Riyadh Global
Digital Health
Summit
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Epidemiology in the Digital Era

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What is Digital Epidemiology?

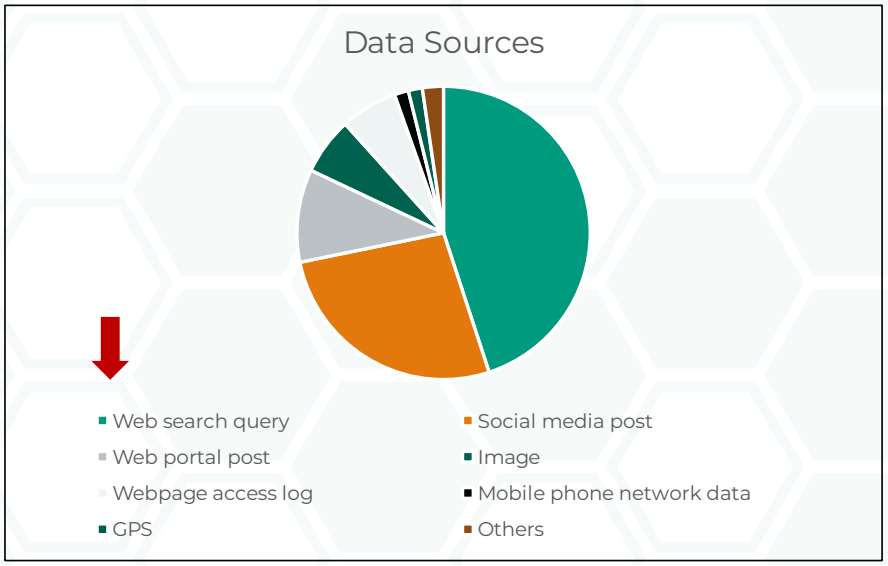
- **Traditional Epidemiology**
  - "The study of the distribution and determinants of disease in human populations"

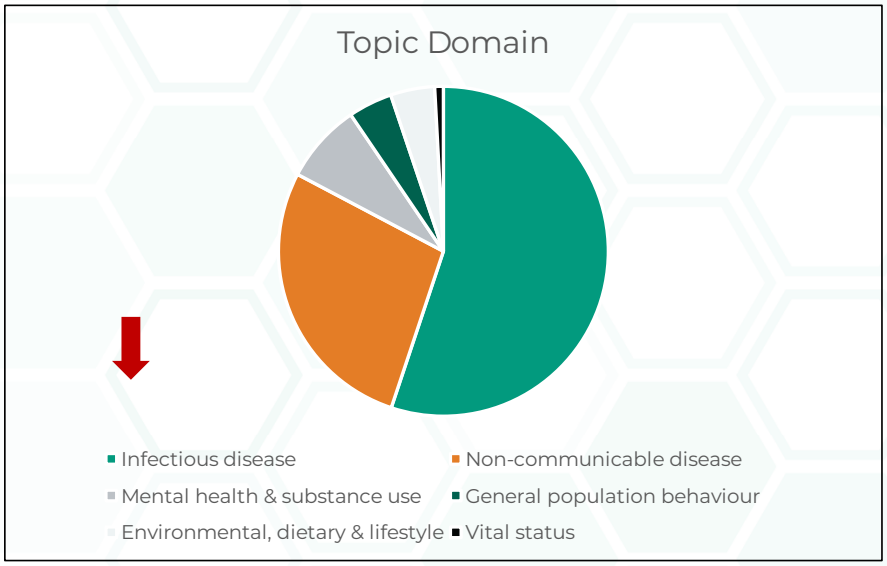
- **Digital Epidemiology**
  - "Epidemiology that uses digital data"... *Broad definition*
  - "Epidemiology that uses data that was generated outside the public health system (i.e. with data that was not generated with the primary purpose of doing epidemiology"... *Narrow definition*

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5754279/pdf/40504_2017_Article_65.pdf

Digital Epidemiological Studies

An increasing number of epidemiological studies are using digital data generated for a purposes other than epidemiology





https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6230537/pdf/hir-24-253.pdf

