

I AM THE Cavalry

Where Bits & Bytes Meet Flesh & Blood

CyberSafety in Healthcare Delivery

National Committee on Vital & Health Statistics January, 25 2022

Joshua Corman **@joshcorman** **@iamthecavalry**

www.iamthecavalry.org

I AM THE Cavalry

I Am The Cavalry is a grassroots organization focused on the intersection of digital security, public safety, and human life.

Safer. Sooner. Together.

iamthecavalry.org/about

THE



Context & Inflection Points

Through our over dependence on undependable IT, we have created the conditions such that the actions any single outlier can have a profound and asymmetric impact on human life, economic, and national security.

I AM THE Cavalry

Hippocratic Oath for Connected Medical Devices

I will revere and protect human life and act always for the benefit of my patients. I recognize that all systems fail; inherent defects and adverse conditions are inevitable. Capabilities meant to improve or save life, may also harm or end life. Where failure impacts patient safety, care delivery must be resilient against both indiscriminate accidents and intentional adversaries. Each of the roles in a diverse care delivery ecosystem shares a common responsibility: As one who seeks to preserve and improve life, I **must first do no harm.**

To that end, I swear to fulfill, to the best of my ability, these principles.

- 1. Cyber Safety by Design:** I respect domain expertise from those that came before. I will inform design with security lifecycle, adversarial resilience, and secure supply chain practices.
- 2. Third-Party Collaboration:** I acknowledge that vulnerabilities will persist, despite best efforts. I will invite disclosure of potential safety or security issues, reported in good faith.
- 3. Evidence Capture:** I foresee unexpected outcomes. I will facilitate evidence capture, preservation, and analysis to learn from safety investigations.
- 4. Resilience and Containment:** I recognize failures in components and in the environment are inevitable. I will safeguard critical elements of care delivery in adverse conditions, and maintain a safe state with clear indicators when failure is unavoidable.
- 5. Cyber Safety Updates:** I understand that cyber safety will always change. I will support prompt, agile, and secure updates.

Connections and Ongoing Collaborations



Security
Researchers



Patients



Device
Makers



Policy
Makers



Insurers
& Payers



Physicians &
Care Givers



Standards
Organizations



Healthcare
Providers



Government
Agencies





Warnings & Warning Signs





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HEALTH CARE INDUSTRY CYBERSECURITY TASK FORCE

June 2017

**REPORT ON IMPROVING CYBERSECURITY IN THE
HEALTH CARE INDUSTRY**

HEALTHCARE CYBERSECURITY IS IN CRITICAL CONDITION

Severe Lack of Security Talent

The majority of health delivery orgs lack full-time, qualified security personnel

Legacy Equipment

Equipment is running on old, unsupported, and vulnerable operating systems.

Premature/Over-Connectivity

'Meaningful Use' requirements drove hyper-connectivity without secure design & implementation.

Vulnerabilities Impact Patient Care

One security compromise shut down patient care at Hollywood Presbyterian and UK Hospitals

Known Vulnerabilities Epidemic

One legacy, medical technology had over 1,400 vulnerabilities



*If you can't afford to **protect** it
then
you can't afford to **connect** it*

*With great **connectivity**
comes great **responsibility***



Ooops, your files have been encrypted!

English

Payment will be raised on

5/15/2017 14:57:41

Time Left

02:23:59:02

Your files will be lost on

5/19/2017 14:57:41

Time Left

06:23:59:02

[About bitcoin](#)

[How to buy bitcoins?](#)

[Contact Us](#)

What Happened to My Computer?

Your important files are encrypted.

Many of your documents, photos, videos, databases and other files are no longer accessible because they have been encrypted. Maybe you are busy looking for a way to recover your files, but do not waste your time. Nobody can recover your files without our decryption service.

Can I Recover My Files?

Sure. We guarantee that you can recover all your files safely and easily. But you have not so enough time.

You can decrypt some of your files for free. Try now by clicking <Decrypt>.

But if you want to decrypt all your files, you need to pay.

You only have 3 days to submit the payment. After that the price will be doubled.

Also, if you don't pay in 7 days, you won't be able to recover your files forever.

We will have free events for users who are so poor that they couldn't pay in 6 months.

How Do I Pay?

Payment is accepted in Bitcoin only. For more information, click <About bitcoin>.

Please check the current price of Bitcoin and buy some bitcoins. For more information, click <How to buy bitcoins>.

And send the correct amount to the address specified in this window.

After your payment, click <Check Payment>. Best time to check: 9:00am - 11:00am



Send \$300 worth of bitcoin to this address:

115p7UMMngoj1pMvkpHijcRdfJNXj6LrLn

Copy

Check Payment

Decrypt

ANDY GREENBERG SECURITY 08.22.18 05:00 AM

THE UNTOLD STORY OF NOTPETYA, THE MOST DEVASTATING CYBERATTACK IN HISTORY

SHARE



SHARE
18183



TWEET



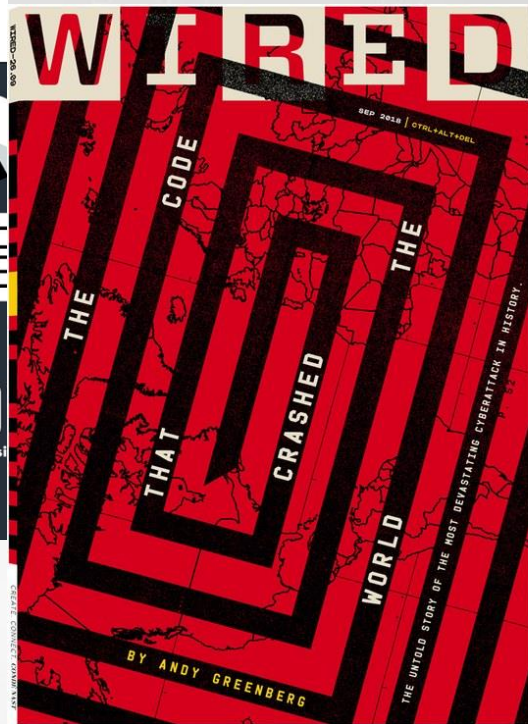
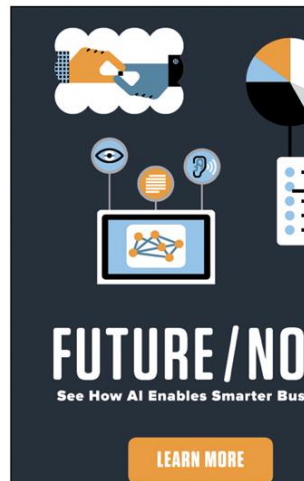
COMMENT



EMAIL

IT WAS A perfect sunny summer afternoon in Copenhagen when the world's largest shipping conglomerate began to lose its mind.

