public Health Service will give you a new disposable mask and a plastic bag for storing your personal mask. Reserved parking is conveniently available in the MLP9 garage while you donate. You may enter Building 10 at the north or south entrance.

To donate platelets or double red cells at the NIH Donor Center at Fishers Lane, call **301-496-4321** to make an appointment. Be sure to let them know you are with NIAID. The Donor Center at Fishers Lane is open for donations Monday through Thursday from 8 am to 3 pm and Friday from 7:30 am to 12 pm and is located at 5625 Fishers Lane, Room 1S02.

Thank you for considering this worthwhile cause.

Best regards,
A.S. Fauci

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National Institute of Allergy and Infectious Diseases

NIAID Blood Drive

In support of NIH Clinical Center patients

July 20-31, 2020

Blood donations at the Clinical Center (Bldg 10), Room 1C713, M-F, 7:30 am - 4:30 pm
Platelet donations at the NIH Donor Center, 5625 Fishers Lane, Room 1S02, M-Th 8:00 am - 3 pm and Friday 7:30 am - 12:00 pm

- Free parking while donating
- Great snacks
- Professional healthcare team

To donate whole blood, call 301-496-1048
To donate platelets call, 301-496-4321

For more information, visit www.bloodbank.nih.gov

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Tue, 21 Jul 2020 21:36:50 +0000
To: (b) (6)
Subject: FW: farmers to families boxes

Let us discuss.

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Sent: Tuesday, July 21, 2020 4:00 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Folkers, Greg (NIH/NIAID) [E] (b) (6); Billet, Courtney (NIH/NIAID) [E] (b) (6)
Subject: FW: farmers to families boxes

From: McGuffee, Tyler Ann A. EOP/OVP (b) (6)
Sent: Tuesday, July 21, 2020 3:58 PM
To: Conrad, Patricia (NIH/NIAID) [E] (b) (6); Barasch, Kimberly (NIH/NIAID) [C] (b) (6)
Subject: FW: farmers to families boxes

From: Hurley, Carolina L. EOP/WHO (b) (6)
Sent: Tuesday, July 21, 2020 3:57 PM
To: Birx, Deborah L. EOP/NSC (b) (6); (b) (6) (b) (6)
Cc: Radford, Julie T. EOP/WHO (b) (6); Craddock, Rachel A. EOP/WHO (b) (6); McGuffee, Tyler Ann A. EOP/OVP

<[redacted] (b) (6)
Subject: farmers to families boxes

Dr. Birx, Dr. Fauci

I wanted to reach out about the letters that we are putting in the Farmers to Families Food Boxes from the President highlighting the program and urging Americans to consider wearing face-coverings

I know Ivanka had reached out earlier this week. would you all be interested in sending a quote to include in a press story on these letters? We will be pitching to AP in the coming days. Thank you.

Kindly,

Carolina L. Hurley
White House Specialty Media Director
c: [redacted] (b) (6) (*no texting*) | o: [redacted] (b) (6)
t: @CLH45

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Thu, 14 May 2020 11:47:54 +0000
To: (b) (6)
Subject: FW: Urgent Invitation from the Association of Black Cardiologists to Dr. Anthony Fauci
Attachments: Letter of Invitation_Dr A Fauci.pdf, ABC-COVID-19-FAQs.pdf, CIRCULATIONAHA.120.At the Heart of the Matter. Unmasking and Addressing COVID 19s Toll on Diverse Populations.pdf

I just do not have time for this.

Patty:
Please gracefully decline.
Thanks,
Tony

Anthony S. Fauci, MD
Director
National Institute of Allergy and Infectious Diseases
Building 31, Room 7A-03
31 Center Drive, MSC 2520
National Institutes of Health
Bethesda, MD 20892-2520
Phone: (b) (6)
FAX: (301) 496-4409
E-mail: (b) (6)

From: Eisinger, Robert (NIH/NIAID) [E] (b) (6) **On Behalf Of** Fauci, Anthony (NIH/NIAID) [E]
Sent: Thursday, May 14, 2020 7:35 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: FW: Urgent Invitation from the Association of Black Cardiologists to Dr. Anthony Fauci

An invitation from the Association of Black Cardiologists.

Robert W. Eisinger, Ph.D.
Special Assistant for Scientific Projects
Immediate Office of the Director
National Institute of Allergy and Infectious Diseases

National Institutes of Health
31 Center Drive, Room 7A-03
Bethesda MD 20892
Telephone: (b) (6)
Email: (b) (6)

From: Cassandra McCullough <cmccullough@abcardio.org>
Sent: Wednesday, May 13, 2020 10:28 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6) Barasch, Kimberly (NIH/NIAID) [C] (b) (6) Conrad, Patricia (NIH/NIAID) [E] (b) (6); Folkers, Greg (NIH/NIAID) [E] (b) (6)
Subject: Urgent Invitation from the Association of Black Cardiologists to Dr. Anthony Fauci

Dear Dr. Fauci , Ms. Conrad, Ms. Barasch and Mr. Folkers:

I hope you are enjoying a fine week! Please review the attached letter of invitation to Dr. Anthony Fauci from Dr. Michelle Albert, President of the Association of Black Cardiologists (ABC). We would be delighted to have him participate in an upcoming virtual conference sponsored by the ABC on May 20, 2020, from 12:00 PM – 1:30 PM ET. We recognize that it may be difficult for Dr. Fauci to be available for the full 1-1/2 hours, and welcome any period of time he could join us. The COVID-19 Webinar details are included in the attached letter.

Thank you in advance for your consideration of this request.

Sincerely,

Cassandra McCullough on behalf of
Dr. Michelle Albert, ABC President
Private Cell: (b) (6) (private cell)

Cassandra McCullough, MBA
Chief Executive Officer

Association of Black Cardiologists, Inc.
2400 N Street, NW, Suite 200
Washington, DC 20037
(b) (6) Cell
cmccullough@abcardio.org
www.abcardio.org

Michelle A. Albert, MD MPH
Professor of Medicine / Director, Ce**N**ter for the St**U**dy of Adve**R**si**T**y and Cardiovasc**U**la**R** Disease
(NURTURE Center)

University of California, San Francisco / Division of Cardiology, Department of Medicine
505 Parnassus Avenue, San Francisco, CA 94143
President - San Francisco Bay Area American Heart Association Board of Directors

UCSF PROFILE: http://profiles.ucsf.edu/michelle.albert
Email: michelle.albert@ucsf.edu
NURTURE CENTER Website: http://nurture-center-ucsf-cardiology.org
Phone: 415-502-2415

From: Albert, Michelle A
Sent: Wednesday, May 13, 2020 9:01 AM
To: [redacted]
Subject: Urgent Invitation from the Association of Black Cardiologists

Dear Ms. Conrad,
I hope that you are having a great day. Please find enclosed a formal invitation letter of request to Dr. Fauci. I will be seeing patients all day- hence feel free to send a text to my cell (noted in the letter) and an email.
Best regards,
Michelle

Michelle A. Albert, MD MPH
Professor of Medicine / Director, Ce**N**ter for the St**U**dy of Adve**R**si**T**y and Cardiovasc**U**la**R** Disease**E** (NURTURE Center)
University of California, San Francisco / Division of Cardiology, Department of Medicine
505 Parnassus Avenue, San Francisco, CA 94143
President - San Francisco Bay Area American Heart Association Board of Directors

UCSF PROFILE: http://profiles.ucsf.edu/michelle.albert
Email: michelle.albert@ucsf.edu
NURTURE CENTER Website: http://nurture-center-ucsf-cardiology.org
Phone: 415-502-2415

Association of Black Cardiologists, Inc.
Saving the Hearts and Minds of a Diverse America

2400 N Street NW, Suite 200
Washington, DC 20037

(800) 753-9222
www. abcardio.org

ABC MISSION:
To promote the prevention and treatment of cardiovascular disease, including stroke, in Blacks and other minorities and to achieve health equity for all through the

May 12, 2020

Anthony Fauci, MD
Director, National Institute of Allergy and Infectious Diseases
5601 Fishers Lane
Bethesda, MD 20892-9806

Dear Dr. Fauci:

By way of introduction, my name is Michelle Albert and I am the current President of the Association of Black Cardiologists (ABC), a Professor of Medicine and Cardiologist at UCSF as well as a resident of the San Francisco Bay Area, CA. On a fundamental level, I am so proud and thrilled of your leadership on a ton of levels.

Regarding COVID-19, we in the ABC are very concerned about the disparities by race/ethnicity particularly in relation to African-Americans. Many are dying due to cardiovascular conditions and we are thus uniquely poised to highlight these issues as the primary organization that concerns itself with cardiovascular disease in diverse communities, especially blacks.

We are very interested in being at the table of any task force or other leadership initiatives that address the issue of COVID-19 and minorities. We ran the first webinar on this topic on April 8th and have just published a paper released on the topic.
(https://www.ahajournals.org/doi/10.1161/CIRCULATIONAHA.120.048126) . The publication includes a figure that comprehensively addresses the issues at play. Please feel free to use. The Frequently Asked Questions (FAQ Watch) were also created for health care providers.
http://abcardio.org/wp-content/uploads/2020/04/ABC-COVID-19-FAQs-v3.pdf

Most urgently, we would like to kindly invite you to participate in our next COVID-19 webinar as a panelist or via a short recorded message (we can discuss desired content) on May 20th, 2020, 12:00 pm – 1:30 pm EST. The panel will be from 1-1:30 pm.

Thanks so much for your time and prompt response. Please do not hesitate to call with any questions Cassandra McCullough, ABC's CEO (404-964-3171 or cmccullough@abcardio.org) or myself.

Sincerely,

Michelle Albert
Michelle Albert, MD, MPH
President, Association of Black Cardiologists
(b) (6)**(private cell)**

Michelle A. Albert, MD MPH
Professor of Medicine / Director, CeNter for the StUdy of AdveRsiTy and CardiovascUlaR DiseasE (NURTURE Center)
University of California, San Francisco / Division of Cardiology, Department of Medicine
505 Parnassus Avenue, San Francisco, CA 94143
President - San Francisco Bay Area American Heart Association Board of Directors

UCSF PROFILE: http://profiles.ucsf.edu/michelle.albert
Email: michelle.albert@ucsf.edu
NURTURE CENTER Website: http://nurture-center-ucsf-cardiology.org
Phone: 415-502-2415

About the Association of Black Cardiologists

Since 1974, ABC has been a preeminent leader in and foremost voice for the elimination of disparities in cardiovascular care and outcomes. Through the belief in the need to bring special attention to the adverse impact of cardiovascular disease on African Americans, the ABC has grown into an international organization of healthcare, lay professionals, community health advocates, corporate and institutional members. ABC's deep roots in the community anchor the *Seven Steps to a Healthy Heart* focusing on the daily practice of cardiovascular risk factor control. ABC education initiatives are further enriched through continuing medical education and clinical research. The Association has always advocated for better health care for all as embodied in the tagline: *Saving the hearts and minds of a diverse America*.

ASSOCIATION OF BLACK CARDIOLOGISTS COVID-19 FAQ WATCH

Editors: Kevin M. Alexander, MD (Chair), Michelle A. Albert, MD MPH, Peter Chin-Hong, MD MPH, Norrisa Haynes, MD MPH

We know there are a lot of questions about COVID-19, and the impact is evolving every day. These frequently asked questions are for the health care provider audience. Please check **www.abcardio.org** for regular updates. You can also watch the **ABC Webinar, At The Heart of The Matter: Unmasking the Invisibility of COVID-19 in Diverse Populations**, to learn more about the virus.

What are the clinical stages of COVID-19?

In the early stage of infection (day 1 – 7), the pathogenesis of the disease is driven by viral entry and replication. Common symptoms are fever, dry cough, body aches, headache, and fatigue; however, many persons may be asymptomatic. Viral load is highest in the early stage of infection when many individuals are asymptomatic. Hence, asymptomatic persons may be a source of spread. Additionally, some infected persons may have gastrointestinal symptoms, such as nausea and diarrhea. There are also increasing reports that some people may experience unusual symptoms, such as loss of smell (anosmia) or eye pain. Blood tests may reveal a low lymphocyte count (lymphopenia) and elevated markers or inflammation (e.g., C-reactive protein).

Some individuals may develop more severe lower respiratory tract infection. Signs and symptoms include shortness of breath, hypoxia, and lung abnormalities on chest X-ray or CT. Patients with respiratory symptoms may need to be evaluated in the emergency room and hospitalized for oxygen supplementation and supportive care.

A small subset of patients will further progress to advanced disease. While the progression to advanced disease can occur at any time, this tends to occur day 10 – 14. This late stage of COVID-19 is caused by a hyper-inflammatory response of the host against the virus. Patients can have acute respiratory distress syndrome, shock, and thrombosis. These patients require management in an intensive care unit (ICU).

Overall, approximately 80% of patients do not need hospitalization. However, patients who need ICU care with associated intubation have done poorly with death rates in excess of 60-80%.

What are the cardiovascular complications associated with COVID-19?

Based on case reports, the most commonly described cardiovascular complications include acute cardiac injury (defined as troponin I elevation > 99th percentile of the upper reference limit which has been found to be a predictor of mortality based on **cohort studies from China**), myocarditis, myopericarditis, cardiogenic shock, and life-threatening arrhythmias, including ventricular tachycardia and heart block. Heart failure without cardiogenic shock may also occur. The etiology of heart failure is unclear but might include viral infection, cytokine effects, and stress-induced cardiomyopathy.

What medical treatments are currently recommended for management of COVID-19?

There are currently no therapies specifically approved for COVID-19 infection prevention or treatment. There is no vaccine yet available for COVID-19, and one is not expected for at least 12 months. Most persons will recover with medications, such as acetaminophen (Tylenol) for fever. Data about treatment with hydroxychloroquine with or without azithromycin remains equivocal; thus, these medications are not recommended. Moreover, both drugs can potentially result in cardiac arrhythmias due to QT interval prolongation. Remsedivir, inhibits viral replication, is under evaluation for use in hospitalized patients. Convalescent COVID-19 plasma from recovered persons with COVID-19 is also being evaluated as a mode of treatment.

How should interventional cardiologists and catheterization laboratories change their practice in the midst of the COVID-19 pandemic?

- The centers of Medicare and Medicaid services recommend that all elective procedures be delayed during the pandemic.
- According to the Society for Cardiovascular Angiography and Interventions (SCAI) https://doi.org/10.1002/ccd.28887, intubation in the catheterization lab should be avoided. If indicated, early intubation should be performed prior to presentation to the catheterization lab. Additionally, patients presenting with a myocardial infarction should be screened for COVID-19, and all patients should wear masks. Catheterization lab staff should all wear personal protective equipment.
- According to the SCAI guidelines, all patients should be screened for COVID-19. If negative, then proceed with standard of care. If the patient, however, is COVID-19 positive (or suspected of having COVID-19 if testing is not available), they should be risk stratified into high risk vs. low risk STEMI. For high risk STEMIs in COVID-19+ patients, primary PCI should be performed (high risk is defined as an anterior STEMI,

hypotension, elevated Killip class, cardiogenic shock or a life-threatening presentation >12 hours). For low-risk STEMI presentations, fibrinolysis should be considered in those without contraindications (intracranial hemorrhage, prior stroke, recent trauma/surgery, intracranial malignancy/AVMs/aneurysm, active bleeding or uncontrolled hypertension), otherwise consider primary PCI or medical management.

- For NSTEMI in COVID-19+ patients, the recommendation is early angiography (<2 hours) for very high-risk patients (refractory chest pain, heart failure, cardiogenic shock, life-threatening arrhythmias), and conservative management for low- or moderate-risk patients.

In the setting of the COVID-19 pandemic, what are the new recommendations for transthoracic echo (TTE) and transesophageal echo (TEE) procedures?

According to the American Society of Echocardiography (ASE) **https://www.asecho.org/wp-content/uploads/2020/03/COVIDStatementFINAL4-1-2020_v2_website.pdf**, elective TTEs and TEEs should be deferred. At this time, TTEs and TEEs should only be performed if they will directly impact the management of patients. If the TTE/TEE is indicated and the patient is known to have COVID-19 or is suspected to have COVID-19, the following precautions should be taken:

- According to the ASE, for TTEs or stress tests performed in the echo lab, ward, EP or cath lab, or the ED, droplet precautions should be taken (surgical mask, gown and gloves)
- According to the ASE, for TTEs performed in the OR, ICU, or on an intubated patient or a patient on NIPPV, airborne precautions should be taken (N-95 mask, gown, gloves and face shield)
- According to ASE, TEEs are high risk procedures and should be deferred whenever possible. If a TEE is absolutely necessary, then airborne precautions should be used
- Alcohol based solutions are typically adequate for disinfecting machine surfaces, however, ASE has links to each manufacturer's official cleaning recommendations https://www.asecho.org/covid-19-resources/.

Is it safe to continue taking angiotensin converting enzyme inhibitors or angiotensin receptor blockers?

SARS-CoV-2, the virus that causes COVID-19, enters host cells via an interaction with cells' angiotensin converting enzyme 2 (ACE2). Preclinical studies suggest that ACE inhibitors and ARBs may increase the expression of ACE2, and thus in theory, increase the pathogenicity of SARS-CoV-2. To date, there are no clinical data demonstrating an increased risk of adverse outcomes in COVID-19 patients taking an ACE inhibitor or ARB. Furthermore, abrupt discontinuation of these drugs, in the certain populations, such as heart failure patients, has been associated with adverse outcomes. Therefore, the Heart Failure Society of America, American College of Cardiology, and American Heart Association recommend that patients currently on ACE inhibitors or ARBs continue to take these medications.

Are African Americans at increased risk of contracting SARS-CoV-2 and are they at increased risk of more severe disease from COVID-19?

African Americans are not at increased risk of contracting COVID-19 due to any genetic predisposition that we are currently aware of, however, many people of color live in metropolitan, densely populated areas, often in multi-generational households and rely on public transportation, all of which can increase the rate of transmission and risk of contracting COVID-19. In regard to the risk of severe disease, the African American community on an epidemiological level is at an increased risk of severe disease due to a higher prevalence of risk factors such as hypertension, diabetes, cardiovascular disease, asthma, and obesity.

How can communities of color mitigate the spread of COVID-19 and decrease their risk of infection?

To decrease the rate of transmission, it is important to stay home if feeling unwell to avoid potentially spreading COVID-19 to others. Additionally, if unwell, it is also important to contact a health care provider to help determine next steps. Symptoms of shortness of breath should result in urgent seeking of medical care. It is also important to wash your hands with soap and water frequently. Hand washing should be with soap and water for at least 20 seconds or use of a hand-sanitizer with > 70% alcohol content if soap is unavailable.

The CDC also recommends practicing social distancing (at least 6 feet apart) and wearing a mask in public settings. In circumstances where a mask is unavailable, use of a homemade mask or bandanna although not optimal is okay. If possible, it is advisable to walk to work or to grocery stores to avoid public transportation. It is also important to be physically and mentally healthy during these challenging times. Try to eat a diet rich in fruits and vegetables as much as possible especially because there is some evidence that vitamins, such as vitamin C, may be beneficial. Also, stay in frequent communication with friends and family via telephone or video chat to combat feelings of isolation. It is essential to continue all medications provided by a health care provider as conditions, such as heart attack and stroke, remain significant causes of disability and death in all at-risk persons, especially in communities of color.

10.1161/CIRCULATIONAHA.120.048126

At the Heart of the Matter: Unmasking and Addressing COVID-19's Toll on Diverse Populations

Running Title: *Haynes et al.; Unmasking COVID-19 Health Disparities*

Norrisa Haynes, MD, MPH[1]; Lisa A. Cooper, MD, MPH[2]; Michelle A. Albert, MD, MPH[3]; On Behalf of the Association of Black Cardiologists

[1]Division of Cardiology, University of Pennsylvania, Philadelphia PA; [2]Department of Medicine, Johns Hopkins University, Baltimore MD; [3]University of California, San Francisco, CeNter for the StUdy of AdveRsiTy and CardiovascUlaR DiseasE (NURTURE Center), Division of Cardiology; San Francisco CA

Address for Correspondence:
Michelle A. Albert, MD, MPH
Professor of Medicine, Division of Cardiology
University of California, San Francisco
President, Association of Black Cardiologists
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Introduction

The COVID-19 pandemic has unmasked longstanding racial and ethnic health-related disparities. As noted by Ta-Nehisi Coates in reference to racial/ethnic inequities, the *"sociology, the history, the economics, the graphs, the charts, the regressions all land with great violence upon the body"*[1] and COVID-19's impact on the body, especially on bodies of color is too often fatal.

Epidemiology

Emerging racial/ethnic data from local health departments and the CDC indicate alarming fatality statistics for COVID-19 by race/ethnicity. Data indicate that co-morbidities such as hypertension, diabetes, cardiovascular disease, obesity, chronic lung disease, and kidney disease are risk factors for poor COVID-19 outcomes.[2] African-Americans (Blacks) have the highest prevalence of hypertension and kidney disease, with an earlier age of onset.[2] Native Americans have an extremely high prevalence of diabetes, and Hispanic/LatinX individuals suffer from similar comorbidities at comparable rates.[2] Thus, it is no surprise that people of color have been disproportionately impacted by the present pandemic.

On a national level, CDC data representative of 10% of the US population reveals that Blacks account for 33% of COVID-19 hospitalizations, despite consisting of 18% of the sample population. In Louisiana, Blacks make up 32% of the population, yet account for 70% of COVID-19 related fatalities.[2] In NYC, Hispanic/LatinX persons account for 28% of the population, but 34% of COVID-19 related deaths.[2] In New Mexico, Native Americans account for 11% of the population, but 37% of COVID-19 positive cases.[3]

The outsized impact of COVID-19 on communities of color extend beyond the U.S. In the United Kingdom (UK), data show that while UK Blacks comprise approximately 3% of the UK population, they represent 12% of COVID-19 ICU patients.[2] By contrast, Blacks only

accounted for 3% of non-COVID-19 viral pneumonia ICU admissions.[2] Blacks were also disproportionately represented among those with COVID-19 who required ventilators; ventilation was associated with a 67% mortality rate. [2]

Social Determinants

The health disparities exposed by the current public health crisis did not materialize in a vacuum, but are largely driven by socio-economic and environmental factors. The effects of COVID-19 on vulnerable populations highlight large disparities in resource allocation which perpetuate poverty and segregation. Data show that the most impoverished communities, which are largely communities of color, have been hardest hit by COVID-19.[2] Moreover, social distancing is difficult in impoverished communities due to overcrowding, residence in multi-generational households, and the inability to work from home. For example, 16% of Hispanic/LatinX and 20% of Black workers can telework compared to 30% of White and 37% of Asian workers.[2]

Given that unemployment rates for Blacks are typically twice that of Whites, the full impact of the economic fallout from COVID-19 will be especially hard-felt in Black and other communities of color. After the 2008 recession, while white household wealth stabilized, the median Black household wealth continued to fall. If the 2008 recession is an indication of the future, the wealth gap will continue to widen given the steeply rising unemployment rates due to COVID-19. Additionally, the insurance coverage gap will undoubtedly increase. A significant percentage of communities of color are uninsured.[4] With increasing unemployment rates, public insurance options such as Medicaid will be vital.

Clinical Presentation

The emerging differences in COVID-19 complications by race/ethnicity are disturbing and as previously noted might be in part driven by a higher prevalence of co-morbidities at an earlier

age among U.S minorities. Furthermore, against a historical backdrop of healthcare system mistrust, marginalized groups may present to hospitals later, during the late pulmonary phase and the hyper-inflammatory phase.

There remains a lack of published data regarding racial/ethnic variance in COVID-19 presentation. However, San Francisco county data from 4/15/20 showed that young Hispanic/LatinX persons are disproportionately affected by COVID-19 such that 42% of cases are among persons <40 years old of which 24% are of Hispanic/LatinX heritage. These reports are contrary to published data annotating that the most severe disease presents in individuals older than 60 years of age.

Additionally, as the social distancing messaging permeates media airwaves, the number of medical encounters and hospitalizations for non-COVID-19 related illnesses has sharply decreased. For example, emerging research indicates, a 38% reduction in the activation of the cardiac catheterization laboratory for acute myocardial infarction at some centers.[5] The decrease is likely due to people delaying medical attention for cardiac symptoms out of concern for becoming infected with COVID-19. Although systematic data are currently unavailable, other vulnerable groups, including those of lower socioeconomic status, low health literacy, undocumented immigrants and non-English speakers are also likely at differential increased risk due to delayed presentations.

Additionally, the mental health impact of COVID-19 on society, especially on COVID-19 survivors and their families cannot be overstated. For survivors and their families, the tincture of time will reveal long-term clinical effects typically patterned by race/ethnicity, including disproportionate levels of psychosocial stress and anxiety.

Potential Solutions

In order to mitigate the spread of COVID-19, attenuate further stigmatization of communities of color, and decrease the effects of the economic downturn, several actions must be taken **(Figure).** Healthcare entities must collect and present COVID-19 data according to socio-demographic characteristics. COVID-19 testing must be easily available in all communities and contact tracing must be relentless. Housing availability should be expanded. Facilities such as hotels and dorms should be used to quarantine symptomatic individuals to avoid spread to family members and neighbors. Suspension of foreclosures and evictions should occur. Incentives to provide free or discounted food delivery to low-income neighborhoods and the elderly are necessary. Food banks will benefit from additional funding to reduce food insecurity. Due to the increased reliance on telemedicine and distance learning, policymakers should support broad access to computers and free internet for vulnerable communities. Employers should provide paid sick and quarantine leave to help reduce the risk of unwitting spread. Ultimately, lessons learned from the COVID-19 pandemic must be taken as an opportunity to address long-standing social and racial/ethnic disparities. Our vulnerable interconnectedness highlighted by the COVID-19 pandemic should ignite meaningful solution-focused collaborations among community leaders, scholars and policymakers to orchestrate sustainable change aimed at addressing pervasive healthcare disparities.

Conflict of Interest Disclosures

All authors have no conflicts of interest

References

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2. Albert MA, Chin-Hong P, Haynes N, Alexander K, Cooper L, Ybarra M. At The Heart of the Matter: Unmasking the Invisibility of COVID-19 in Diverse Populations Webinar. Association of Black Cardiologists (ABC). April 8th 2020. ABCardio.org. http://abcardio.org/covid19-webinar/. Accessed April 8th 2020.
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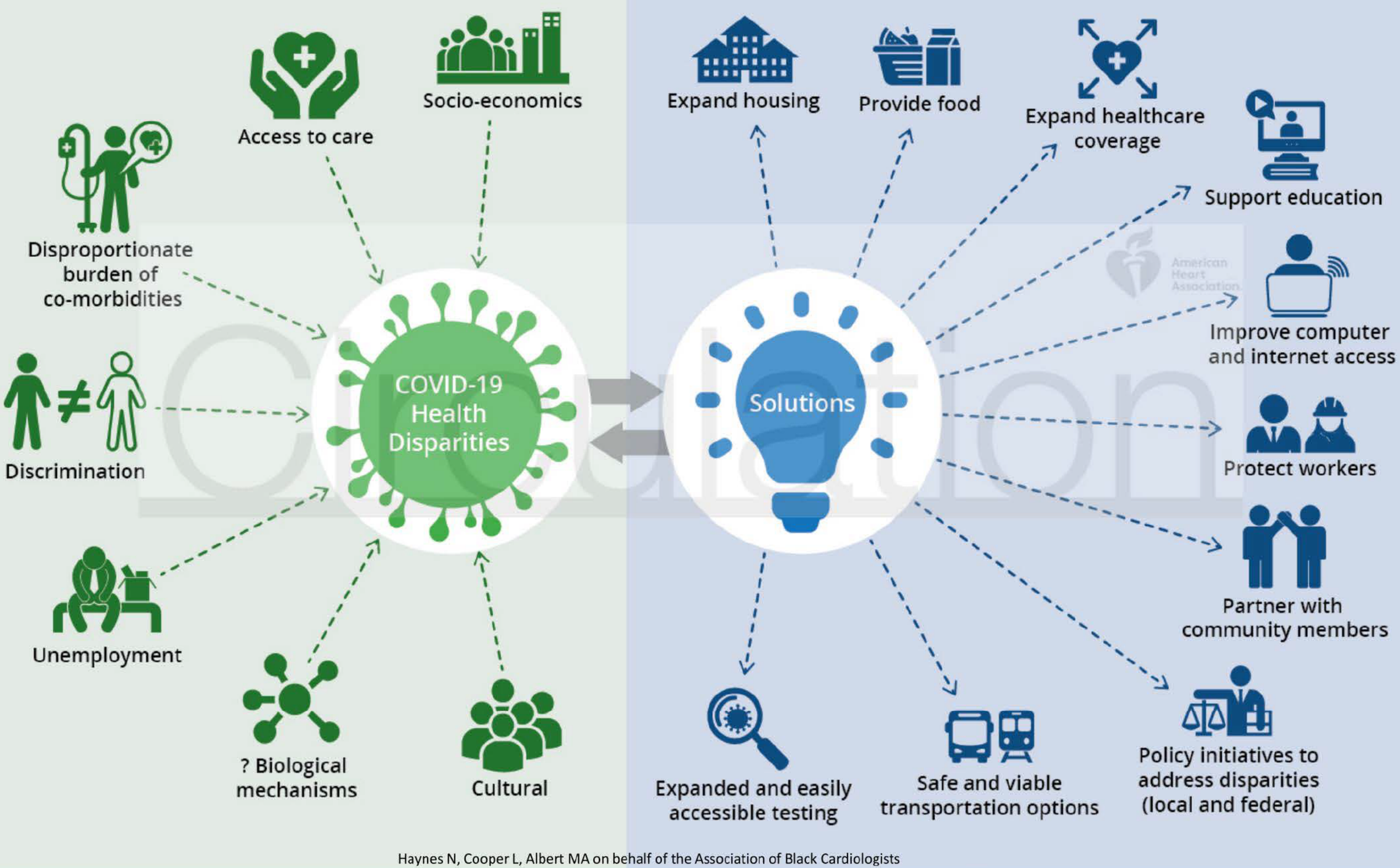
Figure Legend

Figure. Novel Coronavirus Health Disparities and Solutions

Coronavirus (COVID-19) Health Disparities and Solutions



Haynes N, Cooper L, Albert MA on behalf of the Association of Black Cardiologists

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Thu, 16 Jul 2020 18:24:46 +0000
To: Michael Earnest
Cc: (b) (6)
Subject: RE: Details for Dr. Fauci

Mike:

Thank you for your kind note. It is much appreciated. I will take a look at your son's request with my team. I am not travelling at all and even if I start again, it probably will be limited. Nonetheless, we will take a serious look at the request.

Best regards,

Tony

Anthony S. Fauci, MD
Director
National Institute of Allergy and Infectious Diseases
Building 31, Room 7A-03
31 Center Drive, MSC 2520
National Institutes of Health
Bethesda, MD 20892-2520
Phone: (b) (6)
FAX: (301) 496-4409
E-mail: (b) (6)

From: Michael Earnest (b) (6)
Sent: Thursday, July 16, 2020 1:57 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: FW: Details for Dr. Fauci

Tony,

Wow! Things are getting hot for our nation and even for you (b) (6) and I are in awe of your equanimity and your consistent voice of wisdom.

My best wishes and prayers continue daily for you, for the other voices of integrity (eg our Gov. Polis) and our nation. We and our whole nation need such reassuring and honest leadership.

(b) (6)

When he heard I knew you he was very interested and later he asked if I would be willing to contact you on his behalf. After conversation, I agreed.

(b) (6)

So I am sending his request as stated in his letter below. He and I both know that you are extraordinarily busy, and so may not even have time to even consider his request. We fully will respect whatever response you make.

David's contact information is below. Thank you for receiving his request.

My continuing admiration and support for you, and your family.

"Illegitimi non carborundum"! For real.

Mike

From: David Earnest (b) (6)
Sent: Wednesday, July 15, 2020 3:47 PM
To: Michael Earnest (b) (6)
Subject: Re: Details for Dr. Fauci

Hi, (b) (6)

You asked that I share some details with you concerning an invitation to Dr. Fauci to speak at USD. Here is my latest thinking, although all of this is subject to negotiation:

The Department of Political Science at the University of South Dakota would invite Dr. Fauci to visit our main campus in Vermillion at a time of his choosing during the 2020-21 academic year (August 2020 to May 2021). I envision a visit of perhaps two days consisting of two activities: a general public event at which he would discuss a topic of his choice (presumably but not necessarily related to the pandemic), and a closed-door, off-the-record event at which he would meet with students in the Department of Political Science. For the forthcoming fall semester, we are offering an undergraduate seminar on the "The Politics of COVID-19" which offers him a natural audience; at the moment I think we have about a dozen juniors and seniors enrolled. We would be just as happy to have a small group for a socially-distanced brown-bag lunch, off-campus dinner or some other small-scale event of his choice.

You may reassure Dr. Fauci that USD is taking numerous precautions to open and operate safely. Although the state's Board of Regents has opined that we do not have the legal authority to mandate the wearing of face coverings, USD's leadership is strongly encouraging all faculty, staff and students to do so while on campus--the university has purchased and issued USD-branded face masks to all faculty and staff. USD is also reorganizing the fall schedule to reduce overall classroom density and maximize social distancing to the required minimum of six feet. The administration is working closely with the state public health authorities and has developed contingency plans for the provision of care, isolation of suspected positive cases, and contact tracing and notification. Finally, the university has made a number of other operational changes: increased cleaning and disinfecting efforts, the provision of hand sanitizer for all faculty and staff, the provision of extra cleaning supplies for departments, and the increased use of remote meeting technologies. Our webpage (COVID-19 | USD) documents all of these changes and more.

Of course, if Dr. Fauci were to visit we would take all necessary precautions for his safety. We have a good working relationship with our local Holiday Inn Express (our best VIP hotel) and would work to make his room as safe as possible.

The **Department of Political Science would cover all of Dr. Fauci's travel expenses**. We will provide airfare to/from Washington, DC to the closest airport of his choice (Sioux Falls, SD and Sioux City, IA are each within an hour; Omaha is less than two hours away but has nonstop flights to/from National Airport). We will pay for hotel in Vermillion, meals and other related expenses. We would be pleased to have a faculty member meet him at the airport of his choice or, if he prefers, to pay for a rental car.

If federal rules permit Dr. Fauci to receive an **honorarium**, USD would offer one.

The Department has enjoyed **a history of distinguished guest speakers**. South Dakota's congressional delegation and state leaders are regular visitors to our campus; within the last year, Governor Kristi Noem, former Governor Dennis Daugaard, Senator John Thune and Congressman Dusty Johnson all have spoken to our students. Past guest speakers include Justice Clarence Thomas; dissident, statesman and Nobel Peace Prize Laureate Lech Walesa; and journalist/USD alumnus Tom Brokaw.

I understand that both Dr. Fauci and USD face many uncertainties. He may wish to wait until after the November elections to visit Vermillion or consider our invitation. Likewise, the invitation presumes that USD will continue with uninterrupted on-campus instruction. Given these many uncertainties, **USD would work to be as flexible and accommodating as possible**.

Finally, **if Dr. Fauci would prefer to appear virtually, we would very much support and welcome that request**.

I trust you find these details informative. If you have any questions or concerns, just let me know. Of course, Dr. Fauci's staff is welcome to contact me directly at David.Earnest@usd.edu (my contact information is in my signature below) or at this personal email address, (b) (6)

(b) (6)