Digital Epidemiological Studies

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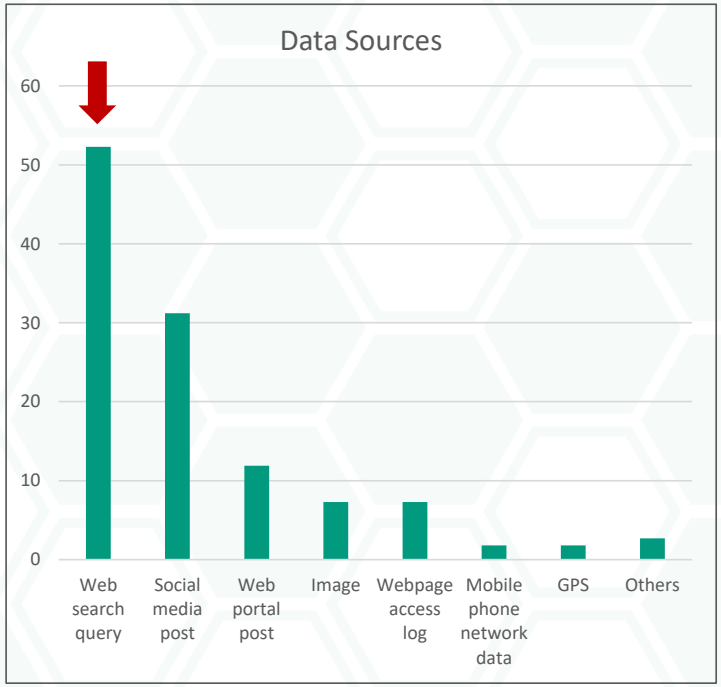