The headquarters of A.P. Møller-Maersk sits beside the breezy, cobblestoned esplanade of Copenhagen's harbor. A ship's mast carrying the Danish flag is planted by the building's northeastern corner, and six stories of blue-tinted windows look out over the water, facing a dock where the Danish royal family parks its yacht. In the building's basement, employees can browse a corporate gift shop, stocked with Maersk-branded bags and ties, and even a rare



The book cover features a central vertical panel with a black and white wavy, optical illusion pattern. This central panel is flanked by two vertical gray panels, each containing a large, blurred red letter: 'S' on the left and 'M' on the right. The title 'SANDWORM' is printed in white, bold, sans-serif capital letters within a red rectangular box at the top of the central panel. Below the title, the subtitle 'A NEW ERA OF CYBERWAR AND THE HUNT FOR THE KREMLIN'S MOST DANGEROUS HACKERS' is written in smaller, white, sans-serif capital letters within a red rectangular box. At the bottom of the central panel, the author's name 'ANDY GREENBERG' is displayed in white, bold, sans-serif capital letters within a red rectangular box.

SANDWORM

A NEW ERA OF CYBERWAR
AND THE HUNT FOR THE KREMLIN'S
MOST DANGEROUS HACKERS

ANDY GREENBERG

SPECIAL ARTICLE

Delays in Emergency Care and Mortality during Major U.S. Marathons

Anupam B. Jena, M.D., Ph.D., N. Clay Mann, Ph.D., Leia N. Wedlund,
and Andrew Olenski, B.S.

ABSTRACT

BACKGROUND

Large marathons frequently involve widespread road closures and infrastructure disruptions, which may create delays in emergency care for nonparticipants with acute medical conditions who live in proximity to marathon routes.

SPECIAL ARTICLE

CONCLUSIONS

Medicare beneficiaries who were admitted to marathon-affected hospitals with acute myocardial infarction or cardiac arrest on marathon dates had longer ambulance transport times before noon (4.4 minutes longer) and higher 30-day mortality than beneficiaries who were hospitalized on nonmarathon dates. (Funded by the National Institutes of Health.)

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Large marathons frequently involve widespread road closures and infrastructure disruptions, which may create delays in emergency care for nonparticipants with acute medical conditions who live in proximity to marathon routes.

cybermedsummit.com ≡

CYBERMED SUMMIT

Phoenix, 8-9 June 2017

ATTEND



B425 Sim Rm 5 Ceiling Camera



Fears of hackers targeting hospitals, medical devices | ABC News

9,178 views • Jun 29, 2017

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Fears of hackers targeting hospitals, medical devices | ABC News

9,178 views • Jun 29, 2017

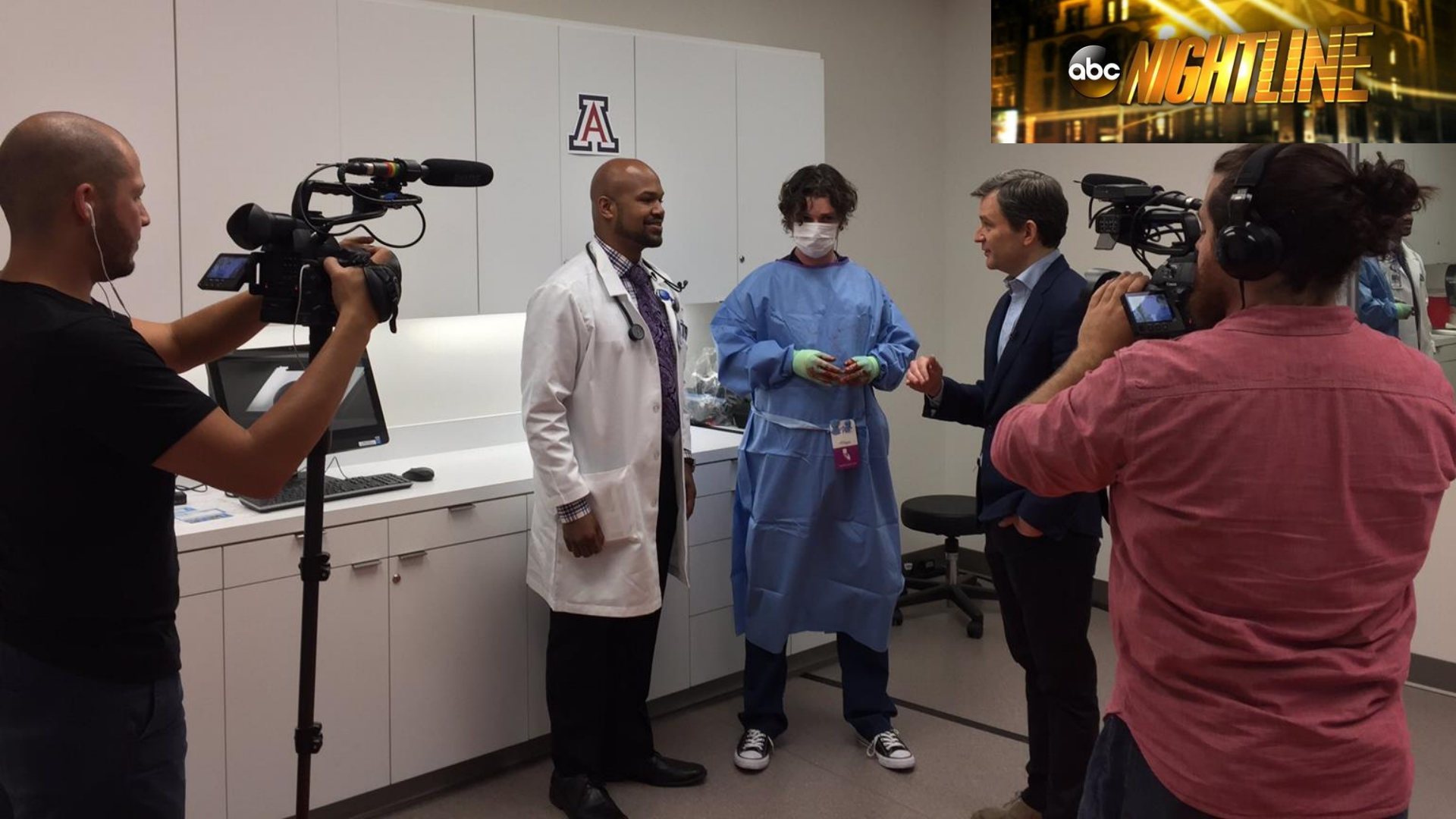
👍 168 💬 18 ➦ SHARE ➦+ SAVE ...



