Today (9/14/20)

• Lecture 4
• Discussion
• Break
• Student Presentations
Constitution Day reading for September 17

• Privacy and the Constitution

September 17 Guest Speaker / Data and Health

- Liz Chiarello, Sociologist, St. Louis University

- To prepare for class, read “This is your country on Drugs” in Radcliffe Magazine on Liz’ work: https://www.radcliffe.harvard.edu/news/radcliffe-magazine/your-country-drugs (on the class website)
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Lecture 4 – Data and COVID-19 – contact tracing

• Digital contact tracing
• Contact Tracing in China and elsewhere
• Contact Tracing in the U.S.
• Apple/Google Exposure Tracing app
• Discussion
Contact Tracing

- [Wikipedia] In public health, **contact tracing** is the process of **identification of persons who may have come into contact with an infected person** ("contacts") and subsequent collection of further information about these contacts.

- **Commonly performed for other diseases** -- tuberculosis, vaccine-preventable infections like measles, sexually transmitted infections (including HIV), blood-borne infections, ebola, some serious bacterial infections, and novel infections (e.g. SARS-CoV, H1N1, and COVID-19).

Contact tracing finds cases quickly so they can be isolated to reduce spread.

By CFCF - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=88348237

Fran Berman, Data and Society, CSCI 4370/6370
Digital Contact Tracing – using technology to determine whether you are at risk for COVID-19

- **Multiple approaches:**
  - Use **location** information to restrict movement of infected or exposed individuals
  - Use **proximity** data to warn you when you have been exposed to infected individuals

- **Successful digital contact tracing strategies show:**
  - Digital contact tracing is **not a stand-alone strategy**. It must be used with other strategies to be effective
  - Digital contact tracing **must fit within the prevailing political system and culture** of the country it’s in to be accepted and effective
Daily new COVID-19 cases around the globe

What did China do to create rapid containment?

Data reflects the number of new confirmed cases for each specific date listed.

Source: WHO

COVID-19 Containment in China – Comprehensive Approach

• Easy and widespread testing:
  • Coronavirus testing easily available and free
  • People who thought they might have COVID-19 could go to “fever clinics” (triage and other tests done before COVID-19 tests)

• Expansion of Medical Care:
  • China postponed non-urgent medical care; moved many doctor's visits online.
  • New hospitals built in a rush (~2 weeks or less); Wards walled off for COVID-19

• Country-wide Shut Down and Public Strategies:
  • Public transportation curtailed (e.g. trains to and from Wuhan)
  • Country-wide shut-down – relatively easy to get extra food and supplies
  • People quickly shifted jobs to assist during the outbreak
  • Culture of collectivism and political surveillance contributed to compliance with government measures. Social credit scores lowered for non-compliance

Fran Berman, Data and Society, CSCI 4370/6370
Chinese contact tracing app – how it worked
Digital contact tracing used to retrace locations of infected citizens and determine exposure of others.

https://science.sciencemag.org/content/early/2020/04/09/science.abb6936
Chinese contact tracing – digital infrastructure

• **Individuals asked to download App**
  • Needed to move between home and public spaces/transport.
  • App relies on **personal identification information** combined with **location histories**
  • Information stored in a **central DB** and shared with law enforcement and others
  • DB analyzed by (proprietary) **Artificial Intelligence algorithm** that issues color codes

• **App registered and temp taken at wide variety of health checkpoints.**
  • Allows/restricts movement: “**Green move freely; Red or Yellow, report immediately.**”

COVID-19 interventions elsewhere

• Effectiveness of contact tracing and other interventions has around the world but highly dependent on political and cultural environment

• South Korea – government programmatic response, strong social distancing, high volume of testing, “cluster investigations” and contact tracing, quick isolation

• Germany – rigorous contact tracing system (call centers for worried citizens, contact tracers reaching out, digital contact tracing), expanded testing, programmatic government policy on social distancing and re-openings, state-mandated quarantines and tests for those exposed (resources provided as needed)
COVID-19 around the world
(from https://science.sciencemag.org/content/369/6504/24)
COVID-19 in Africa
(from https://science.sciencemag.org/content/369/6504/624)

• “Coronavirus disease 2019 (COVID-19) has spread rapidly and extensively to most countries in the world, resulting in considerable mortality in Europe and the United States, as well as in numerous upper-middle-income countries in South America and Asia. Experts predicted millions of COVID-19 deaths in Africa because many countries in the continent rank poorly on the United Nations Development Programme's Human Development Index. However, more than 4 months after the first cases in Africa were detected, prevalence and mortality are still low.

• It remains unclear if Africa is really spared from substantial cases and deaths. However, differences between Africa and the most affected countries in reliable reporting and death registration, lockdown stringency, demography, sociocultural aspects, environmental exposures, genetics, and the immune system could help to explain the experience of COVID-19 in Africa.”