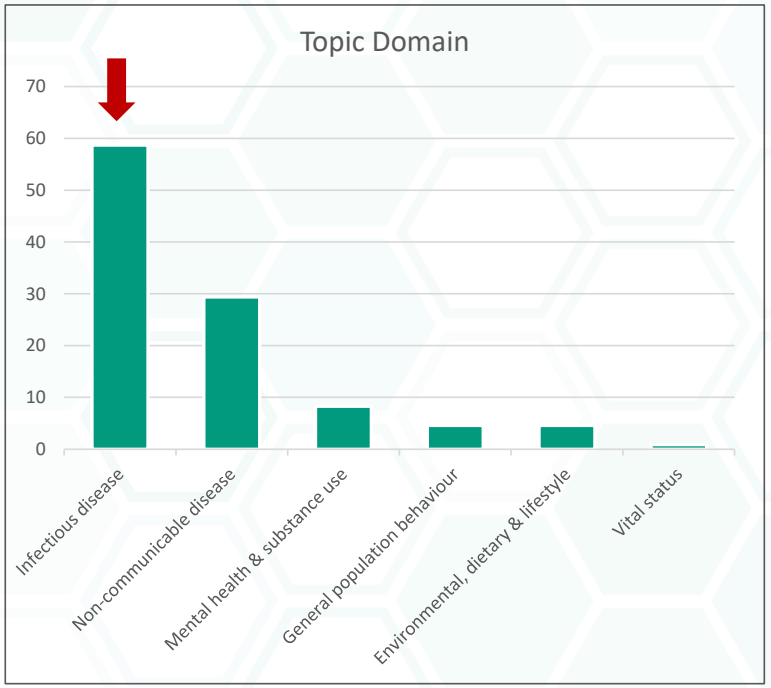

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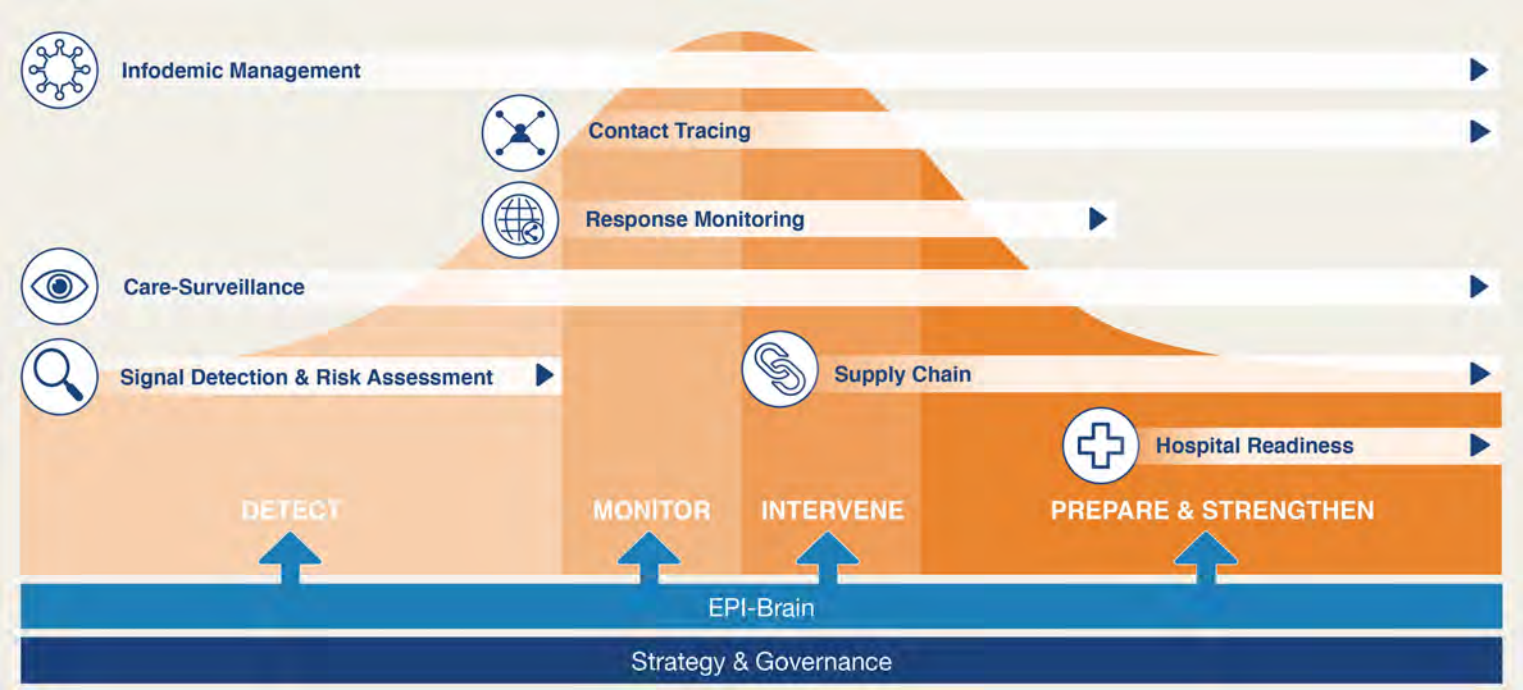
Context: COVID-19

Digital investments in health emergencies are driven by public health needs and operations



COVID-19 & Digital Epidemiology

Digital public health technologies against COVID-19

- Outbreak response tools
- Proxmity & contact tracing tools
- Symptom tracking tools
- Quarantine compliance tools
- Flow modeling tools