Fears of hackers targeting hospitals, medical devices | ABC News

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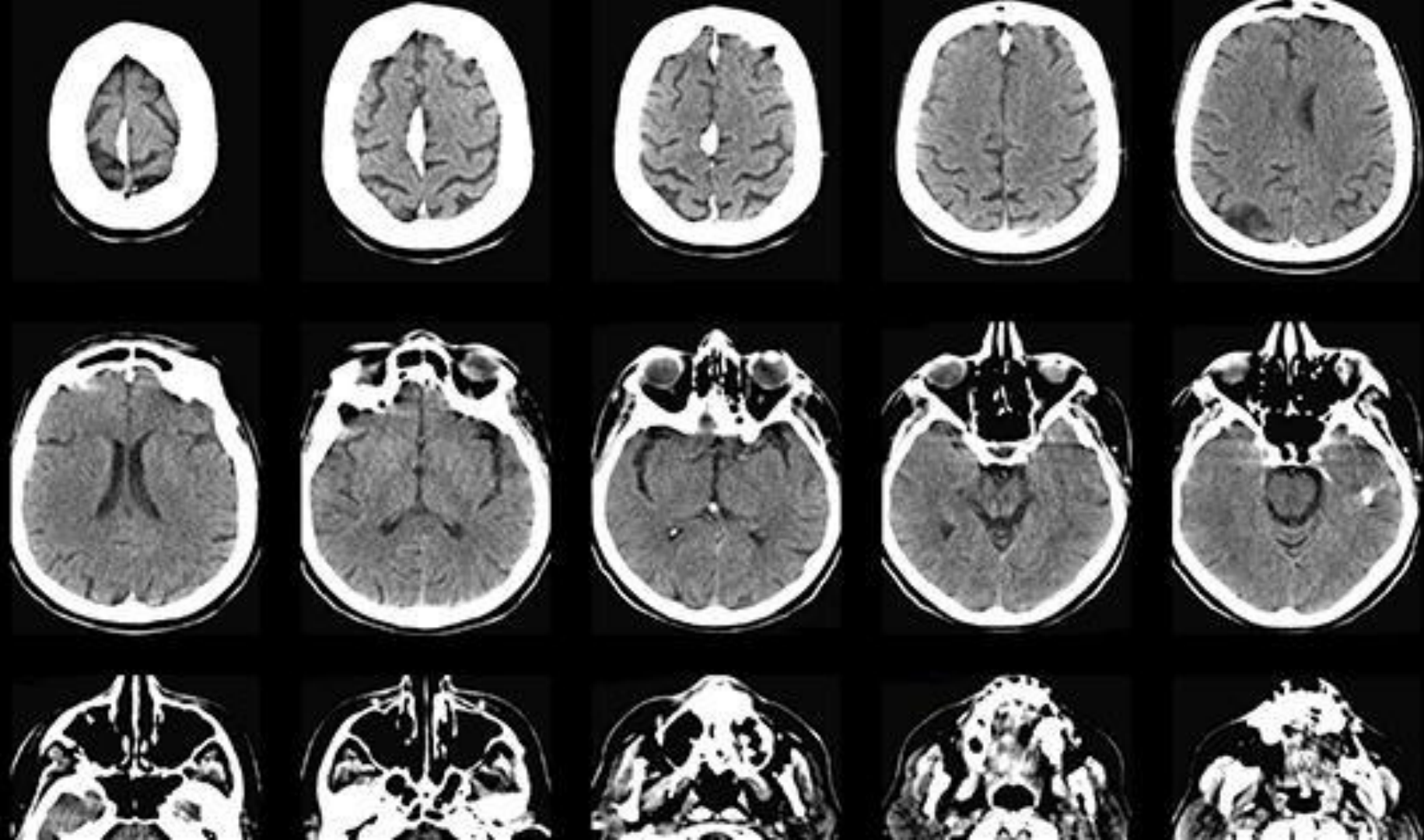