David

~~~~~~

David C. Earnest, Ph.D.
Odeen-Swanson Distinguished Professor of Political Science
Chair, Department of Political Science & Director, W.O. Farber Center
University of South Dakota
414 E. Clark Street
Vermillion, SD 57069

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Fax: 605-677-8808

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From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Wed, 1 Jul 2020 00:06:54 +0000
To: (b) (6)
Subject: FW: 6/30 Testimony Re: Contact Tracing

Let us discuss. I will explain.

From: Kennedy Walls <kwalls@princeton.edu>
Sent: Tuesday, June 30, 2020 2:01 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6) Redfield, Robert R. (CDC/OD) (b) (6)
Cc: Auchincloss, Hugh (NIH/NIAID) [E] (b) (6); Redd, Stephen (CDC/DDPHSIS/OD) (b) (6)
Subject: 6/30 Testimony Re: Contact Tracing

Dear Dr. Fauci, Dr. Redfield, and Team,

I am Kennedy Walls from Atlanta, GA and will be a (b) (6) at Princeton University this fall. I am writing to respectfully inform you that there is a severe disconnect in the contact tracing system.

After hearing urgent calls to action to apply to become a COVID-19 Contact Tracer on the news in late May, I watched the WHO:GO Training on Case Finding & Contact Tracing, read and annotated the sample contact tracing training plan PDF posted on the CDC website, and completed the Johns Hopkins COURSERA COVID-19 Contact Tracing Course. I then immediately applied to all of the contact tracing jobs/volunteer positions I could find during the first week of June. Here are a few of them:

- Georgia Department of Public Health- Georgia Contact Tracer
- MAXIMUS- Public Health Contact Tracing
- Joining the CONTRACE database as willing to work full time or part as well as for pay or as a volunteer

Many of the applications expressed preference for undergraduate students majoring in Public Health. I will be concentrating in Medical Anthropology while receiving a certificate in Global Health beginning this fall. Additionally, many of the applications seek applicants proficient in languages other than English. I speak French at a full professional capacity and Mandarin and Arabic at an elementary level.

Throughout the month of June, I continually checked in on my applications an reapplied when allowed but have yet to receive a request for an interview let alone a job/volunteer position.

I am dedicated to improving the public health of all of our country's inhabitants. In 2017, I founded a nonprofit that provides health care resources and feminine hygiene products to refugees in Clarkston, GA (known as the Ellis Island of the South due to the large influx of refugees and immigrants). Now, I have shifted gears to contactlessly supplying COVID-19 necessities to the refugee population such as free, homemade, reusable masks (with 2 layers of thick fabric and 2 filters) and feverscan forehead thermometers.

I am doing the best I can and felt compelled to write to you (which I still cannot believe I am doing considering your stature and professional positions) after watching your testimony this morning where contact tracing was again mentioned as a core strategy to saving lives and stopping the spread of the virus. I am sure I am not the only person who has been unable to secure a contact tracing position and wanted to bring to your attention that I am at the ready to be, as the unofficial motto of my University states, and in the words of Princeton President Eisgruber "in the nation's service and the service of humanity" as a contact tracer.

I cannot thank you enough for taking the time to read my email and for your unwavering commitment to protecting our country's public health.

Respectfully,

Kennedy Walls
Princeton University 2024
(b) (6)

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Wed, 17 Jun 2020 00:29:40 +0000
To: Fauci, Anthony (NIH/NIAID) [E]
Subject: Politico story

With help from Myah Ward

VEEP IN THOUGHT — Since February there has been a rift inside the White House between the scientists and the politicians over how to contain the spread of coronavirus. Anthony Fauci has been the consistent advocate of a forceful response and an opponent of any sugar-coating of the perils Americans face. President Donald Trump has been the reluctant warrior against the disease who took some major steps early on but soon grew impatient of the stay-at-home restrictions, the masks, and — most of all — the economic calamity that might jeopardize his re-election.

Vice President Mike Pence, the chair of the president's coronavirus task force, often played the role of bridge between the factions. At the awkward task force briefings that dominated afternoon television in March and April, the three roles of the three men played out as theater: Fauci the doomsayer, Trump the misinformed optimist, and Pence the child of a troubled marriage trying to smooth things over during mom and dad's public fights.

Anthony S. Fauci, MD
Director
National Institute of Allergy and Infectious Diseases
Building 31, Room 7A-03
31 Center Drive, MSC 2520
National Institutes of Health
Bethesda, MD 20892-2520
Phone: (b) (6)
FAX: (301) 496-4409
E-mail: (b) (6)

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Wed, 17 Jun 2020 01:04:36 +0000
To: (b) (6)
Subject: FW: NIAF HONORS

I should do this (b) (6)

From: Harrison, Pat <pharrison@cpb.org>
Sent: Tuesday, June 16, 2020 8:28 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: NIAF HONORS

Dear Tony:

I hope you know you have the support and admiration of so many Americans—most of us are following your advice regarding masks and social distancing. NIAF is so proud to be able to honor you in October 2020, but as this virus waxes, wanes and upticks again, I wanted to get your input as we begin to make plans for the gala. Following your counsel, we have made the decision not to gather a group of 2000 people !-- but instead we are proposing the following scenarios:

1. We can host a small group of leaders at the Omni Hotel where we can physically present you with the Leonardo da Vinci Award and announce the Anthony Fauci scholarship to be given to a young Italian American researcher annually. We would consult with you regarding the details of the award and its presentation beginning in 2021. Unless you have a candidate in mind for 2020. At this event we will use ZOOM or TEAMS and utilize videos of people who want to express their appreciation for all you are doing for our country—and all you have done. Our NIAF membership will join the program through Zoom as well.

(2) If the virus spikes in the fall, we will do the entire presentation utilizing ZOOM from your home and will have the videos available as well.
Our NIAF members will be able to join the presentation.

If you agree, we will plan for both scenarios unless you want to decide now. Which would work as well.

In any case, Ambassador Armando Varricchio is looking forward to welcoming you in person or virtually. As am I.
Warm regards, Pat

From: Auchincloss, Hugh (NIH/NIAID) [E] on behalf of Fauci, Anthony (NIH/NIAID) [E]
Sent: Sun, 31 May 2020 16:59:23 +0000
To: (b) (6)
Subject: FW: Norris School District Input
Attachments: Return to School Blueprint (4).pdf

Should we tape a generic response to these?

From: John Schwartz <john.schwartz@nsdtitans.org>
Sent: Saturday, May 30, 2020 1:11 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: Norris School District Input

Dr. Fauci,

My name is John Schwartz and I am theNorris School District superintendent in Nebraska. Norris is both rural and urban in its composition. We are growing and enroll 2,500 students in four schools that all exist on one campus. We have developed a collaborative and iterative planning process to prepare for the various circumstances in the fall. We have our first full Return to School Core Task Force meeting next Tuesday beginning at 1 p.m. central standard time. I was wondering if you would be willing to join our meeting via Zoom for even a short period of time to share some thoughts and insights for our planning. I think it would be motivating to have someone such as yourself join our group and help to set a positive trajectory. Even five minutes of your time to share general comments would be worthwhile and appreciated.

Attached is the framework we intend to use to guide planning. It is driven by core values, beliefs, and essential planning questions. It strategically seeks to involve key stakeholders and breaks planning down into management tenets and tiers. All of this is in draft form, but the structure is intended to provide a framework to inform our work together. I share this so you can get a sense for how we intend to plan as an organization.

This is not a political request. We would not inform the media or let others know you will join us for the meeting. I'm a public school administrator trying to do a good job, motivate a well intended team, and set a positive trajectory during an unprecedented time. It would be an honor to have you join us even if for a short period of time.

Thank you for your consideration.

Sincerely,

John Schwartz

--
Dr. John Schwartz, Ed.D.
Superintendent
Norris School District

25211 S. 68th
Firth, NE 68358
(b) (6)

Norris School District

Return to School Blueprint

The purpose of this blueprint is to provide a framework for how Norris School District will respond to the COVID-19 pandemic and its impact on the educational program at Norris School District during the 2020-2021 school year. The framework is structured using tenets and tiers in order to allow the district to be nimble and responsive to changing public health circumstances. The presence of a formal plan will also support the district in articulating its plan for next fall in a clear, comprehensive, and transparent manner.

Norris Vision Statement:
All Norris students will develop the skills, knowledge, and attitudes necessary to be successful.

Norris Mission Statement:
The Norris School District, in collaboration with its communities and families, shall provide the best possible learning experiences and opportunities to assure that all students have the capability to become responsible, productive citizens and life-long learners.

Driving Values (TBD):

- Planfulness
- Proactiveness
- Transparency
- Flexibility
- Patience
- Responsiveness
- Resourcefulness
- Collaboration
- Accountability

Driving Beliefs (TBD):

- We believe in providing a high quality educational experience to all students regardless of the circumstances.
- We believe in making decisions that ensure the health and safety of students and staff, especially for those that are at an elevated risk.
- We believe that being proactive in planning and preparation is critical in order to effectively respond to the situation
- We believe that it is important to share with Norris stakeholders the “why” behind decisions and action steps.
- We believe it is important to presume positive intent and to model it to other Norris stakeholders.
- We believe that reflection is an important tool to support the development, and improvement, of any plans we implement in response to the COVID-19 pandemic.
- We believe that teachers are the most important factor in supporting student learning.
- We believe that being in school is the best place for students to receive an education.

Essential Planning Questions:

- How can we effectively serve Norris students educationally regardless of the modality and circumstances in which we are asked to serve them?
- Do school calendars, start times, or days of operation need to change in order to serve students within the guidelines to operate our schools safely?
- What school operations do we need to be prepared to alter on short notice as public health guidance changes when students and staff are on campus?
- As a rural campus, how do we get students to campus and concurrently honor public health guidelines such as social distancing?
- How can we meet social distancing guidelines and still operate with some or all students on the Norris campus?
- How do we protect students in high risk categories when school is in session on campus and still deliver high quality instruction to them?
- How do we safely deliver an extracurricular program for sports, fine arts, and other co-curricular experiences?
- How do we protect staff in high risk categories when school is in session on campus and still operate a school effectively?
- What safety measures need to be in place to resume some degree of in-person instruction in the fall (e.g., screening)?
- How do we improve the quality of the remote learning experience for students and staff should an extended school closure be needed again in the 20-21 school year?
- What professional development, support, or planning opportunities do we need to provide to Norris staff this summer in order to prepare them for the 2020-2021 school year?
- What supplies and other resources do we need to acquire proactively in order to ensure we can carry out any on campus plans next fall?
- What steps can we take to promote best practices for personal hygiene for students, staff, and families?
- How can we meet the communication needs of Norris stakeholders (families, students & staff) in a systematic way so that our efforts are not overwhelming and yet sufficient to explain the “what,” “why,” and “how” any plans we make and implement?
- How will we respond if someone that has been on Norris’ campus and has interacted with students and staff tests positive for COVID-19?
- How do we handle students that are unable to report to campus because they have been recommended for self-quarantine?
- How should Norris School District begin the 2020-2021 school year (instructionally and operationally)?

Return to School Blueprint Core Task Force:
Dr. John Schwartz, Superintendent
Dr. Brian Maschmann, Assistant Superintendent
Dr. Brenda Tracy, Director of Special Education/Curriculum
Mr. Nate Seggerman, High School Principal
Mr. Mitchell Stine, High School Assistant Principal/Athletic Director
Ms. Robyn Warner, High School Assistant Principal
Dr. Brittany Hajek, Middle School Principal
Mr. Matt Rice, Middle School Assistant Principal
Mrs. Kris Morrison, Intermediate Principal
Mrs. Brooke Kastanek, Intermediate Assistant Principal
Dr. Jenny Piening, Elementary Principal
Mrs. Jamie Kernes, Elementary Assistant Principal
Mr. Noel Erskine, Technology Director
Mrs. Mel Maendele, Food Service director
Mrs. Becky Progreba, Head School Nurse
Dr. Kristyn Jones, NAE President
Mrs. Patty Bentzinger, Board of Education President
Mrs. Jane Hansmeyer, School Wellness Coordinator
Mrs. Jill Behrends, Elementary Counselor/Former PK-12 Psychologist
Mr. Joe Gehr, School Resource Officer

Return to School Blueprint Consultation Task Force:
Elementary Parent Rep
Intermediate Parent Rep
Middle School Parent Rep
High School Parent Rep
Elementary Staff Rep
Intermediate Staff Rep
Middle Staff School Rep
High Staff Staff Rep
Support Staff Rep
Support Staff Rep
Transportation (Driver) Staff Rep
Norris Board of Education

Draft Core Planning Scenarios:

Scenario	Description	Rationale
A1	School is in session for all (100%) students and staff on campus in August.	• In this scenario, the school has a plan to meet guidelines provided for the reopening of schools and local public health conditions warrant a return to school on campus with appropriate safety precautions being made.
A2	Delayed start of school until after Labor Day.	• This calendar option would only be used if public health officials, the commissioner, or governor indicated that an on time August star with student in person on campus was not possible until after Labor Day. Another potential rationale for this calendar option would involve the timeline for a vaccine and the desire to maximize the amount of in person instruction that takes place in the calendar. This is an initial draft that would need to be tweaked, but it provides an initial starting point for discussions.
A3	Early start of school and extended holiday break from Thanksgiving through the new year.	• This calendar option would only be used if public health officials, the commissioner, or governor indicated it was necessary and appropriate to start early in order to allow for an early end to on campus instruction during the first semester and to prevent a return to campus in the immediate weeks following the holiday break to curb anticipated virus spread. The use of remote learning would allow for semester balance and provide a contingency to achieve instructional hours without scheduling school into June. This is an initial draft that would need to be tweaked, but it provides an initial starting point for discussions.
B	Social Distancing Scenario - 50% Capacity. Hybrid of on campus (in-person) and virtual (remote learning) instruction. Examples: • AM/PM Cohort • Alternating A/B Days • M/T & T/F with Wednesday online planning/ delivery. • K-5 spread out among all facilities & 6-12 remote. • Other???	• Actual hybrid approach TBD. • Why: ○ Necessary to achieve social distancing expectations in public health guidance within the school and/or on a school bus. ○ Necessary to adequately daily screen students and staff reporting to campus.
C	Remote Learning	• Necessary in the event of an extended school closure of more than 2+ weeks.

Core Planning Tenets:

Governance: includes this document as the core structure that will guide decision making and the response to the public health crisis in addition to board policy, administrative regulations and memorandums which will guide the application of the district vision/mission during the pandemic.

Screening: includes steps taken to assess students and staff for COVID-19 symptoms prior to engaging in the school environment.

School Operations: includes operational aspects of how schools run such as arrival/dismissal, passing periods, visitor access, student movement throughout the school, staff meetings, recess, student attendance policies, etc.

Food Service: includes school meal services such as breakfast, lunch, and grab and go when school is operating on campus and during extended school closure.

Cleaning/Facility Modifications: includes guidelines for custodians and staff for how to proactively avoid the spread of germs and illness, how to respond when someone who has tested positive for COVID-19 has been on campus, and any safety related facility modifications made.

Extracurricular Activities/External Facility Use: includes sports, activities, field trips, and co-curricular functions beyond core, within school day, instruction as well as access to school athletic facilities by external groups.

Academics: includes plans to address unfinished learning, continuity of learning (remote learning) in the event of extended school closure, and the delivery of educational services to special populations (e.g., special education, LEP, etc.).

Technology Services: includes promotion and support for the use of instructional technology for in-person and remote learning as well as logistics related to the distribution of devices and technology support (device repair, internet access strategies, etc.) in the event of an extended school closure.

Transportation: includes plans to keep students safe and healthy on school buses within guidelines provided by public health experts.

Human Resources: includes policies and programs related to staff absenteeism, strategies to address personnel shortages, and high risk populations.

Health Services: includes the delivery of services by school nurses on campus during the pandemic including but not limited to the location of the health office, how to handle symptomatic students, and monitoring of on campus illness and absentee rates.

Wellness: includes social and emotional supports and programs for students and staff as well as the strategic promotion of good personal hygiene habits across the Norris campus.

Crisis Team: includes delivery modification plans related to providing crisis support for students, staff, and the Norris community in the event of a tragic incident or death during the pandemic.

PPE: includes recommended or required PPE for students and staff to be worn during regular school operations.

At-Risk or Vulnerable Populations: includes strategies to protect students and staff in higher risk categories.

Tiered Model: Many of the elements in the plan below have tiered levels of response from the school district. The intended definition of each tier has been provided below; however, the application may vary depending upon guidance from local public health officials or the governor (issued directed health measures). The tiers below correspond with the Lincoln-Lancaster County Health Department Risk Assessment Dial that is updated on a weekly basis. Depending upon public health guidance and other local context, the application of the tiers may be applied more rigorously than the degree of spread indicated in the chart. For example, public health recommendations may compel the use of tier II or III strategies even when no area spread exists. Likewise, the school district may choose to apply tier II actions in one tenet area when the conditions and public health recommendations will only result in the use of tier I practices. In this way, the real intent behind the tiered model below is to proactively outline the progressively rigorous actions the district may take as circumstances change throughout the pandemic.

Tier I	No to Minimal Area Risk/Spread
Tier II	Minimal to Moderate Area Risk/Spread
Tier III	Moderate to Substantial Area Risk/Spread
Confirmed COVID-19 Case in Building Regardless of Degree of Community Risk	• Short (2-5 days) building dismissal to clean, disinfect, and contract trace in consultation with local health officials. • Potential 14+ day closure depending upon public health recommendations.

Tenet: Screening

Core Team: Becky Progreba; Brenda Tracy; John Schwartz (Notes Captured - Not Final)
Extended Team Members:

	District
Tier I	• Staff for themselves and parental self-screening for students at home. District provides self-screening resource for families to utilize at home (e.g., refrigerator magnet or card stock checklist.
Tier II	• Staff are stationed at main entrances and ask students whether they have experienced any of the symptoms on signage provided. Students that answer "yes" have a temperature taken and receive a referral to the school nurse for further assessment.
Tier III	• All staff and students have temperature taken prior to the start of the school day (e.g., bus or school campus TBD).

Tenet: School Operations

Core Team: Nate Seggerman; Brittany Hajek; Kris Morrison; Jenny Piening; John Schwartz
Extended Team Members:

	Elementary	Intermediate	Middle	High
Tier I	•	•	•	•
Tier II	•	•	•	•
Tier III	•	•	•	•
School Calendar	School Calendar A	Draft School Calendar A2	Draft School Calendar A3	

Tenet: Food Service/Security

Core Team: Mel Maendele; Jamie Kernes; Brooke Kastanek; Matt Rice; John Schwartz
Extended Team Members:

	Elementary Intermediate	**Middle**	**High**
Tier I	Preliminary Notes…. • Implement CDC Guidance for School Nutrition Professionals • No self service • Remove finger scanners and use ID cards/name badges • Disposable trays and utensils		
Tier II	•	•	•
Tier III	•	•	•

Tenet: Cleaning/Facility Modifications

Core Team: Brian Maschmann; Keith Brunkow
Extended Team Members: Becky Progreba (or other nurse); others TBD

	District
Tier I	• Base Pandemic Cleaning Plan - Link to Cleaning Guidance • Proactive purchase of clearing supplies (9 week supply): ○
Tier II	•
Tier III	Note Steps when someone has been sick with COVID-19

Tenet: Extracurricular Activities

Core Team: Mitchell Stine; Matt Rice; Brooke Kastanek
Extended Team Members:

	Athletics	Fine Arts	Activities, Co-Curriculars, & Field Trips	External Facility Use
Tier I	•	•	•	•
Tier II	•	•	•	•
Tier III	•	•	•	•

Tenet: Academics (Link to Plans)

Core Team: Mr. Seggerman; Brittany Hajek; Kris Morrison; Jenny Piening; Brenda Tracy; Noel Erskine; Brittany Sullivan; Jason Gault
Extended Team Members: Teachers TBD by Core Team

	Elementary	Intermediate	Middle	High
Unfinished Learning	Fall Transition Plan			
Extended School Closure School Continuity (Remote) Learning Plan	District Continuity of Learning Plan (To be updated for 20-21)	District Continuity of Learning Plan (To be updated for 20-21)	District Continuity of Learning Plan (To be updated for 20-21)	District Continuity of Learning Plan (To be updated for 20-21)
Short-Term (2-5 days) Closure Continuity Plan				
District				
Special Education	• Extended School Closure (To be updated for 20-21)			
LEP				

Tenet: Technology

Core Team: Noel Erskine; Jason Gault; Bryan Williams; Mark Hausner
Extended Team Members: TBD by Core Team

	Access: Devices & Internet	**Help Desk/Support**	**Professional Development for Staff, Students & Families**
Pre-Closure	•	•	•
Extended Closure	•	•	•

Tenet: Transportation (Sample Draft)

Core Team: Brian Maschmann; Gaylen DeVries; Mitchell Stine; Brenda Tracy
Extended Team Members: Drivers TBD; Parents TBD

	District
Tier I	• All buses will be sanitized between each use. • Students and parents will be encouraged to self-screen for cold or flu-like symptoms prior to coming to the bus. • Maintain open windows to promote airflow on the bus when feasible (e.g., weather elements).
Tier II	• All students and drivers wear face coverings. • Students use hand sanitizer when getting on the bus. • The bus will load from back to front and exit from front to back.
Tier III	• Reduce bus capacity to 50% or one student per seat. . • Student seating to promote social distancing (row 1 = window seat; row 2 = isle; alternate by left/right side of bus). • Students will be screened for symptoms prior to boarding the bus (e.g. temperature, asked if they have cold or flu-like symptoms).

Tenet: Human Resources

Core Team: John Schwartz; Brian Maschmann; Linda Lindersmith; Kim Broderson
Extended Team Members: Board of Education; Administrative Team; Justin Knight

	District
Tier I	• Relaxed Certified Staff Leave (Memorandum) • Relaxed Support Staff Leave (Memorandum) • Families First Coronavirus Response Act • FMLA and Extended FMLA • High Risk Staff Members: Plan to protect TBD
Tier II	•
Tier III	• Extended School Closure Staff Expectations

Tenet: Wellness (Social and Emotional Supports)

Core Team: Brenda Tracy; Jane Hansmeyer; Becky Progreba; School Counselors
Extended Team Members:

Staff Wellness Supports: •	Student Social and Emotional Supports: • CDC guidance for talking with children about the coronavirus. •
Personal Hygiene Promotional Efforts: •	

Tenet: Health Office Services

Core Team: Becky Progreba; ….
Extended Team:

	District
Tier I	•
Tier II	•
Tier III	•

Tenet: Crisis Team Services (Delivery Modifications)

Core Team: Brenda Tracy; Jamie Kernes; School Counselors
Extended Team Members: District Crisis Team

	Positive COVID-19 Test	Student or Staff Death
Campus Open	•	•
Campus Closed	•	•

Tenet: PPE

Core Team: John Schwartz, LLCHD, and Lancaster County Health Department
Extended Team Members: Return to School Blueprint Core Task Force

	District
Tier I	• Face coverings provided and recommended for staff and students but not required. • High risk students and staff have an N95 mask provided.
Tier II	• Face coverings required for all students and staff on the bus, in classrooms, and during passing periods except when outdoors and socially distant and eating lunch. •
Tier III	•

Tenet: At-Risk or Vulnerable Populations

Core Team: John Schwartz, LLCHD, and Lancaster County Health Department
Extended Team Members: Return to School Blueprint Core Task Force

	District
Tier I	• High risk students and staff have an N95 mask provided.
Tier II	• High risk students are provided an N95 mask alternative and optional face shield.
Tier III	•

SCHOOLS DURING THE COVID-19 PANDEMIC

The purpose of this tool is to assist administrators in making (re)opening decisions regarding K-12 schools during the COVID-19 pandemic. It is important to check with state and local health officials and other partners to determine the most appropriate actions while adjusting to meet the unique needs and circumstances of the local community.

Should you consider opening?

- ✓ Will reopening be consistent with applicable state and local orders?
- ✓ Is the school ready to protect children and employees at higher risk for severe illness?
- ✓ Are you able to screen students and employees upon arrival for symptoms and history of exposure?

ANY NO → **DO NOT OPEN**

ALL YES →

Are recommended health and safety actions in place?

- ✓ Promote healthy hygiene practices such as hand washing and employees wearing a cloth face covering, as feasible
- ✓ Intensify cleaning, disinfection, and ventilation
- ✓ Encourage social distancing through increased spacing, small groups and limited mixing between groups, if feasible
- ✓ Train all employees on health and safety protocols

ANY NO → **MEET SAFEGUARDS FIRST**

ALL YES →

Is ongoing monitoring in place?

- ✓ Develop and implement procedures to check for signs and symptoms of students and employees daily upon arrival, as feasible
- ✓ Encourage anyone who is sick to stay home
- ✓ Plan for if students or employees get sick
- ✓ Regularly communicate and monitor developments with local authorities, employees, and families regarding cases, exposures, and updates to policies and procedures
- ✓ Monitor student and employee absences and have flexible leave policies and practices
- ✓ Be ready to consult with the local health authorities if there are cases in the facility or an increase in cases in the local area

ANY NO → **MEET SAFEGUARDS FIRST**

ALL YES → **OPEN AND MONITOR**

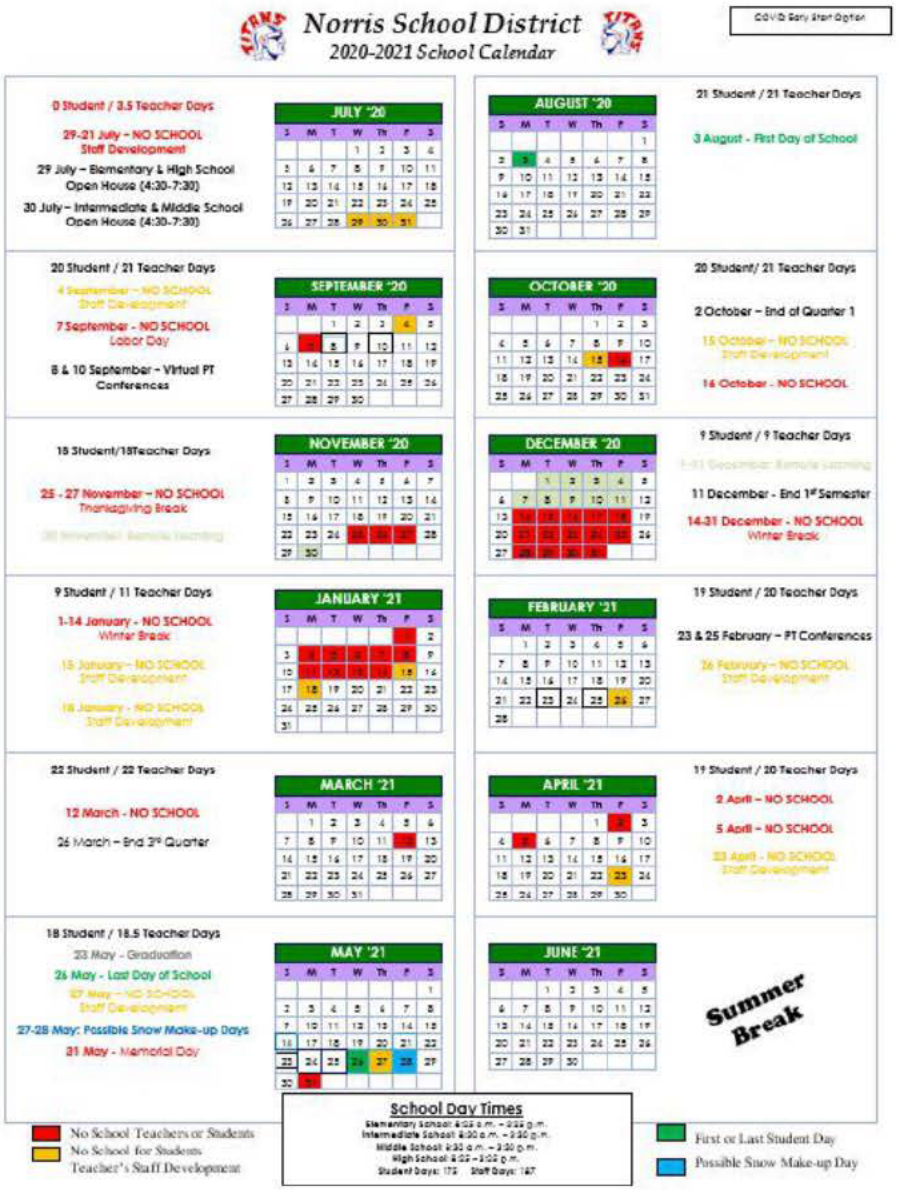
CDC

cdc.gov/coronavirus

School Calendar A1 - Current 20-21 School Calendar

DRAFT School Calendar A2 - Late Start Calendar

DRAFT School Calendar A3 - Early Start Calendar



From: Folkers, Greg (NIH/NIAID) [E] on behalf of Fauci, Anthony (NIH/NIAID) [E]
Sent: Wed, 26 Feb 2020 21:50:05 +0000
To: Laurencot, Elizabeth;Fauci, Anthony (NIH/NIAID) [E];Folkers, Greg (NIH/NIAID) [E]
Cc: Conrad, Patricia (NIH/NIAID) [E];Eisinger, Robert (NIH/NIAID) [E];Lane, Cliff (NIH/NIAID) [E]
Subject: RE: NEJM content proof (Fauci)

Eli,

[redacted] (b) (5)

Thanks,
Tony

From: Laurencot, Elizabeth <elaurencot@nejm.org>
Sent: Wednesday, February 26, 2020 4:45 PM
To: Fauci, Anthony (NIH/NIAID) [E] [redacted] (b) (6)
Cc: Conrad, Patricia (NIH/NIAID) [E] [redacted] (b) (6); Eisinger, Robert (NIH/NIAID) [E] [redacted] (b) (6); Lane, Cliff (NIH/NIAID) [E] [redacted] (b) (6); Folkers, Greg (NIH/NIAID) [E] [redacted] (b) (6)
Subject: RE: NEJM content proof (Fauci)

Dear Dr Fauci,

[redacted] (b) (5)

Please clarify --- thank you!

Best,
Eli

From: Folkers, Greg (NIH/NIAID) [E] (b) (6) > **On Behalf Of** Fauci, Anthony (NIH/NIAID) [E]
Sent: Wednesday, February 26, 2020 3:48 PM
To: Laurencot, Elizabeth <elaurencot@nejm.org>; Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Conrad, Patricia (NIH/NIAID) [E] (b) (6) >; Eisinger, Robert (NIH/NIAID) [E] (b) (6); Lane, Cliff (NIH/NIAID) [E] (b) (6); Folkers, Greg (NIH/NIAID) [E] (b) (6)
Subject: RE: NEJM content proof (Fauci)

Dear Eli,

(b) (5)

[redacted]

Thanks,
Tony

From: Laurencot, Elizabeth <elaurencot@nejm.org>
Sent: Wednesday, February 26, 2020 9:04 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Folkers, Greg (NIH/NIAID) [E] (b) (6); Conrad, Patricia (NIH/NIAID) [E] (b) (6); Eisinger, Robert (NIH/NIAID) [E] (b) (6) Lane, Cliff (NIH/NIAID) [E] (b) (6)
Subject: RE: NEJM content proof (Fauci)

Dear Dr Fauci,

Many thanks for your quick reply and for the clear list of responses regarding the proof. I will review today and will let you know if there are any items needing further discussion.

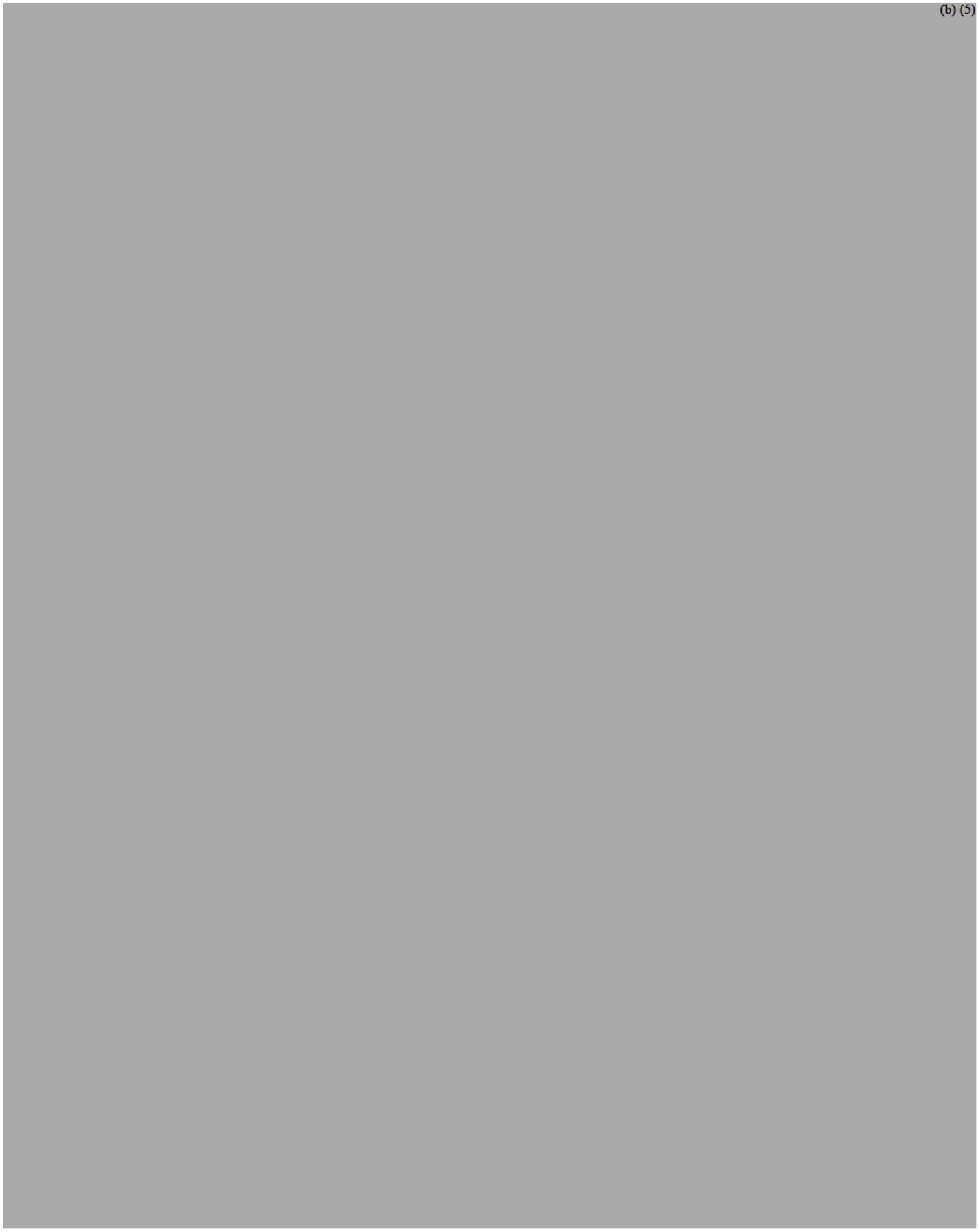
The current plan is for publication early Friday afternoon. As I mentioned yesterday, there is a new article on Covid-19 that is also scheduled for publication that day, and the Journal editors would like you to mention it in your editorial. I expect to be able to send you a proof of that article sometime today.

Best,
Eli

From: Fauci, Anthony (NIH/NIAID) [E] (b) (6)>
Sent: Wednesday, February 26, 2020 7:37 AM
To: Laurencot, Elizabeth <elaurencot@nejm.org>
Cc: Folkers, Greg (NIH/NIAID) [E] (b) (6) Conrad, Patricia (NIH/NIAID) [E] (b) (6) Eisinger, Robert (NIH/NIAID) [E] (b) (6); Fauci, Anthony (NIH/NIAID) [E] (b) (6) Lane, Cliff (NIH/NIAID) [E] (b) (6)
Subject: RE: NEJM content proof (Fauci)

Dear Eli,

(b) (5)


(b) (5)

(b) (5)

Thanks,

Tony

Anthony S. Fauci, MD
Director
National Institute of Allergy and Infectious Diseases
Building 31, Room 7A-03
31 Center Drive, MSC 2520
National Institutes of Health
Bethesda, MD 20892-2520
Phone: (b) (6)
FAX: (301) 496-4409
E-mail: (b) (6)

From: Laurencot, Elizabeth <elaurencot@nejm.org>
Sent: Tuesday, February 25, 2020 8:51 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: NEJM content proof (Fauci)
Importance: High

Dear Dr Fauci,

Attached is the content proof of your editorial. **Please read *ALL* of the following instructions and information carefully before** you begin reviewing your proofs.

First, please **stop and take a moment now** to confirm receipt, so that we can be assured that your proofs did not end up in a spam folder.

Your editorial has been edited for grammar, consistency, readability, adherence to Journal style, and clarity for nonspecialist readers. To expedite publication, we do not ask authors for specific approval of routine changes; please read the entire article to make sure your meaning has been retained. Note that we may be unable to make changes that conflict with Journal style or create grammatical or other problems. Finally, please note that a delayed or incomplete response may delay publication of your editorial.

Please read the entire proof carefully, including all queries. Please return your query replies and proof corrections ****before 12pm (US Eastern) this Friday, February 28, 2020****.

Instructions are provided below. Note that you will be reading for content only; the article will be rendered for print after the content has been finalized.

The Journal's senior medical editors will be reading your article at this stage. If they have any additional comments or queries for you, I will forward them to you in the next few days.

TO ANSWER THE QUERIES: The proof contains in-line numbered query markers and a numbered list of queries at the end. The query markers and the queries are linked, so you can jump back and forth within the file. Please respond to all the queries (see below for instructions; please do ****NOT**** use e-annotation tools) and convey any additional changes as needed.

TO RESPOND BY E-MAIL: If your corrections and your responses to the queries are straightforward, we encourage you to respond by replying to this message. Please copy and paste the list of queries into an e-mail message or a Word document and type your responses there. You may also include a list of changes (e.g., page 1, line 20, change xxx to yyy). Again, please do ****NOT**** use e-annotation tools in the PDF file; the marks are small and easy to miss, which may lead to errors in your article.

Please note that this material is confidential and embargoed until publication. If you have questions about our embargo policy, please contact NEJM Media Relations at 781-434-7847 or at Mediasupport@nejm.org.

Again, please do confirm receipt at this time. Thank you very much for your efforts with these content proofs!

Best,
Eli

Elizabeth Laurençot
Senior Manuscript Editor
New England Journal of Medicine

(b) (6)
elaurencot@nejm.org

TO READ THE PROOF: You will need Adobe Acrobat Reader software (version 4.0 or later) to view this file. Acrobat Reader is available free of charge at the Adobe Web site (http://www.adobe.com/products/acrobat/readermain.html).

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From: Eisinger, Robert (NIH/NIAID) [E] on behalf of Fauci, Anthony (NIH/NIAID) [E]
Sent: Thu, 16 Apr 2020 11:05:02 +0000
To: Fauci, Anthony (NIH/NIAID) [E]
Subject: FW: Notes from call with Dr. Fauci and Adm. Giroir

Email below is from Jeff Percak in followup to recent call with you and Brett Giroir.

Robert W. Eisinger, Ph.D.
Special Assistant for Scientific Projects
Immediate Office of the Director
National Institute of Allergy and Infectious Diseases
National Institutes of Health
31 Center Drive, Room 7A-03
Bethesda MD 20892
Telephone: (b) (6)
Email: (b) (6)

From: Percak, Jeffrey M <jpercak@tulane.edu>
Sent: Wednesday, April 15, 2020 8:59 PM
To: David Barr (b) (6); Fauci, Anthony (NIH/NIAID) [E] (b) (6) allison.arwady@cityofchicago.org; Giroir, Brett (HHS/OASH) (b) (6) Haddad, Carla (HHS/OASH) (b) (6); Conrad, Patricia (NIH/NIAID) [E] (b) (6) Demetre Daskalakis <ddaskalakis@health.nyc.gov>; Mushatt, David M <dmushatt@tulane.edu>; Jason Halperin <jason.halperin@crescentcare.org>; Duchin, Jeff <jeff.duchin@kingcounty.gov>; Barasch, Kimberly (NIH/NIAID) [C] (b) (6) (b) (6) preetha.iyengar@dc.gov; sbalter@ph.lacounty.gov
Subject: Re: Notes from call with Dr. Fauci and Adm. Giroir

Thanks to all for the time and the insights in to the situation nationally. I would like to clarify a few comments from New Orleans
-our inpatient turnaround time has been fantastic, and there have been laudable collaborations between local healthcare systems on testing. capacity is good with multiple platforms available.
-my concern regarding turnaround time may have been a few days outdated, as most have since reported much better TAT. I do remain concerned about the legacy of slower TAT in recent weeks, with both providers and patients often choosing to forego testing due to its perceived utility, and decreased patient demand due to restrictive testing criteria, with some local sites relaxing criteria dramatically as recently as the past day or two. will work on messaging to ensure testing is promoted.
-regarding concerns with employers, my concerns were actually in regards to reports of employers who are requiring proof of POSITIVE tests in order to allow patients leave, thus encouraging inappropriate presenteeism for people who have been ill

Many thanks to all, especially Adm. Giroir and Dr. Fauci. Be well everyone,

Jeff Percak

From: David Barr (b) (6)
Sent: Wednesday, April 15, 2020 4:06 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6); allison.arwady@cityofchicago.org <allison.arwady@cityofchicago.org>; Giroir, Brett (HHS/OASH) (b) (6); Haddad, Carla (HHS/OASH) (b) (6) Conrad, Patricia (NIH/NIAID) [E] (b) (6); Demetre Daskalakis <ddaskalakis@health.nyc.gov>; Mushatt, David M <dmushatt@tulane.edu>; Jason Halperin <jason.halperin@crescentcare.org>; Duchin, Jeff <jeff.duchin@kingcounty.gov>; Percak, Jeffrey M <jpercak@tulane.edu>; Barasch, Kimberly (NIH/NIAID) [C] (b) (6); laquandra.nesbitt@dc.gov <laquandra.nesbitt@dc.gov>; preetha.iyengar@dc.gov <preetha.iyengar@dc.gov>; sbalter@ph.lacounty.gov <sbalter@ph.lacounty.gov>
Subject: Notes from call with Dr. Fauci and Adm. Giroir

all last night. Below are notes. Please add to these and/or make corrections as needed.

Participants:
Anthony Fauci - NIAID
Brett Giroir - HHS/OASH
Allison Arwady - Chicago Dept. of Health
David Mushatt - Tulane University
Jeff Percak - Crescent Care
Demetre Daskalakis - NYC Dept of Health and Mental Health

PPE:
- More supplies are flowing and should be available. Trying to better understand the burn rate in cities and other locations. But masks and gloves are now widely available. There remains a shortage of gowns. Federal government has purchased millions of yards of fabric to make gowns. Chicago, NY and New Orleans all confirmed that supplies are more readily available with exception of gowns. In Chicago, the number of available ventilators has also improved significantly.

TESTING:
- This remains a major problem in cities as confirmed in Chicago and New York. Supply shortages are widespread including swabs, test tubes, reagents and media. Hospitals are increasing testing but with shortages, it is difficult to prioritize who gets tested and who does not.
- Major issue regarding test results with use of rapid tests in non-traditional settings include drive-up testing sites. Because these rapid tests are not linked electronically and also produce no paper report, none of these test results are getting to health departments. Positive results may be reported, but negative results are not. So, supply shortages and delays in getting test results are one problem - but data collection is another problem. A new rapid test should become available soon which is electronically linked. But how long scale up will take is not clear.
- Adm. Giroir reported that many labs are actually underutilized now. People have been told that either testing is not available or that they should not seek out testing. So, numbers are lower than they could be. The upside of this is that it makes turnaround time faster. In New Orleans, outpatient testing feels

useless as it takes too long to get results and people are not coming in for testing. More information is needed regarding lab turnaround time to better understand where the back logs are occurring and why.
- A more diverse variety of swabs are now shown to be effective. Nasal and nasal pharyngeal swabs have been shown to be equally effective. LabCorp is using cotton swabs dipped in saline to good effect. Some of these swabs will be easy to use and could be used by the person being tested with direction.
- Distribution of supplies is the biggest problem in testing scale up as is ensuring quality of supplies. FEMA will soon be able to distribute 1.5 million tests a week. There are 3.1 million test tubes coming in. By May, FEMA will be able to distribute 7 - 9 million tests a month.
- The major upcoming challenge: By this Fall, it is expected that 20 - 30 million tests per month will be performed. A work force of tens of thousands will be needed to test people and trace contacts. CDC will organize some of this work, but the majority of it will need to be organized at local levels.
- Employers are beginning to want proof of a negative test results in order to let people come back to work. This needs to be dissuaded through information campaign. Proof of a negative test result does not provide any real time view as to whether someone is infected or not.

ANTIBODY TESTING:

FDA has allowed a large number of ineffective tests to become available publicly. They are trying to get FDA to take down the list of unvalidated available tests to discourage their use. A validated test is coming with info in a few days. 20 - 40 million tests are coming from China.
- But we still don't understand whether the presence of antibodies confers immunity from illness or transmission.

From: Auchincloss, Hugh (NIH/NIAID) [E] on behalf of Fauci, Anthony (NIH/NIAID) [E]
Sent: Tue, 28 Apr 2020 14:46:56 +0000
To: (b) (6)
Subject: FW: HIGH SCHOOL MUN CONFERENCE

For discussion

From: Dane Cohn (b) (6)
Sent: Tuesday, April 28, 2020 10:44 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6); Barasch, Kimberly (NIH/NIAID) [C] (b) (6); Conrad, Patricia (NIH/NIAID) [E] (b) (6); Fauci, Anthony (NIH/NIAID) [E] (b) (6)>
Subject: HIGH SCHOOL MUN CONFERENCE

Dear Dr. Anthony Fauci,

My name is Dane Cohn, and I am an (b) (6) I have often listened to your inspiring words on the news and followed your assiduous work to help us through this pandemic. Our school participates in Model UN, an event in which high school students represent various countries in debates on international issues from the past and present. Colorado's final Model UN conference was canceled, so our school (b) (6) decided to host an online conference for the whole state of Colorado and beyond. Our team would like to formally invite you to give a short address (be it pre-recorded or live online) to the students during our opening ceremony.

We hope that our conference will inspire the youth of our nation and the world to stand up and fight for our future rather than resign their aspirations to lockdown. We host this conference because we see the importance of keeping our academic passions going while staying safe within the confines of our homes. We host this conference because we want to contribute to the fight against COVID-19 — money raised from our conference will go towards buying masks, food, and other resources for those who need it most.

This is why we ask you, a hero during this troubling time, to speak to the students of our conference, who not only include the youth of Colorado, but also the youth of our country and world. Any type of address would be greatly and wholeheartedly appreciated. If your address is pre-recorded, we would appreciate it if we could receive it by May 1st, as our conference is the morning of May 2nd. We believe you can bring true inspiration into our hearts and minds. We know you are very busy, but if it were at all possible to share with us even a short 2-3 minute pre-recorded greeting and message to the students participating in this Model UN conference, it would be truly inspirational. Thank you so much for your time, we hope to hear from you soon.

Most Respectfully,
Dane Cohn and the entire (b) (6) Model UN Team

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Thu, 2 Apr 2020 21:52:30 +0000
To: Lerner, Andrea (NIH/NIAID) [E];NIAID OD AM
Subject: RE: My take on masks

Thanks, Andrea

From: Lerner, Andrea (NIH/NIAID) [E] (b) (6)
Sent: Thursday, April 2, 2020 1:01 PM
To: (b) (6) (b) (6)
Subject: My take on masks

Given our discussion this AM, just thought I would summarize my take on masks across varying scenarios:

(b) (5)

Also should be noted that sick people with COVID-19 should wear a surgical mask for "source control".