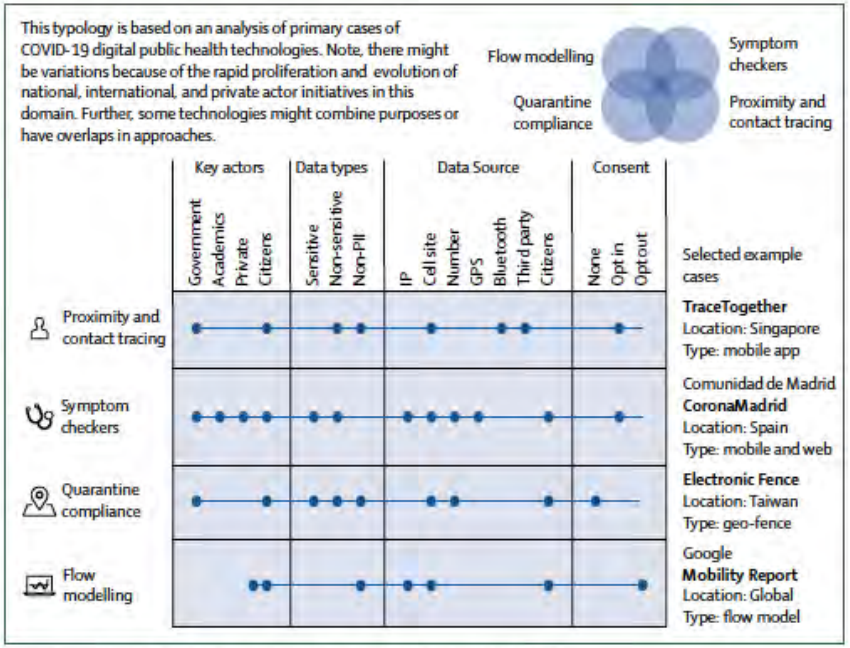


Figure 1: **Typology of digital public health technologies against COVID-19**
IP=Internet Protocol. GPS=Global Positioning System. PII=Personally Identifying Information.

https://www.thelancet.com/action/showPdf?pii=S2589-7500%2820%2930137-0;

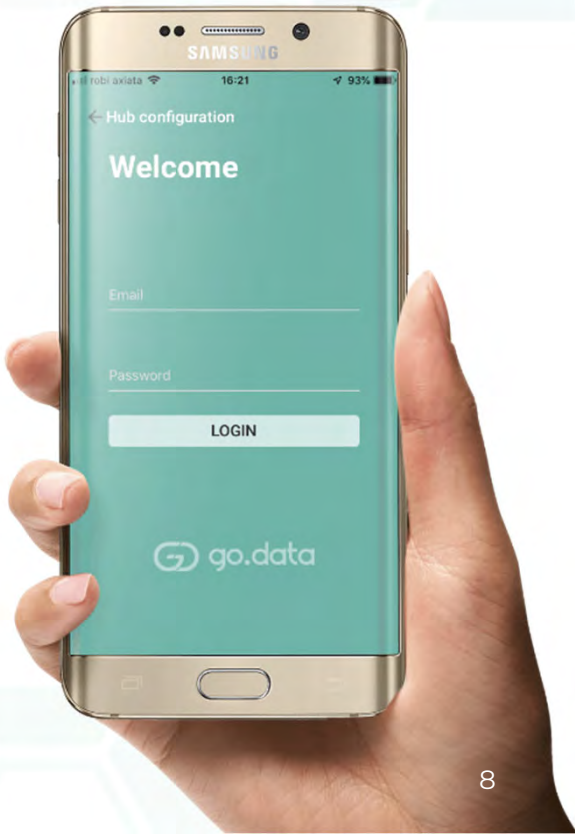
https://www.who.int/publications/i/item/WHO-2019-nCoV-Contact_Tracing-Tools_Annex-2020.1

Proximity & Contact Tracing - Go.Data

- Building on previous WHO and partners' experience, Go.Data is a field data collection tool for outbreak investigation and **contact tracing**.

- Its focus is on **case** (*including lab, hospitalization and other variables through a case investigation form*) and **contact** data (*including contact follow-up*) with smartphone application for **contact tracers** to record their visits with contacts of interest.