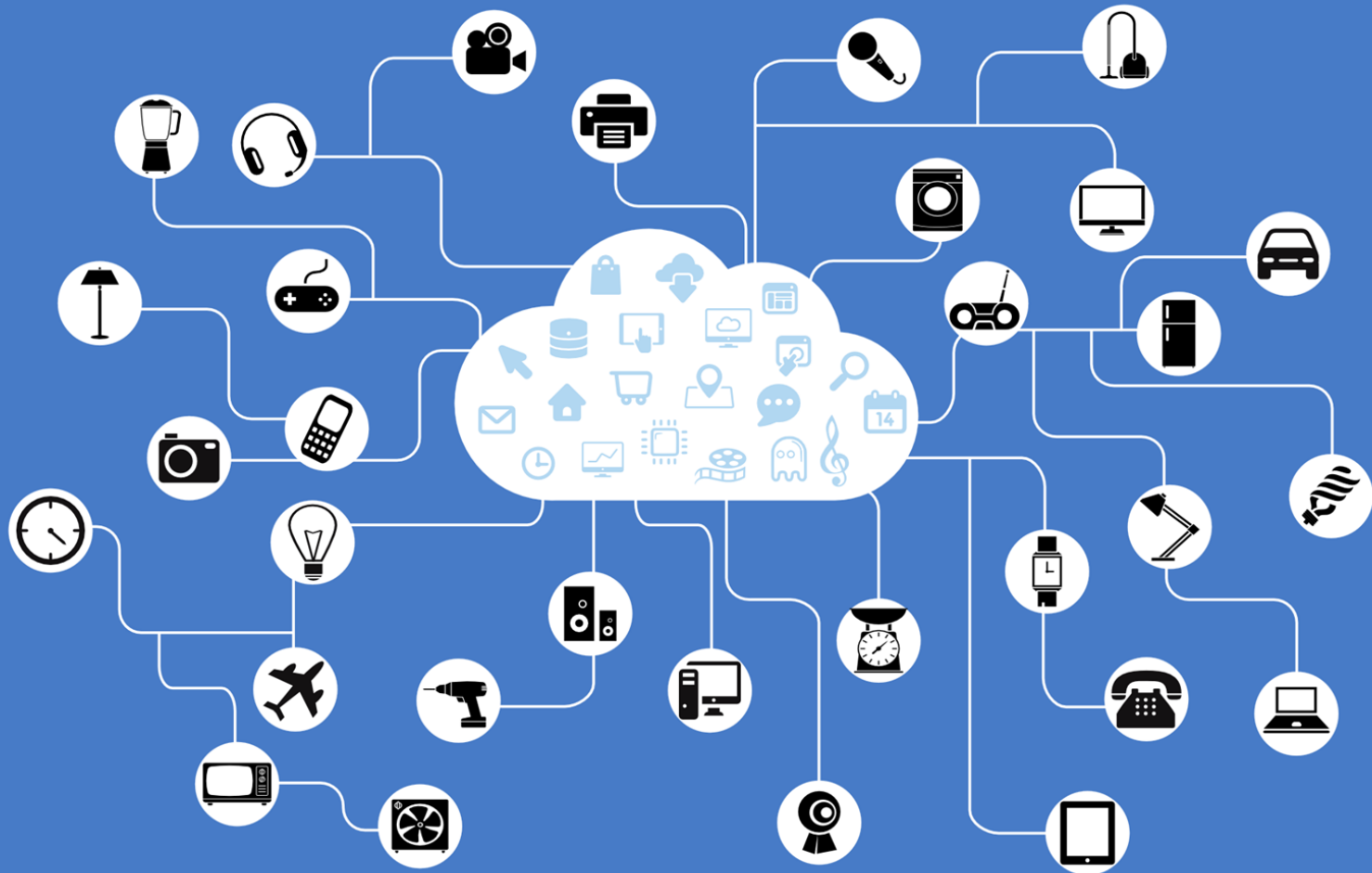


College of Medicine
Phoenix

A cyber healthcare crisis is unfolding in Phoenix, with severe implications on patient care, industry, government, and citizens' trust extending far beyond any single hospital's borders. How do government entities, the private sector, and others respond to this escalating situation?









The Pandemic & Breaking Points

"All the News
That's Fit to Print"

The New York Times

VOL. CLXX.... No. 59,091

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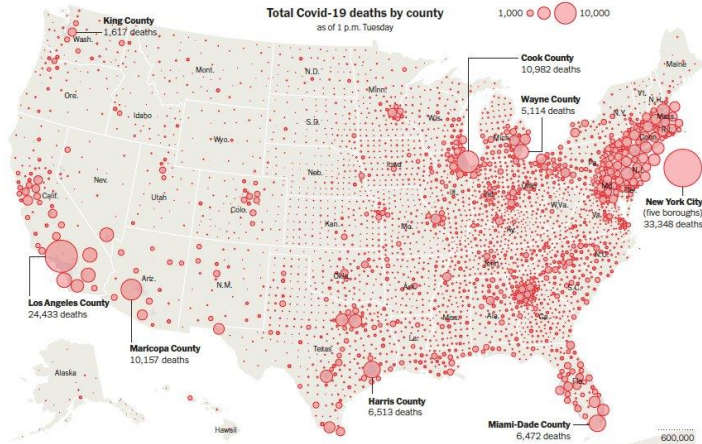
NEW YORK, WEDNESDAY, JUNE 16, 2021

\$3.00

Late Edition

Today, plenty of sunshine, less humid than recent days, high 78. Tonight, mostly clear, light winds, low 58. Tomorrow, mostly sunny, dry, high 77. Weather map, Page B12.

'MOMENTOUS': NEW YORK AND CALIFORNIA OPEN



Nation Approaching 600,000 Deaths, Despite Progress

By DAN LEVIN
and JULIE BOSMAN

It is a number that once seemed unimaginable.

In the next few days, the United States will surpass 600,000 deaths from Covid-19, the highest known death toll in the world. The milestone approaches even though virus cases and deaths in this country have sharply fallen, vaccinations have been distributed widely, and many people have shed their masks and resumed pre-pandemic lives.

Yet the coronavirus remains agonizingly present for those who knew the hundreds across the country still dying of it each day.

In April, one of the victims was Toni Gallo, 67, of Valparaiso, Ind., who had been sick with the virus for five months. "The world has lost a loving shining star," her obituary read. On May 25, the coronavirus claimed the life of Frank Sanchez Jr., a 61-year-old Army veteran from Nekimi, Wis.; he was a union leader and lover of music who had built a successful D.J. business with his wife. Last week, Officer Ryan Barham, 43, of the Sanaville, Calif., police died from the virus, the department announced.

Though the sheer number of deaths in the United States is higher than anywhere else, the country's toll is lower, on a per capita basis, than in many European and Latin American countries, including Peru, Brazil, Belgium and Italy. It is 10 times the toll that former President Donald J. Trump once predicted.

"It's a tragedy," said Stephen Morse, a professor of epidemiology at the Columbia University Medical Center. "A lot of that tragedy was avoidable, and it's still happening."

In the early days of the pandemic, federal officials had shocked the country by announcing at a White House briefing that even with strict stay-at-home orders, the virus might kill as many as 240,000 Americans.