Fran Berman, Data and Society, CSCI 4370/6370
COVID-19 in Africa (each country different) – risk factors but lower reported rates
Analysis a work in progress

- **African risk factors for COVID-19**
  - Weak health system
  - Population crowding
  - Unhygienic conditions
  - Few functional civil registration services
  - Age-stratified data not available

- **African interventions implemented early**
  - Travel restrictions
  - Curfews
  - School closures, etc.
  - Many work in informal business sector (e.g. traditional markets) making strict lockdown measures impossible to implement

- **Other factors**
  - Comparatively young population (median age for continent is 19.7 years)
  - Different immunological profiles – studies exploring if this is relevant
  - Digital contact tracing unlikely to be effective – only 23% of the population in sub-Saharan Africa use the mobile internet on a regular basis (https://www.gsma.com/mobileeconomy/wp-content/uploads/2020/03/GSMA_MobileEconomy2020_SSA_Eng.pdf)
Contact tracing in the U.S.: public health and privacy challenges

- No national contact tracing system. Each state doing their own thing.

- Privacy challenges. U.S. citizens discomfort with providing location and other personal information to the government, even in a pandemic.

Contact Tracing has been challenging in the U.S.
Contact parameters: Looking for people who spent 15+ minutes within 6 feet of infected person

- No federal program, each state doing their own thing
- Implementation problems
  - Problems with hiring enough tracers (e.g. including those that speak prevalent non-English languages)
  - Problems with adequate training (e.g. Florida, New York)
  - Problems with reaching contacts (e.g. Arizona, Texas, North Carolina)
- Compliance problems
  - Some people refuse to participate
  - Some people ignore advice
- Effectiveness problems
  - May take too long to get test results back
  - Large community spread (e.g. many people at risk for infection)
  - CDC recommends 100K contact tracers, currently less than 40K
  - Many people are asymptomatic
  - Need to provide resources to people who need them in quarantine
- Contact tracing has worked well when people tested frequently with fast turnarounds (e.g. sports teams, White House)
Digital exposure tracing: Apple / Google project – initial design

• Apple and Google teamed to create a decentralized exposure notification tool to help individuals determine whether they have been exposed to someone with COVID-19.

• Tool does not use location data: Focus is not on where infected people are but whether you have been near them (proximity).

How the Apple/Google Design Works:

- App is voluntary. Only download it if you want to. Only share information if you are confirmed to have COVID-19 if you want to.
- App seeks to anonymize the information of participating users.
- Apps interoperable between iPhones and Androids.

Your smartphone sends unique keys (representing you) to those you have been close to for a sufficient amount of time.

Your smartphone collects unique keys (representing them) of those you have been close to for a sufficient amount of time.

Fran Berman, Data and Society,
If you have COVID-19:

You can choose to upload the last 14 days of your keys into a cloud-based database (where they are retained for 14 days)

Self-quarantine or go to the hospital as directed by your health care provider.
How the Apple/Google Design Works:

Periodically:

Your smartphone downloads the keys of confirmed COVID-19 cases.

Your smartphone compares your keys with keys of confirmed cases.

- match: You have been exposed to COVID-19. Instructions on next steps will be provided.
- no match: You have not been exposed to COVID-19 (through the system of participants).

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Details matter for the system to work as planned

• Model to determine proximity must be accurate:
  • Signals need to track distance between users of less than 6 feet
  • Duration of contact must be sufficient
  • Obstacles (walls, etc.) must be taken into consideration
  • NOTE: System doesn’t track coronavirus on surfaces or untested users who are asymptomatic

• Uptake must be sufficient
  • System won’t work with users who don’t opt in
  • System won’t work with users who have older or different smartphones
  • System can’t work if it’s hard for users to get tested

• Security and privacy protocols must work as expected

Blue tooth:

• Range of about 30 feet
• Bluetooth identified by random, rotating “beacon” numbers based on keys stored in each device
• Phone regularly pings out Bluetooth signals to others nearby while also listening for communications from nearby phones
• Captures proximity vs. location
Apple / Google app – current status

• Contact tracing **effective if 60% adoption** of app (University of Oxford model)
  • Could still be helpful with as little as 15% adoption

• **Uptake:**
  • After one week, Virginia had 300+K downloads in a population of roughly 8.5M
  • Canadian Digital Service reports that app only works on Apple or Android phones purchased in the last 5 years
  • Available in the U.S. in Alabama, Arizona, Nevada, North Dakota, Virginia, Wyoming
    • Pennsylvania and South Carolina planning on participating

• **Effectiveness TBD**
Reading for Today’s Discussion

• “I downloaded America’s first coronavirus exposure app. You should too.”, The Washington Post

• https://www.washingtonpost.com/technology/2020/08/17/coronavirus-exposure-notification-app/, on class website
Lecture 4 resources not already on slides


• “Apple and Google’s contact tracing apps only work on new phones. That’s a problem.”, Fast Company, https://www.fastcompany.com/90542415/apple-and-googles-contact-tracing-apps-only-work-on-new-phones-thats-a-problem


• “COVID-19 in Africa: Dampening the Storm.” Science Magazine, https://science.sciencemag.org/content/369/6504/624
Presentations
Presentations for September 17


Presentations for next week

• Presentations for September 21

• Presentations for September 24
September 28 – Need Volunteers


Presentations for Today

• “Contact Tracing: Ensuring our data privacy isn’t gone without a trace”, Security Magazine, 

• “On Native Land, Contract Tracing is Saving Lives”, New York Times, 