GOARN
Global Outbreak Alert and Response Network
go.data



https://www.who.int/godata

General Ethical Principles & Issues

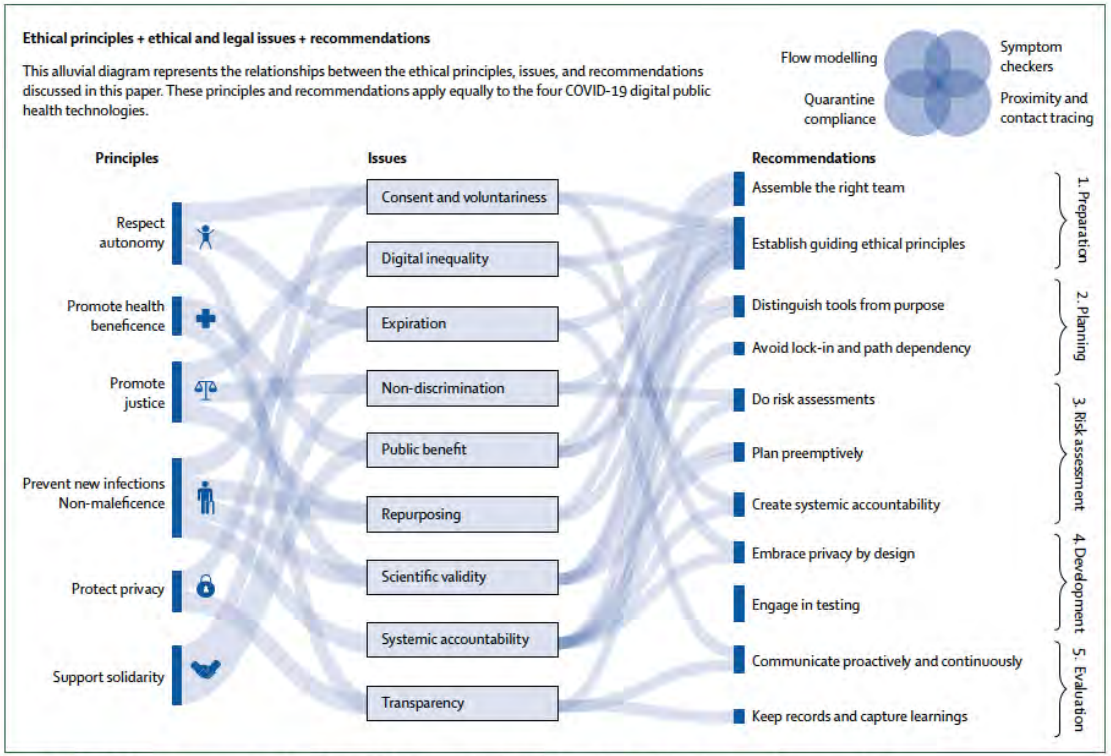


Figure 3: **Alluvial diagram representing the relationship between ethical principles, ethical and legal issues, and recommendations**

https://www.thelancet.com/action/showPdf?pii=S2589-7500%2820%2930137-0

WHO Interim Guidance-Ethical Considerations

To guide the use of digital proximity tracking technologies for COVID-19 contact tracing

- *Effectiveness remains unknown* and more research is needed to build public support and to determine if the trade off of privacy is proportional to the public health impact
- An *enabling environment* for use is required as it is one intervention in a wider system of policies and interventions
- *Suggested Principles*: 17 principles have been identified to provide ethical guidance to governments and other stakeholders

Ethical considerations to guide the use of digital proximity tracking technologies for COVID-19 contact tracing

Interim guidance
28 May 2020

World Health Organization

Background

This interim guidance is intended to inform public health programmes and governments that are considering whether to develop or implement digital proximity tracking technologies for COVID-19 contact tracing. The document covers ethical principles, technical considerations and requirements that are consistent with these principles; and how to achieve equitable and appropriate use of such technologies.

Contact tracing is the process of identifying, assessing, and managing people who have been exposed to a disease to prevent onward transmission. When systematically applied, contact tracing will break the chains of transmission of an infectious disease and is thus an essential public health tool for controlling infectious disease outbreaks. For contact tracing to be effective, countries need adequate capacity, including human resources, to test suspect cases in a timely manner.[1] Digital technology can play a role in contact tracing programmes implemented in Member States.

Member States are obliged under the International Health Regulations to develop public health surveillance systems[2] that capture critical data for their COVID-19 response, while ensuring that such systems are transparent, responsive to the concerns of communities, and do not impose unnecessary burdens, for example infringements on privacy.[3] Failure to implement effective surveillance systems can hamper an effective public health and clinical response.[4] Digital technologies are used in public health surveillance to support rapid reporting, data management and analysis. Especially when combined with machine learning and artificial intelligence, they could constitute powerful tools that provide public health agencies with valuable information to make appropriate decisions.[5]

One form of digital technology for surveillance that has been receiving attention in many countries facing COVID-19 epidemics in recent months is proximity tracking. Proximity tracking measures signal strength to determine whether two devices [e.g. smartphones] were close enough together for their users to spread the virus from an infected individual to an uninfected person. If one user is infected, others who have been identified as within proximity of the other person can be notified, and thereby take appropriate steps to reduce health risks to themselves and others.[6] Proximity tracking is often conflated with 'contact tracing', although contact tracing is a broad public health discipline, and proximity tracking is a new technique for aiding contact tracing.