"As sobering a number as that is, we should be prepared for it."

Lifting Most Limits on Businesses and Social Events

By LUIS FERRÉ-SADURNÍ
and SHAWN HUBLER

The governors of New York and California, the states hit earliest and hardest by the pandemic, triumphantly announced on Tuesday that they had lifted virtually all coronavirus restrictions on businesses and social gatherings as both states hit milestones in vaccinating their residents.

In New York, where 70 percent of adults have received at least one dose of the vaccine, the order from Gov. Andrew M. Cuomo means that restaurants will no longer be forced to space tables six feet apart, movie theaters will be allowed to pack their auditoriums without spacing seats apart, and entering commercial buildings won't require a temperature check.

"This is a momentous day, and we deserve it because it has been a long, long road," Mr. Cuomo said at the World Trade Center in Lower Manhattan on Tuesday, adding that the changes meant a "return to life as we know it."

In California, where 72 percent of adults have received at least one dose of the vaccine, Gov. Gavin Newsom called Tuesday "re-opening day," as he lifted similar capacity limits on businesses and social distancing requirements, with some exceptions.

Businesses in both states, however, will still have the option of requiring health precautions on their premises. The two governors, both Democrats who are facing political difficulties, made their announcements at events that seemed more like rallies than news conferences.

For all the celebration, however, the nation was also poised to reach 600,000 dead from the coronavirus, a grim reminder of the virus's painful toll even as Americans begin to enjoy a summer with significantly fewer limitations, if any, on their ability to live, work and socialize. More than 63,000 have died from the virus in California, while in New York that number has reached nearly 53,000 — the two highest totals in

A Once Unfathomable Toll

According to a New York Times database of Covid-19 fatalities, the country is nearing a death toll of 600,000. The first reported coronavirus death was on Feb. 29, 2020, in Washington State. Several people are now known to have died earlier in February, and scientists believe others died from the virus before then, when the cause was unknown.

The pace of every 100,000 deaths nationwide



Source: Reports from state and local health agencies

CHARLES SMART, LARSEN LEATHERBY AND BILL MARSH FOR THE NEW YORK TIMES

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Select a dashboard:

- ☐ Weekly Excess Deaths
- ☐ Excess deaths with and without COVID-19
- ☒ Excess deaths with and without weighting
- ☐ Number of Excess Deaths

[Update Dashboard](#)

- ☐ Percent Excess Deaths
- ☐ Weekly Number of Deaths by Age
- ☐ Weekly Number of Deaths by Race/Ethnicity
- ☐ Change in Number of Deaths by Race/Ethnicity

- ☐ Weekly Number of Deaths by Cause Group
- ☐ Weekly Number of Deaths by Cause Subgroup
- ☐ Change in the Number of Deaths by Cause
- ☐ Total number above average by cause
- ☐ Total number above average by jurisdiction/cause

Download Data:

CSV Format:

- [National and State Estimates of Excess Deaths](#)
- [Weekly Deaths by State and Age](#)
- [Weekly Deaths by State and Cause of Death](#)
- [Weekly Deaths by State and Race and Ethnicity](#)

Data.CDC.gov^[?]:

- [National and State Estimates of Excess Deaths](#)
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- [Weekly Deaths by State and Race and Ethnicity](#)

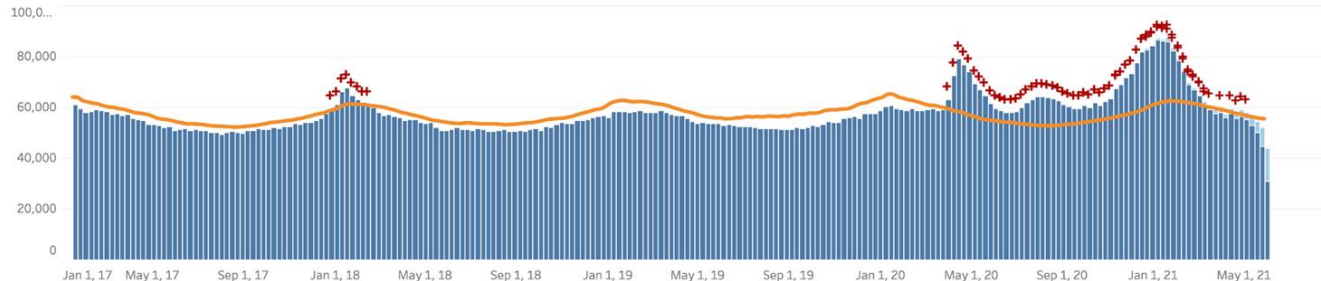
Select a jurisdiction:

United States

- + indicates observed count above threshold
- Predicted number of deaths, accounting for underreporting (weighted)
- Reported number of deaths (unweighted; does not account for underreporting)
- upper bound threshold for excess deaths

Weekly number of deaths (from all causes)

Comparing predicted (weighted) and reported (unweighted) estimates



SPECIAL ARTICLE

CONCLUSIONS

Medicare beneficiaries who were admitted to marathon-affected hospitals with acute myocardial infarction or cardiac arrest on marathon dates had longer ambulance transport times before noon (4.4 minutes longer) and higher 30-day mortality than beneficiaries who were hospitalized on nonmarathon dates. (Funded by the National Institutes of Health.)

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Large marathons frequently involve widespread road closures and infrastructure disruptions, which may create delays in emergency care for nonparticipants with acute medical conditions who live in proximity to marathon routes.

Patients of a Vermont Hospital Are Left 'in the Dark' After a Cyberattack

A wave of damaging attacks on hospitals upended the lives of patients with cancer and other ailments. "I have no idea what to do," one said.



The University of Vermont Medical Center in Burlington, Vt., was the victim of a cyberattack in late October. Elizabeth Frantz for The New York Times



By Ellen Barry and Nicole Perlroth

Published Nov. 26, 2020 Updated Dec. 14, 2020









Morbidity and Mortality Weekly Report (MMWR)

CDC



Impact of Hospital Strain on Excess Deaths During the COVID-19 Pandemic — United States, July 2020–July 2021

Weekly / November 19, 2021 / 70(46);1613–1616

Geoffrey French, MA¹; Mary Hulse, MPA¹; Debbie Nguyen²; Katharine Sobotka²; Kaitlyn Webster, PhD²; Josh Corman¹; Brago Aboagye-Nyame²; Marc Dion²; Moira Johnson²; Benjamin Zalinger, MA²; Maria Ewing² ([View author affiliations](#))

[View suggested citation](#)

Summary

What is already known about this topic?