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Mon, 15 Jun 2020 15:26:05 +0000
To: (b) (6)
Subject: FW: Confirmation Hearing
Attachments: 2020 - ILF Invitation to Fauci.pdf, 2020 ILF factsheet.docx

Let us discuss.

Anthony S. Fauci, MD
Director
National Institute of Allergy and Infectious Diseases
Building 31, Room 7A-03
31 Center Drive, MSC 2520
National Institutes of Health
Bethesda, MD 20892-2520
Phone: (b) (6)
FAX: (301) 496-4409
E-mail: (b) (6)

From: Szabat, Joel (OST) (b) (6)
Sent: Monday, June 15, 2020 9:44 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Barasch, Kimberly (NIH/NIAID) [C] (b) (6)
Subject: RE: Confirmation Hearing

Tony,

Thanks for all your help on the call. My testimony is tomorrow… I will let you know how it goes. Fortunately, I'm one of five nominees, two of whom are likely more controversial than I am. So perhaps I have 'overprepared' – but if so, that's where I would like to be.

Per our conversation, see attached. Thanks again. Folks will be excited to hear from you.

YMOS
~ Joel

Joel Szabat
Assistant Secretary
Aviation and International Affairs
U.S. Department of Transportation

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Monday, June 1, 2020 6:13 AM
To: Szabat, Joel (OST) (b) (6)
Cc: Barasch, Kimberly (NIH/NIAID) [C] (b) (6) Conrad, Patricia (NIH/NIAID) [E] (b) (6)>
Subject: RE: Confirmation Hearing

Joel:
No problem at all. Happy to do so. Please have your office give my assistant Kim Barasch (copied here) a call at (b) (6) to set up a call. If we can coincide it with a TF meeting, we can do it in person. Whatever works.
Best regards,
Tony

From: Szabat, Joel (OST) (b) (6)
Sent: Monday, June 1, 2020 1:36 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)>
Subject: Confirmation Hearing

Tony,

The Senate Commerce Committee plans to hold a hearing on my nomination to be Under Secretary of Transportation (the Department only has one) on June 16.

The hearing will provide an opportunity that Committee members would not normally have to ask a wide range of questions about administration actions on COVID-19.

I will be working with the White House legislative affairs office to ensure that my answers to the most obvious questions are consistent with our positions.

I hope that I might also be able to shake loose 30 minutes of your precious time later this week - preferable Wednesday, Thursday or Friday- to get your perspective on hard questions, and how best to respond.

Thanks!

YMOS
~Joel

International Leadership Foundation
Ronald Reagan Building and International Trade Center
1300 Pennsylvania Ave, NW, Suite 700, Washington, DC 20004
Tel: (202) 204-3019 Fax: (202) 351-0575 www.ILFnational.org

June 15, 2020

Dr. Anthony S. Fauci
Director of National Institute of Allergy and Infectious Diseases
5601 Fishers Lane, MSC 9806
Bethesda, MD 20892

Dear Dr. Fauci,

Thank you for agreeing to videotape a message to Asian Pacific American leaders who have been coordinating efforts to fight COVID-19 in the United States. Through their volunteer efforts Chinese-American and other APA organizations worked together to purchase and donate over ten million masks and other protective items to hospitals and other emergency service providers in the New York City and Washington, DC areas.

We hope you can tape a ten to fifteen minute message, thanking these leaders for their efforts, summarizing the progress we have made in fighting the disease, and outlining what we can do to face the challenges ahead. Our volunteers will be very grateful to hear from you.

These leaders and organizations will be recognized at the Annual Conference of the International Leadership Foundation (ILF), on July 25, 2020. This year's event will be a virtual Conference, with hundreds of people videoconferencing from across the country. The ILF is a non-partisan, non-profit organization that promotes the civic awareness, involvement and effectiveness of the APA communities. A full description of the organization is attached.

We propose to send you more detailed information in early July, including draft talking points that you might choose to incorporate in your remarks.

Mr. Linh Hoang, Interim Executive Director is available to work with your staff to arrange the details, and provide whatever additional information and support you need from us. He can be reached at hoang@ileader.org or call at (202) 412-0350. We hope to receive your taped remarks by July 10, 2020. Thank you again for agreeing to our request. Please find attached factsheets or check additional information at www.ILFnational.org and www.united-usa.net We want to do whatever we can to help America, and you, defeat this awful pandemic.

Sincerely,

Paul S. Hsu, Ph.D.
Chairman

Chiling Tong
Founding President

Linh D. Hoang
Interim Executive Director

Fact Sheet

International Leadership Foundation

The International Leadership Foundation (ILF) is a 501(c)(3) non-profit organization that promotes the civic awareness, public service, and economic effectiveness of the Asian American Pacific Islander (AAPI) community. The mission is to develop young leaders in the United States, Asia, and other Pacific Rim countries in the fields of public service, entrepreneurship, and international business and politics through a network of business and community leaders. Since our founding in 2000, ILF has provided scholarships and leadership training for over a thousand select AAPI college students nation-wide. ILF has a network of national advisory boards and global advisory councils in 20 cities, comprised of professional, civic, business, and community leaders. ILF helps prepare the young generation to become leaders in the public, business, academic, community, and professional fields. The programs include the Civic Fellowship Program, Global Exchange Program, Business and Leadership Conference, and Leadership Activities. These programs offer a series of internships, lectures, seminars, and discussions on topics ranging from international business relations to public policy and the legislative process.

The Washington D.C. Civic Fellowship is the nation's most prestigious AAPI civic leadership development program. Each Fellow participates in a supervised training program, including a public service internship to learn how to network and access government and public policy to help their communities. ILF also sponsors over one hundred additional college students each year for the Washington Leadership Program in conjunction with other leading AAPI organizations.Every year, ILF hosts an exciting business and leadership conference, comprised of various events, policy discussions, and meetings with Members of Congress and other high-ranking officials. This conference also includes a Global Strategic Economic Forum, Business to Business matchmaking, and the ILF's annual awards and scholarship gala.

ILF also promotes and recognizes exemplary contributions to the AAPI community by individuals and organizations. Past Conference & Awards Gala honorees and speakers include the Honorable Elaine L. Chao, Secretary of Transportation and former Secretary of Labor; the Honorable Norman Mineta, former Secretary of Transportation and Commerce, and Honorary ILF Chairman; Mitch McConnell, U.S. Senate Majority Leader; Nancy Pelosi, Speaker of the House; Max Baucus, former U.S. Ambassador to China; Members of Congress Judy Chu, Grace Meng, Doris Matsui, Ted Lieu, and Amata Radewagen; Yoshimi Inaba, Executive Chairman of Toyota Motor Sales, U.S.A., Inc.; Kanwal Rekhi, Founder of The Indus Entrepreneurs (TiE) organization; international film star Jackie Chan; David Ho, prominent AIDS researcher; and Toby Dawson, Olympic medalist.

WWW.United-USA.Net

The mission of UnitedUSA (https://united-usa.net/) is to share inspiring stories, positive messages, and best practices to bring our community together and make it stronger during these challenging times. UnitedUSA is a platform for collecting and sharing information about the efforts made by Asian American and Pacific Islander (AAPI) communities around the U.S. in the fight against COVID-19. We are grateful and proud of the tremendous contributions made by AAPIs all over the country and want to pay tribute to every person who is combating the pandemic in his or her own way. We are bound by our shared love for America. Together, we will rebuild a better country for all.

Our platform collects information on donation efforts across the country made by Asian Americans and Pacific Islanders. According to information collected so far, AAPI community efforts around the U.S. have donated an estimated total of **$31,508,449** dollars worth of contributions, including:

N95 Masks: 2,507,927
Medical Masks: 6,769,948
Gloves: 1,332,375
Goggles: 126,852
Protective Gowns: 214,398
Participating Organizations: 312

Contributions went to support over 2,564 institutions around the country, such as hospitals, nursing homes, police departments, post offices, public transportation, fire departments, supermarkets, and local governments.

THE ORGANIZER
International Leadership Foundation

MAJOR PARTICIPATING ORGANIZATIONS
Asian Pacific Islander American Public Affairs Association
Committee of 100
Tzu Chi USA
Taiwanese Chambers of Commerce of North America (TCCNA)
Daofeng and Angela Foundation
New York Young Entrepreneur Roundtable

PARTICIPATING ALLIANCES
American Chinese United Care Alliance
WeStar Alliance

From: Auchincloss, Hugh (NIH/NIAID) [E] on behalf of Fauci, Anthony (NIH/NIAID) [E]
Sent: Mon, 4 May 2020 14:00:23 +0000
To: (b) (6)
Subject: FW: inquiry

Another one that he will probably want to do.

From: Augustine M. K. Choi <amc2056@med.cornell.edu>
Sent: Monday, May 4, 2020 9:21 AM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Conrad, Patricia (NIH/NIAID) [E] (b) (6)
Subject: inquiry

Hi Tony,

I can only imagine your schedule. Thank you for all you are doing for the country in our fight against this virus.

Weill Cornell would like to invite you for a 3 min remarks to the Class of 2020 at their upcoming graduation if your schedule allows. The virtual graduation is on May 28th. We can tape your remarks at any time which fits your schedule, from now or up to right before May 28.

If you able to accept this invitation, please let me know. If not, totally understandable and we would love to have you back again after covid subsides.

Thanks again!

Augustine M.K. Choi, M.D.
Stephen and Suzanne Weiss Dean, Weill Cornell Medicine
Provost for Medical Affairs, Cornell University

Weill Cornell Medicine
1300 York Avenue, Suite F-113 Box 83 | New York, NY 10065
Telephone: 212-746-6005
Fax: 212-746-8424
Email: amc2056@med.cornell.edu

From: Anthony Fauci (b) (6)
Date: Monday, March 30, 2020 at 12:19 PM
To: Augustine Choi <amc2056@med.cornell.edu>
Subject: [EXTERNAL] RE: all wearing masks

My work with the Coronavirus Task Force and the large volume of incoming emails precludes me or my staff from answering each individual message. I would encourage you to visit www.coronavirus.gov for the latest information and guidance related to COVID-19.

Thank you, and best regards.

Anthony S. Fauci, M.D.

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Sat, 15 Feb 2020 02:24:07 +0000
To: Conrad, Patricia (NIH/NIAID) [E]
Subject: FW: nCoV WHTF Documents and Deliverables for Review

fyi

From: Pottinger, Matthew F. EOP/WHO (b) (6)
Sent: Friday, February 14, 2020 8:44 PM
To: Ferro, Phil J. EOP/NSC (b) (6)
Cc: (b) (6) (OS/IOS) (b) (6); AS2KTC (b) (6); (b) (6) Bigley, Mark C. EOP/ (b) (6)>; Blair, Robert B. EOP/WHO (b) (6); Harrison, Brian (HHS/IOS) (b) (6); Butterfield, Nicholas W. EOP/WHO (b) (6) Campana, Alexandra D. EOP/WHO (b) (6); Cetron, Marty (CDC/DDID/NCEZID/DGMQ) (b) (6); Chafin, Kelly B. EOP/NSC (b) (6)>; Conant, Ann M. EOP/OMB (b) (6); (b) (6) USN WHMO/WHMU (b) (6); Conrad, Patricia (NIH/NIAID) [E] (b) (6); Davis, May M. EOP/WHO (b) (6) Ditto, Jessica E. EOP/WHO (b) (6); DL Chief of Staff Office <DLChiefofStaffOffice@WHO.eop.gov>; donna.o'berry (b) (6) (b) (6) Duffey, Michael P. EOP/OMB (b) (6); Eisenberg, John A. EOP/WHO < (b) (6)>; Fabina, Lauren C. EOP/NSC (b) (6); Fauci, Anthony (NIH/NIAID) [E] (b) (6); Grogan, Joseph J. EOP/WHO (b) (6); Hemme, Jake W. EOP/NSC (b) (6) Hennessey, Millicent S. EOP/NSC (b) (6)>; Hoelscher, Douglas L. EOP/WHO (b) (6)>; Kan, Derek T. EOP/OMB (b) (6); (b) (6); Liddell, Christopher P. EOP/WHO (b) (6); Miller, Julie L. EOP/OMB < (b) (6)>; Mulvaney, Mick M. EOP/WHO (b) (6)>; OS Salesses, Robert (b) (6) Pataki, Tim A. EOP/WHO (b) (6)>; Riggs, Charlotte R. EOP/WHO (b) (6)>; Redfield, Robert R. (CDC/OD) (b) (6); Kadlec, Robert (OS/ASPR/IO) (b) (6)>; Ruggiero, Anthony J. EOP/NSC (b) (6); Scher, Adam A. EOP/OMB (b) (6) Shellooe, Ryan P. EOP/NSC (b) (6) Sinclair, Michael R. EOP/NSC (b) (6); Szabat, Joel (OST) (b) (6); Troye, Olivia EOP/NSC (b) (6) Williams, Michael B. EOP/WHO (b) (6); Woolfolk, Jon J. EOP/OVP (b) (6)>
Subject: Re: nCoV WHTF Documents and Deliverables for Review

TF members
There will be a quick TF call at noon tomorrow (Saturday) regarding our operation (b) (5) . Phil and Anthony will send around an agenda immediately following the 9 am working level call in the morning.

Matt Pottinger

Assistant to the President &
Deputy National Security Advisor
The White House

On Feb 14, 2020, at 5:39 PM, Ferro, Phil J. EOP/NSC (b) (6) wrote:

Good Afternoon WHTF,

WHTF members have concurred with the proposed CONOP to repatriate American citizens from Japan.

Please find the following documents attached for consideration by the TF. If amenable to the group, we would propose discussion by the TF at a future date.

- Dr. Navarro has provided three memos with recommendations
  - (b) (5)
  -
  -
- Supply chain update from NEC
- Country matrix for spread of nCoV to other countries that (b) (5)
- Updated phased response to nCoV white paper
- US response to nCoV decision tree

Currently, there are no TF calls scheduled Saturday – Monday.

Best Regards,

Phil

Philip J. Ferro, PhD, MS
Director for Countering Biological Threats
National Security Council
(b) (6) (O) 2 ((cell)
b
(b) (6)

<20200214 Supply Chain Update.pdf>
<nCoV_CountryRiskMatrix14 Feb.pdf>
<NEEDLES.docx>
<remdensivir.docx>
<FACE MASKS.docx>
<WHTF Framework Decision Tree_V4.pptx>
<Phases of USG nCoV Response _WHTF_13 Feb_PCC_Master.FINAL.DOCX>

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Sat, 22 Feb 2020 14:06:21 +0000
To: Cassetti, Cristina (NIH/NIAID) [E]
Subject: FW: CoVid-19 In Infants

Please hsandle.

-----Original Message-----
From: JF K (b) (6)
Sent: Friday, February 21, 2020 2:44 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: CoVid-19 In Infants

Dr. Fauci,

Infants and children infected with CoVid-19 seem to be an anomaly. Could it be as simple as childhood vaccinations? Are Chinese children vaccinated with anti malarial drugs such as Chloroquine phosphate, which is proving effective in older patients for CoVid-19?

If infants and children are not getting severe infections, why?

Jonathan F. King

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Sat, 22 Feb 2020 20:38:12 +0000
To: Conrad, Patricia (NIH/NIAID) [E]
Cc: Routh, Jennifer (NIH/NIAID) [E]
Subject: RE: interview request: draft responses for Greek newspaper

Good job! See my minor edits in **red.** Thanks.

Anthony S. Fauci, MD
Director
National Institute of Allergy and Infectious Diseases
Building 31, Room 7A-03
31 Center Drive, MSC 2520
National Institutes of Health
Bethesda, MD 20892-2520
Phone: (b) (6)
FAX: (301) 496-4409
E-mail: (b) (6)

From: Conrad, Patricia (NIH/NIAID) [E] (b) (6)>
Sent: Friday, February 21, 2020 4:57 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: FW: interview request: draft responses for Greek newspaper

Do you want to edit these..greek paper/pring?

Patricia L. Conrad
Public Health Analyst and
Special Assistant to the Director
National Institute of Allergy and Infectious Diseases
The National Institutes of Health
31 Center Drive, MSC 2520 - Room 7A03
Bethesda, Maryland 20892
(b) (6)
301-496-4409 fax

from your mailbox or any other storage devices. National Institute of Allergy and Infectious Diseases (NIAID) shall not accept liability for any statement made that are sender's own and not expressly made on behalf of the NIAID by one of its representatives.

From: Routh, Jennifer (NIH/NIAID) [E] (b) (6)
Sent: Friday, February 21, 2020 4:52 PM
To: Conrad, Patricia (NIH/NIAID) [E] (b) (6); NIAID FOG <fog@niaid.nih.gov>
Cc: NIAID COGCORE <COGCORE@mail.nih.gov>; NIAID Media Inquiries <mediainquiries@niaid.nih.gov>
Subject: interview request: draft responses for Greek newspaper

Reporter: Theodora Tsoli
Organization: Greek newspaper To VIMA (www.tovima.gr)
Phone #(s): 0030-6945988550, thtsoli@tovima.gr
Subject: COVID-19
Deadline: Monday 2/24

The reporter emailed questions for ASF. I have drafted proposed responses for his review, also attached.

1. **Do you believe that SARS-COV2 is capable of causing a pandemic? Are you expecting many secondary transmissions of the virus outside China?**
   A pandemic is generally defined as sustained transmission of a new pathogen in multiple regions of the world. COVID-19 does not yet meet that definition, and I hope that China and other countries in Asia with some transmission are able to contain the outbreak. However, it is possible that COVID-19 could become a pandemic. It would not be surprising to see additional secondary transmissions of the virus outside of China.

2. **Chinese authorities are reporting a decline of new cases. Could we say that the virus has peaked and maybe it will slow down? When are you expecting to have a clearer picture about the evolution of this epidemic?**
   Although the number of **daily** cases in China appears to have gone down, it is too early to tell if this is really a decline in the outbreak.

3. **Could the virus become endemic and give seasonal outbreaks?**
   If China is not able to contain the outbreak, it is possible COVID-19 could become endemic and lead to seasonal outbreaks. However, it is too early to know the likelihood of this scenario.

4. **What about its transmissibility? Some experts say that WHO is underestimating it's transmissibility. Could the reality be different maybe because, among other things, many cases stay undetected?**
   Because of the many unknowns about SARS-CoV-2, it is difficult to make any firm conclusions regarding overall transmissibility and severity. However, it appears to be much more transmissible than SARS. Also, there are likely asymptomatic COVID-19 infections that are not getting counted because people do not go to the doctor for testing or treatment if they are not sick.

5. **Do you believe that the measures taken by China and countries around the world are adequate to stop SARS-COV2 spread? There is a lot of discussion about thermal cameras and travel restrictions for example.**
China has taken extreme measures to control the outbreak. Restricting the movement of 50 million people is unprecedented. However, it might ultimately have an effect on slowing transmission. Precautions implemented in the U.S. are not intended to detect every person with COVID-19 entering the country. However, our approach has allowed us time to better plan and prepare our health system.

6. **What is the key to stop the worldwide spread of the virus?**
Though we have mobilized a rapid research response to quickly develop effective countermeasures, right now, the outbreak response remains focused on the proven public health practices of identifying cases, isolating patients and tracing contacts.

7. **In the northern hemisphere we have a flu outbreak - in Greece as well. Some experts say that this is the real danger and not the coronavirus. What is your view?**
I am always concerned about influenza. Every flu season, millions of people are at risk of getting very sick or dying. Currently people in the U.S. and most countries in the northern hemisphere are at a much higher risk of being exposed to influenza than SARS-CoV-2. However, the COVID-19 outbreak is an evolving situation and we are treating it as a very serious public health threat.

8. **Many efforts are being in process for the development of a vaccine for the new coronavirus. Are you coordinating any of them and which ones? Are there any efforts more promising than others? Which platforms of vaccine development are more promising? When do you believe that we could have a vaccine available for clinical trials and then for human use?**
NIAID is exploring multiple candidates and is on track to test an experimental messenger RNA (mRNA) vaccine in a Phase 1 clinical trial this spring. This first phase of clinical testing will involve giving the vaccine to healthy adults in the United States to see if it is safe and if it can induce an immune response in recipients. It is important to realize that the development of investigational vaccines and the clinical testing to establish their safety and effectiveness takes time. A vaccine against the novel coronavirus will likely not be widely available for **more than** a year.

9. **What about therapies? Dozens are being tried - from plasma to herbal medicines in China. Which are the most promising?**
NIAID is pursuing the development of antivirals and monoclonal antibodies for potential use against COVID-19. NIAID is preparing protocols for *in vitro* and *in vivo* studies of the antiviral remdesivir, which has shown promise against other coronaviruses in animal models. NIAID also plans to evaluate Kaletra (lopinavir/ritonavir) and interferon-beta for their activity against SARS-CoV-2. In addition, NIAID scientists are working to identify monoclonal antibodies with

therapeutic potential from stored SARS patient samples as well as COVID-19 patient samples.

10. **Are the things we know about this new virus more than the ones we don't know? Which are the main questions about it that remain to be answered?**
New data **are** published about SARS-CoV-2 every day. However, we still have a lot to learn. For example, we do not know why there are **so few cases among** children, which is uncommon for a respiratory virus.

11. **How worried should people outside China be about SARS-COV2? What is the biggest danger from this virus?**
. **T**he risk to the general American public remains low at this time**; however, this could change and that is why we are treating the emergence of a novel coronavirus as a very serious public health threat**. We understand that people may be worried. We ask that people not let fear or panic guide their actions.

12. **Which are the protective measures anyone should take against the new virus? Do masks work?**
The vast majority of people outside of China do not need to wear a mask. A mask is more appropriate for someone who is infected than for people trying to protect against infection.

Jennifer Routh [E]
News and Science Writing Branch
Office of Communications and Government Relations
National Institute of Allergy and Infectious Diseases (NIAID)
NIH/HHS
31 Center Drive Room 7A17C
Bethesda, MD 20892
Direct: (b) (6)

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Mon, 24 Feb 2020 11:15:02 +0000
To: Kadlec, Robert (OS/ASPR/IO);Redd, John (OS/ASPR/SPPR);Yeskey, Kevin (OS/ASPR/IO);Shuy, Bryan (OS/ASPR/IO);Phillips, Sally (OS/ASPR/SPPR)
Cc: Redfield, Robert R. (CDC/OD)
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

We really need to discuss this.

From: Kadlec, Robert (OS/ASPR/IO) (b) (6)
Sent: Sunday, February 23, 2020 11:31 PM
To: Redd, John (OS/ASPR/SPPR) (b) (6); Yeskey, Kevin (OS/ASPR/IO) (b) (6); Shuy, Bryan (OS/ASPR/IO) (b) (6); Phillips, Sally (OS/ASPR/SPPR) (b) (6)
Cc: Redfield, Robert R. (CDC/OD) (b) (6) Fauci, Anthony (NIH/NIAID) [E] (b) (6)>
Subject: Fwd: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Read this! This is unsettling if true efficient spreading in asymptomatics with negative test. Is that possible? Report is intermittent shedding is that true or artifact of poor sample collection or lack of sensitivity of pcr testing?

From Dr Eva Lee GaTech

"Means of spread A study from AMA confirmed many of the parameters assumed in our models:

- A 20-year old infected with COVID-19 left Wuhan and went on infecting 5 relatives. When they tested positive, she was finally isolated, but tested negative still, and later tested positive, and remain normal on chest CT with no fever, stomach or respiratory symptoms (cough or sore throat as late as Fen 11 (time of the papert study duration).

So spreading and its wide scope is unavoidable because there exists these very healthy individuals who can spread effectively -- even during incubation period -- while they remain perfectly healthy. It also showcases difficulty in testing -- negative test -- may not be the end of it. "
Sent from my iPhone

Begin forwarded message:

From: "Dr. Eva K Lee" (b) (6)
Date: February 23, 2020 at 7:37:12 AM EST
To: Carter Mecher (b) (6)
Cc: Richard Hatchett (b) (6), Tracey McNamara (b) (6), "Caneva, Duane" (b) (6) (b) (6) < (b) (6) "Dodgen, Daniel (OS/ASPR/SPPR)" (b) (6), "DeBord, Kristin (OS/ASPR/SPPR)" (b) (6), "Phillips, Sally (OS/ASPR/SPPR)" < (b) (6) David Marcozzi (b) (6) >, (b) (6) USARMY (USA)" (b) (6), Lisa Koonin (b) (6), (b) (6) , "HARVEY, MELISSA' (b) (6) "WOLFE, HERBERT" (b) (6) "Eastman, Alexander" < (b) (6) "EVANS, MARIEFRED" (b) (6), "Callahan, Michael V.,M.D." (b) (6) ' (b) (6)' (b) (6) (b) (6)' (b) (6) >, "Johnson, Robert (OS/ASPR/BARDA)" (b) (6), "Yeskey, Kevin' (b) (6) >, "Disbrow, Gary (OS/ASPR/BARDA)" < (b) (6), "Redd, Johnt(OS/ASPR/SPPR)" (b) (6), "Hassell, David (Chris) (OS/ASPR/IO)" (b) (6), "Hamel, Joseph (OS/ASPR/IO)" (b) (6) "Dean, Charity A@CDPH" <Charity.Dean@cdph.ca.gov>, "Lawler, James V" (b) (6), "Kadlec, Robert (OS/ASPR/IO)" (b) (6) " (b) (6) " (b) (6) "Borio, Luciana" (b) (6), "Hanfling, Dan" (b) (6) "McDonald, Eric" (b) (6), "Wade, David" (b) (6) >, "TARANTINO, DAVID A" (b) (6) >, "WILKINSON, THOMAS" (b) (6), "David Gruber (b) (6))" (b) (6), "KAUSHIK, SANGEETA" (b) (6) >, Nathaniel Hupert (b) (6)
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start
Reply-To: "Dr. Eva K Lee" (b) (6)

A few things I want to highlight --

1. **Means of spread** A study from AMA confirmed many of the parameters assumed in our models:
- A 20-year old infected with COVID-19 left Wuhan and went on infecting 5 relatives. When they tested positive, she was finally isolated, but tested negative still, and later tested positive, and remain normal on chest CT with no fever, stomach or respiratory symptoms (cough or sore throat as late as Fen 11 (time of the papert study duration).

So spreading and its wide scope is unavoidable because there exists these very healthy individuals who can spread effectively -- even during incubation period -- while they remain perfectly healthy. It also showcases difficulty in testing -- negative test -- may not be the end of it.

2. **Iranian cases**, though mysterious since the origin was not traced to China, may very well show that COVID-19 virus is very adaptable and mutating rapidly.

3. **Long recovery** The long recovery period is troubesome and must be taken seriously by health providers as they prepare for hospitalization. Therei s not much surge capacity in hospitals. So they must be innoative in the staggering process and isolation is of paramount importance. Government/Local should be readied for supplementing medical tents outside hospitals when needed (clearly extra staff too).

4. **Citizes' view** I was traveling so I did a real-time on-the-road analysis of human behavior and anxiety level. I overheard many people
-- (a) asked when CDC would tell us more on what to do.
-- (b) wish they could pull their kids out of school but there is no such option as part of the preventive measure (not announced by CDC).
-- (c) wish CDC would recommend tele-work options so they don't have to travel and expose themselves and their family to unneccessary risk.
-- (d) have no clue what the government is doing to keep the risk low as it is now. What exactly is being implemented to keep it low.

5. **Resource-limited countries** I pray that it would not reach the resource-limited countries like many in Africa (though it seems unavoidable). I cannot imagine the consequence.

6. **What we must do:** We must leverage the knowledge from other countries to better prepare ourselves. Japan's Crusis shows the importance of TIMELY proper isolation and STRATEGIC operations logistics in testing and in quarantine. South Korea (contrasting with Hong Kong, Singapore) demonstrates critical importance of EARLY social distancing and high compliance community NPI intervention. China's latest lockdown of 1/2 billion people truly signifies that gravity and unchartered terrority of this virus. No country would take to such extreme measure.

7. **CFR** Since over 90% of influenza is never recorded/known, this COVID-19 seems to fall into similar spirit now, with so many cases of asymptomtic and transmission while incubating. While the true CFR remains unknown, the CFR of tested positive cases should offer a good comparison to the CFR of tested positive flu cases. That gives us a clearer estimate of health-resource burden.

(b) (6)

Sent with ProtonMail Secure Email.

------- Original Message -------
On Saturday, February 22, 2020 10:19 PM, Carter Mecher (b) (6) wrote:

Updates

South Korea (+123 with +2 deaths)—Total cases 556; Total deaths 4

https://www.cdc.go.kr/board/board.es?mid=a30402000000&bid=0030

Singapore (+3)--Total cases 89; Total deaths 0

Hong Kong (unchanged)--Total cases 69; Total deaths 2

Japan—Total cases 135; Total deaths 1

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Saturday, February 22, 2020 6:28 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) J CIV USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Roundup this morning.

Singapore and Hong Kong are holding steady—both have implemented NPIs pretty early and have good surveillance.

Things are really accelerating in South Korea. Case count increased to 433 with 2 deaths.

https://www.cdc.go.kr/board/board.es?mid=a30402000000&bid=0030

Report below of COVID hitting Samsung's mobile device factory, which has now been shut down. This is what will happen here. The greatest concern is what this would mean for critical infrastructure sectors (including components of our healthcare system), The strategies I outlined

for outpatient clinics could be used by business (most especially CI sectors) to maintain business continuity. It is as simple as the old saying, "Don't put all your eggs in one basket." It is both contingency planning (continuity of operations/continuity of business) and application of NPIs/TLC (especially social distancing in the community supported by home isolation and home quarantine).

We now have COVID in several countries across the ME (Iran, Israel, Egypt, Lebanon, UAE). We added Iran the day before yesterday and 3 countries yesterday (Israel, Egypt and Lebanon). Iran already appears to have a well established outbreak that will be tough to slow down given the estimated size with 5 deaths already (that is where Wuhan was by Jan-20). Japan is also seeing acceleration with local transmission (119 cases).

Italy is another area to watch.

https://protect2.fireeye.com/url?k=c92f3372-957b2a0e-c92f024d-0cc47adc5fa2-927014023819d8ec&u=https://www.ilgazzettino.it/nordest/...D0yaqI09ac4o84 Numerous infected in the hospital of Schiavonia (Padua)
"And unfortunately, what the experts feared since yesterday has occurred, when it was discovered that two patients had been hospitalized for about ten days at the Schiavonia hospital (Padua) without knowing that they had contracted the Coronavirus: since yesterday evening everyone those who attended the hospital were subjected to a swab to detect any infections, and the examination gave positive results in numerous cases. It means that there are other people, probably among those who attended the ward where two patients were hospitalized, who are now positive for the virus and consequently could in turn have spread the infection. Already yesterday evening the Governor of Veneto Luca Zaia ordered the progressive evacuation of the Padua hospital which should take place within 5-6 days."

"The hospital is surrounded by a 'sanitary cordon', with Carabinieri, workers of the Red Cross and Civil Protection. Cardiology chief Giampaolo Pasquetto arrived outside the hospital for a few minutes and reported the results of the swabs 'as far as I have been able to know from my colleagues so far,' he said. The modern structure is located between the towns of Este and Monselice and was recently inaugurated to serve the Euganean Hills area."

https://www.reuters.com/article/us-china-health-southkorea-samsung-elec/samsung-electronics-confirms-coronavirus-case-at-phone-factory-complex-in-south-korea-idUSKCN20G0CG

SEOUL (Reuters) - Samsung Electronics said on Saturday that one coronavirus case had been confirmed at its mobile device factory complex in the southeastern city of Gumi, causing a shutdown of its entire facility there until Monday morning.

Samsung Electronics, the world's top smartphone maker, said the floor where the infected employee worked would be shut down until the morning of Feb. 25.

"The company has placed colleagues who came in contact with the infected employee in self-quarantine and taken steps to have them tested for possible infection," Samsung said in a news release.

Samsung's factory in Gumi accounts for a small portion of its total smartphone production, and it makes high-end phones, mostly for the domestic market. Samsung produces most of its smartphones in Vietnam and India.

Gumi is close to the city of Daegu, home to a church at the center of South Korea's largest coronavirus outbreak.

South Korea said on Saturday that the number of people infected with the coronavirus in the country had more than doubled to 433.

Samsung said production at its chip and display factories in other parts of South Korea would not be affected.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Friday, February 21, 2020 6:52 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) CIV USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) U; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6))'; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (david.gruber@dshs.texas.gov); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Wuhan to add 19 additional hospital (when combined with the other 3 hospitals, this would add 30,000 beds).

Just to put that in perspective.

- There are 2.8 hospital beds in the US per 1,000 population.
- 30,000 beds is about the number of beds we would have for a population of 11 M.

When you add the 30,000 beds plus the 13,348 other beds added (total of 43,300 beds)

- There are 4.5 hospital beds in China per 1,000 population
- 43,300 beds is about the number of beds in China for a population of 9.6 M
- Wuhan will have nearly doubled its bed capacity

How hard would that be for us to double bed capacity in any major US city? (Really isolation beds for mild illness)

https://www.straitstimes.com/asia/east-asia/coronavirus-wuhan-to-activate-one-more-temporary-hospital-with-3690-beds?fbclid=IwAR1otfI4xNxKIuBRuODJzoTDMJWHueF9gTc06u1IM9nM2u-3VTpohOtFt7s

WUHAN (XINHUA) – Wuhan, the epicentre of the coronavirus outbreak, plans to build another 19 makeshift hospitals to receive more infected patients, local authorities said Friday (Feb 21).

Upon their completion, all the makeshift hospitals in Wuhan are expected to offer 30,000 beds on Feb 25, said Mr Hu Yabo, deputy mayor of Wuhan at a press briefing on epidemic prevention and control.

To date, Wuhan has converted 13 existing venues into temporary hospitals, with a total of 13,348 beds, and about 9,313 beds have been put into use to treat patients with mild symptoms, said Mr Hu.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Friday, February 21, 2020 1:59 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Weekly CDC update looks like flu might be on the downslope (good news). Watching the curves of % positive flu tests and ILI (should track one another as flu is receding). Trouble is the data reported today is for the week ending Feb 15 (so a week old).

Our inpatient nursing sick leave is tracking ILI (current thru 2/20)—nothing unusual

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Friday, February 21, 2020 10:54 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); ' (b) (6) '; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (david.gruber@dshs.texas.gov); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Singapore and Hong Kong are holding the line. Both implemented NPIs early. No change in numbers from Hong Kong and Singapore saw its case count increase by only 1 for the past two days.

Japan reported to have 107 cases. First reported case in young children (se below)

Hokkaido boy 1st Japan case of coronavirus infection under 10
February 21, 2020 (Mainichi Japan)

SAPPORO -- Two elementary school brothers and a woman in her 40s in Hokkaido have been infected with the new coronavirus, with the younger sibling becoming the first infection under 10 in Japan, Hokkaido Gov. Naomichi Suzuki announced on Feb. 21.

Some graphics of the drop off in travel in China (pretty dramatic)

Jan-23

Feb-13

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Friday, February 21, 2020 10:28 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) '; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

https://www.cdc.go.kr/board/board.es?mid=a30402000000&bid=0030

Here is the best link to track cases in South Korea. South Korea is now up to 204 cases and 1 death (South Korea is where Wuhan was 1 month ago).

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Friday, February 21, 2020 10:02 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

On a totally different note. Others have been plying with and modifying the notional conops for a healthcare system.

I set up some simple rules:

1. Protect uninfected patients and staff from infectious patients and staff (using all the tools that we have including home isolation and home quarantine, cohorting/physical separation, PPE, telehealth, etc.)
2. Provide acute care for COVID patients (continuum of ER-inpatient care-intensive care)
3. Support mildly ill COVID patients in home isolation--telehealth
4. Support patients in voluntary home quarantine--telehealth
5. Continue to address the usual mix of healthcare needs for patients (from outpatient care to acute care to mental health care to long term care)

    a. Outpatient clinics and providers focus on wellness to minimize ER visits/hospitalization to unburden the acute care system—leverage telehealth
    b. Continue to provide acute care and inpatient mental health care (continuum of ER-inpatient care-intensive care) for non-COVID conditions
    c. Protect high-risk patients in residential/long term care (nursing homes, hospice, long term psychiatry, etc.)

The notional conops divides the healthcare system into hot and safe areas. The hot area is only acute care: ER-acute inpatient care-ICU care. The safe areas include a separate acute care area (ER-acute inpatient care-ICU care), all the outpatient clinics/care, other inpatient care areas such as mental health, as well as long term/residential care (nursing home, hospice, long term psychiatry, etc.).

Triage will not be easy (between hot and safe). Best I could come up with would be: (1) anyone already on home isolation or home quarantine (may need a medical record flag); (2) anyone with ILI (could narrow that down with a negative rapid flu test); (3) anyone with a sick household member with suspected COVID. Could be very difficult for an unconscious/confused, or trauma patient etc., but would probably err on the side of hot and think of additional layered strategies to minimize patient risk within that area (private rooms, patient PPE?). Triage would need to err on the side of keeping the safe area safe.

The mitigation measures are our best tools to reduce community transmission and reduce the probability of an infectious patient getting into a safe area. If we have a breach in a safe inpatient area, it pretty much converts that inpatient area into a hot area. That also means that we have the staff in that area exposed (because of limited availability of PPE, the staff in the safe area would not be PPE—PPE would have been directed to the staff in the hot area). Those staff would likely need to be placed on quarantine. The effect is we now have a much larger hot area with even fewer staff. That would really be a mess.

You have the same problem in the outpatient areas. Have a sick patient slip through and come in contact with a number of the clinic staff (not in PPE), and we now need to quarantine all those staff. In contrast to a breach for the inpatient area, the outpatient area can still operate as a safe area (just minus those staff who would now be on quarantine). But do that a few times and pretty soon you have nobody left to fight. One way I thought about dealing with this scenario is to take the outpatient staff and split them in two. One group works the clinic (physically present) for the usual clinic hours for a 14 day stretch (1 incubation period). Another group works from home (and practices social distancing, etc., really acting as if they are on home quarantine) and leverages telehealth technology to care for patients and help with monitoring those patients in home isolation and home quarantine. After 14 days the groups switch. [All along we monitor employees daily (whether at work or at home) for symptoms or sick household members] In the event of a breach, the groups immediately switch and the group that was working is placed on actual home quarantine (but still continues to work from home leveraging telehealth). That way if a breach does happen, we have a fallback response (that we are constantly practicing) that allows us to sustain outpatient care.

For the inpatient areas, I thought about the lone survivor model (holding back 1 Secretary and staff in the event that the government is decapitated). So think of a small group (would need to

think thru what the composition of that team would look like for each area (acute care, inpatient mental health, long term care) that would at least provide the nucleus of the expertise necessary to reconstitute the service in the event of a major breach). This smaller group would vary in team members every 2 weeks and would rotate to work from home for 14 days stretches and practice social distancing (acting as if they were on home quarantine). They could also assist via telehealth (inpatient consultation, etc., while out of the hospital).

Is anyone thinking along these lines (really continuity of operations for the healthcare system)?

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Friday, February 21, 2020 8:35 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6) KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

https://www.cbc.ca/news/canada/ottawa/diamond-princess-coronavirus-trenton-cornwall-1.5470386

Canada flies home passengers from cruise line.

Data in article:

47 of 256 Canadians contract

https://protect2.fireeye.com/url?k=96ebd7bc-cabfcec0-96ebe683-0cc47adc5fa2-16a39afbec00c653&u=https://www.timesofisrael.com/israel...nee-diagnosed/
Israel confirms first coronavirus case as cruise ship returnee diagnosed
One of 11 Israelis who arrived in the morning after quarantine aboard Diamond Princess ship tests positive, after entering 14-day isolation at Sheba Medical Center

Trying to track cruises ship passenger/crew by country (data is sketchy)

Country	Passengers/Crew	Total Confirmed Cases	ICU Admissions	Deaths	% Infected
US	434	58	1?		13%
Hong Kong	330				
Canada	256	47			18%
Australia	241	48			20%
UK	78	6			8%
Italy	35				
South Korea	14				
Israel	11	1			9%
Japan				2	
Subtotal	1,399	160			
Total	3,711	634			17%

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Friday, February 21, 2020 5:46 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6)om; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; j (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); ' (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
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China has again modified its reporting (first it added clinical cases to lab confirmed cases on Feb-12). Now it is subtracting out those clinical cases and limiting numbers to lab confirmed). Have continued to follow the hospitalization data from Hubei (see below).

Here is the data being reported by Hubei and Wuhan. Data is pretty sketchy prior to Jan-21.

	Hubei 2019-nCoV Confirmed Hospital Data							**Hubei and Wuhan Cases & Hospitalization Rates**				
Date	Total Current Inpatients	Mild Disease	Severely Ill	Critically Ill	Cum Discharges	Cum Deaths	Cum Inpatients	Hubei Cum cases	Wuhan Cases	Hubei Cum Hospitalization Rate per 100,000	Wuhan Cum Hospitalization Rate per 100,000	%Hubei Cases Hospitalized
1/14/20	6		6				6	41	41	0.01	0.5	
1/15/20	5		5			2	7	41	41	0.01	0.5	
1/16/20	5		5			2	7	45	45	0.01	0.5	
1/17/20	8		8			2	10	62	62	0.02	0.7	
1/18/20	136	100	33	3		3	139	121	121	0.2	1.4	
1/19/20	170	126	35	9		4	174	198	198	0.3	2.4	
1/20/20	239	176	51	12		7	246	270	258	0.4	3.1	
1/21/20						15		375	320	0.0	3.8	
1/22/20	399	304	71	24		17	416	444	390	0.7	4.7	
1/23/20	494	365	106	23	31	24	549	549	495	0.9	5.9	100%
1/24/20	658	472	129	57	32	39	729	729	572	1.2	6.8	100%
1/25/20	915		221		85	52	1,052	1,052	618	1.8	7.4	100%
1/26/20	1,645	1,013	563	69	44	76	1,423	1,423	698	2.4	8.3	100%
1/27/	2,567	1,877	563	127	47	100	2,714	2,714	1,59	4.6	19.0	100%

20									0			
1/28/20	3,349	2,450	671	228	80	125	3,554	3,554	1,905	6.1	22.8	100%