Digital proximity tracking, however, has its limitations. This technology cannot capture all the situations in which a user may acquire COVID-19, and it cannot replace traditional person-to-person public health contact tracing, testing or outreach which is usually done over the phone or face to face. Digital proximity tracking applications can only be effective in terms of providing data to help with the COVID-19 response when they are fully integrated into an existing public health system and national pandemic response. Such a system would need to include health services personnel, testing services and the manual contact tracing infrastructure.[7]

Considering these limitations, health authorities could use digital proximity tracking tools for notifying a person of an increased risk of exposure to another who has tested positive for COVID-19. Such notification of a person who may have had close contact with a COVID-19-positive individual could encourage the former person to seek out testing (if available) or take precautions to limit potential transmission such as self-isolation and physical distancing, even before the onset of any symptoms.[8] Early public health response actions can make a significant difference between control and a resurgence of COVID-19. Furthermore, data generated by digital proximity tracking technologies could be useful for researchers to prepare for future COVID-19 outbreaks and to assist general preparedness for future epidemics and pandemics.

Yet such uses of data may also threaten fundamental human rights and liberties during and after the COVID-19 pandemic. Surveillance can quickly traverse the blurred line between disease surveillance and population surveillance. Thus, there is a need for laws, policies and oversight mechanisms to place strict limits on the use of digital proximity tracking technologies and on any research that uses the data generated by such technologies.

Through their products, services or platforms, some private companies capture as much data as governments gather. Such companies may develop or are even sharing their own digital proximity tracking applications with governments and, in some cases, are given the responsibility for collecting and analysing the data thus harvested. Moreover, there is a broader concern that private companies may permanently integrate their commercial products, services and architecture within public health infrastructures.

Member States can achieve their public health objectives while protecting fundamental rights, such as privacy, at the

-1-

https://www.who.int/publications/i/item/WHO-2019-nCoV-Ethics_Contact_tracing_apps-2020.1

WHO Interim Guidance-Ethical Considerations

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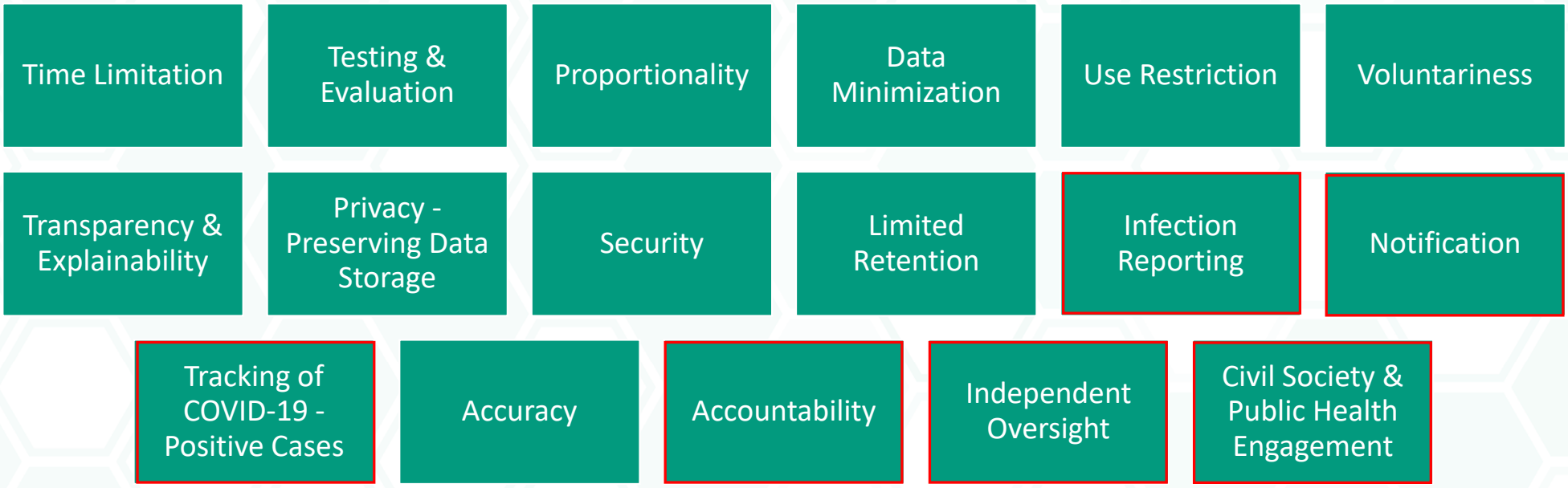