COVID-19 surges have stressed hospital systems and negatively affected health care and public health infrastructures and national critical functions.

What is added by this report?

The conditions of hospital strain during July 2020–July 2021, which included the presence of SARS-CoV-2 B.1.617.2 (Delta) variant, predicted that intensive care unit bed use at 75% capacity is associated with an estimated additional 12,000 excess deaths 2 weeks later. As hospitals exceed 100% ICU bed capacity, 80,000 excess deaths would be expected 2 weeks later.

What are the implications for public health practice?

State, local, tribal, and territorial leaders could evaluate ways to reduce strain on public health and health care infrastructures, including implementing interventions to reduce overall disease prevalence such as vaccination and other prevention strategies, and ways to expand or enhance capacity during times of high disease prevalence.

Surges in COVID-19 cases have stressed hospital systems, negatively affected health care and public health infrastructures, and degraded national critical functions (1,2). Resource limitations, such as available hospital space, staffing, and supplies led some facilities to adopt crisis standards of care, the most extreme operating condition for hospitals, in which the focus of medical decision-making shifted from achieving the best outcomes for individual patients to addressing the immediate care needs of larger groups of patients (3). When hospitals deviated from conventional standards of care, many preventive and elective

Article Metrics

Altmetric:

Citations:

Views:

Views equals page views plus PDF downloads

[Metric Details](#)

[Figure](#)

[References](#)

Related Materials

[PDF](#)  [319K]

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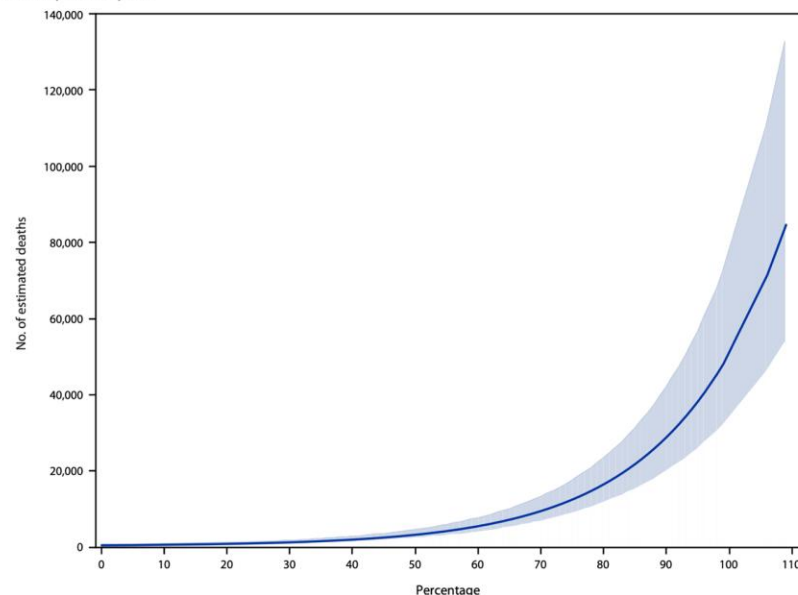
[Figure](#)

[References](#)

Related Materials

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FIGURE. Estimated number of excess deaths* 2 weeks after corresponding percentage of adult intensive care unit bed occupancy — United States, July 2020–July 2021



* Upper and lower boundaries of shaded area indicate 95% CIs.

Cybersecurity & Infrastructure Security Agency, unpublished data, 2021). As hospitals exceed 100% ICU bed capacity, 80,000 (95% CI = 53,576–132,765) excess deaths would be

health care and public health sectors, with excess deaths emerging in the weeks after a surge in COVID-19 hospitalizations. The results of this study support a larger body of evidence

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1



2



3



4



IT Security



Supply Chain



OT Security



Insider Threat



Physical Security



Interoperable Communications

CISA INSIGHTS



Provide Medical Care is in Critical Condition: Analysis and Stakeholder Decision Support to Minimize Further Harm

September 2021

CRITICAL INFRASTRUCTURE DECISION SUPPORT

As the COVID-19 pandemic reaches another phase, with increased and protracted strains on the nation's critical infrastructure and related National Critical Functions such as *Provide Medical Care*, CISA is undertaking a renewed push for cyber preparedness and resilience, as well as decision support for stakeholders within critical infrastructure sectors. Over time, we find these original insights increasingly valuable, and in service of timely decision support, we offer them to you in their original form. As British statistician George E. P. Box noted, "All models are wrong, but some are useful." We hope that these models and insights are useful to you and stimulate additional discussion and exploration for mutual benefit.

This CISA Insight will speak to:

- Analysis and insights into strains on the nation's critical infrastructure, specifically through impacts to the National Critical Function *Provide Medical Care*,
- The compounding risks and harms that apply to all critical infrastructure sectors and the 55 National Critical Functions, through impact to essential critical infrastructure workers, and
- Our intention to share our preliminary analysis, enable decision support, and assist in risk reduction across multiple stakeholders and critical infrastructure sectors.

By late September, at least four states have declared Crisis Standards of Care (CSC), and an additional eight have delayed elective surgeries and/or are at risk of enacting CSC. Patient diversions across state lines further punctuate the dynamic we outlined in the Cascading failures model (see page 7).