1/29/20	4,334	3,346	711	277	90	162	4,586	4,586	2,261	7.8	27.0	100%
1/30/20	5,486	4,392	804	290	116	204	5,806	5,806	2,639	9.9	31.5	100%
1/31/20	6,738	5,444	956	338	166	249	7,153	7,153	3,215	12.2	38.4	100%
2/1/20	8,565	7,003	1,118	444	215	294	9,074	9,074	4,109	15.5	49.1	100%
2/2/20	9,618	7,917	1,223	478	295	350	10,263	11,177	5,142	17.5	56.4	92%
2/3/20	10,990	8,857	1,557	576	396	414	11,800	13,522	6,384	20.2	66.6	87%
2/4/20	12,627	10,107	1,809	711	520	479	13,626	16,678	8,351	23.3	81.6	82%
2/5/20	14,314	11,230	2,328	756	633	549	15,496	19,665	10,117	26.5	95.3	79%
2/6/20	15,804	11,802	3,161	841	817	618	17,239	22,112	11,618	29.5	108.3	78%
2/7/20	19,835	14,640	4,188	1,007	1,113	699	21,647	24,953	13,603	37.0	141.1	87%
2/8/20	20,993	15,746	4,093	1,154	1,439	780	23,212	27,100	14,982	39.7	153.4	86%
2/9/20	22,160	16,655	4,269	1,236	1,795	871	24,826	29,631	16,902	42.4	169.3	84%
2/10/20	25,087	18,743	5,046	1,298	2,222	974	28,283	31,728	18,454	48.3	196.7	89%
2/11/20	26,121	18,880	5,724	1,517	2,639	1,068	29,828	31,728	18,454	51.0	207.4	94%
2/12/20	33,693	26,609	5,647	1,437	3,441	1,310	38,444	48,206	32,994	65.7	314.6	80%
2/13/20	36,719	27,081	7,953	1,685	4,131	1,426	42,276	51,986	35,991	72.3	349.9	81%
2/14/20	38,107	27,955	8,276	1,876	4,774	1,457	44,338	54,406	37,914	75.8	369.4	81%
2/15/20	39,447	29,051	8,439	1,957	5,623	1,596	46,666	56,249	39,462	79.8	391.4	83%
2/16/20	40,814	31,017	8,024	1,773	6,639	1,696	49,149	58,182	41,152	84.0	415.6	84%
2/17/20	41,957	30,987	9,117	1,853	7,862	1,789	51,608	59,989	42,752	88.2	439.7	86%
2/18/	43,471	32,22	9,289	1,957	9,128	1,921	54,520	61,682	44,4	93.2	469.3	88%

20		5							12			
2/19/20	43,745	32,567	9,128	2,050	10,337	2,029	56,111	62,013	45,027	95.9	487.0	90%
2/20/20	42,056	31,059	8,979	2,018	11,788	2,144	55,988	62,422	45,346	95.7	486.2	90%

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Sent: Friday, February 21, 2020 5:09 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

More on South Korea (sounds just like what happened at Jefferson Barracks, just outside St. Louis, in 1918, armed with the exact same tools they had more than 100 years ago to control an outbreak). I assume they must also be taking measures within the base to limit spread (keeping infectious individuals apart from those not yet infected with isolation and quarantine and social distancing).

https://en.yna.co.kr/view/AEN20200221003000325?section=national/defense

SEOUL, Feb. 21 (Yonhap) -- The military is making all-out efforts to prevent the new coronavirus from spreading further into the barracks, officials said Friday, after the country's first infections in the armed forces were confirmed.

Earlier in the day, a Navy sailor on the southern island of Jeju was confirmed to have contracted COVID-19 in the first such case among service personnel here.

Following the confirmation, the Navy has checked the temperature of all personnel at the base where the infected sailor served and quarantined all those who had contacts with the person, it said.

"We have carried out disinfection work at the base and are devoting all our efforts to preventing the spread of the new virus," the Navy said in a release.

An officer each from the Army and the Air Force were also confirmed to have the virus the same day.

The military is now working to identify personnel who have visited the southeastern city of Daegu and the surrounding North Gyeongsang Province since Feb. 10, as these areas have recently seen a surge in the number of infected people.

More than 5,000 service personnel are estimated to have visited the region during their vacation according to the military's preliminary investigation.

On Thursday night, the defense ministry said all personnel will be barred from vacationing, staying outside their bases and meeting visitors starting Saturday.

The decision was made at a meeting of top defense officials presided over by Defense Minister Jeong Kyeong-doo, during which he called for "extraordinary measures" to contain the spread of the virus.

Amid growing fears over the disease, the government called off a planned ceremony to mark the 60th anniversary of a pro-democracy movement in Daegu, which was designated a "special care zone" over the virus earlier in the day.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Thursday, February 20, 2020 9:21 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) OV); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID

A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

S. Korea reports 52 new virus cases, total now at 156

Welfare/Medicine 10:37 February 21, 2020

SEOUL, Feb. 21 (Yonhap) -- South Korea reported 52 new cases of the new coronavirus Friday, bringing the total number of infections in the nation to 156, with the potentially fatal illness spreading fast across the country.

The number of COVID-19 infections here has almost tripled in just three days, with most new infections traced to church services in the southeastern city of Daegu.

Of the 52 new cases, 41 are in Daegu, 300 kilometers southeast of Seoul, and the neighboring North Gyeongsang Province. Another three were reported in Seoul, the Korea Center for Disease Control and Prevention (KCDC) said in a statement.

Tour buses are parked at a logistics terminal in Daegu, 300 kilometers southeast of Seoul, on Feb. 20, 2020. Thirty-eight new coronavirus cases were reported in the city on Feb. 21, 2010. (Yonhap)

The spike of infections in Daegu and several cases in Seoul, where routes of infections are not immediately traceable, have prompted health officials to declare that COVID-19 has begun spreading locally.

The KCDC said two new cases were reported in South Gyeongsang Province. In a sign that the virus may broadly spread nationwide, six provinces, including Gyeonggi, Jeju, Chungcheong and North Jolla, each reported one case.

Of the 52 new cases, 39 are linked to the Shincheonji Church of Jesus in Daegu, where the 31st patient, the country's probable "super spreader," attended worship services, the KCDC said.

A 61-year-old South Korean woman, who tested positive for the virus earlier this week, attended worship services at the church on Feb. 9 and this past Sunday.

KCDC Director Jung Eun-kyeong told reporters Thursday that the agency is uncertain whether the woman, known as the 31st patient, was a "super spreader" of the virus but asked 1,001 members of the church to self-isolate to stem the spread of the virus.

The government decided to designate Daegu and neighboring Cheongdo as "special management zones," following the spike in the number of infected people and the nation's first death from the virus.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Thursday, February 20, 2020 5:38 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6))'; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
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From Feb-15 to Feb-20 the number of confirmed cases increased from 355 to 634 (increase of 279). The number of asymptomatics increased from 73 to 322 (increase of 249). So from Feb-15 to Feb-20, 249 of the 279 confirmed cases (89%) were asymptomatic. Seems a little odd. Also, read reports that all passengers and crew have beem tested (but reports only note that 3,066 of the 3,711 have been tested).

Date	Event	Cumulative Number of Confirmed Cases	Cumulative Number of Deaths	Notes
20-Jan	Cruise ship departs from Yokohama Japan			
25-Jan	80 year old passenger disembarks in Hong Kong			
1-Feb	80 year old passenger confirmed to have COVID-19			

	When results known, certificate of landing canceled and ship under quarantine. Tests for the virus would be administered to three groups: those with symptoms, those who got off in Hong Kong, and those who had close contact with the infected passenger.			
3-Feb	Ship arrives in port of Yokohama Japan			
5-Feb	10 passengers and crew confirmed +	10		
6-Feb	31 more passengers and crew confirmed +	41		
7-Feb	30 more passenger and crew confirmed +	61		
8-Feb	9 more passenger and crew confirmed +	70		
10-Feb	66 more passenger and crew confirmed +	136		439 tested
11-Feb	39 more passenger and crew confirmed +	175		492 tested
12-Feb	28 more passenger and crew confirmed +	203		4 in ICU
13-Feb	15 more passenger and crew confirmed +	218		713 tested
14-Feb	67 more passenger and crew confirmed +	285		927 tested
15-Feb	70 more passenger and crew confirmed +	355		1,219 tested; 73 asymptomatic
16-Feb	329 American evacuated from cruise ship (14 of the evacuees found to be +) 61 Americans remained on board 44 Americans remained hospitalized in Japan	369		
17-Feb	85 more passenger and crew confirmed +	454		1,723 tested; 19 seriously ill
18-Feb	167 more passenger and crew confirmed +	621		3,011 tested
19-Feb	2 deaths	621	2	

20-Feb	13 more passenger and crew confirmed +	634	2	3,066 tested; 28 seriously ill; 322 asymptomatic

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Sent: Thursday, February 20, 2020 4:49 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6))'; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

This is new

- Now 634 cases confirmed on the cruise ship (3,063 tested) (so not all the ship and crew have been tested 3.711)
- Slightly more than half are asymptomatic (previously we heard that 73 of 355 are asymptomatic)
- 28 in serious condition (4.4%)

Japan's Health Minister Katsunobu Kato told Parliament the two people from the Diamond Princess cruise ship who died had "received the best medical treatment" but couldn't be saved after catching the novel coronavirus on board. As of Thursday, 634 passengers and crew members were diagnosed with the virus out of 3,063 tested. Slightly more than half have no symptoms at all, officials said, and many of the remainder have only mild fever or a cough. Among patients who tested positive for the virus, 28 were reported in serious condition Thursday.

Doctors have said the virus can be particularly harmful in elderly patients, and one of the two fatal cases from the Diamond Princess, a Japanese man in his 80s, had pre-existing bronchial asthma and had been treated for angina. The other, a Japanese woman in her 80s without underlying illnesses, came down with a fever on Feb. 5, the same day passengers were told they would be quarantined in their cabins for two weeks, according to health ministry officials. The next day, she started suffering from diarrhea and saw a doctor on board.

She wasn't taken to a hospital until Feb. 12 when she started suffering shortness of breath. Her virus test came back positive the following day, and despite treatment with antiviral drugs normally used to treat HIV infection, she died Thursday.

Asked about the woman's case, health ministry official Hiroshi Umeda said, "I believe it was handled promptly." He said the ship was a difficult environment for medical staff but they worked day and night and tried to prioritize the most serious cases.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Thursday, February 20, 2020 11:00 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Keep an eye on South Korea too. Seeing rapid growth in cases in South Korea (see story below)

South Korea now reporting 104 cases and 1 death today. South Korea now implementing NPIs. This story is eerily reminiscent of the actions taken at Jefferson Barracks near St. Louis in 1918.

Also attached are update for Singapore (85 cases; 46 in hospital/4 in ICU; 4 kids, only 1 in hospital) and Hong Kong (69 cases, still no kids reported). Both have implemented NPIs (small increases in cases today). Japan has reported 10 new cases today—total now is 94.

South Korea reports first virus death as Daegu struggles to contain outbreak
https://protect2.fireeye.com/url?k=3b9075da-67c46ca6-3b9044e5-0cc47adc5fa2-08635f0e31f1241a&u=https://www.stripes.com/news/pacific...break-1.619407

SEOUL, South Korea — South Korea reported its first coronavirus-linked death Thursday, while the U.S. military tightened restrictions on travel to the southeastern city of Daegu due to an outbreak in infections in the area.

Daegu also urged residents to stay home as the city of 2.5 million people and surrounding areas struggled to contain an outbreak of the pneumonia-like disease.

The Army garrison in Daegu also restricted access and announced that schools and nonessential business would be closed for a second day on Friday.

In an exception to policy, U.S. service members were authorized to wear face masks in uniform "regardless of air quality conditions," according to the garrison's Facebook page.

Fast-moving developments this week were a blow to South Korea's hope that the crisis was easing.

Instead, dozens of new cases were confirmed in recent days, with the total number of infections soaring to 104 on Thursday, according to the Korea Centers for Disease Control and Prevention

U.S. Forces Korea said, "there remains zero confirmed cases of USFK personnel with COVID-19."

The virus first appeared in December in Wuhan, China, and spread to nearly 30 countries. More than 2,000 people have died — most in mainland China.

A South Korean man in his 60s died Wednesday at a hospital in the southeastern city of Cheongdo and posthumously tested positive for the virus, the KCDC said Thursday. It was South Korea's first death from the virus.

USFK **raised the risk level for the military community** to moderate on Wednesday and banned all nonessential travel to Daegu due to an outbreak linked to a church near the Army garrison in the city.

On Thursday, USFK added that all travel by American troops to, from and around Daegu requires authorization from their leadership. The precaution was "highly encouraged" for all family members, civilians and contractors as well.

"All off-installation travel for all USFK populations should be minimized to reduce potential contamination," USFK announced on its website.

U.S. Army Garrison Daegu, about 200 miles southeast of Seoul, also said visitors not performing mission essential or official business would be denied access as it implemented health checks at the gates.

Nonessential personnel were not required to go to work on Friday and most activities would be suspended, including the schools, it said.

The garrison also recommended that members of the military community avoid public places and transportation in the city, including stores, restaurants and other heavily congested areas until the situation is brought under control.

Self-quarantine measures were ordered for any American troops who had visited the affected New World Church, but garrison commander Col. Edward Ballanco said earlier Thursday that no Americans were known to have done so.

He also urged Americans to avoid a local hospital where the woman believed to have been a carrier was treated.

The garrison also lifted limits on wearing face masks for American troops in uniform, who normally are only allowed to wear them on days with extreme pollution.

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From: Carter Mecher
Sent: Thursday, February 20, 2020 8:20 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Last thing. Keep a very close eye on Japan. The outbreak is starting to take off there with numbers of cases scattered across the country with no link to known cases. We are also seeing nosocomial transmission (a number of healthcare workers infected). There is also a large number of cases hospitalized in Japan related to the cruise ship, and now the release of large

numbers of passengers from the cruise ship into the community. Yesterday they reported a total of 84 cases—caught up to Singapore. But unlike Singapore, Japan has been slow to implement NPIs. The other concern is that Japan's population is disproportionately aged (it has the highest % age 65 of any country). In Japan, 27% of the population is ≥ 65; in the US, 15.6% of the population is ≥ 65. And Japan can also claim the largest city in the world (metro Tokyo with 38 M people—pretty much the population of California crammed into an area smaller than the size of Connecticut). Japan also has the 10th largest city in the world (Osaka with 19 M people).

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Thursday, February 20, 2020 7:15 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

What has me worried is what happened on the cruise ship is a preview of what will happen when this virus makes its way to the US healthcare system (not to mention institutionalized high-risk populations in the US, like nursing homes). I'm not sure that folks understand what is just over the horizon.

Remember the story about Mann Gulch? We are at the equivalent of about 5:44. I anticipate that when we reach 5:45, there is going to be chaos and panic to get anything in place. I doubt that what we would then hurriedly put in place will be any better than what they did on that cruise ship. As a consequence, would expect much the same results.

I listened to the discussion yesterday. After listening to James and Michael describe the conditions on and around the cruise ship, I wondered whether anyone in healthcare leadership (outside the expertise at our biocontainment facilities) is thinking about infection control

practices for any staff entering areas of a hospital caring for COVID patients (like changing clothes before entering and perhaps wearing scrubs, not bringing personal items into the area like iphones, ipads, stethoscopes, white coats, purses, briefcases, etc.)? And instituting policies that require all patients to phone for clearance to enter prior to presenting at safe acute and non-acute areas including community based clinics? Are we confident of the infection control practices of acute care staff (that they know the basics of how to don and doff PPE and behavior while in PPE?) Would HCWs in outpatient clinics or long term care facilities be any better prepared than the crew on board the cruise ship or the responders in Japan? I'm no expert in infection control and would defer to the expertise in this group. I was just a little surprised how little this seemed to be a concern for the healthcare leaders gathered yesterday.

I think we are getting close to the point where we need to drop those things that are not critical and focus on the most important things.

We are going to have a devil of time with lab confirmation—it is just too slow (they had a 2 day turnaround on the cruise ship) and we just don't have the capacity for the volume of tests we would anticipate. Charity has stressed this point again and again. That means we are going to have to fly blind early on. Perhaps the best we are going to be able to do in the near term if things begin to accelerate is screen all suspect cases (pretty much anyone with ILI symptoms) with a quick flu test and assume anyone who tests negative is suspected COVID until proven otherwise; and treat everyone who tests positive with Tamiflu. It will prove problematic early on, but as the epidemic barrels along, COVID will displace everything (at that point we will just assume that anyone with a fever or ILI has COVID). The problem is in the beginning. It is going to be so hard to sort things out. Matt, James and others are pushing for more rapid screening—but we just aren't there yet. The consequence is that we will be placing patients with resp illness (that is not flu and presumed to be COVID) in areas with actual COVID patients. I hate to do that, but not sure how it could be avoided early on. But we would only do that for those who are ill enough to be hospitalized. The large number of asymptomatic and mildly ill patients would be under home isolation (so no worries about mixing confirmed and suspected patients). The downside is that we would have larger number of people is isolation and home quarantine than is really necessary (and the consequence of increased workplace absenteeism).

And it is because home isolation and home quarantine are so important, healthcare systems (and not just public health) have to grab a hold of operationalizing those NPIs with both hands. A while back, I created some prescriptions (tongue in cheek), just to underscore that physicians do have a role in isolation and quarantine (it is not limited to public health). We might not have pharmaceuticals available to treat COVID, but why can't we write prescriptions for non-pharmaceuticals? I don't think healthcare leaders appreciate this point. Every COVID patient we admit or see in the ER will require us to follow up with household members to make sure they know to home quarantine (need to do the same anywhere in our system we find a patient who is infected). You could not imagine the pushback I have received when I proposed that we

must have an active role—people seem to think that state and local public health is alone responsible for this. I would think public health will be overwhelmed and taking charge of this is our best strategy to keep our safe areas safe.

I would be interested to hear how other healthcare systems and public health leaders are thinking about this.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Thursday, February 20, 2020 6:39 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Keeping track of the outbreak aboard the cruise ship. The latest update is the announcement of 2 deaths (both patients in their 80s). An 87-year-old man and an 84-year-old woman, died on the 20th. Both were Japanese (the 87-year-old man was hospitalized on Feb-11 and the 84-year-old women on Feb-12). So time to death from recognition of infection was 8-9 days. On Feb-12, the total number of confirmed cases was 203. So estimated CFR back dating the denominator to Feb-12 is 1%. Assuming a denominator of 621, the CFR is 0.3%. if deaths are lagging by 8-10 days (and confirmed cases plateau), we should have a pretty good estimate of CFR for he entire group in another week or so. Will need to peel off the number of cases involving the crew member to get a better estimate of CFR in the elderly. These numbers are within the range we have been estimating.

The 2,666 passengers are similar in age (and likely in co-morbidities) to the population we see in a nursing home or residential care facility. The 1,045 crew are a proxy for a young healthy population. It will be important to look at the outcomes separately. One of the concerns is how a 'remake of this movie' could play out in similarly confined populations of elderly frail Americans. Here are the numbers of long term care facilities/programs in the US that care for the frail elderly. A large number of locations and a large number of residents/participants. I know that healthcare leaders were engaged yesterday, is anyone engaging this sector (long term care)? The healthcare leaders seemed more concerned about critical supply shortages (akin to the IV fluid shortage). Listening to them, it felt like their concerns seemed almost divorced from the threat of COVID.

	Number of Facilities / Communities	Number of Agencies / Centers	Number of Beds	Number of Residents	Number of Participants
Nursing Homes	15,600		1,700,000	1,300,000	
Residential Care	28,900		996,100	811,500	
Hospice Care		4,300			1,400,000
Adult Day Care		4,600			286,300

Source: https://www.cdc.gov/nchs/fastats/nursing-home-care.htm

The outbreak on the cruise ship should be the wake up call for leaders in long term care (and I would think healthcare overall).

Here is a summary of the cruise ship data (as of Feb 20)

Date	Event	Cumulative Number of Confirmed Cases	Cumulative Number of Deaths	Notes
20-Jan	Cruise ship departs from Yokohama Japan			
25-Jan	80 year old passenger disembarks in Hong Kong			
1-Feb	80 year old passenger confirmed to have COVID-19			

	When results known, certificate of landing canceled and ship under quarantine. Tests for the virus would be administered to three groups: those with symptoms, those who got off in Hong Kong, and those who had close contact with the infected passenger.			
3-Feb	Ship arrives in port of Yokohama Japan			
5-Feb	10 passengers and crew confirmed +	10		
6-Feb	31 more passengers and crew confirmed +	41		
7-Feb	30 more passenger and crew confirmed +	61		
8-Feb	9 more passenger and crew confirmed +	70		
10-Feb	66 more passenger and crew confirmed +	136		439 tested
11-Feb	39 more passenger and crew confirmed +	175		492 tested
12-Feb	28 more passenger and crew confirmed +	203		4 in ICU
13-Feb	15 more passenger and crew confirmed +	218		713 tested
14-Feb	67 more passenger and crew confirmed +	285		927 tested
15-Feb	70 more passenger and crew confirmed +	355		73 asymptomatic; 1,219 tested
16-Feb	329 American evacuated from cruise ship (14 of the evacuees found to be +) 61 Americans remained on board 44 Americans remained hospitalized in Japan	369		
17-Feb	85 more passenger and crew confirmed +	454		1,723 tested; 19 seriously ill
18-Feb	167 more passenger and crew confirmed +	621		3,011 tested
19-Feb	2 deaths	621	2	

Data by country is a bit sketchy

Country	Passengers	Total Confirmed Cases	ICU Admissions	Deaths
US	434	58	1	
Hong Kong	330			
Canada	256	32		
Australia	241	46		
UK	78	6		
Italy	35			
South Korea	14			
Japan				
Subtotal	1,388	142		

New virus cruise ship disembarks and kills two Japanese passengers in hospital

February 20, 2020 11:38

Two Japanese men and women in their 80s who were hospitalized and treated for the virus were killed on the 20th in a cruise ship passenger who was confirmed to be infected with the new coronavirus. This is the first time a cruise ship passenger has died and three people have been killed in the country.

As of the 19th, 621 cruise ships out of approximately 3,700 crew members and passengers on the cruise ship where outbreaks of the new coronavirus were confirmed were confirmed.

According to government officials, two of them, a 87-year-old man and an 84-year-old woman, died on the 20th.

Both were Japanese and had a basic illness and were confirmed to have been infected with the virus, so it was said that men were hospitalized on the 11th of this month and women on the 12th to be treated.

This is the first time a cruise ship passenger has died.

In addition, three people have been killed in Japan, following the death of a woman in her 80s living in Kanagawa Prefecture on the 13th of this month.

From: Carter Mecher
Sent: Wednesday, February 19, 2020 10:05 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

More puzzle pieces.

Italy https://protect2.fireeye.com/url?k=e5d05247-b9844b3b-e5d06378-0cc47adc5fa2-e16553f827677d60&u=https://www.journalgazette.net/news/world/20200216/quarantine-ends-for-germans-italy-to-fly-citizens-from-ship

Italy plans to evacuate 35 Italians from the cruise ship

- 25 Italian crew members (including the ship's captain)
- 15 passengers

UK https://www.telegraph.co.uk/global-health/science-and-disease/coronavirus-news-uk-china-singapore-death-toll-latest/

UK plans to evacuate British passengers Friday 2/21

78 British passengers on board

4 confirmed COVID the Foreign Office

2 passengers on board say they are infected

Hong Kong https://www.japantimes.co.jp/news/2020/02/16/national/science-health/canada-evacuate-passengers-coronavirus-covid19-diamond-princess-cruise-ship/

There are around 330 Hong Kong residents on board, including 260 holding Special Administrative Region of Hong Kong passports and roughly 70 people with foreign ones.

South Korea https://www.japantimes.co.jp/news/2020/02/18/national/science-health/south-korea-evacuate-diamond-princess/

The South Korean government is sending a presidential plane to Japan on Tuesday afternoon to evacuate several citizens on a coronavirus-stricken cruise ship docked in Yokohama, a government official said Tuesday.

14 South Koreans — nine passengers and five crew members

Canada https://www.japantimes.co.jp/news/2020/02/18/national/science-health/canada-diamond-princess-covid19/

Global Affairs Canada had confirmed that 32 out of 256 Canadians on the ship had tested positive.

Canadian passengers are set to be evacuated from the virus-hit boat soon, passengers will be screened before boarding the evacuation aircraft, and those who exhibit symptoms of COVID-19 will be transferred to the Japanese health care system

Australia https://www.news.com.au/travel/travel-updates/health-safety/unusual-rescue-flight-ahead-for-australian-evacuees-of-the-diamond-princess/news-story/564e590bec70b71825c897df85d0bc24

Australia evacuated passengers from the cruise ship today.

- ~180 evacuated
- 15 declined evacuation
- 36 confirmed COVID hospitalized in Japan
- 10 newly confirmed had to stay behind

So there were a total of ~241 Australians aboard the ship; 46 tested + (19%)

The story from Australia sounds familiar (see below).

Australian cruise passengers arrive to Darwin after Diamond Princess virus outbreak ordeal

Feb 20

A rescue mission of Australian cruise ship passengers from Japan has officially landed in Darwin, but the flight wasn't free from drama.

Thousands of people sharing toilets, pools and buffets – is this the petri dish of the sea?

The Qantas coronavirus rescue flight, carrying about 180 citizens and permanent residents on board from Japan, has landed in Australia.

Qantas flight 6032 touched down in Darwin at 8.11am local time, after being slightly delayed from takeoff our of Haneda.

The last-minute drama hit the rescue mission when 10 Australians, who were set to leave the coronavirus-hit Diamond Princess ship and head to the airport, were told they had tested positive to coronavirus and had to stay behind.

About 180 citizens and permanent residents, who have spent the past fortnight on the quarantined cruise ship off the coast of Japan, had taken up the Federal Government's offer of a seat on the repatriation flight to Australia.

They join another 36 Australians who contracted coronavirus on the *Diamond Princess* and are being treated in Japan. About 15 of their relatives declined the offer of repatriation to stay with them.

The Australians on board will be screened for coronavirus five times before they are taken to a quarantine facility at Howard

Qantas boss Alan Joyce praised the crew who took part in the repatriation flight as well as two previous Qantas chartered flights that brought Australians home from virus epicentre Wuhan.

"It took literally thousands of hours to plan complex operations like these," Mr Joyce said at t press conference today.

"The crew were all volunteers and they did us proud."

Yesterday, Australians who were cleared to finally disembark the *Diamond Princess* were driven by bus to Haneda Airport for the chartered flight home.

They first needed to pass a health check to receive an approval of disembarkation notice by Japanese quarantine officials.

They were then screened several more times before they could board the Qantas 747.

On the plane, they had no contact with Qantas crew, who remained upstairs for the flight. Food for passengers was already waiting for them at their seats when they boarded.

If they passed the latest health check, they would have been given "approval of disembarkation" notices by Japanese quarantine officials, which grant them permission to enter Japan.

From Yokohama Port, where the ship was docked, they boarded buses to Haneda Airport.

Brisbane student Tehya Pfeffer, 18, who has been quarantined on the *Diamond Princess* with her grandmother Cathy, was among them.

"At 10.30am (local time, 12.30pm AEDT) we will start to be screened and given luggage tags and wrist bands," Ms Pfeffer told news.com.au yesterday.

"At 5pm we have to have our luggage put outside, and at 6pm we will disembark the ship and go through a makeshift customs. This is where we use our wrist bands.

"And then we will take a bus to the airport and at around 12am Thursday we will fly to Darwin."

On the evacuation flight, cabin crew would not be making direct contact with evacuees.

Meals were already waiting for passengers at their seats when they boarded, and Qantas staff remained upstairs.

All those returning to Australia on the Qantas flight will spend two weeks in quarantine at the Howard Springs facility, in addition to the two weeks in lockdown they've had on the ship.

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From: Carter Mecher
Sent: Wednesday, February 19, 2020 8:36 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

South Korea cases are taking off.

S. Korea reports 31 more cases on 2/20; total now at 82

Singapore, Hong Kong, Japan, and South Korea are the new front lines. Matter of time before travel from those areas will raise concerns.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Wednesday, February 19, 2020 4:45 PM
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Was listening to the discussion today. There was a discussion about the shortages of PPE. There was also discussion re NPIs, but I'm not sure that most folks appreciate that the NPIs that have been arrayed as part of the TLC strategy to reduce disease transmission in the community can be leveraged to create safer compartments or spaces by shunting disease toward the home. By implementing these interventions, one could reduce the likelihood of disease in workplaces (by home isolation and home quarantine-- keeping sick employees at home and keeping employees who are well but potentially infected because someone is sick in their household, at home). Adding in other social distancing measures including social distancing at work, helps to reduce community transmission (adds additional protection to the workplace). The consequence is shunting disease to the home--120 M different compartments in the US, and making the workplace the safe place. That is potentially very important for critical infrastructure. The answer is not PPE for these employees. And why would we expect that employees in these sectors would have any better IPC with the use of PPE than we saw with staff on the Diamond Princess?

Healthcare is a key critical infrastructure. It is different from the other sectors in that it will be attracting patients with COVID like a magnet. It is hard to imagine how one could makes healthcare a safe workplace. But it is only hard to imagine how one could do that unless you begin to look a little closer at the different components of the healthcare system and the roles each component might play during this pandemic.

To illustrate this, I took a stab at developing a conops or roadmap to look at the various pieces of the healthcare system. The shunting of disease is really fractal. Just as we can look at shunting disease across a community into one compartment (the home) to make other compartments safer, we can do the same within our healthcare system—shunt disease to the acute care area where COVID patients will be concentrated. What are the strategies to do that?

This conops is notional. It is purposely designed for a severe outbreak with severe disease and assumes that the healthcare system must somehow continue to limp along and continue to care for the background disease we see during normal times (strokes, AMIs, fractures and trauma, appendicitis, other serious infections, CHF, diabetic emergencies, psychotic episodes, preeclampsia, complicated deliveries, end stage renal disease and dialysis, etc.) as well as sustain outpatients with chronic conditions that require monitoring and care to keep them well and out of the ER and out of the hospital.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Wednesday, February 19, 2020 2:36 PM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Update for South Korea (see attached) 51 cases; 1 child

Colombia confirms first case of Coronavirus - citizen on Japan cruise ship

February 17th, 2020, 09:06 AM

@Stats_Alerts
BREAKING: Colombia confirms first case of Coronavirus Colombia confirms first case of coronavirus: citizen was on a Diamond Princess cruise

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Wednesday, February 19, 2020 10:05 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) , Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Update on HK (65 cases; no children) and Singapore (84 cases; 49 currently hospitalized/4 in ICU; still only 4 children (2 asymptomatic/2 hospitalized).

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Wednesday, February 19, 2020 8:20 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) '; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

As of yesterday, there are 251 Canadians on board the Diamond Princess, of whom 34 have tested positive.

https://globalnews.ca/news/6567907/c...hip-canadians/
Canada walks back expected departure date for evacuees of Japanese cruise ship
By Staff The Canadian Press
Posted February 19, 2020 7:47 am
Updated February 19, 2020 7:49 am

Global Affairs says the departure date for a plane that will carry Canadians home from a coronavirus-stricken cruise ship in Japan is yet to be confirmed. Spokeswoman Barbara Harvey says the departure will be settled once final arrangements are made with the Japanese government and the cruise ship company. A news release from the company operating the Diamond Princess cruise ship says the Canadian flight has been "shifted" to early Friday morning.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Wednesday, February 19, 2020 8:09 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

621 cases on cruise ship (17% of the passengers and crew have been infected).

https://www.channelnewsasia.com/news...itive-12450498

79 more people test positive for COVID-19 on Diamond Princess cruise ship

19 Feb 2020 06:21PM
(Updated: 19 Feb 2020 06:30PM)

TOKYO: An additional 79 cases of coronavirus have been discovered aboard the Diamond Princess cruise ship in Japan, the health ministry said Wednesday (Feb 19), bringing the total to 621.

Sent from Mail for Windows 10

From: Carter Mecher
Sent: Wednesday, February 19, 2020 6:06 AM
To: Richard Hatchett; Dr. Eva K Lee
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

I saw a news story yesterday (WashPost) that testing was completed. So we should know in the next coupe of days.

Also saw a story about the 100 or so Americans left behind (44 in hospitals and 61 who declined evacuation).

https://mainichi.jp/english/articles/20200219/p2g/00m/0in/028000c

Hard to find data on the status of those still hospitalized in Japan.

James made a very important point yesterday. Although the passengers are elderly (2,666 passengers), the crew members are relatively young (1,045 crew members). James also expected the attack rates to be very high among the crew members (they were housed together in a relatively small space aboard the ship, perfect conditions for explosive disease transmission). So this combined data on passengers (elderly) and crew (young and healthy) will be invaluable in

terms of helping understand severity. I would think that Japan also realizes how invaluable this data is. Japan will be in the best position to assess the impact on the crew, since they will know the results of lab screening and hospitalization of all + crew members (as well as the monitoring quarantine of the rest of the crew over the next 14 days). But now that the passengers are being dispersed, it will be important for several nations to share the data on these passengers—it is really our best chance to understand severity (would need collaboration of the US, Canada, Australia, Hong Kong, Japan).

Sent from Mail for Windows 10

From: Richard Hatchett
Sent: Wednesday, February 19, 2020 4:47 AM
To: Dr. Eva K Lee; Carter Mecher
Cc: Tracey McNamara; Caneva, Duane; (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

I understand from contacts at WHO that Japan is testing everyone on the Diamond Princess, so we should have a complete accounting of that closed population (and thus a nice dataset to inform severity estimates).

From: Dr. Eva K Lee (b) (6)
Sent: 19 February 2020 03:54
To: Carter Mecher (b) (6)
Cc: Tracey McNamara (b) (6)>; Caneva, Duane (b) (6)>; Richard Hatchett (b) (6) Dodgen, Daniel (OS/ASPR/SPPR) (b) (6); DeBord, Kristin (OS/ASPR/SPPR) < (b) (6)>; Phillips, Sally (OS/ASPR/SPPR) (b) (6)>; David Marcozzi (b) (6)>; (b) (6) (USA) (b) (6)>; Lisa Koonin (b) (6) Wargo Michael (b) (6); (b) (6) (b) (6); HARVEY, MELISSA (b) (6); WOLFE, HERBERT (b) (6); Eastman, Alexander (b) (6)>; EVANS,

MARIEFRED [redacted]>; Callahan, Michael V.,M.D. [redacted]; Johnson, Robert (OS/ASPR/BARDA) [redacted] Yeskey, Kevin [redacted]; Disbrow, Gary (OS/ASPR/BARDA) [redacted] Redd, Johnt(OS/ASPR/SPPR) [redacted] Hassell, David (Chris) (OS/ASPR/IO) [redacted] Hamel, Joseph (OS/ASPR/IO) [redacted]; Dean, Charity A@CDPH [redacted] Lawler, James V [redacted]>; Kadlec, Robert (OS/ASPR/IO) [redacted]; [redacted] Borio, Luciana [redacted]; Hanfling, Dan [redacted] McDonald, Eric [redacted]>; Wade, David [redacted]; TARANTINO, DAVID A [redacted]; WILKINSON, THOMAS [redacted]>; David Gruber [redacted])
[redacted]>; KAUSHIK, SANGEETA < [redacted]; Nathaniel Hupert [redacted]
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Just talked to a lab director in Hong Kong U. They tested 3,600 passengers and crews on World Dream in 24 hours, all using the definitive RT-PCR test. The tests were performed in government labs. They disembarked everyone after 3 days (all came back negative). And they are still performing contact tracing and monitoring on all at the moment.

old news:

https://www.scmp.com/news/hong-kong/health-environment/article/3049714/coronavirus-3600-passengers-and-crew-members

For surveillance, regional hospitals do an initial screening, then suspected cases are tested by a governmental lab for confirmation.

Schools are still closed for another month.

[redacted]

Sent with ProtonMail Secure Email.

------- Original Message -------

On Tuesday, February 18, 2020 7:56 PM, Carter Mecher (b) (6) wrote:

Japan inching toward mitigation

Abe urges people with cold-like symptoms to avoid work, school

Today 06:30 am JST 24 Comments

TOKYO

Prime Minister Shinzo Abe on Tuesday advised people across the country not to go to work or school if they develop cold-like symptoms, as the country grapples with the spread of a new coronavirus originating in China.

Workplaces in the country, known for their long hours, need to encourage people to take days off without hesitation if they do not feel well, Abe said.

"The first thing that I want the people of Japan to keep in mind is to take time off school or work and refrain from leaving the house if they develop cold-like symptoms such as fever," Abe told a meeting of a government task force on the viral outbreak.

Teleworking is an "effective alternative" to help prevent the virus from spreading further, Abe said.

He made the remarks as the government is scrambling to contain the virus that originated in Wuhan, with more people with no obvious link to China getting infected in Japan.

The global outbreak of the disease called COVID-19 has prompted some event organizers in Japan to rethink their plans for hosting mass gatherings.

The number of confirmed cases in Japan has topped 600, including over 500 passengers and crew on the Diamond Princess, a quarantined cruise ship docked at Yokohama near Tokyo with more than 3,000 confined.

The steady rise in infections in various parts of Japan has raised public concern, prompting the health ministry to ask people who develop symptoms such as a temperature of 37.5 C or higher for at least four days to consult local health care centers and go to designated hospitals. The period is set shorter for the elderly, those with underlying conditions and pregnant women.

As Tokyo and other major cities in the country are notorious for packed rush-hour trains, commuters have been encouraged by a government panel of medical experts to go to work earlier or later than usual as the risk of infection is increased in crowds.

On Tuesday, Fujitsu Ltd and Hitachi Ltd said they are expanding teleworking, though Japanese companies overall have been slow to introduce it.

Sent from Mail for Windows 10

From: Tracey McNamara

Sent: Tuesday, February 18, 2020 4:38 PM

To: Dr. Eva K Lee; Caneva, Duane

Cc: Carter Mecher; Richard Hatchett; (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, Johnt(OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

I must be psychic. This just came out. Like I said – Oxford Nanopore Sequencers are being sent to China!

Tracey

https://protect2.fireeye.com/url?k=0a860669-56d21f15-0a863756-0cc47adc5fa2-

4fc7adc96dfbde59&u=https://globalbiodefense.com/newswire/oxford-nanopore-sequencers-have-left-uk-for-china-to-support-rapid-near-sample-coronavirus-sequencing-for-outbreak-surveillance/

To: 'Caneva, Duane' (b) (6); Carter Mecher (b) (6); Richard Hatchett (b) (6)>; Dr. Eva K Lee (b) (6)
Cc: (b) (6)
Dodgen, Daniel (OS/ASPR/SPPR) < (b) (6); DeBord, Kristin (OS/ASPR/SPPR) (b) (6)>; Phillips, Sally (OS/ASPR/SPPR) (b) (6); David Marcozzi (b) (6); (b) (6) USARMY (USA) (b) (6); Lisa Koonin (b) (6)>; Wargo Michael (b) (6) (b) (6); HARVEY, MELISSA (b) (6); WOLFE, HERBERT (b) (6)>; Eastman, Alexander (b) (6); EVANS, MARIEFRED (b) (6); Callahan, Michael V.,M.D. (b) (6) (b) (6) Johnson, Robert (OS/ASPR/BARDA) (b) (6); Yeskey, Kevin (b) (6)>; Disbrow, Gary (OS/ASPR/BARDA) (b) (6); Redd, John (OS/ASPR/SPPR) (b) (6); Hassell, David (Chris) (OS/ASPR/IO) (b) (6); Hamel, Joseph (OS/ASPR/IO) (b) (6); Dean, Charity A@CDPH (b) (6) Lawler, James V (b) (6); Kadlec, Robert (OS/ASPR/IO) (b) (6); (b) (6) Borio, Luciana (b) (6); Hanfling, Dan (b) (6)>; McDonald, Eric (b) (6) Wade, David (b) (6) TARANTINO, DAVID A (b) (6)>; WILKINSON, THOMAS (b) (6); David Gruber (b) (6) KAUSHIK, SANGEETA (b) (6); Nathaniel Hupert

[redacted] (b) (6)

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Hello all - Clearly, the most important thing of all is a reliable, real-time diagnostic test that can differentiate between flu and COVID-19. CDCs test kits were recalled because states said they were not working. Now they have to remanufacture the faulty reagent. How long will that take? If and when more kits are available, will they be available in sufficient quantity that all health care providers will have access?

In all of this, I have not heard anyone talk about the Nanopore MinION technology that has been used for Ebola. What gives??? It is field deployable and can be run in-house. Hospital labs can run thousands of samples at once. It gives results of all viruses, bacteria, protozoa, fungi, in 2 hours. We all know this technology is quite promising. Why aren't we going gangbusters to validate this rapid technology and get it to all diagnosticians? If ever there was a time to invest in a diagnostic technology, this is it!

Tracey

From: Dr. Eva K Lee [redacted] (b) (6)

Sent: Tuesday, February 18, 2020 1:06 PM

To: Caneva, Duane [redacted] (b) (6)

Cc: Carter Mecher [redacted]; Richard Hatchett <[redacted]
Tracey McNamara [redacted]; Dodgen, Daniel
(OS/ASPR/SPPR) [redacted]
[redacted] /SPPR) [redacted]; David
Marcozzi [redacted]; [redacted] USARMY (USA)
[redacted]; Lisa Koonin [redacted]; Wargo Michael
[redacted]; [redacted])
[redacted] HARVEY, MELISSA [redacted]; WOLFE,
HERBERT [redacted]; Eastman, Alexander
[redacted]; EVANS, MARIEFRED
[redacted]; Callahan, Michael V.,M.D.
[redacted];
Johnson, Robert (OS/ASPR/BARDA) [redacted]; Yeskey, Kevin
[redacted]; Disbrow, Gary (OS/ASPR/BARDA) <[redacted]
Redd, Johnt(OS/ASPR/SPPR) [redacted]; Hassell, David (Chris) (OS/ASPR/IO)
[redacted]; Hamel, Joseph (OS/ASPR/IO) [redacted]; Dean,
Charity A@CDPH [redacted]; Lawler, James V [redacted];
Kadlec, Robert (OS/ASPR/IO) [redacted]; [redacted]
[redacted]; Borio, Luciana [redacted]; Hanfling,
Dan [redacted]; McDonald, Eric [redacted]; Wade, David
[redacted]; TARANTINO, DAVID A [redacted];
WILKINSON, THOMAS [redacted] David Gruber
[redacted] KAUSHIK, SANGEETA
[redacted]; Nathaniel Hupert [redacted]

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Carter,

Just listened in to our state COVID-19 response effort update. Georgia has no COVID-19 cases yet, and hence they remain in the containment period where they place medium-risk individuals on supervised monitoring of home quarantine, advise them to take temperature daily and report any respiratory symptoms (24/7). Educate them not to show up in ED, or any place without facilitation. To avoid potential disease spread, they are advised to remain at home.

The next stage will be mitigation when a confirmed case is reported. That will initiate the pandemic planning and community-based NPI will be considered. This includes social distancing -- telework, teleclass, etc.

I assume at cities where there are confirmed local COVID-19 cases, the public health leaders have already begun the mitigation phase now and hence are practicing some degree of social distancing and rolling out telework, and various strategies to protect health in the population and to maintain business continuity already. Is that true or they are still waiting to execute their operations?

There are not many tests needed here in Georgia. But rapid robust and reliable testing kits (Tracey's reporting of current bottleneck) remain critical in all communities with positive cases. If we have such means, testing can also be conducted (sampling) on some flu-like cases at strategic selected cities also.

------- Original Message -------

On Tuesday, February 18, 2020 2:20 PM, Dr. Eva K Lee (b) (6) wrote:

Duane, Yes. (asymptomatic or mild symptoms) this is the worry at the very start, and it remains the most critical. Hence even 1% of infection for us -- can balloon out of proportion and we can't handle. Shedding not only during infection period, but also post-recovery. It's a very long timeline that we have to deal with. Then you have all the university siudents. Students travelled to China and came back to school, they asked health service if they needed to quarantine or take any action, theadvice -- no need. Those are missed opportunities. Again, seasonal influenza affects 8-10% Americans, 0.7% of those infected required hospitalization, and morality is roughly 0.1%. So it is easy to "calculate" all these numbers backwards... So 20% ofCOVID-19 infected may need hospitalization, mortality is 10-30 times higher than seasonal flu. How much can we tolerate before anyone would spring into action? Keep in mind, some begin to infect rapidly upon contracting the virus, the incubation is so short (and so long) and infectious too during that period (with much being unknown).

Carter, I think you will expect heterogeneous approaches from different communities in the overall response strategy, since it depends on the social setting and the demographics and more importantly the local resources. We have to optimize for sure.

------- Original Message -------

On Tuesday, February 18, 2020 1:51 PM, Caneva, Duane (b) (6) wrote:

Seems to me a big challenge will be asymptomatic or mild symptoms in kids, spread through the schools, shed to parents who staff both categories acute and non-acute care clinics. If there are several days of asymptomatic shedding, how do you prevent spread to the vulnerable, high risk patients in each category?

Will mild symptoms drive complacent compliance?

From: Carter Mecher (b) (6)>

Sent: Tuesday, February 18, 2020 1:32 PM

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

My thinking is evolving in terms of healthcare system response. Initially I described how I would refocus the outpatient clinics away from COVID care and leverage the NPIs of isolation and quarantine to help keep the workplace safe (for the clinic staff and other patients) rather than a strategy that employs PPE. I would only use the outpatient clinic staff to help with telephone/home care support of those patients under home isolation or home quarantine--to help with compliance/adherence to isolation and quarantine, monitoring their health, and optimizing the care of their other chronic medical conditions (to keep them out of the ER and the hospital). But as I thought more about this, it occurs to me that this can be generalized beyond outpatient clinics.

I would think about dividing our healthcare system into two big pieces: (1) acute care (EDs, acute inpatient care, critical care); and (2) non-acute care including outpatient clinics (PC/Family Practice, pediatrics, OB/GYN, medical specialty, surgical specialty, dental, mental health, rehab, etc.), as well as other inpatient areas (inpatient mental health, substance abuse, nursing homes, hospice care, memory care, assisted living, etc.). Inpatient surgery (and I suppose labor and delivery) is part of acute care, but for this outbreak, it probably best belongs bundled with the other non-acute inpatient areas. I would anticipate that the tripwire for implementing NPIs (community transmission), will also be the trigger for healthcare systems to dial down or turn off

elective admissions (primarily surgical) to free up acute care and ICU/monitored meds. The most effective way to protect these non-acute areas is by shunting potential COVID patients away from these areas and either providing this type of care while the patients is hospitalized in acute care or thru telephone care/home care for patients with mild illness receiving care at home. And the most effective way to shunt these patients away from non-acute care areas is thru the implementation of early and aggressive NPIs of isolation of the ill and home quarantine of household contacts (and not fit testing the world and passing out PPE that we don't have).

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Tuesday, February 18, 2020 11:02 AM

To: Richard Hatchett; Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: (b) (6)>; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) ; HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

More puzzle pieces re the cruise ship outbreak.

- About 2/3rds of the passengers have been tested so far (2,404 out of 3,711).
- 61 Americans opted to remain onboard and not be evacuated.

Japan has completed tests for all passengers and crew aboard the ship as of Monday, but the results for the last batch of tests aren't expected until Wednesday, the day that the quarantine is slated to end. So far, results are back for 2,404 passengers and crew, out of the 3,711 who were on board the ship when the quarantine began on Feb. 5.

Japanese Health Minister Katsunobu Kato said Tuesday that people who have tested negative for the virus would start leaving on Wednesday, but that the process of releasing passengers and crew won't be finished until Friday, according to the Washington Post.

The remaining 61 American passengers on the DP who opted not to join the evacuation will not be allowed to return to the US until March 4, according to the American embassy in Tokyo. The governments of Australia, Hong Kong and Canada have also said they would evacuate passengers.

Elsewhere, Japan confirmed three more cases of the virus. This time, they were confirmed in Wakayama, a prefecture in eastern Japan.

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Tuesday, February 18, 2020 10:50 AM

To: Richard Hatchett; Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) ; HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Maybe he was misquoted or it was a typo—perhaps what was meant was 4 per 100 (and that would be a low estimate)

Sent from Mail for Windows 10

From: Richard Hatchett

Sent: Tuesday, February 18, 2020 10:45 AM

To: Carter Mecher; Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: (b) (6)>; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Note that 4/100,000 would imply that only 440 people have been infected.

From: Carter Mecher (b) (6)>

Sent: 18 February 2020 15:26

To: Caneva, Duane (b) (6); Tracey McNamara (b) (6) Dr. Eva K Lee (b) (6)

Cc: [redacted] Dodgen, Daniel (OS/ASPR/SPPR) [redacted]; DeBord, Kristin (OS/ASPR/SPPR) [redacted]; Phillips, Sally (OS/ASPR/SPPR) [redacted]>; David Marcozzi [redacted]>; [redacted] USARMY (USA) [redacted]; Lisa Koonin [redacted]>; Wargo Michael [redacted]>; [redacted]) [redacted]; HARVEY, MELISSA [redacted]; WOLFE, HERBERT [redacted]; Eastman, Alexander [redacted]v>; EVANS, MARIEFRED [redacted]v>; Callahan, Michael V.,M.D. [redacted]; Johnson, Robert (OS/ASPR/BARDA) [redacted]; Yeskey, Kevin [redacted]; Disbrow, Gary (OS/ASPR/BARDA) [redacted]>; Redd, John (OS/ASPR/SPPR) [redacted]>; Hassell, David (Chris) (OS/ASPR/IO) [redacted]; Hamel, Joseph (OS/ASPR/IO) [redacted]>; Dean, Charity A@CDPH [redacted]>; Richard Hatchett [redacted]; Lawler, James V [redacted]; Kadlec, Robert (OS/ASPR/IO) [redacted]>; Borio, Luciana <LBorio@iqt.org>; Hanfling, Dan McDonald, Eric [redacted]>; Wade, David [redacted]>; TARANTINO, DAVID A [redacted]; WILKINSON, THOMAS [redacted]>; David Gruber [redacted]>; KAUSHIK, SANGEETA Nathaniel Hupert [redacted]

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

WHO estimates 80% of patient with COVID-19 have mild disease and recover; that implies that 20% have severe disease. WHO estimated that 14% develop pneumonia and 5% are considered critical. [We were estimating that 12% of cases needed hospitalization (so 88% did not) and 2% needed ICU care (with mortality of patients with pneumonia in the ICU generally between 15%-50% so a CFR of 0,3%-1.0%). Also noet his comment on sparing children. The latter comments are reminiscent of the early comments of public health leaders during the 1918 pandemic—always minimizing. I have no idea where an attack rate of 4 per 100,000 comes from.]

https://www.channelnewsasia.com/news/world/covid-19-coronavirus-who-china-patients-have-mild-disease-12445010

GENEVA: The new novel coronavirus only causes mild disease for 80 per cent of infected patients, said the World Health Organization on Monday (Feb 17). Speaking to reporters, WHO chief Tedros Adhanom Ghebreyesus said that 14 per cent of patients would have severe diseases such as pneumonia.

"Around five percent of cases are considered critical with possible multi-organ failure, septic shock and respiratory failure and, in some cases, death," he added.

Tedros also said there were "relatively few cases" among children and more research was needed to understand why.

The WHO chief also warned against "blanket measures" over the novel coronavirus outbreak, pointing out the epidemic outside of China was only affecting a "tiny" proportion of the population.

Ryan said that even at the epicentre of the crisis in the city of Wuhan in central Hubei Province, the "attack rate" - a measure of the speed of spread of the virus - was four per 100,000.

"This is a very serious outbreak and it has the potential to grow, but we need to balance that in terms of the number of people infected. Outside Hubei this epidemic is affecting a very, very tiny, tiny proportion of people," he said.

Tedros also referred to an apparent decline in new cases of the disease in recent days but said that the trend "must be interpreted very cautiously".

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Tuesday, February 18, 2020 10:15 AM

To: Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: (b) (6) >; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6); Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Update on cruise ship, Japan (implementing NPIs) and South Korea (evacuating passengers)

https://www.channelnewsasia.com/news/asia/covid19-japan-virus-testing-complete-quarantine-cruise-ship-12445788

88 more people test positive for COVID-19 on Diamond Princess cruise ship.

The new cases take the total number of confirmed cases on the Diamond Princess to 542 - the biggest cluster outside the epicentre in China. [Almost 15% of the crew and passengers have been infected.]

Japan has also confirmed at least 65 cases domestically, including many involving people with no history of recent travel to China. Authorities have said the virus is being transmitted locally now, and have asked citizens to avoid crowds and non-essential gatherings. On Monday, the amateur portion of the Tokyo Marathon, which had been expected to attract some 38,000 runners, was cancelled. Only elite athletes will now be able to take part. The public celebration for Emperor Naruhito's birthday has also been scrapped over virus fears.

South Korea will send a presidential aircraft on Tuesday to fly back four nationals and one Japanese spouse, an official told reporters. There are 14 South Koreans on board in total, but the other ten have declined to be evacuated from the ship because they live in Japan, the Yonhap news agency reported.

Vietnam NPIs

https://protect2.fireeye.com/url?k=5a2fa482-067bbdfe-5a2f95bd-0cc47adc5fa2-a5b86bc1581cf39c&u=https://saigoneer.com/saigon-health/...ue-to-covid-19

Due to COVID-19: As of February 15, all 63 provinces and cities in Vietnam have extended their school closing time, 56 of which — including Saigon — have announced that schools will

be closed until the end of February. Ho Chi Minh City's People Committee proposing students stay at home until the end of March.

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Tuesday, February 18, 2020 7:10 AM

To: Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: (b) (6); Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

More things to keep an eye on (attached links of stories and translations of news reports):

Yesterday a 5th flight of evacuees from Hubei arrived in Japan. There were 65 on board and 7 people were symptomatic (11%). Watch for the number of confirmed—it will provide a point estimate of prevalence of COVID-19 in Hubei as of yesterday. Sounds like this is the last flight japan will accept.

Yesterday, Japan provided an update of all cases in Japan:

- 53 people were infected in Japan and travelers from China
- 454 passengers and crew members on cruise ships, and
- 13 people returned on charter aircraft.
- 520 people in total.
- 23 people were determined to be seriously ill

Watching for other countries to evacuate passengers from cruise ship

- 256 Canadians on the Diamond Princess cruise ship
- 32 tested + (as of Feb-17)
- A plane chartered by the Canadian government has left for Japan to evacuate its nationals aboard a virus-hit cruise ship off Yokohama, TV Asahi reported on Tuesday, citing a tweet by Canada's foreign minister

Can't find anything about other countries evacuating passengers (UK, Hong Kong, Italy, etc.)

Last thing. Am seeing stories from Japan re patients going from clinic to clinic with resp symptoms and fever and being confirmed. They are finding nosocomial transmission—so underscores the concerns outlined in the proposal I outlined for re-aligning outpatient clinics.

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 10:39 PM

To: Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: [redacted]; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; [redacted] USARMY (USA); Lisa Koonin; Wargo Michael; [redacted]); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; [redacted]; Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); [redacted] Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber [redacted]); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

I really need help thinking thru the testing piece (screening for COVID-19). How do we protect the staff in outpatient clinics (where all the ILI is typically seen) and conserve PPE by shifting all the mild illness away from clinics and toward patients' homes using telephone care/telehealth and home healthcare and employing home isolation for those who are infected and voluntary home quarantine for otherwise well (but exposed and potentially infected) household contacts? Having all the suspected patients coming in to clinics to be screened really defeats the purpose. So how would very large numbers of outpatients get screened? Home screening? Drive thru screening? Or creating a free standing screening facility for rapid screening? Has anyone thought this thru (how you screen for disease plus promote adherence/compliance to home isolation and home quarantine and shift outpatient care of patients with mild disease to telephone/home care to protect outpatient clinic staff? Looking for practical solutions.

Just to remind you, here are the estimates of demand (assuming we would need to screen all ILI)—about 88K per day in primary care clinics across the US.

US Data	
US population	325,700,000
Hospital Beds	924,107
ICU Beds	81,790
Hospital Admissions	36,353,946.00
ER Visits	145,600,000
Family Practice/PC Visits	481,963,000
Total Deaths	2,813,503

A Day in the US	
Hospital Admissions	99,600
Inpatient Census (85% occupancy)	785,491
ICU Census (85% occupancy)	69,522
ER Visits	398,904
Family Practice/PC Visits	1,320,447
Deaths	7,708
Current Background of Illness Similar to COVID-19	
2019-20 Flu Season MMWR Week 5 ILI Rate 6.7%	
1.4M hospitalizations annually for pneumonia	
Medicare Average LOS Pneumonia 6 days	
55,672 pneumonia & influenza deaths annually	
Daily Hospital Admissions Pneumonia	3,836
Hospital Census Pneumonia	23,014
Daily ILI cases seen in ERs	26,727
Daily ILI cases seen in FP/PC clinics	88,470
Daily pneumonia & influenza deaths	153

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 9:04 PM

To: Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) ;

Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); [redacted]; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber [redacted]; KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

I tinkered with the strategy for integrating outpatient clinics and hospitals for the care of COVID-19 patients. Proposing this for my system.

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 7:17 PM

To: Caneva, Duane; Tracey McNamara; Dr. Eva K Lee; [redacted]

Cc: [redacted] Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; [redacted] USARMY (USA); Lisa Koonin; Wargo Michael; [redacted]; HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; [redacted] Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); [redacted] Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber [redacted]; KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

More details on evacuation of American passengers aboard the cruise ship.

Total evacuated: 177 + 151 = 328

https://www.usatoday.com/story/travel/cruises/2020/02/17/coronavirus-diamond-princess-evacuees-test-positive-allowed-fly-united-states/4783787002/

Fourteen evacuees from the Diamond Princess cruise ship quarantined in Japan were allowed to fly back to the United States Sunday despite testing positive for coronavirus, the U.S. State Department and Health and Human Services said in a joint statement. The evacuees were not symptomatic.

"These individuals were moved in the most expeditious and safe manner to a specialized containment area on the evacuation aircraft to isolate them in accordance with standard protocols," the statement, published Sunday, read.

The State Department was unaware the individuals had coronavirus when they were being removed from the ship; they had tested negative just a few days before, Robert Kadlec, the assistant secretary for preparedness and response at the U.S. Department of Health & Human Services, said on a phone call with reporters.

"If those results had come back four hours earlier before we'd started to disembark the ship and before these people were evacuees within an evacuation system, then it would've been a different discussion." Dr. William Walters, director of operational medicine at the U.S. Department of State, said on the call.

Kadlec said that individuals received multiple screenings when moving from ship to bus to plane and a more extensive medical assessment upon arrival.

Two charter flights carrying the Diamond Princess passengers landed at military bases in California and Texas overnight, starting the clock on a 14-day quarantine period to ensure those passengers don't have coronavirus. In total, approximately 380 Americans were on board the Diamond Princess ship for the duration of the cruise and quarantine at sea.

'Something went awry': Why did US break Diamond Princess coronavirus quarantine?

One plane carrying American passengers touched down at Travis Air Force Base in northern California just before 11:30 p.m. Sunday local time. A second flight arrived at Lackland Air Force Base in Texas around 2½ hours later, early Monday.

The California flight had 177 people on it, seven of whom tested positive for coronavirus, Walters said. An additional three people were isolated during the flight for fever. Upon arrival, 171 stayed in Travis while six traveled to Omaha.

It's unclear which passengers were transferred there and whether initial tests were positive or whether they were at risk for the virus.

The Texas flight had 151 people board and included the other seven who tested positive for coronavirus. Two additional passengers were isolated on account of fever. All passengers who tested positive for coronavirus then moved on to Omaha.

The aircraft design allowed passengers to sit in isolation thanks to a plastic divider at the tail of the aircraft.

13 high-risk passengers await test results at Nebraska Medical Center

Officials from the University of Nebraska Medical Center and Nebraska Medicine confirmed that they are assessing 13 adults at their quarantine and biocontainment facility in Omaha.

“Late last night at about 2 or 3 a.m., we were asked to bring some individuals here who had either tested positive or had a high likelihood of testing positive because of symptoms they were exhibiting,” said Dr. Chris Kratochvil, the executive director at the University of Nebraska Medical Center’s Global Center for Health Security.

Twelve of them are housed in the quarantine center while one man was transferred to the hospital’s biocontainment unit for testing and observation because of symptoms including cough, fever, shortness of breath, lightheadedness and an undisclosed chronic condition that would make him particularly vulnerable to the COVID-19 virus.

"He is doing good and in stable condition at this time,” reported Shelly Schwedhelm, Nebraska Medicine’s executive director of emergency management and biopreparedness.

She went on to note that “the folks in the quarantine center have all been tested, and we’re waiting for those results.”

She added that the other 12 are isolated in “very nice rooms with WiFi, TV and a small refrigerator – a lot of the amenities at hotels but with engineering controls” to prevent contaminated air from escaping.

Their test results, which are due back Monday afternoon, will determine whether the patients will be allowed to see their spouses or leave their rooms.

Regardless of whether they test positive or negative, all of the new arrivals will spend at least 14 days in the facility, and any who test positive will likely stay longer, said Dr. Mike Wadman, the co-medical director of the National Quarantine Unit.

Kratochvil says it’s possible that they may be asked to take more patients should more of the Diamond Princess passengers now in quarantine at the airbases test positive.

Dr. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases at the National Institutes of Health, told the USA TODAY editorial board and reporters Monday that the original idea to keep people safely quarantined on the ship wasn't unreasonable. But even with the quarantine process on the ship, virus transmission still occurred.

"The quarantine process failed," Fauci said. "I'd like to sugarcoat it and try to be diplomatic about it, but it failed. People were getting infected on that ship. Something went awry in the process of the quarantining on that ship. I don't know what it was, but a lot of people got infected on that ship."

USA TODAY reached out to Princess Cruises for clarification on how many Americans from the ship have the virus.

Sent from Mail for Windows 10

From: Caneva, Duane

Sent: Monday, February 17, 2020 4:51 PM

To: Carter Mecher; Tracey McNamara; Dr. Eva K Lee; (b) (6)

Cc: (b) (6) Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6) KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: Re: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

+ Bob Glass

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From: Carter Mecher (b) (6)
Sent: Monday, February 17, 2020 4:47:38 PM
To: Tracey McNamara (b) (6); Dr. Eva K Lee (b) (6)>
Cc: (b) (6) Caneva, Duane (b) (6); Dodgen, Daniel (OS/ASPR/SPPR) (b) (6); DeBord, Kristin (OS/ASPR/SPPR) (b) (6); Phillips, Sally (OS/ASPR/SPPR) (b) (6) David Marcozzi (b) (6); (b) (6) USARMY (USA) (b) (6)>; Lisa Koonin (b) (6) Wargo Michael (b) (6)>; (b) (6)) (b) (6); HARVEY, MELISSA (b) (6); WOLFE, HERBERT (b) (6); Eastman, Alexander (b) (6); EVANS, MARIEFRED (b) (6)>; Callahan, Michael V.,M.D. (b) (6) (b) (6); Johnson, Robert (OS/ASPR/BARDA) (b) (6); Yeskey, Kevin (b) (6)>; Disbrow, Gary (OS/ASPR/BARDA) (b) (6)>; Redd, John (OS/ASPR/SPPR) (b) (6)>; Hassell, David (Chris) (OS/ASPR/IO) (b) (6); Hamel, Joseph (OS/ASPR/IO) (b) (6); Dean, Charity A@CDPH (b) (6); Richard Hatchett (b) (6); Lawler, James V (b) (6); Kadlec, Robert (OS/ASPR/IO) (b) (6)>; (b) (6) >; Borio, Luciana (b) (6); Hanfling, Dan (b) (6); McDonald, Eric (b) (6); Wade, David (b) (6); TARANTINO, DAVID A (b) (6)>; WILKINSON, THOMAS (b) (6); David Gruber (b) (6) (b) (6); KAUSHIK, SANGEETA (b) (6) Nathaniel Hupert (b) (6)>
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

A correction. Should not have included breakdown of hospitalized since we have spotty data 9or could have used a range). Only solid data we have is number confirmed (58), number in hospital

(44), and number in ICU (≥1). Mix of hospital patients is unknown (from the Singapore data the ratio of hospitalized to ICU has ranged from 6:1 to 13:1 from two data points).

So estimates of severity looking only at the American passengers:

~400 total American passengers

58 confirmed to have COVID-19

12 Asymptomatic (20%)

46 Symptomatic (80%) (44 cases actually hospitalized)

~2% of total cases requiring ICU admission (1 case)

Expected mortality for patients with pneumonia admitted to ICU (15-50%); assuming 2% of those who become infected with COVID-19 require ICU care, these mortality rates equate to a CFR of 0.3%-1.0%

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 4:15 PM

To: Tracey McNamara; Dr. Eva K Lee

Cc: (b) (6) Caneva, Duane; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) (USA); Lisa Koonin; Wargo Michael; (b) (6) V); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6) (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6) KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Latest data from Singapore (77 cases; 4 children, 2 are asymptomatic) and Hong Kong (60 cases; no children)

More puzzle pieces.

Singapore status: https://protect2.fireeye.com/url?k=f6750fe4-aa211698-f6753edb-0cc47adc5fa2-76d29cc40fd8c03f&u=https://www.moh.gov.sg/news-highligh...tion-confirmed

Update on condition of confirmed cases

To date, a total of 24 cases have fully recovered from the infection and have been discharged from hospital. Of the 53 confirmed cases who are still in hospital, most are stable or improving. Four are in critical condition in the intensive care unit.

[Ratio of hospitalized to ICU of 53/4 or ~ 13:1] Consistent with estimates in earlier email. [On Feb-12 Singapore reported that 8 patients were in ICU.]

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 2:57 PM

To: Tracey McNamara; Dr. Eva K Lee

Cc: Caneva, Duane; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.;

(b) (6); (b) (6) Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) '; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert; (b) (6)

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Trying to estimate severity by bringing a number of pieces together.

The Diamond Princess Cruise Ship had a crew of 1,745 and 2,666 passengers (total pf 3,711) Approximately 400 of the passengers are Americans (11%). Several days ago (Feb-13) we attempted to estimate disease severity using the current data being reported by the media (number of confirmed cases and ICU cases) as well as data on the outbreak in Singapore (number of confirmed cases, number hospitalized, and number in ICU) (see attached Word file).

Given the additional information becoming available (including more specific information being reported by the media on the numbers of Americans infected), I was interested in an updated crude estimate of severity (and to see how well the early predictions of severity matched with what was being reported by the media on illness in the Americans. See latest re the cruise ship outbreak below (two stories). We can glean from these stories that the number infected is now up to 454. And 14 positive passengers were included among the Americans who were evacuated to the US. Canada, South Korea, Italy and Hong Kong announced Sunday that they would also arrange charter flights to evacuate their citizens. A few additional pieces of data. News reports yesterday stated that 73 of the 355 confirmed cases from the cruise ship were asymptomatic (20%). Also, yesterday the media quoted Dr. Fauci that the total number of Americans who were confirmed to have COVID yesterday and who remained at hospitals in Japan at 44. Assuming that this number does not include the 14 confirmed cases that were evacuated, suggests that the total number of Americans with confirmed COVID is 58. An earlier news report from Feb-12 re a couple from California, noted the husband was in the ICU in Japan (so at least 1 American in the ICU). ["…remained in a hospital intensive care unit and has been able to communicate with his family, his wife said in a phone interview from the ship, where she remained in quarantine." https://protect2.fireeye.com/url?k=5b014cc3-075555bf-5b017dfc-0cc47adc5fa2-5be62cf1a816fc6d&u=https://web.archive.org/web/20200212093725/https://www.ocregister.co

m/2020/02/11/southern-california-man-on-cruise-sent-to-a-hospital-in-tokyo-with-a-high-fever-tested-for-coronavirus/]

So, piecing all the data together:

The ~400 Americans account for 11% of the 3,711 passengers and crew of the Diamond Princess.

The 58 confirmed cases among Americans account for 12% of the 454 total confirmed COVID cases

Assuming that proportion of asymptomatic cases in Americans is similar to the proportion of asymptomatic cases for the entire ship (73/355 or 20%), we would estimate the number of Americans with asymptomatic infection at ~12. Symptomatics would be 46. If 2% of cases result in ICU admission (based on earlier estimates on Feb-12 where 4 ICU cases were reported with 203 total confirmed cases), we would expect ~9 ICU cases overall with 454 infected. Media reports from today note 19 of the passengers are "seriously ill, with some of whom treated in intensive care units." (Would be helpful to quantify "some"—from the earlier data, we would estimate about half that number would require ICU care at some point). For the 54 Americans confirmed to have COVID, we would estimate 1 would require ICU care if 2% of cases required ICU care (we are already aware of at least 1 American who was receiving ICU care in Japan).

So estimates of severity looking only at the American passengers:

~400 total American passengers

58 confirmed to have COVID-19

- 12 Asymptomatic (20%)
- 46 Symptomatic (80%)
  - ~55% of total cases mildly ill (hospitalized for isolation only) (31 cases)
  - ~25% of total cases acutely ill requiring inpatient care (15 cases)
    - ~2% of total cases requiring ICU admission (1 cases)

      Expected mortality for patients with pneumonia admitted to ICU (15-50%); assuming 2% of those who become infected with COVID-19 require ICU care, these mortality rates equate to a CFR of 0.3%-1.0%

Those estimates fit pretty well with the estimates from Feb-13. To firm up these numbers it would be useful to have actual numbers from Japan on ICU admissions, number requiring mechanical ventilation, number in the hospital because they are acutely ill, and number in the hospital because of isolation only (mildly ill or asymptomatic). Also would be helpful to have more granular information on the Americans (hospital data in Japan including number acutely ill, number needing ICU admission, and number only in the hospital for isolation). Would also be critical to gather/compile the same information from Canada, South Korea, Italy, Hong Kong, and other nations as they also evacuate their citizens. The cruise ship is a circumscribed population where it is possible to get a handle on severity fairly early in an epidemic. The limitation though, is the population on board that ship is elderly (so need to be careful about generalizing to the entire population). But it is the best data we have.

The reason why this is so important is decisions re the implementation of NPIs depend upon severity (the more severe the more intense the NPIs). The sooner we have a more accurate assessment of severity, the better for making plans for NPIs.

Story #1

https://protect2.fireeye.com/url?k=fb4e1b73-a71a020f-fb4e2a4c-0cc47adc5fa2-6b70ca76908c81a4&u=https://www3.nhk.or.jp/news/html/20200217/k10012289341000.html?utm_int=news_contents_news-main_001

Translation

New virus cruise ship confirmed 99 new infections

February 17, 2020 18:54

A new outbreak of the coronavirus was confirmed on February 17, with 99 new passengers and crew members infected on a cruise ship. As a result, 454 passengers and crew members of cruise ships have been infected, of which 19 are severely affected.

According to the Ministry of Health, Labor and Welfare, a total of 99 new passengers, including 85 passengers and 14 crewmembers, were revealed on March 17 on the cruise ship "Diamond Princess" anchored in Yokohama Port. Among them, there are 43 Japanese.

This means that a total of 1723 passengers and crew members were inspected on the cruise ship, and a total of 454 infections were confirmed.

According to the Ministry of Health, Labor and Welfare, 19 of the confirmed individuals are seriously ill, some of whom are being treated in intensive care units.

According to the Ministry of Health, Labor and Welfare, the Ministry of Health, Labor and Welfare said that infections were confirmed one after another on cruise ships. Need to be analyzed quickly. "

The Ministry of Health, Labor and Welfare has a policy to conduct a virus test on all passengers and crew members remaining on board, and those who have a negative result will be asked to leave the ship after the 19th.

Story #2

Fourteen people who were evacuated from the Diamond Princess cruise ship and flown back to the United States on charter flights tested positive fornovel coronavirus, according to a joint statement from the US Departments of State and Health and Human Services.

The passengers are among the more than 300 people removed from the ship, which is docked off the Japanese port city of Yokohama, Sunday night and flown to military bases in the United States.

US officials were notified that they had tested positive for coronavirus during the evacuation process, after passengers had disembarked the ship, the agencies said in the joint statement Monday. The passengers had been tested two to three days before the evacuation flights, the statement said.

"After consultation with HHS officials, including experts from the HHS Office of the Assistant Secretary for Preparedness and Response, the State Department made the decision to allow the 14 individuals, who were in isolation, separated from other passengers, and continued to be asymptomatic, to remain on the aircraft to complete the evacuation process," the agencies said.

One charter flight carrying evacuated Americans arrived at Travis Air Force Base near Fairfield, California, around 11:28 p.m. local time Sunday. A second arrived at Joint Base San Antonio-Lackland in San Antonio, Texas at 3:56 a.m. local time Monday.

The passengers who tested positive were isolated from the other passengers during the flights, the statement said. And all passengers are being "closely monitored" throughout the flight.

"Any who become symptomatic will be moved to the specialized containment area, where they will be treated," the statement said.

After the flights land, any passengers that developed symptoms on the flights and those who had already tested positive will be transported to "an appropriate location for continued isolation and care."

The remaining passengers will remain under quarantine for 14 days.

Passengers arriving to Travis Air Force Base will be housed in the same facility as evacuees who arrived from Wuhan earlier this month, a spokesperson for the base told CNN. New evacuees will be kept in a separate area of the Westwind Inn on the base, the spokesperson said.

Before the announcement about the infected flight passengers, some Americans aboard the Diamond Princess said they didn't want to take a chance being evacuated for fear they would be subject to possible infection.

Sacramento resident Matthew Smith told CNN affiliate KOVR that he would rather deal with issues in Japan than be evacuated and quarantined in the United States.

"We decided we would just face whatever consequences here rather than exposing ourselves to that situation," Smith told the affiliate."It kind of didn't make any sense if the us was fearful that these were infected people which is why they're going to quarantine them for another 2 weeks to have thrown them all together"

Smith's wife Katherine Codekas was met with some surprise when she told authorities that she and her husband weren't going to go with the other American evacuees, KOVR reported.

"They came back around again and I said no we're not going and they very sincerely wished us luck but there was a little look of surprise on their face," Codekas explained to the affiliate.

"You know, it's not like we're the last helicopter off the roof top in Ho Chi Mihn City," she told KOVR. "We're on a boat and we're watching people go away and people just make different choices about how they want to confront the virus."

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 11:00 AM

To: Tracey McNamara; Dr. Eva K Lee

Cc: Caneva, Duane; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6)); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Attached is Bob Glass' original paper—his co-author was his high-school age daughter.

Here is a link to another paper.

Glass RJ, Glass LM, Beyeler WE, Min HJ. Targeted social distancing designs for pandemic influenza. Emerg Infect Dis [serial on the Internet]. 2006 Nov [*date cited*]. http://dx.doi.org/10.3201/eid1211.060255

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 9:59 AM

To: Tracey McNamara; Dr. Eva K Lee

Cc: Caneva, Duane; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) V); HARVEY, MELISSA;

WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6); Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

This is the original graph of Bob Glass' data. He modeled the various interventions alone or in combination. Along one axis are the social distancing measures from doing nothing, to just closing schools but allowing kids to mix in the community, to social distancing of kids in the community but keeping schools open, to only social distancing of adults in the community, to closing schools and adults social distancing, to kids and adults social distancing in the community, to closing schools and social distancing of kids in the community, to a combo of all 3. Along the other axis are other interventions including doing nothing, to quarantine (Q), treatment of the ill with antivirals (T), prophylaxis of contacts (P), and various combinations. We observed what we called a "cliff effect" or phase transition or a discontinuity once you closed schools and implemented social distancing among kids. The effect was non-linear and dramatic. As a consequence we began a deep dive to better understand the school environment (including the transportation system half the school age kids use each day) and school age kids. An unsung hero in all this was Lisa Koonin (who was at CDC at the time). If Richard birthed TLC, Lisa kept the baby alive in the neonatal ICU.

We still have much to learn about this virus. Thus far, it seems to be sparing kids (just like SARS). We have been monitoring the reports from China as well as the detailed data we can see from Hong Kong, Singapore, and Japan—the numbers of kids remain very low and disease appears to be mild. Nonetheless, TLC (and the NPIs) is focused on reducing disease transmission (effectively decreasing Ro)—the interventions are really agnostic to severity. It is why CDC had to scale the implementation of TLC (later called CMG) to severity. Despite the absence of severe disease in kids, we really are still in the dark in terms of the amount of asymptomatic disease or mild sub-clinical disease in kids because we just haven't been able to look.

I never forgot this graph of the data from Bob Glass and the inflection point that was observed when the combo of closing schools and social distancing of kids was implemented in his model.

Although closing schools is complicated by its 2nd and 3rd order impacts, it is actually a pretty clean intervention in terms of actually pulling the trigger (much cleaner than the other components of TLC). If this outbreak proves to be as severe as our initial estimates, we should think long and hard before dismissing the early implementation of this strategy (closing schools and social distancing of kids).

Sent from Mail for Windows 10

From: Carter Mecher

Sent: Monday, February 17, 2020 8:57 AM

To: Tracey McNamara; Dr. Eva K Lee

Cc: Caneva, Duane; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6)); HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6); KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

NPIs are going to be central to our response to this outbreak (assuming our estimates of severity prove accurate). This email group has grown since we began (not quite epidemic-level growth, but getting there). Looking ahead, I anticipate we might encounter pushback over the implementation of NPIs and would expect similar concerns/arguments as were raised back in 2006 when this strategy first emerged. It was one of the reasons I shared the updated data on US households from American Community Survey, data on USDA programs for nutritional support (including school meal programs), data on schools and enrollment, and even data on juvenile crime. The data that was gathered back in 2006 on social density in various environments (homes, offices/workplaces, schools, daycare, etc., is unchanged). For additional background and context, we attached are 3 papers on NPIs and TLC for those who are interested. Richard

Hatchett deserves full credit for birthing the idea of TLC (it was actually developed in response to the threat of H5N1 and later adopted for pandemic influenza response). Duane, perhaps you can store these documents on MAX for safe keeping and access?