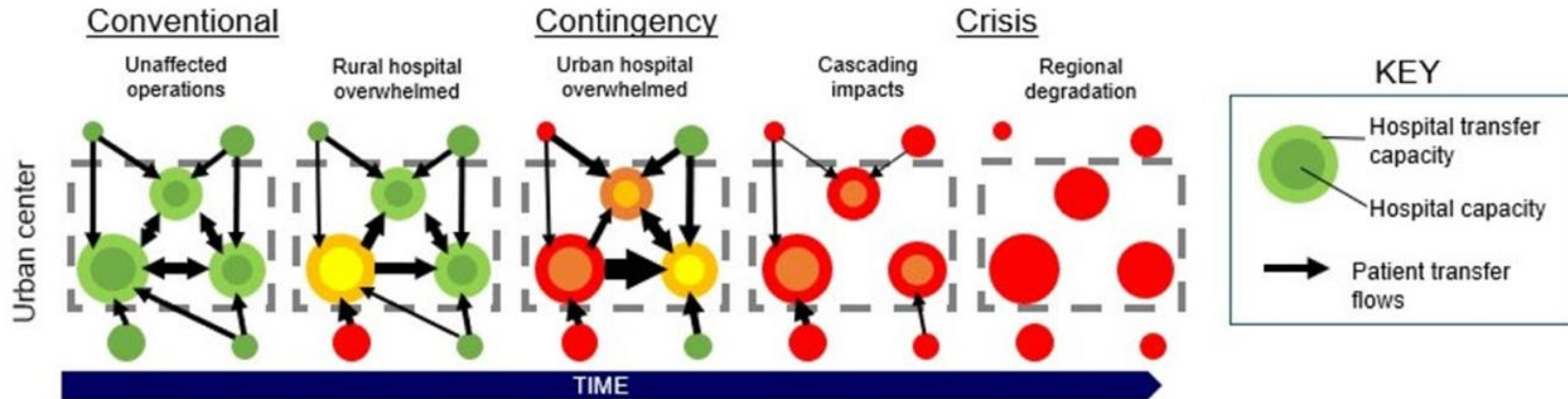


Figure 2 – Conceptual Model of Cascading Impacts of COVID-19 Surge

DEFEND TODAY,
SECURE TOMORROW

Provide Medical Care is in Critical Condition:
Analysis and Stakeholder Decision Support to Minimize Further Harm