The first paper is an historical review of the 1918 pandemic (the comparison of Philadelphia and St. Louis is emblematic of the lesson from 1918 that timing matters when deploying NPIs—need to be early). The second paper is modeling work that was done to evaluate these strategies. At the time, modelers were focused on how best to contain an outbreak overseas (really focusing on using antivirals primarily for treatment and prophylaxis). They focused their models to evaluate the effectiveness of various strategies and quantities of antiviral medications required to quench an emerging outbreak. There were 3 groups who were doing this work back then. They each present their data in that paper. A few things to note. In all the model runs, they did not model perfection or 100% adherence (actually far from it). You will see scenarios from 30/60 (meaning 30% compliance and 60% ascertainment) on up to 90/80). (See figures 1) Even leaky implementation can reduce overall attack rates. The modelers also looked at timing of implementation (see figure 3). At the time there was a great deal of skepticism—was hard for people to believe this was possible. Or even if TLC could be effective, was implementation practical given the challenges trying to implement and the 2nd and 3rd order consequences (especially of closing schools). But the modeling data combined with the historical data was the tipping point. Marty Cetron from CDC and Howard Markel from U of Michigan, published a more extensive historical review of the 1918 pandemic showing much the same. Since then, a group within CDC continued to work on this (collecting additional data from the 2009 pandemic and elsewhere). They published an update of CMG in MMWR in 2017.
https://protect2.fireeye.com/url?k=3985fc87-65d1e5fb-3985cdb8-0cc47adc5fa2-bb4a28993b5aa9e0&u=https://www.cdc.gov/media/dpk/cdc-24-7/preventing-pandemic-influenza/community-mitigation-guidelines-for-preventing-pandemic-flu.html

The third paper, is a more recent paper (from 2017) that Richard shared with me. The paper is a little dense, but

I found this paper useful because it provides a vocabulary for strategies that we have raised (Symptom Monitoring vs Quarantine of potentially infected but symptom-free contacts during an epidemic). This paper identifies those conditions where SM or Q is preferred. Figure 1 is useful for understanding the challenges given the picture that seems to be emerging with this virus. This outbreak seems closer to pandemic flu than SARS in terms of transmission dynamics (and hence the NPIs we would need to employ).

Lastly, another person, Bob Glass at Los Alamos, also did work on this separately from the MIDAS group. He actually began this work as part of a science fair project for his daughter (using social contacts of his daughter and her classmates at school to model disease transmission). He knew someone at VA who forwarded his work to us (chain of transmission). Early on (even before the MIDAS group modeled TLC), we had a "Eureka" moment when we graphed his data in Excel (I can share that single graph to anyone interested). Bob Glass was also interested in trying to determine when you could let up on the NPIs during a pandemic. Here is a story about Bob Glass and that work published in Fast Company

https://protect2.fireeye.com/url?k=3862f880-6436e1fc-3862c9bf-0cc47adc5fa2-9ce5af31e3c2cd64&u=https://www.fastcompany.com/3058542/the-scientists-who-simulate-the-end-of-the-world I will see if I can find his work on when to reopen schools. Decisions in terms of letting up on NPIs could be critical down the line.

Sent from Mail for Windows 10

From: Tracey McNamara

Sent: Sunday, February 16, 2020 7:10 PM

To: Carter Mecher; Dr. Eva K Lee

Cc: Caneva, Duane; Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) ; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber (b) (6) KAUSHIK, SANGEETA; Nathaniel Hupert

Subject: Re: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Here is the link to a town hall mtg at the Munich Security Conference. Shared by Dr Christian Haggenmiller , Dorector of the German Defense Institute.

https://protect2.fireeye.com/url?k=ec4e0592-b01a1cee-ec4e34ad-0cc47adc5fa2-c00af41a186719a2&u=https://securityconference.org/en/medialibrary/asset/townhall-on-the-coronavirus-outbreak-20200215-1000/

Tracey

Get Outlook for Android

From: Dr. Eva K Lee (b) (6)
Sent: Sunday, February 16, 2020 3:05:43 PM
To: Carter Mecher (b) (6)>
Cc: Caneva, Duane (b) (6)>; Dodgen, Daniel (OS/ASPR/SPPR) (b) (6)>; DeBord, Kristin (OS/ASPR/SPPR) (b) (6); Phillips, Sally (OS/ASPR/SPPR) (b) (6); David Marcozzi (b) (6)>; (b) (6) USARMY (USA) (b) (6)>; Lisa Koonin (b) (6)>; Wargo Michael (b) (6)>; (b) (6) OV) (b) (6); HARVEY, MELISSA (b) (6) v>; WOLFE, HERBERT (b) (6); Eastman, Alexander (b) (6); EVANS, MARIEFRED (b) (6); Callahan, Michael V.,M.D. (b) (6) Johnson, Robert (OS/ASPR/BARDA) (b) (6)>; Yeskey, Kevin (b) (6); Disbrow, Gary (OS/ASPR/BARDA) (b) (6); Redd, John (OS/ASPR/SPPR) (b) (6); Hassell, David (Chris) (OS/ASPR/IO) (b) (6)>; Hamel, Joseph (OS/ASPR/IO) (b) (6)>; Tracey McNamara (b) (6) Dean, Charity A@CDPH (b) (6) Richard Hatchett (b) (6) Lawler, James V (b) (6); Kadlec, Robert (OS/ASPR/IO) (b) (6); (b) (6) (b) (6)>; Borio, Luciana (b) (6); Hanfling, Dan (b) (6) McDonald, Eric (b) (6)>; Wade, David (b) (6); TARANTINO, DAVID A (b) (6) WILKINSON, THOMAS (b) (6); David Gruber (b) (6)>; KAUSHIK, SANGEETA (b) (6) Nathaniel Hupert (b) (6)
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Hi Carter, great points.

1. Separate current ED/ICU patients from COVID-19 is a must.

2. Migrating current ED/ICU (non-COVID) patients to other care sites is great idea.

3. Caring for COVID-19 patients:leveraging ED/ICU personnel for high compliance and usage of limited resources (PPE everything that goes with it) is very critical. Strategic usage and minimizing non-medical staff is necessary --- either these operators are well-trained and protected, or they cannot be there.

4. Concentrating care within ED/ICU for COVID-19 ensures rapid learning and sharing of knowledge among workers as they take care of these patients. Clearly from the standpoint of data collection and clinical symptoms recording and organization, it is more feasible and allow for immediate analysis and feedback.

5. Strategic prioritization of limited resources is extremely important. We must do it now, because the supply chain is already being affected and it can go worse.

6. Primary care and call centers are good. If you want to do strategic testing, this is also a good place to involve.

7. So few children are reported among the confirmed positive cases. They may be good spreaders (not necessarily have to be super) and the more vulnerable people would be ones show up with symptomatic disease characteristics (or no/mild symptoms).

Best, Eva

Sent with ProtonMail Secure Email.

------- Original Message -------

On Sunday, February 16, 2020 4:30 PM, Carter Mecher (b) (6) wrote:

Wanted to bounce something off this group.

I have been concerned about some of the preparedness efforts of healthcare systems as they are ramping up their capabilities to care for patients with COVID-19 presenting anywhere in their system. Staff working in ERs and ICUs are pretty familiar with the care of these types of patients and the use of appropriate PPE (standard contact and airborne precautions including eye protection). The staff at the hospitals undergo fit testing for respirators, etc. Staff in outpatient clinics (especially remote community based outpatient clinics) don't typically undergo fit testing for respirators. So ERs and ICUs have muscle memory for isolating patients and providing care to patients with infectious respiratory disease. Community based outpatient clinics do not.

As part of the preparedness efforts, there has been interest in fit testing outpatient clinic staff and supplying these clinics with PPE and establishing procedures for evaluating COVID-19 patients in the community based clinics. Given the projected shortages of PPE, that just doesn't seem like the most prudent approach.

Rather than expand the care of potential COVID-19 patients to community based outpatient clinics, I would focus on hospital care--ERs and inpatient areas (especially ICUs). I would not pursue fit testing for staff working in outlying clinics. As a strategy, I suggested dividing COVID patients into two categories—(1) those with illness that is mild enough to be cared for at home (self care or care by other family members); or (2) those who are sick enough to be seen in the ER for possible hospitalization. I would refocus the efforts of outlying clinics away from COVID and toward keeping non-COVID patients with the usual mix of acute and chronic illnesses we see from hypertension to CHF to diabetes, etc., out of the ER and out of the hospital. That is what they can do to help unburden ERs and hospitals for the surge in COVID patients in ERs and hospitals. I would leverage telephone care as much as possible to handle patients with mild disease seeking care related to COVID (and quickly develop algorithms to determine who has mild disease and can be managed by telephone at home and who needs to evaluated in the ER). Think of it like the program Lisa developed for pandemic influenza (Nurse On Call) on steroids, minus the antiviral piece. Could we repurpose and leverage that program for COVID? Such a strategy would help to conserve our PPE supply (avoid the expansion of fit testing and the redirection of already limited supplies of PPE to outlying clinics) and not ask outlying clinics to do something they don't typically do (that usually doesn't out turn out very well). If the outlying clinics focused on what they normally do (caring for patients with chronic diseases), they could help the ER and hospitals cope with the demands of COVID. I would think about Urgent Care centers in the same way—to help to decompress ERs.

I also think that we need to start thinking about strategies to conserve PPE for hospitals. I'm concerned about the projected burn rates and the supply chains for PPE. Click on Amazon and

check out the prices now. Or click on WalMart (can't pick up any masks from WalMart now). I saw one supplier selling 200 surgical masks on WalMart's site for only $459.99. Such a deal.

As a conservation strategy, we might think about limiting the amount of staff interacting with infected patients and cohorting patients (even thinking of strategies to minimize need for housekeeping or food service or lab services from entering areas with COVID patients--think Ebola-like strategies (not out of concern of disease transmission but simply to limit number of staff to conserve PPE). Could do something similar with ERs (akin to what pediatricians do to separate sick call patients from other appointments). I have recommend prioritizing PPE for EDs and ICUs as well as specific inpatient areas where we would likely initially cohort patients, not pursuing fit testing of outpatient clinic staff, and shifting patients with mild COVID disease to telephone care and away from outpatient clinics.

I know several of you are part of large healthcare systems. Am curious how others are approaching this challenge.

I am also resending the questions I posed for handling sick ER/hospital staff or staff members with a confirmed case of COVID in their household. Carter

Sent from Mail for Windows 10

From: Caneva, Duane

Sent: Sunday, February 16, 2020 3:24 PM

To: Dodgen, Daniel (OS/ASPR/SPPR); DeBord, Kristin (OS/ASPR/SPPR); Phillips, Sally (OS/ASPR/SPPR); David Marcozzi; (b) (6) USARMY (USA); Lisa Koonin; Wargo Michael; (b) (6) HARVEY, MELISSA; WOLFE, HERBERT; Eastman, Alexander; EVANS, MARIEFRED; Callahan, Michael V.,M.D.; (b) (6); Johnson, Robert (OS/ASPR/BARDA); Yeskey, Kevin; Disbrow, Gary (OS/ASPR/BARDA); Redd, John (OS/ASPR/SPPR); Hassell, David (Chris) (OS/ASPR/IO); Hamel, Joseph (OS/ASPR/IO); Tracey McNamara; Dean, Charity A@CDPH; Richard Hatchett; Lawler, James V; Kadlec, Robert (OS/ASPR/IO); (b) (6) '; Borio, Luciana; Hanfling, Dan; McDonald, Eric; Wade, David; TARANTINO, DAVID A; WILKINSON, THOMAS; David Gruber

(b) (6); KAUSHIK, SANGEETA; Dr. Eva K Lee; Nathaniel Hupert; Carter Mecher

Subject: Re: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Sorry for spam.

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From: Caneva, Duane
Sent: Sunday, February 16, 2020 10:21:38 AM
To: Dodgen, Daniel (OS/ASPR/SPPR) (b) (6); DeBord, Kristin (OS/ASPR/SPPR) (b) (6); Phillips, Sally (OS/ASPR/SPPR) (b) (6) David Marcozzi (b) (6); (b) (6) USARMY (USA) (b) (6); Lisa Koonin (b) (6); Wargo Michael (b) (6), (b) (6) HARVEY, MELISSA (b) (6) WOLFE, HERBERT (b) (6)>; Eastman, Alexander (b) (6)>; EVANS, MARIEFRED (b) (6); Callahan, Michael V.,M.D. (b) (6) Johnson, Robert (OS/ASPR/BARDA) (b) (6) Yeskey, Kevin (b) (6); Disbrow, Gary (OS/ASPR/BARDA) (b) (6); Redd, John (OS/ASPR/SPPR) (b) (6); Hassell, David (Chris) (OS/ASPR/IO) (b) (6)>; Hamel, Joseph (OS/ASPR/IO) (b) (6); Tracey McNamara (b) (6); Dean, Charity A@CDPH (b) (6); Richard Hatchett (b) (6); Lawler, James V (b) (6); Kadlec, Robert (OS/ASPR/IO) (b) (6) (b) (6); Borio, Luciana (b) (6) Hanfling, Dan (b) (6); McDonald, Eric (b) (6); Wade, David (b) (6) TARANTINO, DAVID A (b) (6)>; Baric, Ralph S (b) (6); WILKINSON, THOMAS (b) (6) Hassell, David (Chris) (OS/ASPR/IO) (b) (6)>; David Gruber (b) (6)v>; KAUSHIK, SANGEETA (b) (6); Dr. Eva K Lee (b) (6); Nathaniel Hupert (b) (6)
Subject: RE: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Some Mark Lipsitch Tweets copied. Sorry, might not be in the right order…

"So far, we have conducted tests for 1,219 individuals. Of those, 355 people tested positive. Of those, 73 individuals are not showing symptoms," Japan's health minister says

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:42

I did actually say the quote that is going around, but the article contained vital context -- we don't know what proportion are symptomatic. Also we have only a rough estimate of what proportion of symptomatic people will have severe outcomes. pic.twitter.com/cWzvlNSZBm

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:43

Why do I think a pandemic is likely? The infection is in many parts of China and many countries in the world, with meaningful numbers of secondary transmissions. The scale is much larger than SARS for example (where the US had many introductions and no known onward transmission)

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:45

Why do I think 40-70% infected? Simple math models with oversimple assumptions would predict far more than that given the R0 estimates in the 2-3 range (80-90%). Making more realistic assumptions about mixing, perhaps a little help from seasonality, brings the numbers down

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:48

pandemic flu in 1968 was estimated to _symptomatically_ infect 40% of the population, and in 1918 30%. Those likely had R0 less than COVID-

19. Below is from stacks.cdc.gov/view/cdc/11425
pic.twitter.com/EMwjEpA49s

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:49

What could make this scenario not happen? 1) conditions in Wuhan could be so different in some fundamental way from elsewhere that we are mistaken in expecting further outbreaks to have basic aspects in common. No reason I know of to think that but a formal possibility

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:53

2) There could be a higher degree of superspreading than has been appreciated ("dispersion in R0") which could mean that many locations outside Wuhan could "get lucky" and escape major onward transmission. hopkinsidd.github.io/nCoV-Sandbox/D… .

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:53

2) There could be a higher degree of superspreading than has been appreciated ("dispersion in R0") which could mean that many locations outside Wuhan could "get lucky" and escape major onward transmission. hopkinsidd.github.io/nCoV-Sandbox/D… .

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:55

3) Control measures could be extremely effective in locations that have had time to prepare. Maybe in a few, but seems unlikely that is the case in all, especially countries with stretched health systems.

Marc Lipsitch (@mlipsitch)

14/02/2020, 17:56

4) Seasonal factors could be much more powerful at reducing transmission than we currently expect. That doesn't help the Southern hemisphere, and is not consistent with behavior in China (preprint in queue from ☐@MauSantillana☐ et al.)

From: Caneva, Duane

Sent: Sunday, February 16, 2020 9:39 AM

To: Dodgen, Daniel (OS/ASPR/SPPR) (b) (6); DeBord, Kristin (OS/ASPR/SPPR) (b) (6); Phillips, Sally (OS/ASPR/SPPR) < (b) (6); David Marcozzi (b) (6); (b) (6) USARMY (USA) < (b) (6) Lisa Koonin (b) (6); Wargo Michael (b) (6); (b) (6) ; HARVEY, MELISSA (b) (6); WOLFE, HERBERT (b) (6); Eastman, Alexander (b) (6); EVANS, MARIEFRED (b) (6); Callahan, Michael V.,M.D. (b) (6); Johnson, Robert (OS/ASPR/BARDA) (b) (6); Yeskey, Kevin (b) (6); Disbrow, Gary (OS/ASPR/BARDA) (b) (6); Redd, John (OS/ASPR/SPPR) (b) (6) Hassell, David (Chris) (OS/ASPR/IO) (b) (6) Hamel, Joseph (OS/ASPR/IO) (b) (6); Tracey McNamara (b) (6); Dean, Charity A@CDPH (b) (6); Caneva, Duane (b) (6); Richard Hatchett (b) (6)Lawler, James V (b) (6); Kadlec, Robert (OS/ASPR/IO) (b) (6))' (b) (6); Borio, Luciana (b) (6); Hanfling, Dan (b) (6); McDonald, Eric (b) (6)v>; Wade, David (b) (6); TARANTINO, DAVID A (b) (6); Baric, Ralph S (b) (6); WILKINSON, THOMAS (b) (6) Hassell, David (Chris) (OS/ASPR/IO) (b) (6)v>; David Gruber (b) (6) KAUSHIK, SANGEETA (b) (6)

Subject: Red Dawn Breaking, COVID-19 Collaborative, Feb 16 start

Purpose: This is a new Red Dawn String to cut down the size from the previous string, opportunity to provide thoughts, concerns, raise issues, share information across various colleagues responding to COVID-19.

Including all from previous string plus a few additional folks.

Duane C. Caneva, MD, MS

Chief Medical Officer

Department of Homeland Security

(b) (6) (o)

(c)

(b) (6)

Executive Assistant: (b) (6)

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Mon, 24 Feb 2020 18:07:33 +0000
To: Doepel, Laurie (NIH/NIAID) [E]
Subject: FW: ASF ---- measles - aerosol / contact / droplet
Attachments: 1-s2.0-S1879625717301773-main.pdf

From: Folkers, Greg (NIH/NIAID) [E] (b) (6)
Sent: Tuesday, September 4, 2018 3:15 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Cc: Conrad, Patricia (NIH/NIAID) [E] (b) (6); Doepel, Laurie (NIH/NIAID) [E] (b) (6); Eisinger, Robert (NIH/NIAID) [E] (b) (6) Folkers, Greg (NIH/NIAID) [E] (b) (6) Marston, Hilary (NIH/NIAID) [E (b) (6)
Subject: ASF ---- measles - aerosol / contact / droplet

And per CDC -- rrequires airbornes precautions
https://www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html

Table 2

Overview of the evidence on transmission routes of respiratory viruses based on experimental data and the transmission route according to infection prevention guidelines

Virus	Virus family[a]	Transmission route	
		Experimental and observational data	Guidelines[b]
Measles virus	*Paramyxoviridae*	Aerosol [75–77,78•,79•].	Contact [3,110], droplet [3,109–111], aerosol [3,109–111].
Parainfluenza virus	*Paramyxoviridae*	Limited data, contact (by fomite) [83,84] [e].	Contact [3,109–111], droplet [3,109–111], aerosol [3,109].
HMPV	*Pneumoviridae*	Limited data, contact (by fomite)[e] [30]	Contact [3,110,111], droplet [3,110,111].
RSV	*Pneumoviridae*	Contact [89,88], droplet [88], aerosol [90,91••].	Contact [3,109–111], droplet [3,109,110], aerosol [109,111].
HCoV	*Coronaviridae*	Limited data, contact (by fomite) [65–67] [e].	Contact [3,110,111], droplet [3,110,111].
MERS-CoV	*Coronaviridae*	Contact [84] [e] [89] [c] [91••], droplet [89] [c], aerosol [91••].	Contact [111], droplet [3,111]
SARS-CoV	*Coronaviridae*	Contact [70] [e] [73,79,101], droplet [73,78•,79•,117], aerosol [76,118] [c] [82] [c,d].	Contact [3,110,111], droplet [3,110,111], aerosol [3,110,111].
Rhinovirus	*Picornaviridae*	Contact [35,36,42], aerosol [37,40,119].	Contact [109–111], droplet [109,111], aerosol [109–111].
Adenovirus	*Adenoviridae*	Contact [100] [e] [100,101], droplet [103•], aerosol [102,103•].	Contact [3,109–111], droplet [3,109,110], aerosol [110,111].
Influenza virus	*Orthomyxoviridae*	Droplet/aerosol [55,56,57•,59]	Contact [109–111], droplet [3,109–111], aerosol [3,109–111].

[a] Taxonomy was based on [62], airborne transmission is seemingly linked to:
[b] WIP [108], 'Blue Book' [109], 'Red Book' [110], CDC [3] and Up-To-Date [111]. The conclusions on experimental data as presented in this table reflect the conclusions from the authors.
[c] Superspreader events.
[d] Aerosol-generating procedures (in a nosocomial situation).
[e] Conclusions were drawn based on stability experiments.

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Current Opinion in Virology

Transmission routes of respiratory viruses among humans

Jasmin S Kutter[1,3], Monique I Spronken[1,3], Pieter L Fraaij[1,2], Ron AM Fouchier[1] and Sander Herfst[1]

Respiratory tract infections can be caused by a wide variety of viruses. Airborne transmission via droplets and aerosols enables some of these viruses to spread efficiently among humans, causing outbreaks that are difficult to control. Many outbreaks have been investigated retrospectively to study the possible routes of inter-human virus transmission. The results of these studies are often inconclusive and at the same time data from controlled experiments is sparse. Therefore, fundamental knowledge on transmission routes that could be used to improve intervention strategies is still missing. We here present an overview of the available data from experimental and observational studies on the transmission routes of respiratory viruses between humans, identify knowledge gaps, and discuss how the available knowledge is currently implemented in isolation guidelines in health care settings.

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[3] These authors contributed equally to this work.

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This review comes from a themed issue on **Emerging viruses: intraspecies transmission**

Edited by **Sander Herfst** and **Martin Ludlow**

For a complete overview see the Issue and the Editorial

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Introduction

Viral respiratory tract infections are a leading cause of morbidity and mortality worldwide, representing an enormous economic and disease burden [1]. Respiratory viruses replicate in the respiratory tract from where they are subsequently shed and transmitted via respiratory secretions. They are classified in different virus families and differ in virulence and target groups. Respiratory tract infections may range from asymptomatic to acute live threating disease thereby posing a major health threat to young children, elderly, and immunocompromised people. Respiratory viruses spread via three different transmission routes: contact (direct or indirect), droplet and aerosol transmission (Table 1) [2,3]. Contact transmission refers to direct virus transfer from an infected person to a susceptible individual (e.g. via contaminated hands) or indirect virus transfer via intermediate objects (fomites). Transmission of virus through the air can occur via droplets or aerosols. The commonly accepted cut-off size between the large droplets and small aerosols is 5 μm, although this varies considerably between studies, ranging up to 12 μm [4–8]. Droplets generated during coughing, sneezing or talking do not remain suspended in air and travel less than 1 m before settling on the mucosa of close contacts or environmental surfaces. Aerosols have a slow settling velocity, thus they remain suspended in the air longer and can travel further [5,9,10].

Transmission via each of these three routes is complex and depends on many variables such as environmental factors (e.g. humidity and temperature), crowding of people, but also on host factors such as receptor distribution throughout the respiratory tract. The fact that all these variables affect the different transmission routes of the different respiratory viruses in a dissimilar way, makes it very difficult to investigate them experimentally [9,11]. Here, we summarize the evidence from experimental and observational studies on inter-human transmission routes of important respiratory viruses (summarized in Table 2). A literature search was conducted for each respiratory virus using 'human transmission experiments' and 'transmission (routes)' of the virus of interest as search criteria in PubMed and Google Scholar. Subsequently, the backward snowball method was applied in which additional papers were identified based on the reference list of a paper of interest. As this review focuses on the evidence on inter-human transmission routes, data from animal studies were excluded. In addition, intervention studies, (aircraft) outbreak reports and household studies were excluded if the transmission route was not specifically investigated. The strengths and weaknesses of the different methods employed in transmission studies are summarized in Table 3. Finally, we discuss our findings in the light of several available (inter)national guidelines on infection control. Our observations underscore the urgent need for new knowledge on respiratory virus transmission routes and the implementation of this knowledge in infection control guidelines to advance intervention strategies for currently circulating and newly emerging viruses and to improve public health.

Table 1

Commonly accepted respiratory routes of transmission

Transmission route	Particles involved and particle characteristics	Characteristics/definition of transmission
Contact		Self-inoculation of mucous membranes by contaminated hands.
Direct	Deposited on persons.	Virus transfer from one infected person to another.
Indirect	Deposited on objects.	Virus transfer through contaminated intermediate objects (fomites).
Airborne		
Droplet	Droplets (>5 μm). Remain only shortly in air (<17 min) [116]. Dispersed over short distances (<1 m).	Short range transmission. Direct inoculation of naïve person through coughing/sneezing/ breathing of infected person. Deposition mainly on mucous membranes and upper respiratory tract.
Aerosol	Aerosols, droplet nuclei (<5 μm), Remain in air for an almost infinite amount of time. Dispersed over long distances (>1 m).	Long range transmission. Inhalation of aerosols in respirable size range. Deposition along the respiratory tract, including the lower airways.

Table 2

Overview of the evidence on transmission routes of respiratory viruses based on experimental data and the transmission route according to infection prevention guidelines

Virus	Virus family[a]	Transmission route	
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[a] Taxonomy was based on [62], airborne transmission is seemingly linked to:
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[c] Superspreader events.
[d] Aerosol-generating procedures (in a nosocomial situation).
[e] Conclusions were drawn based on stability experiments.

Measles virus (MV)

Measles is one of the most contagious viral diseases in humans that has been associated with aerosol transmission for a long time [12,13,14••,15–17,18••]. However, it should be noted that MV also replicates systemically, and that there is a role for dead cell debris-associated virus spread via fomites. In the late 1970s and early 1980s, data from retrospective observational studies obtained during outbreaks in pediatric practices, a school, and a sporting event suggested transmission through aerosols [14••,15–17,18••]. Indeed, those studies showed that most secondary cases never came in direct contact with the index patient and some were never even simultaneously present in the same area as the index case [14••,18••]. Examination of airflow in the pediatricians' offices showed that aerosols were not only dispersed over the entire examination room but also accumulated in the hallway and other areas [14••,18••]. Furthermore, based on the investigation of air circulation in a sport stadium, in which a MV outbreak occurred, authors suggested that MV had been dispersed through the ventilation system [16]. Thus it was concluded that MV can be transmitted via aerosols. Although coughing is a common symptom associated with measles disease, index patients were described to cough

Table 3

Overview of the methods to study human-to-human transmission and their respective pro's and con's

Study design	Pro	Con	Reference
Virus stability	• Can provide indirect evidence for transmission route. • Easy to perform.	• Not conclusive as transmission itself is not investigated.	[42,43,65,70]
Outbreak (household or hospital) reports	• Study natural infections. • Includes the most susceptible patients who are difficult to include in experimental studies.	• Retrospective. • Usually not conclusive on transmission route or relative importance of transmission routes.	[120–123]
Outbreak report — aircraft	• Relatively easy to perform • Outbreak in closed setting	• Retrospective which can result in recall-bias and hard to trace back passenger movements. • Inconclusive. • Only reported in case of secondary infections and in these cases infections may also occur before or after the flight.	[118,124–127]
Non-pharmaceutical Intervention	• Can help to discriminate between transmission routes if performed properly.	• Usually no controlled environment. • Difficult to determine ideal time-point of the intervention. • Risk of drop-out or perseverance.	[35,128–131]
Pharmaceutical intervention	• Can help to identify relative importance of transmission routes • Controlled environment	• Difficult to include enough patients to obtain statistically significant results	[132]
Experimental infection	• Controlled environment. • Donor selection and control. • Real-time data collection. • Repeatable. • Various parameters can be studied at the same time. • Possibility to study different inoculation routes.	• Ethical obstacles. • Infectivity and disease can differ from that in a natural infection (attenuated strains). • Difficult to create ideal and comparable circumstances. • Many factors have to be taken into account: duration, influence of superspreaders, sampling methods. • Difficult to get naïve or risk group participants who are interesting to study.	[42,44,102]
Miniature field trial	• Can discriminate between contact and airborne transmission.	• Ethical obstacles. • Exposure time may not be sufficient. • Difficult to create ideal and comparable circumstances.	[38••,39••,40]
Air sampling	• Noninvasive for patients. • Quantification of viable virus in the air. • Characterization of droplet/ aerosol size. • Can be used in parallel with human studies or outbreaks. • Can gain information on possible aerosol spread. [34••,37,57•,91••,103•,133]	• In a nosocomial setting aerosol-generating procedures can play a major role. • Frequently only detection by PCR. • Direct human-to-human transmission is not studied (circumstantial). • Technical issues (procedure may affect virus viability) or false interpretation.	
Air tracer studies	• Monitoring airflow pattern can indicate possible airborne transmission (if not done retrospectively). • Visualize airstream	• Usually performed retrospectively and not during outbreaks	[134,135]
Computational Modeling/Simulation	• Describes transmission in a greater context. • Can account for heterogeneity of transmission within a population. • Human mannequins can be used as replacement for humans	• Theoretical (for mathematical modeling). • Artificial setting.	[82,136–141]

frequently and vigorously in the outbreak reports of pediatric practices. Remington *et al.* calculated the infectious dose of MV produced by the index case through coughing, using a mathematical model based on airborne transmission. They found that the index case produced a very high infectious dose compared to cases from other outbreaks and mentioned a phenomenon called superspreading [18••]. Superspreaders are individuals who are able to infect a disproportionally large number of susceptible contacts when compared to a typical individual [19–22], which may contribute to the efficient transmission of MV.

Parainfluenza (PIV) and human metapneumovirus (HMPV)

There is a substantial lack of (experimental) evidence on the transmission routes of PIV (types 1–4) and HMPV. For both viruses, contact and droplet transmission are commonly accepted transmission routes [23–25]. However, only virus stability on various surfaces has been investigated so far and it has been shown that PIV and HMPV are stable on non-absorptive surfaces and can barely be recovered from absorptive surfaces [26–30].

Respiratory syncytial virus (RSV)

Transmission of RSV among humans is thought to occur via droplets and fomites [1,7]. In the 1980s three potential transmission routes of RSV were studied in humans by dividing infected infants and healthy volunteers into three groups, representing: Firstly, all transmission routes, secondly, transmission via fomites and finally, airborne transmission by allowing the volunteers to have either, firstly, direct contact with infants (cuddlers), secondly, touching potential fomites (touchers) or finally, sitting next to the infant (sitters). Volunteers in the group of the cuddlers and touchers but not the sitters became infected, suggesting that direct contact and droplet transmission were the probable routes for efficient infection of the volunteers and that transmission via aerosols was less likely [31]. Another study on the transmission via fomites showed that RSV could be recovered from countertops for several hours, but only for several minutes from absorptive surfaces such as paper tissue and skin [32••]. Later on, in the late 1990s, Aintablian *et al.* detected RSV RNA in the air up to 7 m away from a patient's head [33]. In spite of that, since virus infectivity could not be demonstrated, potential airborne transmission of RSV has been considered negligible and transmission of RSV was thought to occur mainly through contact and droplet transmission. However, in a recent study authors were able to collect aerosols that contained viable virus from the air around RSV infected children [34••]. Although the detection of viable virus in the air is by itself not enough to confirm aerosol transmission, the general presumption that RSV exclusively transmits via droplets should be reconsidered and explored further.

Rhinovirus

Extensive human rhinovirus transmission experiments have not led to a widely-accepted view on the transmission route [35–37,38••,39••,40]. Inhalation of aerosols (0.2–3 μm) resulted in efficient rhinovirus infection [41], but little to no infectious rhinovirus could be demonstrated in sneezes and coughs as detected by virus titration [42]. Rhinovirus can survive on stainless steel, plastic and skin for a couple of hours [42,43]. Additionally, virus was detected in saliva, occasionally on hands and could be recovered from the skin of recipients after rubbing either a contaminated fomite or hand [42,44]. When rubbing of fomites was followed by auto-inoculation this resulted in infection of the volunteers [35]. In a three-day rhinovirus experiment with healthy volunteers different exposure modes were used to investigate the rhinovirus transmission route: Firsrtly, small-particle exposure (separating donor and recipients by wire mesh), secondly, large particle exposure (encouraging contact, coughing and sneezing while wearing gloves) and finally, direct contact exposure (hand contact followed by self-inoculation). From the results it was concluded that direct contact was the main transmission route [36]. Furthermore, rhinovirus RNA was detected in offices by air sampling studies and subsequent sequencing resulted in a matched air-mucus pair [37]. In a miniature field trail, experimentally infected donors with severe colds participated in a card game with susceptible recipients for ~12 hours [38••,39••,40]. A restraining device, preventing touching of the head and face, was used in the aerosol condition and heavily contaminated cards and exaggerated hand-to-face movements in the fomite condition. In these experiments aerosol transmission was suggested [40].

In general, transmission rates and exposure time varied between studies, which may contribute to the different routes of transmission that were observed. Therefore, the donor-hours of exposure was determined using donors with severe rhinovirus infections. At 200 hours of exposure to donors, transmission had occurred to 50% of the susceptible recipients, though the transmission route itself was not investigated [38••].

Influenza A virus

Due to the severity of the yearly influenza epidemics and the potential of zoonotic influenza A viruses to cause severe outbreaks, there have been many studies on influenza A virus transmission among humans. Different kinds of studies, such as air sampling and intervention studies, as well as human challenge studies have been conducted. In addition, transmission events have been described extensively after outbreaks in aircrafts, households and hospital settings. However, until today, results on the relative importance of droplet and aerosol transmission of influenza viruses stay inconclusive and hence, there are many reviews intensively discussing this issue [10,45–50].

Already in the mid-1900s human challenge models were used to assess the transmission route of influenza virus [51•,52–54]. It was shown that illness outcome is dependent on the inoculation route and tends to be milder in intranasally infected volunteers in comparison to inoculation through inhalation [52,53]. Furthermore, illness seemed to be milder in experimentally infected volunteers than in naturally infected individuals [51•]. Increasing numbers of studies focused on the detection and quantification of influenza viruses contained in droplets and aerosols expelled into the air through breathing, sneezing and coughing of infected individuals

[9,55–56,57•,58–61]. Influenza virus RNA was detected in the air up to 3.7 m away from patients with the majority of viral RNA contained in aerosols (<5 μm) [59]. The presence of virus in aerosols could indicate potential airborne transmission, although many studies only quantified the amount of viral RNA [55,57•,61]. A few studies quantified viable virus, although this was only recovered from a minority of samples [9,58,59].

Coronavirus

In humans, alpha (229E and NL63) and beta coronaviruses (OC43, HKU1, SARS and MERS) are associated with respiratory disease [62,63]. Alpha coronaviruses have a high attack rate early in life and spread rapidly during outbreaks, indicating efficient human to human transmission [63]. Furthermore, samples obtained from staff and patients of a neonatal and pediatric intensive care unit showed a high incidence of human coronaviruses HCoV-229E and HCoV-OC43, suggesting staff-to-patient and patient-to-staff transmission [64]. Unfortunately, there is very little data to corroborate on the HCoV-229E, HCoV-NL63 and HCoV-OC43 transmission routes. HCoV-OC43, HCoV-229E and HCoV-NL63 infectivity was lost between 0 and 72 hours on non-absorptive surfaces, although it can survive several days in medium or PBS [65–67]. Aerosolized HCoV-229E had a half-life of 67 hours in a rotating steel drum (at 20 °C and 50% relative humidity) [68]. SARS-CoV and MERS-CoV appeared to have an unusual capacity to survive on dry surfaces as compared to HCoV-229E, HCoV-OC43, and HCoV-NL63 [69,70].

The SARS outbreak was primarily linked to healthcare settings, with ≥49% of the cases linked to hospitals [71], most probably caused by aerosol-generating procedures on severely ill patients [72,73]. Aerosol-generating procedures like intubation, the use of continuous positive-pressure ventilation and drug delivery via nebulizers are likely to produce 'fine infectious droplets', which travel further than droplets from coughs [74]. Additionally, superspreading events contributed to the dispersion of the SARS outbreak [73,75–77], particularly in the Hotel Metropole and the Prince of Wales Hospital in Hong Kong [76]. Moreover, a link with transmission to healthcare workers was observed when they were in close proximity (<1 m) to an index patient, suggesting direct contact or droplet transmission [73,78•,79•]. Air samples and swabs from frequently touched surfaces in a room occupied by a SARS patient tested positive by PCR, although no virus could be cultured from these samples [80]. In the Amoy gardens outbreak fecal droplet transmission was suggested [81,82].

To date, there is little data on the human-to-human MERS-CoV transmission route [83]. MERS-CoV remained stable on non-absorptive for 8 up to 48 hours and for 10 min at 20 °C and 40% relative humidity in aerosols [84]. MERS-CoV outbreaks in humans are, like those with SARS-CoV, primarily linked to healthcare settings, with a link to hospitals in ≥31% of the cases [71,85,86] and healthcare associated human-to-human transmission was observed [87,88]. Superspreader events were shown to play an important role in nosocomial outbreaks [71,89]. Virus was isolated from environmental samples in hospital rooms, suggesting direct contact or fomite transmission. Moreover, the airborne potential of MERS was investigated by air sample analysis [90,91••]. Viral RNA was detected on the inlet of air ventilation equipment [90] and virus was isolated from air samples and surfaces from inaccessible areas like the ventilator exit, implicating potential aerosol transmission [91••].

Adenovirus

Human adenoviruses can cause respiratory disease (mainly type 1–5, 7, 14 and 21) [92,93], conjunctivitis or infantile gastroenteritis (type 40 and 41) [94]. They are a common cause of respiratory illness and pneumonia in children [95,96], whereas infections are generally asymptomatic in adults [92]. Adenoviruses cause nosocomial outbreaks, especially in pediatric care facilities, where they spread rapidly [95,97,98]. Moreover, adenovirus type 4 and 7 are responsible for large outbreaks of acute respiratory disease, especially in crowded conditions. This is illustrated by, for example, outbreaks among military recruits for which airborne spread was suggested [92,94,99]. It is difficult to eliminate adenovirus from skin, fomites and environmental surfaces [100]. An outbreak in a mental care facility was probably enhanced by spending the day mainly in a crowded room while sharing cigarettes and soda cans, suggesting indirect fomite spread [101]. In a study published in 1966, experimental infections with adenovirus administered as aerosols (0.3–2.5 μm) or droplets (15 μm) to healthy, male inmates, resulted in infection of all volunteers, although the resulting illness resembled a natural infection only in the aerosol group [102]. During a military training period, increased numbers of adenovirus infections occurred over time, which correlated with an increased detection of PCR-positive air filters. Additionally, a correlation between disease and the extent of ventilation was observed, with more ventilation resulting in fewer disease cases [103•]. In a more recent study in military recruits, positive viral DNA samples were mainly obtained from pillows, lockers and rifles, although adenovirus DNA was also detected in air samples. No consistent correlation between increased positive environmental samples and disease was observed [104].

Discussion

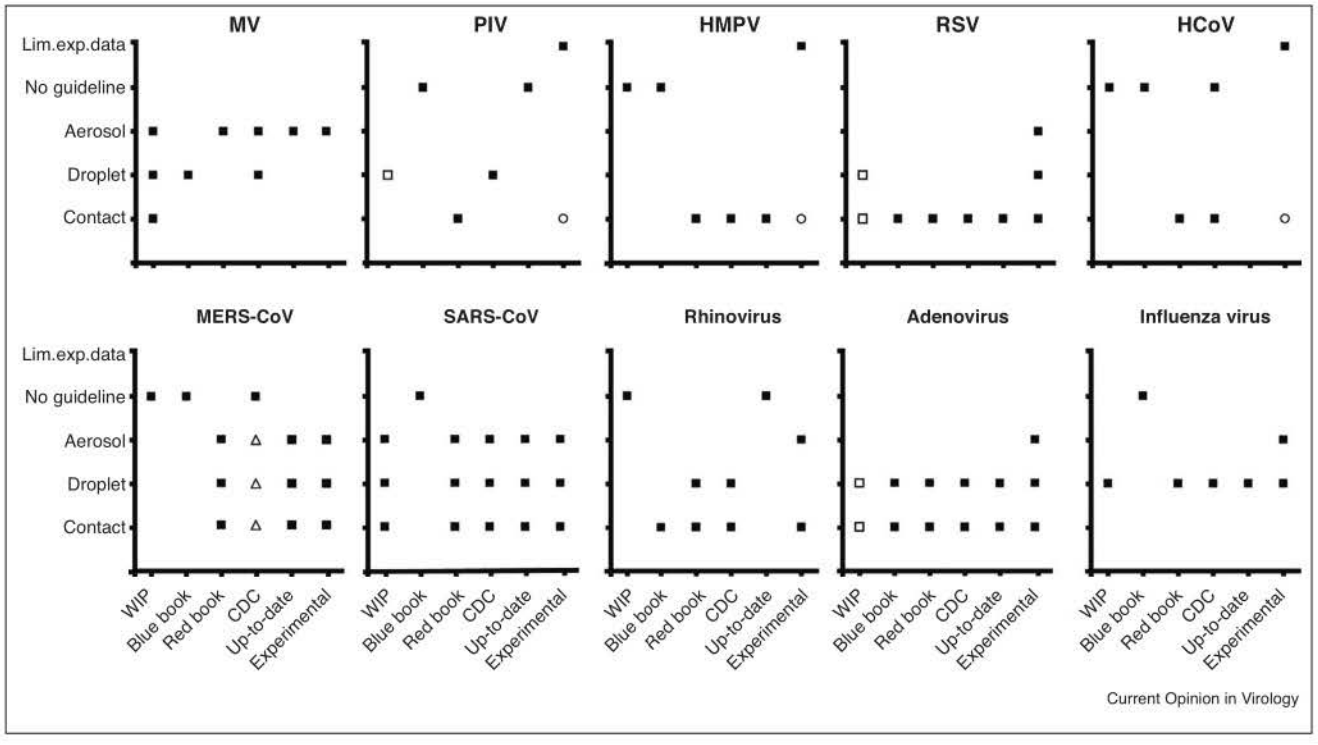
Studies on the transmission routes of respiratory viruses have been performed since the beginning of the 20th century [105]. Despite this, the relative importance of transmission routes of respiratory viruses is still unclear, depending on the heterogeneity of many factors like the

environment (e.g. temperature and humidity), pathogen and host [5,19]. Differences in virus shedding between individuals can contribute to the transmissibility rate, especially in the case of superspreaders [75,106]. In addition, the SARS-CoV outbreak highlighted the impact of aerosol-generating procedures on the increased risk of human-to-human transmission [74,107], demonstrating that for these procedures additional containment measures are necessary.

Inter-human transmission has been studied under many different (experimental) conditions. A summary of the advantages and disadvantages of the different study designs (Table 3) highlights the difficulty of human transmission experiments. As a consequence, contrasting results have been obtained for many viruses. This is also reflected in Table 2, summarizing the experimental data on inter-human transmission. Besides the difficulty of performing studies under well-controlled conditions, another key issue is that often (attenuated) laboratory strains are studied in healthy adults, which does not reflect the natural circumstances and target group and hence influence the outcome of the studies.

Respiratory viruses are an important cause of nosocomial infections, especially in children. Therefore, we consulted the guidelines on infection prevention from National [108], European [109], American [3,110] and International [111]) organizations for their information on transmission routes (Table 2) and associated isolation guidelines (Figure 1). Unfortunately, terms and definitions of respiratory transmission routes and isolation guidelines are not always used in a uniform way, leaving room for personal interpretation. But more importantly, information on the transmission route does not always reflect the isolation guidelines (e.g. for PIV and rhinovirus, Figure 1). As a proxy for transmission route, virus stability is often referred to in the guidelines, however, this can only imply a role for indirect contact transmission but is by no means conclusive on the transmission route. In hospital settings, prevention of contact transmission is generally implemented in standard infection prevention

Fig. 1