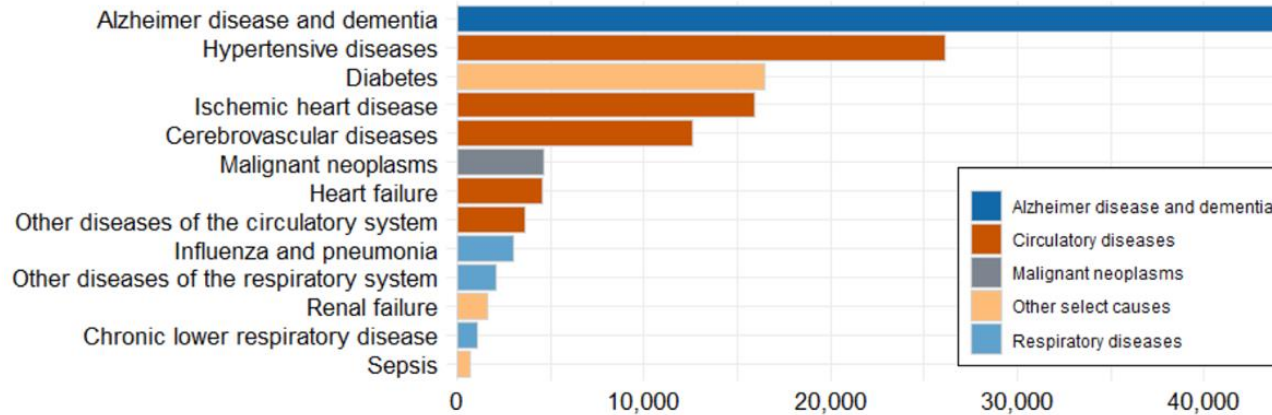


Figure 4 – 2020 U.S. Deaths Above Average, Excluding COVID-19

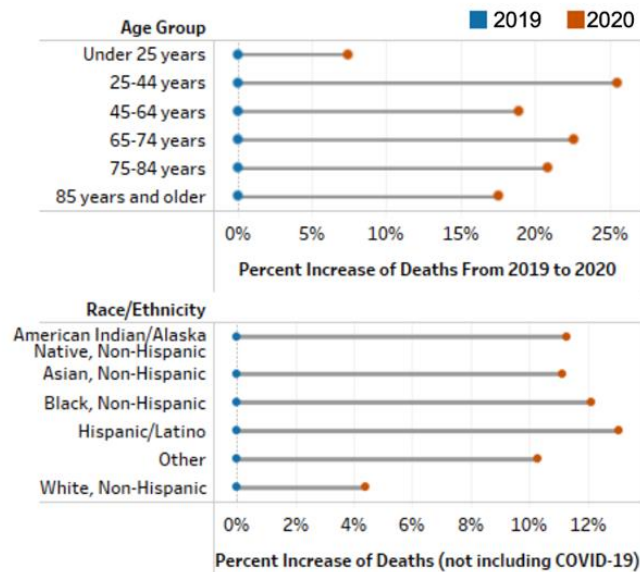


Figure 5 – COVID-19 Deaths 2019 to 2020 Comparison Within Demographics

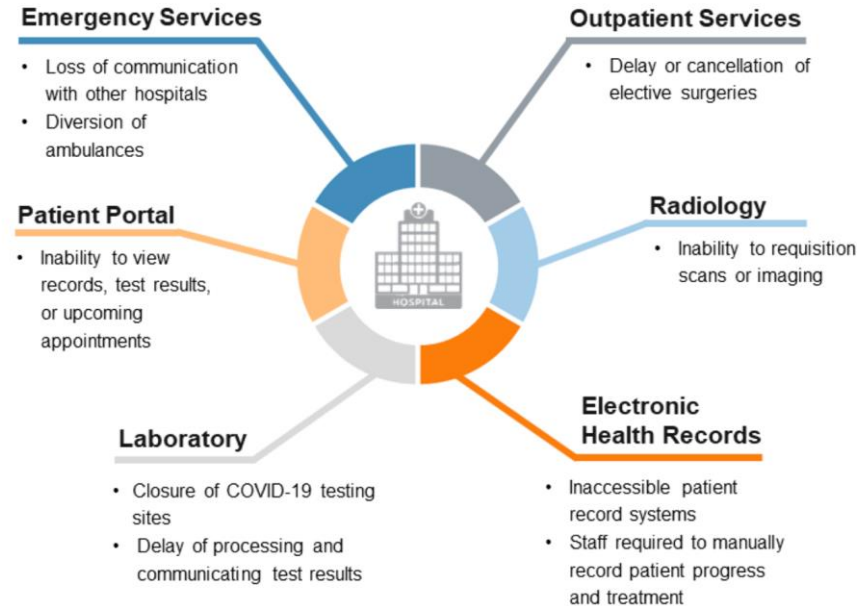
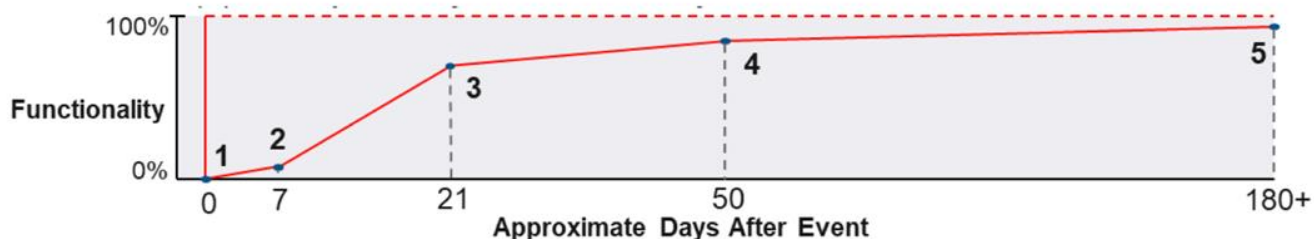


Figure 6 – Hospital System Services and Departments Disrupted by Cyber Attack



1. Immediately after the event, the entire IT network is down, no access to online systems.
2. Available offline back-ups of the system are accessible, restoring access to some.
3. Experts begin returning network functionality to systems after clearing hardware.
4. Majority of hardware has restored access. However, some tools remain offline for cleaning/repair.
5. All hardware has access restored. Some tools may remain out of service or require more cleaning.

Figure 7 – Conceptual IT System Functionality Status After a Ransomware Event

Cyber attacks lead to **1) IT network failure** and disrupt the ability of healthcare systems to access electronic health records (EHRs) and may close hospitals with IT network-based services—such as cardiac technology—and increase hospital strain (i.e., reduced capacity to take in new patients diverting critical care patients to further hospitals). **2) Ambulance diversion**, which is an important system-level interruption that causes delays in treatment and effecting time tolerance, lowering quality of care. In the long term, hospitals that experience cyber events are more likely to experience **3) hospital strain** (measured by ICU bed utilization), worsening health outcomes and contribute to **4) increased mortality**.



Figure 8 – Conceptual Model of Impact of Cyber Attack on Patient Outcomes



The Road(s) Ahead...



PRESIDENT BIDEN'S EXECUTIVE ORDER ON IMPROVING
THE NATION'S CYBERSECURITY

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2021

IST Institute for
SECURITY + TECHNOLOGY

RANSOMWARE
TASK FORCE

Combating Ransomware

“In 2020, 560 healthcare facilities were hit by ransomware attacks in the U.S. alone.”



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NOVEMBER 26, 2020

The New York Times

**Patients of a Vermont Hospital
Are Left 'in the Dark'
After a Cyberattack**



“... clinicians were forced
to send away hundreds of
cancer patients ...”



7:35 / 22:06



JUNE 29, 2017



**Fears of hackers targeting
US hospitals, medical devices
for cyber attacks**

“... about 85 percent ... don’t
have a single qualified
security person on staff.”



7:47 / 22:06



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Hippocratic Oath for Connected Medical Devices

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To that end, I swear to fulfill, to the best of my ability, these principles.

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Connections and Ongoing Collaborations



Security
Researchers



Patients



Device
Makers



Policy
Makers



Insurers
& Payers



Physicians &
Care Givers



Standards
Organizations



Healthcare
Providers



Government
Agencies

“Best Practices”...
...aren’t

“Good Enough”...
...isn't

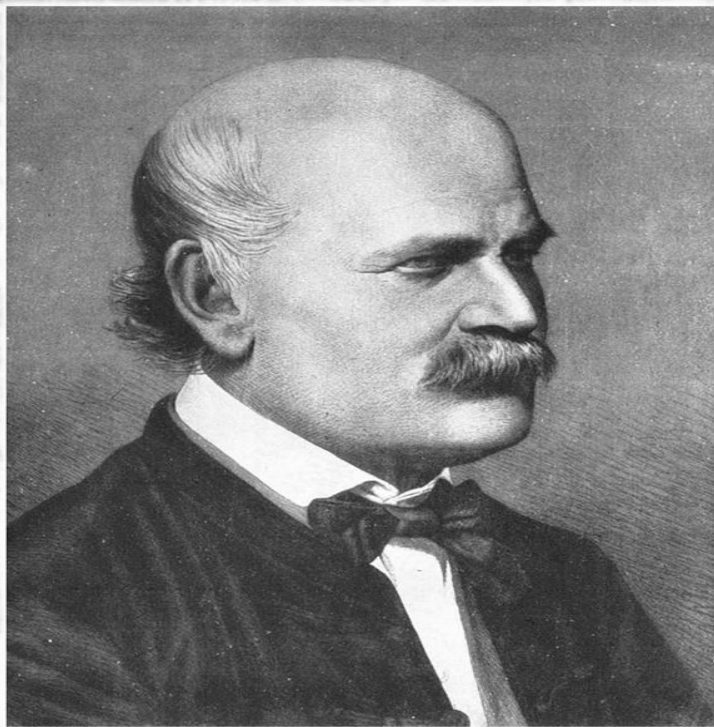
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Emil J. French, M.D.
Ruth H. Kinsworth
Chair

Through our over dependence on undependable IT, we have created the conditions such that the actions any single outlier can have a profound and asymmetric impact on human life, economic, and national security.

THE

I Am The Cavalry is a grassroots organization focused on the intersection of digital security, public safety, and human life.

Safer. Sooner. Together.

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THANK YOU!

@joshcorman

@iamthecavalry

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