Isolation guidelines for respiratory virus infections in comparison to experimental evidence on transmission routes. Isolation guidelines for all respiratory viruses discussed in this review from National (Working Group Infection Prevention (WIP) [108], from the Netherlands National Institute for Public Health and the Environment (RIVM)), European ('The Blue Book' [109]), American ('The Red Book' [110] and the Centers for Disease Control (CDC) [3]) and International (UpToDate [111]) organizations are shown on the *X*-axis, together with the experimental evidence on transmission routes (Table 2). The categories on the *Y*-axis are the different transmission routes (contact, droplet or aerosol), the absence of guidelines for infection prevention ('No guideline'), or the limited availability of experimental data ('Lim. exp. data'). The information shown for influenza virus reflects the guidelines on seasonal influenza virus. Closed squares (■): isolation guidelines for the respective respiratory virus. Open squares (□): guidelines are only for children ≤6 years old. Open circles (○): data from stability experiments only. Open triangles (△): specific CDC guidelines for Healthcare Professionals [115] (not the isolation guideline [3] used in this review).

precautions such as strict hand hygiene and cough etiquette. It is important to note differences in isolation guidelines between different organizations and the lack of correlation to scientific data. The variation in described transmission routes and associated isolation guidelines among the different organizations underscores the lack of convincing data.

Well-designed human infection studies could be employed to investigate the role of transmission routes of respiratory viruses among humans [112••]. However, since human transmission experiments are very challenging, animal transmission models can provide an attractive alternative and should be explored and developed for all respiratory viruses. In such experiments, the influence of environmental factors on transmission routes can also be investigated [113]. However, before extrapolating experimentally generated data to humans, it is important to understand the limitations of these models, and appreciate the heterogeneity of experimental setups employed in laboratories [114]. Furthermore, quantitative data such as viral load in the air can be obtained by air sampling methods in various environments, such as hospital settings. Air sampling of viruses is an increasingly used technology in animal and human experiments. However, whereas most studies rely on the detection of viral genome copies, viability assays such as plaque assays or virus titration should be included to gain information on virus infectivity.

Ultimately, the knowledge gap on inter-human transmission should be filled by developing and performing state-of-the art experiments in a natural setting. Combined with animal transmission models and air sampling in different (health care and experimental) settings, these data should result in a thorough scientific understanding of the inter-human transmission routes of respiratory viruses. Eventually, this knowledge will help with an evidence-based risk assessment of the different transmission routes to improve existing infection prevention strategies.

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From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Mon, 24 Feb 2020 20:21:35 +0000
To: Marston, Hilary (NIH/NIAID) [E]
Subject: FW: chloroquine in COVID-19
Attachments: Chloroquine and SARS.pdf

Let us discuss.

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From: Gatti, Philip <Philip.Gatti@fda.hhs.gov>
Sent: Monday, February 24, 2020 3:05 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: RE: chloroquine in COVID-19

Tony,
Thanks for the quick response. There are data from 2005 showing inhibition of SARS infection and spread from 2005. Please see attached.
Regards,
Phil

From: Fauci, Anthony (NIH/NIAID) [E] (b) (6)>
Sent: Monday, February 24, 2020 3:00 PM
To: Gatti, Philip <Philip.Gatti@fda.hhs.gov>
Cc: Lane, Henry C (NIH) (b) (6); Cassetti, Cristina G (NIH) (b) (6); Erbelding, Emily J (NIH) (b) (6)
Subject: RE: chloroquine in COVID-19

Phil:

There are no data in this brief report and so I have no way of evaluating their claim. There are a lot of these types of claims going around. I would love to see their data.
Best regards,
Tony

Anthony S. Fauci, MD
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From: Gatti, Philip <Philip.Gatti@fda.hhs.gov>
Sent: Monday, February 24, 2020 2:42 PM
To: Fauci, Anthony (NIH/NIAID) [E] (b) (6)
Subject: FW: chloroquine in COVID-19

Dear Dr. Fauci,
Is there any indication/data to substantiate this claim from China (attached publication) that chloroquine/hydroxychloroquine can decrease COVID-19 infections and lung disease?
Thank you,
Philip Gatti, Ph.D.
Pharmacologist
FDA
CDER
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Virology Journal

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Research

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Chloroquine is a potent inhibitor of SARS coronavirus infection and spread

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Abstract

Background: Severe acute respiratory syndrome (SARS) is caused by a newly discovered coronavirus (SARS-CoV). No effective prophylactic or post-exposure therapy is currently available.

Results: We report, however, that chloroquine has strong antiviral effects on SARS-CoV infection of primate cells. These inhibitory effects are observed when the cells are treated with the drug either before or after exposure to the virus, suggesting both prophylactic and therapeutic advantage. In addition to the well-known functions of chloroquine such as elevations of endosomal pH, the drug appears to interfere with terminal glycosylation of the cellular receptor, angiotensin-converting enzyme 2. This may negatively influence the virus-receptor binding and abrogate the infection, with further ramifications by the elevation of vesicular pH, resulting in the inhibition of infection and spread of SARS CoV at clinically admissible concentrations.

Conclusion: Chloroquine is effective in preventing the spread of SARS CoV in cell culture. Favorable inhibition of virus spread was observed when the cells were either treated with chloroquine prior to or after SARS CoV infection. In addition, the indirect immunofluorescence assay described herein represents a simple and rapid method for screening SARS-CoV antiviral compounds.

Background

Severe acute respiratory syndrome (SARS) is an emerging disease that was first reported in Guangdong Province, China, in late 2002. The disease rapidly spread to at least 30 countries within months of its first appearance, and concerted worldwide efforts led to the identification of the etiological agent as SARS coronavirus (SARS-CoV), a novel member of the family *Coronaviridae* [1]. Complete genome sequencing of SARS-CoV [2,3] confirmed that this pathogen is not closely related to any of the

previously established coronavirus groups. Budding of the SARS-CoV occurs in the Golgi apparatus [4] and results in the incorporation of the envelope spike glycoprotein into the virion. The spike glycoprotein is a type I membrane protein that facilitates viral attachment to the cellular receptor and initiation of infection, and angiotensin-converting enzyme-2 (ACE2) has been identified as a functional cellular receptor of SARS-CoV [5]. We have recently shown that the processing of the spike protein was effected by furin-like convertases and that inhibition of this cleavage by a specific inhibitor abrogated cytopathicity and significantly reduced the virus titer of SARS-CoV [6].

Due to the severity of SARS-CoV infection, the potential for rapid spread of the disease, and the absence of proven effective and safe *in vivo* inhibitors of the virus, it is important to identify drugs that can effectively be used to treat or prevent potential SARS-CoV infections. Many novel therapeutic approaches have been evaluated in laboratory studies of SARS-CoV: notable among these approaches are those using siRNA [7], passive antibody transfer [8], DNA vaccination [9], vaccinia or parainfluenza virus expressing the spike protein [10,11], interferons [12,13], and monoclonal antibody to the S1-subunit of the spike glycoprotein that blocks receptor binding [14]. In this report, we describe the identification of chloroquine as an effective pre- and post-infection antiviral agent for SARS-CoV. Chloroquine, a 9-aminoquinoline that was identified in 1934, is a weak base that increases the pH of acidic vesicles. When added extracellularly, the non-protonated portion of chloroquine enters the cell, where it becomes protonated and concentrated in acidic, low-pH organelles, such as endosomes, Golgi vesicles, and lysosomes. Chloroquine can affect virus infection in many ways, and the antiviral effect depends in part on the extent to which the virus utilizes endosomes for entry. Chloroquine has been widely used to treat human diseases, such as malaria, amoebiosis, HIV, and autoimmune diseases, without significant detrimental side effects [15]. Together with data presented here, showing virus inhibition in cell culture by chloroquine doses compatible with patient treatment, these features suggest that further evaluation of chloroquine in animal models of SARS-CoV infection would be warranted as we progress toward finding effective antivirals for prevention or treatment of the disease.

Results

Preinfection chloroquine treatment renders Vero E6 cells refractory to SARS-CoV infection

In order to investigate if chloroquine might prevent SARS-CoV infection, permissive Vero E6 cells [1] were pretreated with various concentrations of chloroquine (0.1–10 μM) for 20–24 h prior to virus infection. Cells were then infected with SARS-CoV, and virus antigens were visualized by indirect immunofluorescence as described in Materials and Methods. Microscopic examination (Fig. 1A) of the control cells (untreated, infected) revealed extensive SARS-CoV-specific immunostaining of the monolayer. A dose-dependant decrease in virus antigen-positive cells was observed starting at 0.1 μM chloroquine, and concentrations of 10 μM completely abolished SARS-CoV infection. For quantitative purposes, we counted the number of cells stained positive from three random locations on a slide. The average number of positively stained control cells was scored as 100% and was compared with the number of positive cells observed under various chloroquine concentrations (Fig. 1B). Pretreatment with 0.1, 1, and 10 μM chloroquine reduced infectivity by 28%, 53%, and 100%, respectively. Reproducible results were obtained from three independent experiments. These data demonstrated that pretreatment of Vero E6 cells with chloroquine rendered these cells refractory to SARS-CoV infection.

Postinfection chloroquine treatment is effective in preventing the spread of SARS-CoV infection

In order to investigate the antiviral properties of chloroquine on SARS-CoV after the initiation of infection, Vero E6 cells were infected with the virus and fresh medium supplemented with various concentrations of chloroquine was added immediately after virus adsorption. Infected cells were incubated for an additional 16–18 h, after which the presence of virus antigens was analyzed by indirect immunofluorescence analysis. When chloroquine was added after the initiation of infection, there was a dramatic dose-dependant decrease in the number of virus antigen-positive cells (Fig. 2A). As little as 0.1–1 μM chloroquine reduced the infection by 50% and up to 90–94% inhibition was observed with 33–100 μM concentrations (Fig. 2B). At concentrations of chloroquine in excess of 1 μM, only a small number of individual cells were initially infected, and the spread of the infection to adjacent cells was all but eliminated. A half-maximal inhibitory effect was estimated to occur at 4.4 ± 1.0 μM chloroquine (Fig. 2C). These data clearly show that addition of chloroquine can effectively reduce the establishment of infection and spread of SARS-CoV if the drug is added immediately following virus adsorption.

Electron microscopic analysis indicated the appearance of significant amounts of extracellular virus particles 5–6 h after infection [16]. Since we observed antiviral effects by chloroquine immediately after virus adsorption, we further extended the analysis by adding chloroquine 3 and 5 h after virus adsorption and examined for the presence of virus antigens after 20 h. We found that chloroquine was still significantly effective even when added 5 h after infection (Fig. 3); however, to obtain equivalent antiviral

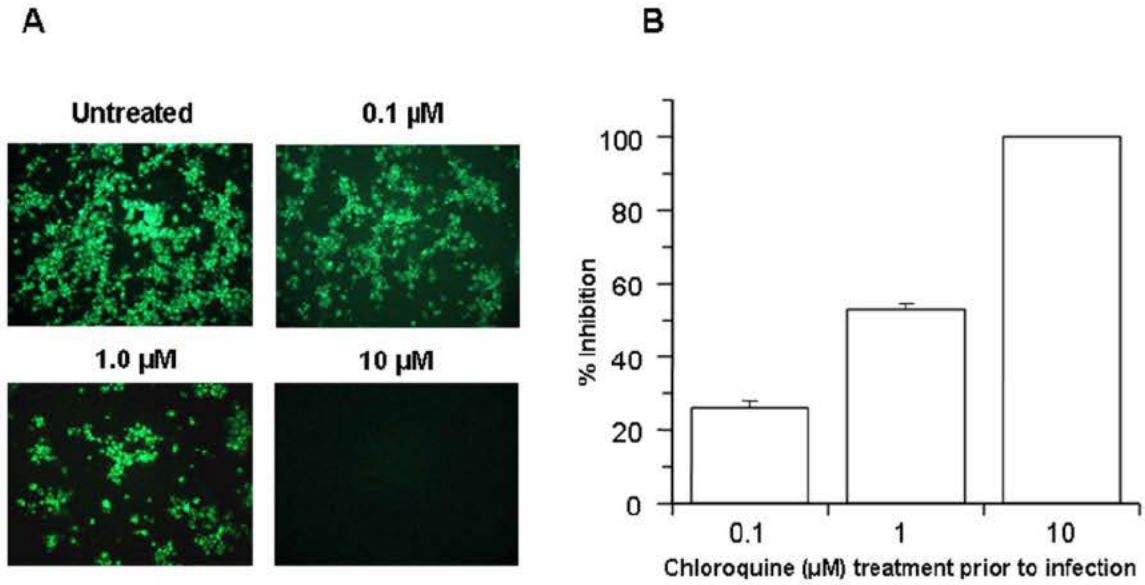

Figure 1

Prophylactic effect of chloroquine. Vero E6 cells pre-treated with chloroquine for 20 hrs. Chloroquine-containing media were removed and the cells were washed with phosphate buffered saline before they were infected with SARS-CoV (0.5 multiplicity of infection) for 1 h. in the absence of chloroquine. Virus was then removed and the cells were maintained in Opti-MEM (Invitrogen) for 16–18 h in the absence of chloroquine. SARS-CoV antigens were stained with virus-specific HMAF, followed by FITC-conjugated secondary antibodies. **(A)** The concentration of chloroquine used is indicated on the top of each panel. **(B)** SARS-CoV antigen-positive cells at three random locations were captured by using a digital camera, the number of antigen-positive cells was determined, and the average inhibition was calculated. Percent inhibition was obtained by considering the untreated control as 0% inhibition. The vertical bars represent the range of SEM.

effect, a higher concentration of chloroquine was required if the drug was added 3 or 5 h after adsorption.

Ammonium chloride inhibits SARS-CoV infection of Vero E6 cells

Since chloroquine inhibited SARS-CoV infection when added before or after infection, we hypothesized that another common lysosomotropic agent, NH_4Cl, might also function in a similar manner. Ammonium chloride has been widely used in studies addressing endosome-mediated virus entry. Coincidently, NH_4Cl was recently shown to reduce the transduction of pseudotype viruses decorated with SARS-CoV spike protein [17,18]. In an attempt to examine if NH_4Cl functions similarly to chloroquine, we performed infection analyses in Vero E6 cells before (Fig. 4A) and after (Fig. 4B) they were treated with various concentrations of NH_4Cl. In both cases, we observed a 93–99% inhibition with NH_4Cl at ≥ 5 mM. These data indicated that NH_4Cl (≥ 5 mM) and chloroquine (≥ 10 μM) are very effective in reducing SARS-CoV infection. These results suggest that effects of chloroquine and NH_4Cl in controlling SARS CoV infection and spread might be mediated by similar mechanism(s).

Effect of chloroquine and NH_4Cl on cell surface expression of ACE2

We performed additional experiments to elucidate the mechanism of SARS-CoV inhibition by chloroquine and NH_4Cl. Since intra-vesicular acidic pH regulates cellular functions, including N-glycosylation trimming, cellular trafficking, and various enzymatic activities, it was of interest to characterize the effect of both drugs on the processing, glycosylation, and cellular sorting of SARS-CoV spike glycoprotein and its receptor, ACE2. Flow cytometry analysis was performed on Vero E6 cells that were either untreated or treated with highly effective anti-SARS-CoV concentrations of chloroquine or NH_4Cl. The results revealed that neither drug caused a significant change in the levels of cell-surface ACE2, indicating that the observed inhibitory effects on SARS-CoV infection are not due to the lack of available cell-surface ACE2 (Fig. 5A). We next analyzed the molecular forms of endog-

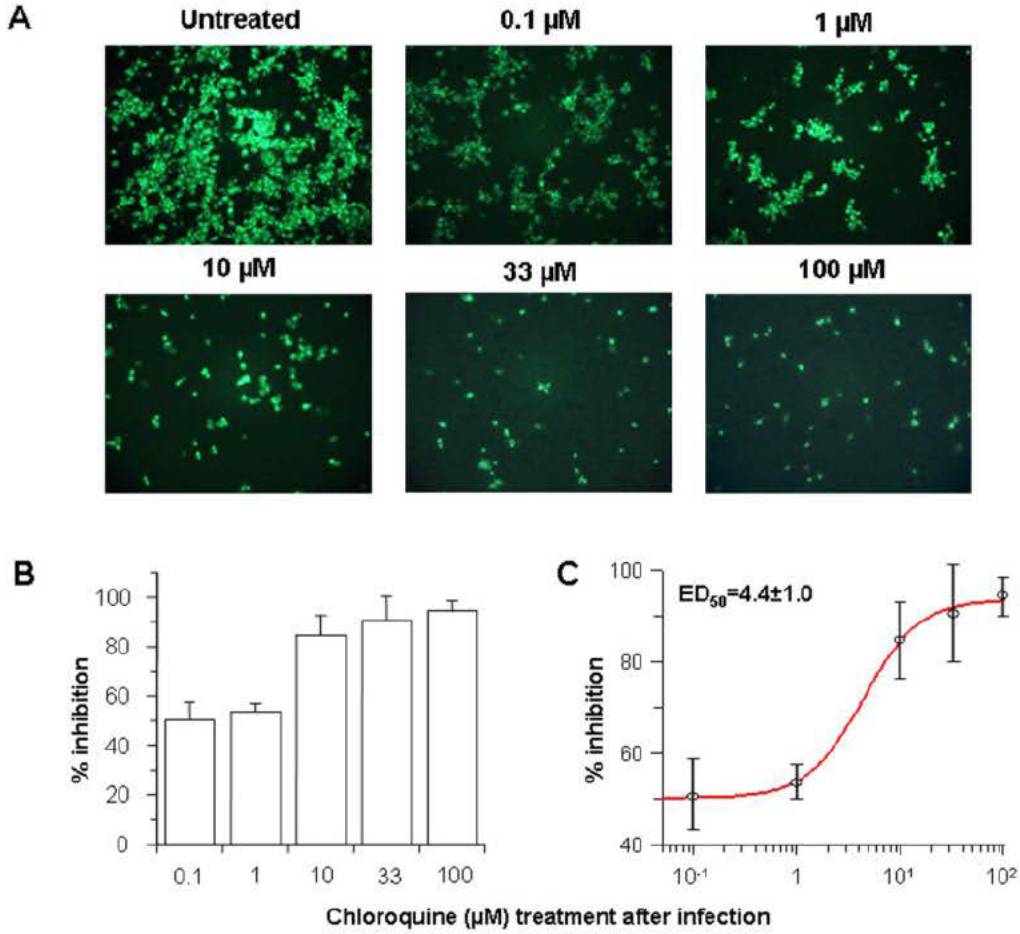

Figure 2

Post-infection chloroquine treatment reduces SARS-CoV infection and spread. Vero E6 cells were seeded and infected as described for Fig. 1 except that chloroquine was added only after virus adsorption. Cells were maintained in Opti-MEM (Invitrogen) containing chloroquine for 16–18 h, after which they were processed for immunofluorescence. **(A)** The concentration of chloroquine is indicated on the top. **(B)** Percent inhibition and SEM were calculated as in Fig. 1B. **(C)** The effective dose (ED_{50}) was calculated using commercially available software (Grafit, version 4, Erithacus Software).

enous ACE2 in untreated Vero E6 cells and in cells that were pre-incubated for 1 h with various concentrations of either NH_4Cl (2.5–10 mM) or chloroquine (1 and 10 µM) and labeled with ^{35}S-(Met) for 3 h in the presence or absence of the drugs (Fig. 5B and 5C). Under normal conditions, we observed two immunoreactive ACE2 forms, migrating at ~105 and ~113 kDa, respectively (Fig. 5B, lane 1). The ~105-kDa protein is endoglycosidase H sensitive, suggesting that it represents the endoplasmic reticulum (ER) localized form, whereas the ~113-kDa protein is endoglycosidase H resistant and represents the Golgi-modified form of ACE2 [19]. The specificity of the antibody was confirmed by displacing the immunoreactive protein bands with excess cold-soluble human recombinant ACE2 (+ rhACE2; Fig. 5B, lane 2). When we analyzed ACE2 forms in the presence of NH_4Cl, a clear stepwise increase in the migration of the ~113-kDa protein was observed with increasing concentrations of NH_4Cl, with a maximal effect observed at 10 mM NH_4Cl, resulting in only the ER form of ACE2 being visible on the gel (Fig. 5B, compare lanes 3–5). This suggested that the trimming and/or terminal modifications of the N-glycosylated chains of ACE2 were affected by NH_4Cl treatment. In addition, at 10 mM NH_4Cl, the ER form of ACE2 migrated with slightly faster mobility, indicating that NH_4Cl at that concentration might also affect core glyco-

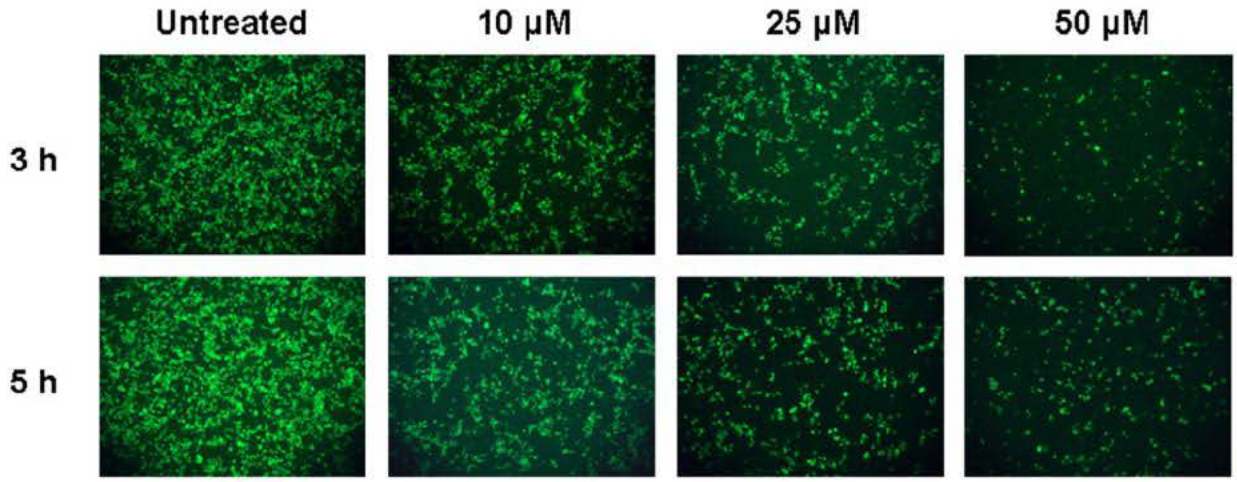

Figure 3
Timed post-infection treatment with chloroquine. This experiment is similar to that depicted in Fig. 2 except that cells were infected at 1 multiplicity of infection, and chloroquine (10, 25, and 50 μM) was added 3 or 5 h after infection.

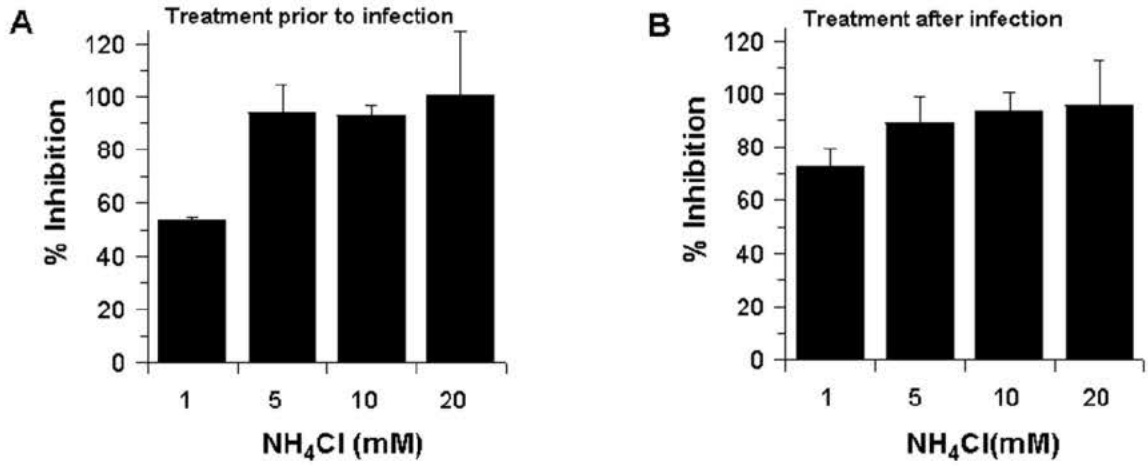

Figure 4
NH_4Cl inhibits SARS-CoV during pre or post infection treatment. NH_4Cl was added to the cells either before (A) or after (B) infection, similar to what was done for chloroquine in Figs 1 and 2. Antigen-positive cells were counted, and the results were presented as in Fig. 1B.

sylation. We also examined the terminal glycosylation status of ACE2 when the cells were treated with chloroquine (Fig. 5C). Similar to NH_4Cl, a stepwise increase in the electrophoretic mobility of ACE2 was observed with increasing concentrations of chloroquine. At 25 μM chloroquine, the faster electrophoretic mobility of the Golgi-modified form of ACE2 was clearly evident. On the basis of the flow cytometry and immunoprecipitation analyses,

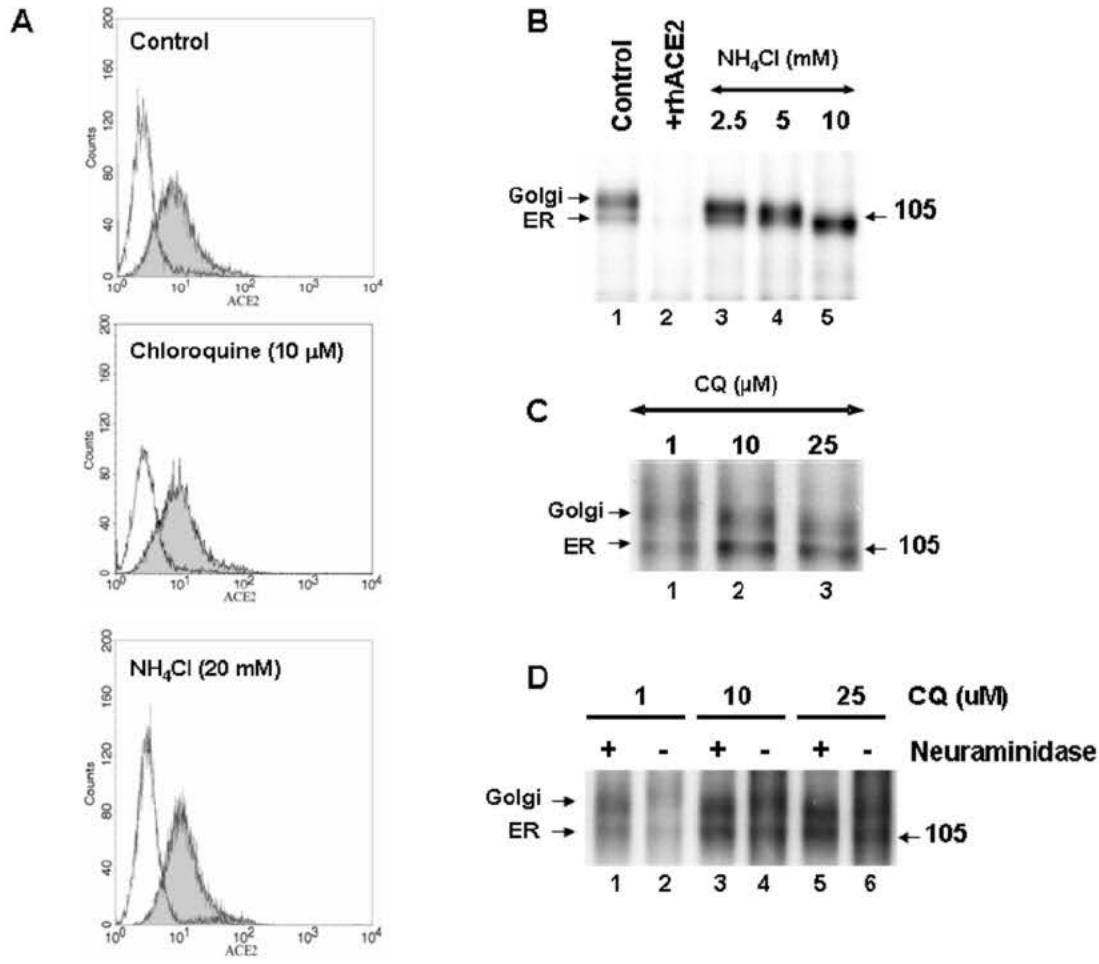

Figure 5

Effect of lysomotropic agents on the cell-surface expression and biosynthesis of ACE2. (A) Vero E6 cells were cultured for 20 h in the absence (control) or presence of chloroquine (10 μM) or NH_4Cl (20 mM). Cells were labeled with anti-ACE2 (grey histogram) or with a secondary antibody alone (white histogram). **(B)** Biosynthesis of ACE2 in untreated cells or in cells treated with NH_4Cl. Vero E6 cells were pulse-labeled for 3 h with ^{35}S-Met, and the cell lysates were immunoprecipitated with an ACE2 antibody (lane 1). Preincunbation of the antibody with recombinant human ACE2 (rhACE2) completely abolished the signal (lane 2). The positions of the endoglycosidase H-sensitive ER form and the endoglycosidase H-resistant Golgi form of ACE2 are emphasized. Note that the increasing concentration of NH_4Cl resulting in the decrease of the Golgi form of ACE2. **(C)** A similar experiment was performed in the presence of the indicated concentrations of chloroquine. Note the loss of terminal glycans with increasing concentrations of chloroquine. **(D)** The terminal glycosidic modification of ACE2 was evaluated by neuraminidase treatment of immunoprecipitated ACE2. Here cells were treated with 1–25 μM concentrations of chloroquine during starvation, pulse, and 3-h chase.

it can be inferred that NH_4Cl and chloroquine both impaired the terminal glycosylation of ACE2, while NH_4Cl resulted in a more dramatic effect. Although ACE2 is expressed in similar quantities at the cell surface, the variations in its glycosylation status might render the ACE2-SARS-CoV interaction less efficient and inhibit virus entry when the cells are treated with NH_4Cl and chloroquine.

To confirm that ACE2 undergoes terminal sugar modifications and that the terminal glycosylation is affected by NH_4Cl or chloroquine treatment, we performed immunopreipitation of ^{35}S-labeled ACE2 and subjected the immu-

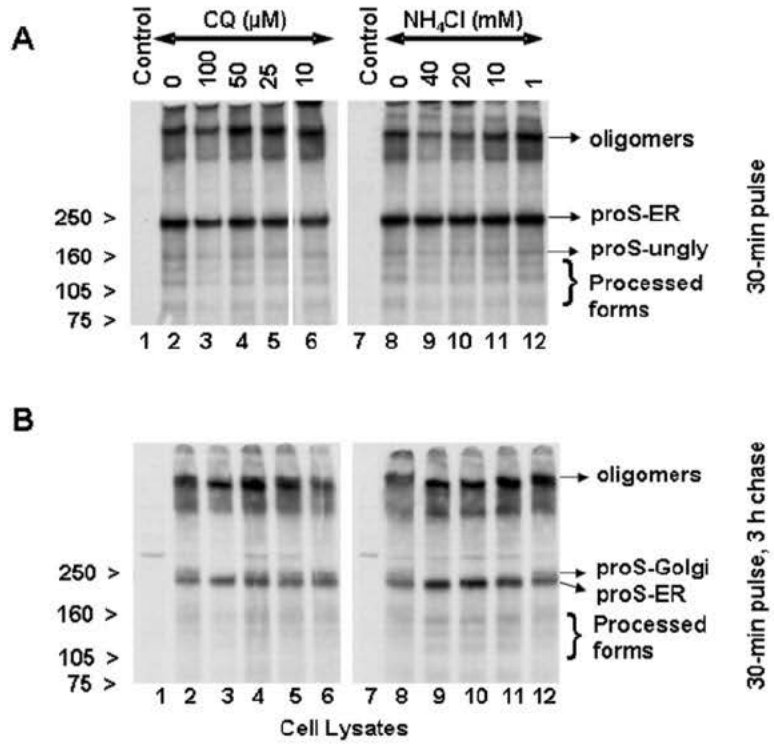

Figure 6

Effects of NH_4Cl and chloroquine (CQ) on the biosynthesis, processing, and glycosylation of SARS-CoV spike protein. Vero E6 cells were infected with SARS-CoV as described in Fig. 2. CQ or NH_4Cl was added during the periods of starvation (1 h) and labeling (30 min) with ^{35}S-Cys and followed by chase for 3 h in the presence of unlabeled medium. Cells were lysed in RIPA buffer and immunoprecipitated with HMAF. Virus proteins were resolved using 3–8% NuPAGE gel (Invitrogen). The cells presented were labeled for 30 min **(A)** and chased for 3 h **(B)**. The migration positions of the various spike molecular forms are indicated at the right side, and those of the molecular standards are shown to the left side. proS-ER and proS-Golgi are the pro-spike of SARS-Co in the ER and Golgi compartments, respectively and proS-ungly is the unglycosylated pro-spike ER.

noprecipitates to neuraminidase digestion. Proteins were resolved using SDS-PAGE (Fig 5D). It is evident from the slightly faster mobility of the Golgi form of ACE2 after neuraminidase treatment (Fig 5D, compare lanes 1 and 2), that ACE2 undergoes terminal glycosylation; however, the ER form of ACE2 was not affected by neuraminidase. Cells treated with 10 μM chloroquine did not result in a significant shift; whereas 25 μM chloroquine caused the Golgi form of ACE2 to resolve similar to the neuraminidase-treated ACE2 (Fig 5D, compare lanes 5 and 6). These data provide evidence that ACE2 undergoes terminal glycosylation and that chloroquine at anti-SARS-CoV concentrations abrogates the process.

Effect of chloroquine and NH_4Cl on the biosynthesis and processing of SARS-CoV spike protein

We next addressed whether the lysosomotropic drugs (NH_4Cl and chloroquine) affect the biosynthesis, glycosylation, and/or trafficking of the SARS-CoV spike glycoprotein. For this purpose, Vero E6 cells were infected with SARS-CoV for 18 h. Chloroquine or ammonium chloride was added to these cells during while they were being starved (1 h), labeled (30 min) or chased (3 h). The cell lysates were analyzed by immunoprecipitation with the SARS-specific polyclonal antibody (HMAF). The 30-min pulse results indicated that pro-spike (proS) was synthesized as a ~190-kDa precursor (proS-ER) and processed into ~125-, ~105-, and ~80-kDa proteins (Fig. 6A, lane 2), a result identical to that in our previous analysis [6]. Except for the 100 μM chloroquine (Fig. 6A, lane 3), there was no significant difference in the biosynthesis or processing of the virus spike protein in untreated or chloroquine-treated cells (Fig. 6A, lanes 4–6). It should be noted that chloroquine at 100 μM resulted in an overall decrease in biosynthesis and in the levels of processed virus glycoprotein. In view of the lack of reduction in the

biosynthesis and processing of the spike glycoprotein in the presence of chloroquine concentrations (10 and 50 μM) that caused large reductions in SARS-CoV replication and spread, we conclude that the antiviral effect is probably not due to alteration of virus glycoprotein biosynthesis and processing. Similar analyses were performed with NH_4Cl, and the data suggested that the biosynthesis and processing of the spike protein were also not negatively affected by NH_4Cl (Fig. 6A, lanes 7–12). Consistent with our previous analysis [6], we observed the presence of a larger protein, which is referred to here as oligomers. Recently, Song et al. [20] provided evidence that these are homotrimers of the SARS-CoV spike protein and were incorporated into the virions. Interestingly, the levels of the homotrimers in cells treated with 100 μM chloroquine and 40 and 20 mM NH_4Cl (Fig. 6A, lanes 3, 9, and 10) were slightly lower than in control cells or cells treated with lower drug concentrations.

The data obtained from a 30-min pulse followed by a 3-h chase (Fig. 6B, lanes 2 and 8) confirmed our earlier observation that the SARS-CoV spike protein precursor (proS-ER) acquires Golgi-specific modifications (proS-Golgi) resulting in a ~210-kDa protein [6]. Chloroquine at 10, 25, and 50 μM had no substantial negative impact on the appearance of the Golgi form (Fig. 6B, compare lane 2 to lanes 4–6). Only at 100 μM chloroquine was a reduction in the level of the Golgi-modified pro-spike observed (lane 3). On the other hand, NH_4Cl abrogated the appearance of Golgi-modified forms at ≥10 mM (compare lane 8 with 9–11) and had a milder effect at 1 mM (lane 12). These data clearly demonstrate that the biosynthesis and proteolytic processing of SARS-CoV spike protein are not affected at chloroquine (25 and 50 μM) and NH_4Cl (1 mM) doses that cause virus inhibitory effects. In addition, with 40, 20, and 10 mM NH_4Cl, there was an increased accumulation of proS-ER with a concomitant decrease in the amount of oligomers (Fig. 6B, lanes 9–11). When we examined the homotrimers, we found that chloroquine at 100 μM and NH_4Cl at 40 and 20 mM resulted in slightly faster mobility of the trimers (Fig. 6B, lanes 3, 9, and 10), but lower drug doses, which did exhibit significant antiviral effects, did not result in appreciable differences. These data suggest that the newly synthesized intracellular spike protein may not be a major target for chloroquine and NH_4Cl antiviral action. The faster mobility of the trimer at certain higher concentration of the drugs might be due the effect of these drugs on the terminal glycosylation of the trimers.

Discussion

We have identified chloroquine as an effective antiviral agent for SARS-CoV in cell culture conditions, as evidenced by its inhibitory effect when the drug was added prior to infection or after the initiation and establishment of infection. The fact that chloroquine exerts an antiviral effect during pre- and post-infection conditions suggest that it is likely to have both prophylactic and therapeutic advantages. Recently, Keyaerts et al. [21] reported the antiviral properties of chloroquine and identified that the drug affects SARS-CoV replication in cell culture, as evidenced by quantitative RT-PCR. Taken together with the findings of Keyaerts et al. [21], our analysis provides further evidence that chloroquine is effective against SARS-CoV Frankfurt and Urbani strains. We have provided evidence that chloroquine is effective in preventing SARS-CoV infection in cell culture if the drug is added to the cells 24 h prior to infection. In addition, chloroquine was significantly effective even when the drug was added 3–5 h after infection, suggesting an antiviral effect even after the establishment of infection. Since similar results were obtained by NH_4Cl treatment of Vero E6 cells, the underlying mechanism(s) of action of these drugs might be similar.

Apart from the probable role of chloroquine on SARS-CoV replication, the mechanisms of action of chloroquine on SARS-CoV are not fully understood. Previous studies have suggested the elevation of pH as a mechanism by which chloroquine reduces the transduction of SARS-CoV pseudotype viruses [17,18]. We examined the effect of chloroquine and NH_4Cl on the SARS-CoV spike proteins and on its receptor, ACE2. Immunoprecipitation results of ACE2 clearly demonstrated that effective anti-SARS-CoV concentrations of chloroquine and NH_4Cl also impaired the terminal glycosylation of ACE2. However, the flow cytometry data demonstrated that there are no significant differences in the cell surface expression of ACE2 in cells treated with chloroquine or NH_4Cl. On the basis of these results, it is reasonable to suggest that the pre-treatment with NH_4Cl or chloroquine has possibly resulted in the surface expression of the under-glycosylated ACE2. In the case of chloroquine treatment prior to infection, the impairment of terminal glycosylation of ACE2 may result in reduced binding affinities between ACE2 and SARS-CoV spike protein and negatively influence the initiation of SARS-CoV infection. Since the biosynthesis, processing, Golgi modification, and oligomerization of the newly synthesized spike protein were not appreciably affected by anti-SARS-CoV concentrations of either chloroquine or NH_4Cl, we conclude that these events occur in the cell independent of the presence of the drugs. The potential contribution of these drugs in the elevation of endosomal pH and its impact on subsequent virus entry or exit could not be ruled out. A decrease in SARS-CoV pseudotype transduction in the presence of NH_4Cl was observed and was attributed to the effect on intracellular pH [17,18]. When chloroquine or NH_4Cl are added after infection, these agents can rapidly raise the pH and subvert on-going

fusion events between virus and endosomes, thus inhibiting the infection.

In addition, the mechanism of action of NH_4Cl and chloroquine might depend on when they were added to the cells. When added after the initiation of infection, these drugs might affect the endosome-mediated fusion, subsequent virus replication, or assembly and release. Previous studies of chloroquine have demonstrated that it has multiple effects on mammalian cells in addition to the elevation of endosomal pH, including the prevention of terminal glycosyaltion of immunoglobulins [22]. When added to virus-infected cells, chloroquine inhibited later stages in vesicular stomatitis virus maturation by inhibiting the glycoprotein expression at the cell surface [23], and it inhibited the production of infectious HIV-1 particles by interfering with terminal glycosylation of the glycoprotein [24,25]. On the basis of these properties, we suggest that the cell surface expression of under-glycosylated ACE2 and its poor affinity to SARS-CoV spike protein may be the primary mechanism by which infection is prevented by drug pretreatment of cells prior to infection. On the other hand, rapid elevation of endosomal pH and abrogation of virus-endosome fusion may be the primary mechanism by which virus infection is prevented under post-treatment conditions. More detailed SARS CoV spike-ACE2 binding assays in the presence or absence of chloroquine will be performed to confirm our findings. Our studies indicate that the impact of NH_4Cl and chloroquine on the ACE2 and spike protein profiles are significantly different. NH_4Cl exhibits a more pronounced effect than does chloroquine on terminal glycosylation, highlighting the novel intricate differences between chloroquine and ammonium chloride in affecting the protein transport or glycosylation of SARS-CoV spike protein and its receptor, ACE2, despite their well-established similar effects of endosomal pH elevation.

The infectivity of coronaviruses other than SARS-CoV are also affected by chloroquine, as exemplified by the human CoV-229E [15]. The inhibitory effects observed on SARS-CoV infectivity and cell spread occurred in the presence of 1–10 μM chloroquine, which are plasma concentrations achievable during the prophylaxis and treatment of malaria (varying from 1.6–12.5 μM) [26] and hence are well tolerated by patients. It recently was speculated that chloroquine might be effective against SARS and the authors suggested that this compound might block the production of TNFα, IL6, or IFNγ [15]. Our data provide evidence for the possibility of using the well-established drug chloroquine in the clinical management of SARS.

Conclusion

Chloroquine, a relatively safe, effective and cheap drug used for treating many human diseases including malaria, amoebiosis and human immunodeficiency virus is effective in inhibiting the infection and spread of SARS CoV in cell culture. The fact that the drug has significant inhibitory antiviral effect when the susceptible cells were treated either prior to or after infection suggests a possible prophylactic and therapeutic use.

Methods

SARS-CoV infection, immunofluorescence, and immunoprecipitation analyses

Vero E6 cells (an African green monkey kidney cell line) were infected with SARS-CoV (Urbani strain) at a multiplicity of infection of 0.5 for 1 h. The cells were washed with PBS and then incubated in OPTI-MEM (Invitrogen) medium with or without various concentrations of either chloroquine or NH_4Cl (both from Sigma). Immunofluorescence staining was performed with SARS-CoV-specific hyperimmune mouse ascitic fluid (HMAF) [8] followed by anti-mouse fluorescein-coupled antibody.

Eighteen hours after infection, the virus-containing supernatants were removed, and the cells were pulsed with ^{35}S-(Cys) for 30 min and chased for 3 h before lysis in RIPA buffer. Clarified cell lysates and media were incubated with HMAF, and immunoprecipitated proteins were separated by 3–8% NuPAGE gel (Invitrogen); proteins were visualized by autoradiography. In some experiments, cells were chased for 3 h with isotope-free medium. Clarified cell supernatants were also immunoprecipitated with SARS-CoV-specific HMAF.

ACE2 flow cytometry analysis and biosynthesis

Vero E6 cells were seeded in Dulbecco's modified Eagle medium (Invitrogen) supplemented with 10% fetal bovine serum. The next day, the cells were incubated in Opti-MEM (Invitrogen) in the presence or absence of 10 μM chloroquine or 20 mM NH_4Cl. To analyze the levels of ACE2 at the cell surface, cells were incubated on ice with 10 μg/mL affinity-purified goat anti-ACE2 antibody (R&D Systems) and then incubated with FITC-labeled swine anti-goat IgG antibody (Caltag Laboratories). Labeled cells were analyzed by flow cytometry with a FACSCalibur flow cytometer (BD Biosciences). For ACE2 biosynthesis studies, Vero E6 cells were pulsed with 250 μCi ^{35}S-(Met) (Perkin Elmer) for 3 h with the indicated concentrations of chloroquine or NH_4Cl and then lysed in RIPA buffer. Clarified lysates were immunoprecipitated with an affinity-purified goat anti-ACE2 antibody (R&D systems), and the immunoprecipitated proteins were separated by SDS-polyacrylamide gel electrophoresis.

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

MV did all the experiments pertaining to SARS CoV infection and coordinated the drafting of the manuscript. EB and SB performed experiments on ACE2 biosynthesis and FACS analysis. BE performed data acquisition from the immunofluorescence experiments. PR and TK provided critical reagents and revised the manuscript critically. NS and SN along with MV and EB participated in the planning of the experiments, review and interpretation of data and critical review of the manuscript. All authors read and approved the content of the manuscript.

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Subject: FW: New Yorker: How Anthony Fauci Became America's Doctor https://bit.ly/2y3h3fi

This is the actual article for which I previously sent you a link.

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Subject: New Yorker: How Anthony Fauci Became America's Doctor https://bit.ly/2y3h3fi

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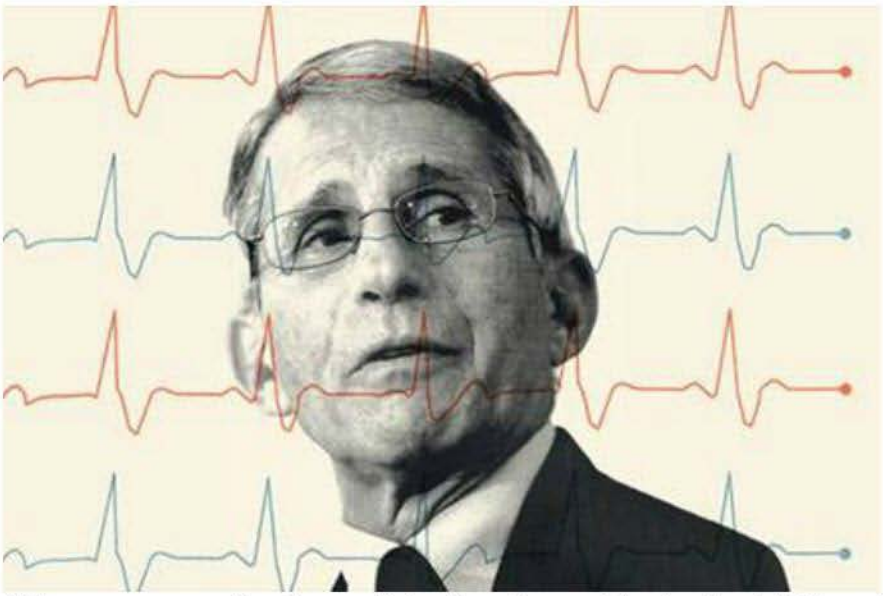
How Anthony Fauci Became America's Doctor

An infectious-disease expert's long crusade against some of humanity's most virulent threats.

By Michael Specter
April 10, 2020



"You stay completely apolitical and non-ideological," Fauci says. "I'm a scientist and I'm a physician. And that's it." Illustration by Tyler Comrie. Photograph by Win McNamee / Getty

Just before midnight on March 22nd, the President of the United States prepared to tweet. Millions of Americans, in the hope of safeguarding their health and fighting the rapidly escalating spread of COVID-19, had already begun to follow the sober recommendation of Anthony S. Fauci, the country's leading expert on infectious disease. Fauci had warned Americans to "hunker down significantly more than we as a country are doing." Donald Trump disagreed. "WE CANNOT LET THE CURE BE WORSE THAN THE PROBLEM ITSELF," he tweeted.

Trump had seen enough of "social distancing." In an election year, he was watching the stock market collapse, unemployment spike, and the national mood devolve into collective anxiety. "I would love to have the country opened up, and just rarin' to go by Easter," he said, on Fox News. "You'll have packed churches all over our country. I think it'll be a beautiful time."

Trump's Easter forecast came more than two months after the first U.S. case of COVID-19 was identified, in Washington State, and more than a hundred days after the novel coronavirus emerged, first from bats and then from a live-animal market in the Chinese city of Wuhan. Every day, more people were falling sick and dying. Despite a catastrophic lack of

testing capacity, it was clear that the virus had reached every corner of the nation. With the Easter holiday just a few weeks away, there was not a single public-health official in the United States who appeared to share the President's rosy surmises.

Anthony Fauci certainly did not. At seventy-nine, Fauci has run the National Institute of Allergy and Infectious Diseases for thirty-six years, through six Administrations and a long procession of viral epidemics: H.I.V., SARS, avian influenza, swine flu, Zika, and Ebola among them. As a member of the Administration's coronavirus task force, Fauci seemed to believe that the government's actions could be directed, even if the President's pronouncements could not. At White House briefings, it has regularly fallen to Fauci to gently amend Trump's absurdities, half-truths, and outright lies. No, there is no evidence that the malaria drug hydroxychloroquine will provide a "miracle" treatment to stave off the infection. No, there won't be a vaccine for at least a year. When the President insisted for many weeks on denying the government's inability to deliver test kits for the virus, Fauci, testifying before Congress, put the matter bluntly. "That's a failing," he said. "Let's admit it."

When Trump was not dismissing the severity of the crisis, he was blaming others for it: the Chinese, the Europeans, and, as always, Barack Obama. He blamed governors who were desperate for federal help and had been reduced to fighting one another for lifesaving ventilators. In one briefing, Governor Andrew Cuomo, of New York, said, "It's like being on eBay with fifty other states, bidding on a ventilator." Trump even accused hospital workers in New York City of pilfering surgical masks and other vital protective equipment that they needed to stay alive. "Are they going out the back door?" Trump wondered aloud.

As a reporter who writes mainly on science and public-health issues, I've known Fauci since the H.I.V./AIDS epidemic exploded, in the mid-eighties. He once explained to me that he has developed a method for dealing with political leaders in times of crisis: "I go to my favorite book of philosophy, 'The Godfather,' and say, 'It's nothing personal, it's strictly business.' " He continued, "You just have a job to do. Even when somebody's acting ridiculous, you can't chide them for it. You've

got to deal with them. Because if you don't deal with them, then you're out of the picture."

Since his days of advising Ronald Reagan and George H. W. Bush, Fauci has maintained a simple credo: "You stay completely apolitical and non-ideological, and you stick to what it is that you do. I'm a scientist and I'm a physician. And that's it." He learned the value of candor early. "Some wise person who used to be in the White House, in the Nixon Administration, told me a very interesting dictum to live by," he told me in 2016, during a public conversation we had at the fifty-year reunion of his medical-school class. "He said, 'When you go into the White House, you should be prepared that that is the last time you will ever go in. Because if you go in saying, I'm going to tell somebody something they want to hear, then you've shot yourself in the foot.' Now everybody knows I'm going to tell them exactly what's the truth."

Americans have come to rely on Fauci's authoritative presence. Perhaps not since the Vietnam era, when Walter Cronkite, the avuncular anchor of the "CBS Evening News," was routinely described as the most trusted man in America, has the country depended so completely on one person to deliver a daily dose of plain talk. In one national poll, released last Thursday, seventy-eight per cent of participants approved of Fauci's performance. Only seven per cent disapproved.

On March 23rd, Fauci failed to appear at the daily briefing in the White House pressroom. Twitter promptly lost its mind. #NoFauci became a top trending topic, followed closely by #whereisFauci and #letTonyspeak. There was speculation that Trump, who is inclined to fire anyone who disagrees with him or, worse, garners some praise in the media, had lost patience with Fauci. As one of Fauci's old friends told me, "This is a President who doesn't give a shit about Fauci's accomplishments, his history, or his learning. If anything, they're negatives."

The truth was less alarming. "I was tied up in a task-force meeting, and we were trying to work out some difficult policies," Fauci said. "I have no trouble with the President. When I talk to him, he listens." My experience with Fauci suggested that this last statement was perhaps a triumph of pragmatism over accuracy. His priority, as he's made clear, is

to do what is necessary to save lives. So I was not surprised to receive an e-mail from Fauci the following day, saying that he had been asked to refrain from participating in personal profiles. It seemed that it was one thing for him to talk about the news with reporters or even to chat on Instagram with Stephen Curry, the Golden State Warriors star. But focussing on himself, rather than on the President, was another thing entirely.

Fauci and Trump are about as odd a duo as American political life has ever produced. Both men are in their seventies. Both come from the outer boroughs of New York City. Both are direct, even blunt. But that's where the resemblance ends. Fauci has always been a person of unusual discipline. Nearing eighty, he works about eighteen hours a day. Long ago, when his three children were young, he and his wife, Christine Grady, who runs the bioethics department at the National Institutes of Health, decided to maintain the sanctity of family dinners by starting them when he got home from the office, at around nine o'clock. For decades, Fauci has taken long lunchtime runs, but, during the crisis, he's cut back his routine to power walking—and only on weekends. Fauci parses his words with care and believes, above all, in the power of facts and the efficacy of data.

David Baltimore, a Nobel laureate and a pioneer of molecular biology, told me, "Tony is unique, in that he has such credibility with politicians that he's been able to insert hard facts into the conversation. That has been wonderful for our country and the world." According to David Relman, a microbiologist at Stanford University who for years has advised the government on biological threats, "Tony has essentially become the embodiment of the biomedical and public-health research enterprise in the United States. Nobody is a more tireless champion of the truth and the facts. I am not entirely sure what we would do without him."

Fauci can be impatient with the compromises of politics. In my conversations with him, he has responded furiously when a dicey amendment, a bogus rider, or a "poison pill" is attached to a public-

health bill. He recalled one congressional provision, in 2016, that tried to make it "legally permissible to fly the Confederate flag at national cemeteries. I am not kidding." When dealing with politicians, he told me, he relies on the pseudo-Latin expression *Illegitimi non carborundum:* Don't let the bastards grind you down. But he has inspired respect throughout the political world and beyond. Fauci's office walls are covered with scores of photographs of him with Presidents, senators, visiting Prime Ministers, business leaders, actors. In October, 1988, George H. W. Bush, during a Presidential debate with Michael Dukakis, was asked who his heroes were. "I think of Dr. Fauci," Bush replied. "You've probably never heard of him. . . . He's a very fine researcher, a top doctor at the National Institutes of Health, working hard, doing something about research on this disease of AIDS." These days, nearly everyone has heard of Fauci. Pandemic-memorabilia entrepreneurs have put his face on bottle openers, coffee mugs, and bumper stickers: "In Dr. Fauci we trust." The National Bobblehead Hall of Fame and Museum has produced a seven-inch likeness of him, partly to raise money to produce protective gear for medical workers. There's a Facebook group called Dr. Fauci Speaks, We Listen, and another called Dr. Fauci Memes for Social Distance Teens. A petition has circulated to nominate him as *People's* "sexiest man alive."

On right-wing social media and talk radio, Fauci has a different image: he is routinely disparaged as a closet lefty who is exaggerating the threat of the coronavirus. "Has anyone else noticed that every suggestion by Dr. Doom Fauci just happens to also be the worst possible thing for the economy?" the conservative Internet TV host Bill Mitchell tweeted. "That's not an accident folks." An analysis in the *Times* found more than seventy Twitter accounts that have pushed the hashtag #FauciFraud, with some tweeting out anti-Fauci bile hundreds of times a day. "There seems to be a concerted effort on the part of Trump supporters to spread misinformation about the virus," Carl Bergstrom, a professor of biology at the University of Washington who has studied misinformation, told the paper. "There is this sense that experts are untrustworthy, and have agendas that aren't aligned with the people." Fauci has received so many personal threats that the Justice Department recently approved a security

detail for him. Fauci shrugged it off, telling reporters, “I’ve chosen this life.”

The crisis that the world now faces comes as no surprise to Fauci. On January 10, 2017, ten days before Trump took the oath of office, Fauci delivered the keynote address at a conference at Georgetown University, titled “Pandemic Preparedness for the Next Administration.” After describing his years of managing epidemics, he posed a series of questions to the audience: “Will there be a resurgence of Zika? We’re getting into the summer in South America. Are we going to see a resurgence or not? What about influenza? Are we going to get a new pandemic?”

Fauci’s last point, he emphasized, was almost certainly the most important: the possibility that some unknown, powerfully infectious pathogen could emerge to threaten the world. “What about things that we’re not even thinking about?” he said. He let the question drift out over the hall. “What is for sure,” he concluded, “is that, no matter what, history has told us definitively that it will happen.”

On the day that Anthony Stephen Fauci was born, the front-page headline in the *Times* was “PRESIDENT TO GIVE EMERGENCY FACTS TO NATION ON RADIO.” It was Christmas Eve, 1940. The Second World War had begun, and the United States was less than a year away from joining the fight.

Fauci grew up in southwest Brooklyn, first in Bensonhurst and later in Dyker Heights, where his family ran a pharmacy and lived in an apartment upstairs. The pharmacy was across the street from the Shrine Church of St. Bernadette. When Mass was finished on Sundays, Fauci recalled, people would walk over to get prescriptions filled and to buy whatever else they needed for the coming week. Tony’s father, Stephen, dispensed medications, and was known to customers as Doc. His mother, Eugenia, worked the register, along with his older sister, Denise. From an early age, Tony spent evenings and weekends riding around the neighborhood on his Schwinn, making deliveries.

Fauci's parents were born in New York; one set of grandparents had emigrated from Naples, the other from Sicily. Anthony first took Communion at the age of seven and was confirmed at twelve. He went to elementary school at Our Lady of Guadalupe, in Bensonhurst. "I had no idea at the time when I was there, being taught by the Dominican nuns, that I would be interested in science," he said. "I was interested in a lot of things, mostly sports, but certainly not science."

In those days, baseball was the social glue of Brooklyn. The borough was Dodger territory and Ebbets Field was consecrated ground—but Fauci was devoted to the Yankees, who played in the faraway Bronx. In the midst of the coronavirus crisis, I e-mailed to ask about this anomaly, not necessarily expecting an answer. He replied almost instantly. "You probably are unaware, but half the kids in Brooklyn were Yankee fans," he wrote. "We spent our days arguing who was better: Duke Snider versus Mickey Mantle; Roy Campanella versus Yogi Berra; Pee Wee Reese versus Phil Rizzuto and on and on. Those were the days, my friend."

Fauci has often referred to his father as "laid-back," which, if true, must be a characteristic that skips a generation. "Tony has always been driven," Michael Osterholm, the director of the University of Minnesota's Center for Infectious Disease Research and Policy, and a longtime friend of Fauci's, told me. "Whatever he was doing, he had to do it better than anybody else. I don't know if it was certainty or something else. But he was meant to lead. Always. Everyone who knew him knew that. And Tony knew it, too."

In 1954, he began attending Regis, a private Jesuit high school on the Upper East Side. Rigorous, small, competitive, and tuition-free, Regis is considered one of the finest all-male schools in the country. Fauci thrived there, though the commute between Dyker Heights and Eighty-fourth and Madison was long. He once estimated that he had spent the equivalent of seventy days of his teen-age life on the various subways and buses he took to get to and from school.

Fauci revelled in the demanding coursework. "We took four years of Greek, four years of Latin, three years of French, ancient history, theology," he recalled. He developed an ability to set out an argument

and to bolster it with evidence—good preparation, it turned out, for testifying before Congress. Last year, at a dinner that Regis held in his honor, he said that the school had taught him "to communicate scientific principles, or principles of basic and clinical research, without getting very profuse and off on tangents."

At the time, though, Fauci had no interest in becoming a doctor. "I was captain of the Regis High School basketball team," he once told me. "I thought this was what I wanted to do with myself. But, being a realist, I very quickly found out that a five-seven, really fast, good-shooting point guard will never be as good as a really fast, good-shooting seven-footer. I decided to change the direction of my career."

At school, Fauci's accomplished peers were headed to careers in medicine, engineering, and the law. At home, he was steeped in the humanities: "Virtually all my relatives on my mother's side—her father, her brother, and her sister's children—are artists." His mother helped tip the balance. "She never really pressured me in any way, but I think I subtly picked up the vibrations that she wanted very much for me to be a physician," Fauci said. "There was this tension—would it be humanities and classics, or would it be science? As I analyzed that, it seemed to me that being a physician was the perfect melding of both of those aspirations."

From Regis, Fauci went on to another Jesuit institution, Holy Cross, in Worcester, Massachusetts. His high-school faculty had left him little choice in the matter. "They just wouldn't write a recommendation for you if you wanted to apply to Harvard or to Cornell, or Columbia," he said. Fauci enrolled in 1958 and was pleased to find that the university took a broad view of premedical studies. He signed up for a program called Bachelor of Arts–Greek Classics–Premed. "It was really kind of bizarre," he recalled. "We did a lot of classics, Greek, Latin, Romance languages. . . . We took many credits of philosophy, everything from epistemology to philosophical psychology, logic, etc. But we took enough biology and physics and science to get you into medical school."

During the summers, Fauci worked construction jobs. One year, he found himself assigned to a crew that was building a new library at

Cornell Medical College, on the Upper East Side. “On lunch break, when the crew were eating their hero sandwiches and making catcalls to nurses, I snuck into the auditorium to take a peek,” Fauci recalled in 1998, at the medical school’s centennial celebration. “I got goosebumps as I entered, looked around the empty room, and imagined what it would be like to attend this extraordinary institution. After a few minutes at the doorway, a guard came and politely told me to leave, since my dirty boots were soiling the floor. I looked at him and said proudly that I would be attending this institution a year from now. He laughed and said, ‘Right, kid, and next year I am going to be Police Commissioner.’ ”

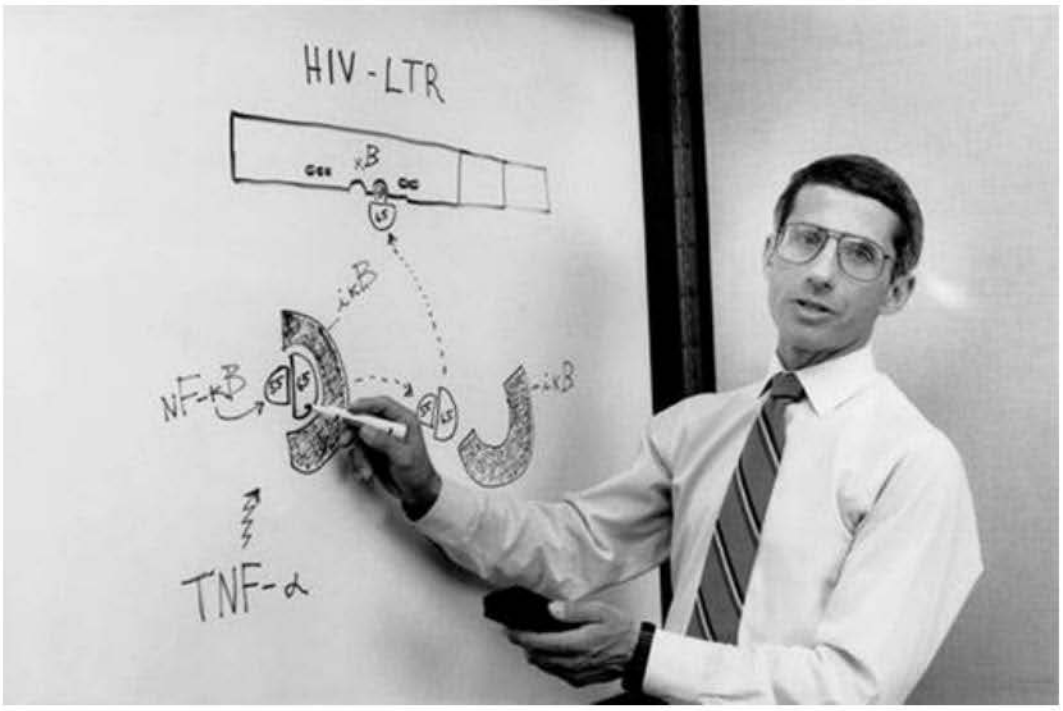
Fauci graduated first in his class from Cornell in 1966, just as America’s involvement in Vietnam was accelerating. Every new physician was required to perform some kind of military service. “We were gathered in the auditorium at Cornell, early in our fourth year of medical school,” Fauci recalled. “Unlike today, we had only two women in the class and seventy-nine men. The recruiter from the armed forces came there and said, ‘Believe it or not, when you graduate from medical school at the end of the year, except for the two women, everyone in this room is going to be either in the Army, the Air Force, the Navy, or the Public Health Service. So you’re going to have to make your choice. Sign up and give your preferences.’ ”

Fauci wanted to work in the U.S. Public Health Service; his fallback was the Navy. He got his first choice, and ended up at the National Institutes of Health, which was then establishing itself as the country’s primary center for biomedical research. Nearly everyone in academic medicine spent some time at one of its branches; except for three years back at Cornell to complete his internship and residency, Fauci has spent five decades there.

In 1972, Fauci started as a senior researcher at the National Institute of Allergy and Infectious Diseases. He was drawn to investigating ailments that were difficult but not impossible to treat. “I wanted something that could make you very sick and kill you unless I intervened. And if I

intervene, you're essentially cured," he told Ushma Neill, the editor of *The Journal of Clinical Investigation*, in 2014. "Now, that seems a little bit too simplistic, but that's really the nature of most infectious diseases."

Working in the lab of Sheldon Wolff, Fauci studied the molecular nature of fever. The field of immunology was still young, but scientists were rapidly learning how to manipulate the smallest components of individual cells, which opened the way to a decade of discovery. Chronic fevers can have a number of underlying causes, among them an uncommon condition known as vasculitis—an inflammation of the blood cells that often occurs when the body's immune system mistakenly attacks its own blood vessels. Many of Fauci's vasculitis patients suffered from rare inflammatory diseases, such as granulomatosis with polyangiitis, which damages blood vessels in the lungs, kidneys, and other organs. The disease was almost always fatal. Fauci and his infectious-disease colleagues at the N.I.H. were frequently asked to visit the National Cancer Institute, which was in the same building as his lab, to consult on patients who were receiving chemotherapy. The drugs suppressed tumors, but they were highly toxic. And they had another side effect, Fauci told me: "Those people are susceptible to a lot of things like infections and bleeding, because the treatment has destroyed their immune systems."



In 1990, Fauci was the government's leading researcher focussed on the AIDS *epidemic.* Photograph by George Tames / The New York Times / Redux

Fauci, together with Wolff, his mentor, wondered if this side effect could be harnessed to help vasculitis patients, whose immune systems were overactive. "I thought if we could somehow give a cancer drug at a low enough dose perhaps we could turn the disease off without any of the secondary complications," he recalled recently. "First we did it in a few patients, and, much to our delight, they had a total remission. Before you know it, we ended up curing a very, very lethal, albeit uncommon, disease."

For the first time, this technique enabled researchers to do effective work on lupus, rheumatoid arthritis, and transplant rejection. "If you look at immunology, it has from the very beginning been inextricably linked to infectious diseases," Fauci said. "What is the immune system for? The immune system protects you against invaders from without—microorganisms—as well as, in some cases, the emergence of certain tumors from within."

In 1981, a strange new syndrome emerged that transformed Fauci's research and, eventually, the lives of millions of people around the

world. “All of a sudden, this new disease comes along,” Fauci recalled, referring to what would soon come to be known as AIDS. “Even before the cause of it was proven to be H.I.V., everybody in the field knew that it had to be a virus. I said to myself, ‘Here it is, a virus, still to be determined, that’s affecting profoundly and destroying the human immune system.’ ” Fauci believed that he had been training all his life for a threat like this one. He was an expert in viruses and in the immune system—and he had always been attracted to combatting serious, even fatal diseases. “I wanted to be where the action was,” he said.

At first, few public-health officials seemed to care. In June of 1981, the *Morbidity and Mortality Weekly Report*, a publication of the Centers for Disease Control, issued a paper that included an account of five young men, all gay, who had contracted pneumocystis, a form of pneumonia that had previously been reported only in people with dramatically impaired immune systems. The young men described in the study had all been healthy. “I thought it was a fluke,” Fauci recalled. “I put it aside on my desk, thinking that maybe this was some drug that they had taken that suppressed their immune system.”

A month later, an even more alarming report arrived from the C.D.C. Fauci read it with an uneasy sense that a disaster was looming: “I made the decision that I was going to stop what I was doing, much to the chagrin of my mentors, who were saying, ‘Why do you want to give up a great trajectory of a career to study a handful of gay men with this strange disease?’ But, deep down, I really knew that this was going to explode.”

Fauci wrote a paper to sound the alarm. “I called it my *apologia pro vita sua*—an explanation for what I’m doing,” he said. In the paper, Fauci pointed out that, although the disease “seems to selectively affect a particular segment of our society,” it demanded a medical solution. Moreover, he warned, “any assumption that the syndrome will remain restricted to a particular segment of our society is truly an assumption without a scientific basis.” Fauci sent the manuscript to *The New England Journal of Medicine*, in late 1981. It was rejected. “One of the reviewers said I was being alarmist,” Fauci said. He tried a different

journal, *The Annals of Internal Medicine*, and the following June the paper was published.

In the laboratory, Fauci began making progress. He had been investigating B cells, which are involved in the production of antibodies. In 1983—before H.I.V. was even known by that name—his lab became the first to report that B cells became hyperactive in patients with AIDS. When a healthy person is invaded by a virus, antibodies mount a defense, but, when H.I.V. hijacked B cells, the antibody system went awry. Fauci and his team had identified one of the crucial features of AIDS. "We made that observation without having any idea of what we were dealing with," he said in an interview for an N.I.H. oral history. "I think that speaks for sound scientific and clinical observation." The politics of seeking a cure, though, would be far harder to manage.

On October 11, 1988, more than a thousand AIDS activists gathered outside the headquarters of the Food and Drug Administration, in Rockville, Maryland, to protest the agency's glacial reaction to the epidemic. The activists knew that their community needed new treatments if they were to avoid catastrophe—but they were stymied by the F.D.A.'s drug-approval process, a remarkably inflexible system that typically took years.

That same day, another group of protesters marched onto the campus of the National Institutes of Health, in Bethesda, Maryland. They were headed for Building 31, the home of the National Institute of Allergy and Infectious Diseases. Fauci, who had become the institute's director in 1984, was now the government's leading scientist focussed on the AIDS epidemic. Even though he was not running the F.D.A., he appeared almost daily in the media to discuss the crisis. "My face was the face of the federal government," Fauci told me. He was asked the same question nearly every day: why wasn't the government moving faster? It didn't help that the Reagan Administration seemed so indifferent to the plague.

Fauci watched from his office window as activists surrounded the building and tried to scale its walls. Some were dressed in black robes

and carried scythes. Many waved pink-and-black banners, bearing the words "NIH Wake Up!" or "Stop Killing Us!" All over campus, a chant could be heard: "Fuck you, Fauci!"

"God, I hated him," Larry Kramer, the writer and activist who helped establish the two most important AIDS advocacy groups in the country, the Gay Men's Health Crisis and ACT UP, said. "As far as I was concerned, he was the central focus of evil in the world." Kramer attacked Fauci relentlessly in the media. He called him an "incompetent idiot" and a "pill-pushing" tool of the medical establishment, insulted his wife, and even compared him to Adolf Eichmann. In 1988, Kramer published a scathing open letter. "Anthony Fauci, you are a murderer," he wrote. "Your refusal to hear the screams of AIDS activists early in the crisis resulted in the deaths of thousands of Queers."

As the epidemic spread and the death toll rose, it was common for gay activists to view Fauci and NIAID with rage. Fauci did not control the drug-approval process, but he was seen as a barrier to opening access to clinical trials, in which volunteers could receive potentially lifesaving medications.

For most people infected with H.I.V., taking experimental drugs was the only alternative to simply waiting for death. Yet the F.D.A.'s arcane rules prevented the vast majority of patients from qualifying for trials. For instance, a significant number of H.I.V. patients suffered from pneumocystis pneumonia. The condition—the same one observed in the initial C.D.C. report—could be fatal, so many who had it used an experimental antimicrobial medication called pentamidine, which had proved highly effective. But people who took experimental medications were barred from participating in other clinical trials.

At first, Fauci held to the standard N.I.H. line that research need not focus on the immediate welfare of patients. "When we had clinical trials, we, the scientific community and the regulatory community, did not listen" to the activists, he recalled. "It was, at the time, an attitude that many of us had, and I probably had it myself." He was right about that. I covered the AIDS epidemic for the Washington *Post*, and it was clear to me that Fauci was inclined to enforce the paternalistic medical tradition in which he had trained: doctors and scientists were unquestioned

authorities, and drug development had to follow a rigid process that included animal testing and rigorous clinical trials. Otherwise, the benefits and the risks of these drugs could not be adequately assessed. In 1987, the F.D.A. approved the first drug to treat H.I.V.—azidothymidine, or AZT—and the announcement was met with a burst of hope. But the drug's liabilities were evident almost instantly. It had harsh side effects, and the benefits wore off; the virus itself soon became resistant to the drug. When new clinical studies began, involving cocktails of AZT and similar compounds, tens of thousands of people asked to participate. Again, though, volunteers were not accepted if they used other experimental drugs. The anger among activists grew more intense. "They started becoming amazingly iconoclastic and confrontational, and that scared the hell out of the scientists, who were fundamentally quite conservative," Fauci told me at his medical-school reunion. "When they were demonstrating on the N.I.H. campus, disrupting Wall Street, disrupting St. Patrick's Cathedral, instead of listening to them, scientists withdrew."

Without entirely understanding his own motives, Fauci decided to look beyond the activists' furious rhetoric and style. He recalls telling himself, "Let me put aside the goth dress—the earrings and the Mohawk haircuts and the black jackets—and just listen to what they have to say. And what they were saying made absolutely perfect sense." It helped that Fauci had something in common with the activists: "They were all New York guys. I had a little affinity to them because I'm a New Yorker. And I said, What would I do if I were in their shoes? And it was very clear: I would have done exactly the same thing."

The activists knew that they were facing a mercilessly lethal disease. In the summer of 1985, I travelled to New York to write my first long story on the toll that the epidemic was taking on the city's gay community. I interviewed dozens of men. To the best of my knowledge, only two of them are still alive: Larry Kramer, who is now eighty-four, and a political activist who prefers to remain anonymous.

Fauci, too, came to understand the severity of the crisis. "Everyone died," he said. "I was used to treating people who had little hope and then saving their lives—that was so wonderful. But, with AIDS in those

days, I saved no one. It was the darkest time of my life." Faced with mounting evidence that his cautious approach made no sense, he did something that few public officials do: he reversed himself. Fauci transformed from a conventional bench scientist into a public-health activist who happened to work for the federal government. "I had to change," he told me.

When the demonstrators marched on the N.I.H. campus in 1988, Fauci no longer saw a threat. "I looked at them, and I saw people who were in pain," he recalled in an article in *Holy Cross Magazine*. He asked the police and the F.B.I. not to arrest any of them. Then he invited a handful of protest leaders to his office. "That began a relationship over many years," Fauci said. "They let me into their camp. I went to the gay bathhouses and spoke to them. I went to San Francisco, to the Castro District, and I discussed the problems they were having, the degree of suffering that was going on in the community, the need for them to get involved in clinical trials, since there were no other possibilities for them to get access to drugs. And I earned their confidence."

Fauci, in his mid-forties, was the youngest director of an N.I.H. institute in a century, and he lacked the political influence to act independently. Even in his own field, he struggled to recruit allies. "I couldn't convince my own people in infectious-disease leadership to take on H.I.V./AIDS," he told me. So he created a division within his institute devoted to the disease.

One day, in the late eighties, Fauci asked me to stop by his office in Building 31 on the N.I.H. campus. He told me that he had a wild idea: he wanted to hire Mark Harrington, ACT UP's point man on drug-treatment trials. Harrington, a prominent AIDS researcher and activist, had no formal scientific training. But Fauci, like most of those who had seen him testify before Congress or speak to a crowd, was dazzled by his brilliance.

Harrington discussed the idea with Fauci, but decided that the job would be a disaster for him. "There's no way I could have functioned within that bureaucracy," he told me recently. "The people I respect would have

seen me as a sellout." Yet Harrington continued to make a profound impression on Fauci's thinking.

Harrington was passionately committed to loosening up the F.D.A.'s restrictive regime. "It was murder," he told me. "I don't know any other way to describe it." Harrington, who went on to win a MacArthur "genius" grant for his work on the disease, established himself as the most knowledgeable student of the agency's byzantine regulations. In meetings with Fauci and other officials, he urged them to move faster and with greater compassion for those who were suffering.

There are three stages in most F.D.A. clinical trials. The first tests whether a drug is safe. The second assesses its efficacy. The last stage, conducted in larger groups, confirms that the drug works and that there are no serious adverse reactions. Harrington argued that people with no alternative should be granted access to those drugs as soon as they had been proved safe, even if their effectiveness remained unknown.

At first, Fauci was concerned that, if people taking multiple experimental medications joined clinical trials, the results would be hopelessly muddled. He was also afraid that granting sick people unrestricted access to unapproved drugs would deter them from participating in the trials at all. Harrington and other activists reassured him that they were committed to strictly monitored drug trials that would provide enough data to know what worked and what did not.

Fauci is a realist, and the facts were obvious to anyone who cared to look. Traditional methods of testing drugs weren't working. Underground networks were growing everywhere. With so many AIDS patients taking untested medications, federal health officials had to concede that their system was broken. Even the most fundamental protocol of a clinical trial—giving some participants a placebo—came into question. In a study conducted in San Francisco in 1989, nearly all the volunteers had their medicine analyzed, to see whether they were receiving an active dose. Those who learned that they had been given placebos almost invariably dropped out.

"There was a feeling in science that doctors know best, scientists know best," Fauci said. "We love our patients, but they don't really know what's best for them. Then, when we dealt with this disease that was

brand new—that was frightening, that was killing people in a way that was historic—the people who were impacted by the disease wanted to have something to say about how we conducted research."

There were still moments of confrontation. In May, 1990, hundreds of ACT UP activists returned to the N.I.H., demanding more AIDS treatments and greater representation of women and people of color in clinical trials. At a planning session for the protest, a young activist named Tony Malliaris performed a rap song called "Storm the NIH," which included the lyrics "I don't know what Fauci thinks, but this ain't Denmark, and something stinks." (Malliaris died five years later, still in his early thirties.)

Fauci was undeterred. He threw his influence behind a program called Parallel Track, which made unapproved AIDS drugs available as soon as they were demonstrated to be safe, even as clinical trials were continuing. The initiative would not have succeeded without Fauci. But he always acknowledged that his approach had been shaped largely by the constructive pressure he received from AIDS advocacy groups and from leaders like Harrington.

This more inclusive approach ushered in a revolution in American medicine. Patients today demand as much information as possible about treatments they might receive, and no longer act as if their doctors' advice came straight from Mt. Olympus. They scour the Internet, assemble statistics, and often arrive at the hospital with a folder full of medical information. The F.D.A., for its part, will no longer consider approving a new drug until it has consulted representatives of groups who would use it. "There are strict scientific principles that have to be adhered to in medicine," Fauci told me. "At the same time, a humanistic touch is needed in dealing with people. You have to combine social aspects, ethical aspects, personal aspects with cold, clean science."

In 2002, I wrote a Profile of Larry Kramer for this magazine. By then, he and Fauci had become friends, with each expressing gratitude for the other's work in those years. Fauci told me, "In American medicine, there are two eras: before Larry and after Larry. There is no question in my mind that Larry helped change medicine in this country. When all the

screaming and the histrionics are forgotten, that will remain." Kramer, who spent years in a constant rage at Fauci, now calls him "the only true and great hero" among government officials in the AIDS crisis.

As Trump defends his Administration's response to the pandemic, he has suggested repeatedly that COVID-19 was impossible to predict. "There's never been anything like this in history," he said, at a press conference on March 19th. "Nobody knew there would be a pandemic or epidemic of this proportion."

As everyone with even a casual interest in the history of science knows, pandemics have altered the destiny of humanity at least since 430 B.C., when Athens was struck by a plague that killed as many as two-thirds of its residents, just as the Spartans were laying siege. Beginning in 165 A.D., smallpox helped ruin the Roman Empire, sowing more destruction than foreign armies ever could. And, in the fourteenth century, the Black Death swept through Europe, killing more than half the population, according to recent estimates.

Yet, by the middle of the twentieth century, many scientists had begun to conceive of a world that was largely free of infectious epidemics. In 1951, Sir Frank Macfarlane Burnet, a future Nobel laureate in medicine, wrote, "The fever hospitals are vanishing or being turned to other uses. With full use of the knowledge we already possess, the effective control of every important infectious disease"—with the exception of polio—"is possible." His optimism was understandable. Antibiotics had made many lethal diseases easy to treat; improvements in sanitary conditions had transformed the lives of hundreds of millions of people. In developed countries, typhoid, cholera, and measles—major killers throughout history—had largely passed into memory; even tuberculosis, one of the great scourges of humanity, had been in decline for nearly half a century. By 1972, Macfarlane, writing with the microbiologist David White, was predicting that the "most likely forecast about the future of infectious diseases is that it will be very dull."

When Fauci was a young trainee, these kinds of predictions sometimes made him wonder if he had picked the wrong career. "I became

concerned that I was entering . . . an area of biomedical research that was disappearing," he recalled in one speech. But, since 1984, when Fauci became the director of NIAID, there has not been a single day in which some epidemic has not threatened the globe. According to the World Health Organization, AIDS has killed more than thirty million people, and nearly forty million are now living with H.I.V. Tuberculosis, far from sliding into obscurity, infects roughly a quarter of the human population; the W.H.O. says that one and a half million people died from the disease in 2018.

But the greatest threat that humanity faces, by far, is a global outbreak of a lethal virus for which no treatment has been found. In just a few months, COVID-19 has forced billions of people, in nearly every country on earth, into a panicked withdrawal from society. Another pandemic like this might appear in two years, or in ten, or in a century. But I have never met a virologist or an epidemiologist who believes we won't encounter one.

For a deadly virus to flourish, it must meet three critical conditions. First, a new virus—one to which no one has yet developed immunity—must emerge from the animal reservoirs that produce and harbor such pathogens. Second, the virus has to make humans sick. (The vast majority do not.) Finally, it must be able to spread efficiently, through coughing, sneezing, or shaking hands. That combination is rare, but, when it appears, the consequences are almost always disastrous.

The Nobel Prize-winning molecular biologist Joshua Lederberg, who died in 2008, was for years the world's most visionary voice about emerging infectious diseases. "Some people think I am being hysterical, but there are catastrophes ahead," he once wrote. "We live in evolutionary competition with microbes—bacteria and viruses. There is no guarantee that we will be the survivors."

In 2003, Lederberg joined the future F.D.A. commissioner Margaret Hamburg and the pandemic specialist Mark Smolinski to edit a seminal report, in which prominent scientists argued for a much more aggressive defense of the planet. Titled "Microbial Threats to Health," the report recommended that the U.S. greatly expand its early-warning systems, particularly in the developing world. It also urged leaders to strengthen

their ability to respond to microbial threats, with new efforts on the federal, state, and local levels. The recommendations were almost completely ignored.

The next year, a highly pathogenic form of avian influenza, H5N1, leaped from waterfowl to chickens and then to humans. Public-health officials were petrified. In Bangkok, I met with Scott Dowell, who led the Thailand office of the C.D.C.'s International Emerging Infections Program. "The world just has no idea what it's going to see if this thing comes," he told me. He paused and then reframed his thought. "When, really. It's when. I don't think we can afford the luxury of the word 'if' anymore."

In a sense, the world was lucky with H5N1. Although the U.S. and other countries mounted a diffident response, the virus turned out to be deadly but not very contagious. Five years later, the situation was reversed. A new influenza virus, designated H1N1, infected nearly a quarter of the global population before vaccines became widely available. This time, the virus was highly contagious but not nearly as deadly as most strains of influenza. The fact that the outbreak was less virulent than public-health officials had feared created its own danger; by encouraging complacency, it did more to expose the world to the risk of a devastating new pandemic than anything else that had happened in decades. Although Congress had appropriated money to stockpile antiviral medications and protective gear, many scientists felt that the effort was grossly insufficient. "We spend many billions of dollars every year on missile-defense systems," Seth Berkley, a medical epidemiologist who leads the Global Vaccine Alliance, told me. "And yet we will not spend pennies on the dollar to prepare for a catastrophe that is far more likely to affect us all."

After the Ebola outbreak of 2014, Barack Obama implemented one of Lederberg's central recommendations: he established the White House's National Security Council Directorate for Global Health Security and Biodefense, an early-warning system for disease in the developing world. Trump disbanded it in 2018, as part of an effort to streamline the N.S.C. In an appearance before Congress, Fauci was asked if the decision was a mistake. He responded diplomatically: "I wouldn't

necessarily characterize it as a mistake. I would say we worked very well with that office. It would be nice if the office was still there."

The combination of money and political will can have extraordinary effects on public health. Under the George W. Bush Administration, Fauci was the principal architect of a landmark program called PEPFAR, the President's Emergency Plan for AIDS Relief.

By the time Bush took office, therapies for H.I.V. had become widely available in Western countries. But, for millions of people in the developing world, these drugs were too expensive or too difficult to obtain. Bush felt that it was unacceptable for the poorest people on earth to die because they could not afford medication that was dispensed routinely in the rich world. He asked Fauci to implement an initiative to prevent and treat H.I.V. on a global scale. It has been uniformly held up as a model of the ways in which global public-health programs can save lives. "PEPFAR has turned around declining life expectancies in many countries and likely saved some countries—even an entire continent—from economic ruin," Harold Varmus, a former director of the N.I.H. and of the National Cancer Institute, wrote in the quarterly journal *Science & Diplomacy*.

But Fauci has at times struggled to compel politicians and businesses to attack the problems that he considers most worrisome. Over the years, he has become concerned about the possible impact of new viruses, particularly a lethal strain of influenza. Other viruses are more consistently deadly; some, like measles, are more contagious. But no virus that we know of is capable of killing as rapidly and as efficiently. "We need a major paradigm shift with influenza vaccines," Fauci told me, four years ago. "The situation is a mess."

Because the flu virus evolves so rapidly, experts deciding how to formulate vaccines can make only a highly educated guess about which strains are most likely to make people sick. Each February, epidemiologists study outbreaks around the world—especially in the Southern Hemisphere, where flu season is under way—to assess which strains might make their way north. The result is always better than

nothing. In many years, though, it is woefully inadequate. In the flu season of 2014-15, the vaccine protected less than a fifth of the people who received it. In 2017-18, it worked for a little more than a third. Fauci has long supported the development of an alternative: a universal influenza vaccine, which would provide lasting defense against all strains. “Similar to tetanus, a universal flu vaccine probably would be given every ten years,” he said. “And, if you get one that is really universal, you can vaccinate just about everyone in the world.” But such a vaccine would cost hundreds of millions of dollars to develop and test—and would replace a product that most consumers already think of as good enough. No one has come close to raising the money that such a project will require.

By the beginning of the new millennium, it had become clear that the next microbial threat might not come from a bat or a duck. It could just as well be created by a human being. After the terrorist attacks of September 11, 2001, anonymous letters laced with deadly anthrax spores began arriving at media companies and congressional offices. In the following months, twenty-two people were infected by inhaling anthrax and five died. Suddenly, biological terror posed an entirely new threat—one that has become only more significant and complex in the ensuing years. In 2016, James Clapper, who was the director of National Intelligence during the Obama Administration, listed gene editing as a potential weapon of mass destruction. Many scientists were furious, but he had a point. Researchers have deployed these tools to rewrite the genes of mosquitoes so that they are unable to transmit malaria. If their success in the lab translates to the field, it will be a historic triumph. But the research also raises an alarming possibility: if a scientist can modify the genes of an insect to protect people from malaria, he could almost certainly use the same technology to add a deadly toxin.
Fauci often cites a similar but more immediate paradox. Thanks to genetic engineering, we are more equipped than ever to respond to the threat of a viral pandemic. After the COVID-19 outbreak began, it took scientists less than a month to sequence the genome of the virus. By the

end of February, the instructions were on the Internet, and the virus had been re-created in laboratories around the world, by scientists seeking to develop drugs and vaccines.

And yet, despite our mastery of molecular biology, we live in an era in which someone can wake up with an infection in China—or France, Australia, or any other place with an airport—and fly to San Francisco in time for dinner, spreading the virus long before he suspects that there's anything wrong. For most of human history, a virus like COVID-19 might have killed many people in the community where it originated, but then stopped spreading. According to a comprehensive analysis carried out by the *Times*, at least four hundred and thirty thousand people have arrived in the U.S. on direct flights from China since the outbreak began. Forty thousand have arrived in the two months since Trump imposed restrictions on travellers from China trying to enter the country.

Fauci insists that an adequate defense against future pandemics will have to be flexible. "I have been saying for eight, ten years that we should make a list of microbes and try to develop a basic platform vaccine," he told me in 2016. A platform vaccine addresses an entire class of virus, not just a particular strain. "We keep trying to develop a vaccine for one thing—usually the last one—and it's a waste of time," he said. "Every time we get hit, it is always something we didn't expect. So, instead of predetermining what it is you're going to prepare for, make universal platforms."

Such an approach is eminently possible. Using gene-sequence information and synthetic DNA, biologists are now capable of making parts of a vaccine in advance. It takes almost no time to sequence a viral strain, and with that information it should be possible to complete a bespoke vaccine in a matter of weeks. "You could build a chassis for the vaccine, and you would have it on the shelf," Fauci said. "Then all you would need to do is insert the gene of the protein you want to express and make a gazillion doses and send it out."

There are even more futuristic aspirations: the genomics pioneer J. Craig Venter has proposed using a sort of 3-D printer to manufacture vaccines on demand. It is already possible to print the nucleotides that make up DNA and assemble them. Venter argues that, in the time it takes for an

infected person to fly from one side of the world to the other, we should be able to print, assemble, and administer a vaccine.

To even contemplate creating these kinds of treatments, Fauci says, would require building an entirely new system for making vaccines before a pandemic arises. But, in addition to the scientific obstacles, this would cost billions of dollars, and no company or politician has been willing to spend the money. Perhaps, just as AIDS transformed our approach to clinical trials, our experience with COVID-19 will change our attitudes about preventing infectious diseases. A proper investment in both research and emergency preparedness would have prevented at least some of the unspeakable human loss we are now experiencing and the economic crash that has just begun.

The COVID-19 epidemic will eventually fade, but the public will demand a reckoning. Inevitably, there will be an investigation, along the lines of the 9/11 Commission, to look into the ramifications of the President's denialism, the shortages in testing and medical equipment, and the dismissal of so many warning signs. Fauci will not necessarily escape criticism. He is an excellent spokesman for the value of scientific research, but he runs a single institute, and he lacks the authority to broadly reshape our response to pandemics. "The kinds of things we really desperately need as foundational tools for dealing with this stuff aren't necessarily research enterprises," Harold Varmus told me. "Tony isn't running C.D.C. He's not running FEMA. To tell him to stockpile defense mechanisms or to move forward surveillance tools into massive operations around the world—that's just not his remit."

Even Fauci's current value as a scientific adviser has been limited by the President's contempt for expertise. Trump's coronavirus kitchen cabinet consists of people like his son-in-law, Jared Kushner, who has no medical knowledge or experience managing crises—yet has been appointed to direct the response to the biggest medical emergency since the influenza pandemic of 1918. Trump has also turned for advice to Dr. Mehmet Oz, who for years has endorsed worthless treatments and used his television show to promote notorious quacks. Trump even seems to think that his trade adviser, Peter Navarro, should debate Fauci about the value of specific drugs. When Navarro, who has a doctoral degree in

economics, was asked about his medical qualifications, he said, “I have a Ph.D. And I understand how to read statistical studies, whether it’s in medicine, the law, economics, or whatever.”

Among Navarro’s enthusiasms is the malaria drug hydroxychloroquine, which he believes could cure COVID-19. There is currently no evidence to support this conclusion, as Fauci has pointed out on several occasions. On April 5th, as Trump continued to tout the drug as a miracle cure, a reporter at the daily briefing asked Fauci to comment. Trump refused to allow him to speak. In an appearance two days later, Trump kept up the hype. “I say try it,” he said. “You’re not gonna die from this pill.” Not long afterward, he even suggested that zinc might help.

To plan a coherent biological future, rather than simply scramble to contain each new pandemic, will require an entirely new kind of political commitment. It would certainly include the creation of a permanent position, a special assistant to the President for biological defense. Similar jobs have existed in the past, but not for long, and not with enough influence to matter. David Relman, the Stanford professor, told me, “This kind of job needs somebody with the authority to preside over domestic and international threats, both natural and deliberate. And that person has to sit in the White House with immediate access to the President. Without that, we will really have nothing that can work.”

Until then, we have Fauci, a seventy-nine-year-old infectious-disease expert pinned between Donald Trump and the American people. It can’t be easy. As Fauci recently put it, with characteristic candor, “I give the appearance of being optimistic. But, deep down, I just do everything I possibly can, assuming that the worst will happen, and I’ve got to stop the worst from happening.” ◆

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