https://www.who.int/publications/i/item/WHO-2019-nCoV-Ethics_Contact_tracing_apps-2020.1

Limitations of Digital Epidemiology

Google

Detecting influenza epidemics using search engine query data

Jeremy Ginsberg[1], Matthew H. Mohebbi[1], Rajan S. Patel[1], Lynnette Brammer[2], Mark S. Smolinski[1] & Larry Brilliant[1]

[1]Google Inc. [2]Centers for Disease Control and Prevention

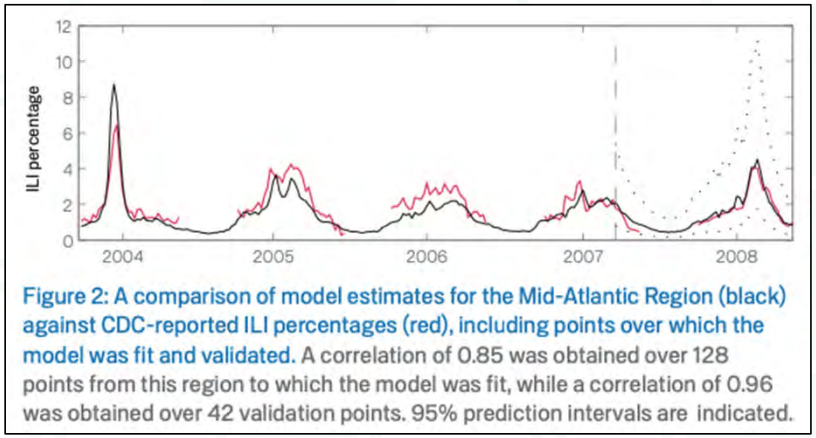
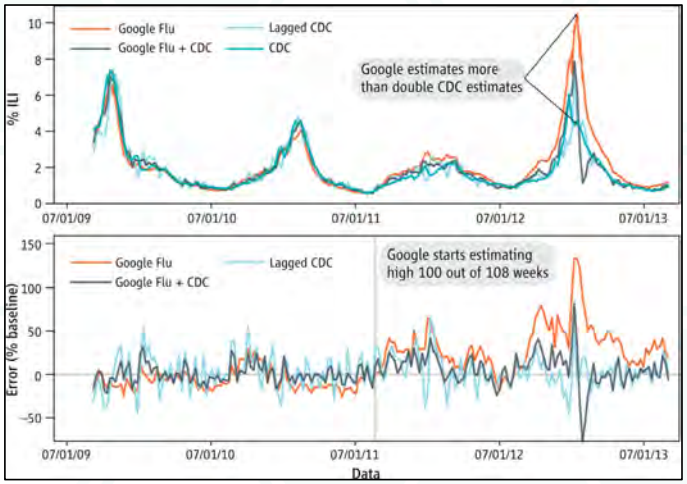


Figure 2: A comparison of model estimates for the Mid-Atlantic Region (black) against CDC-reported ILI percentages (red), including points over which the model was fit and validated. A correlation of 0.85 was obtained over 128 points from this region to which the model was fit, while a correlation of 0.96 was obtained over 42 validation points. 95% prediction intervals are indicated.

BIG DATA

The Parable of Google Flu: Traps in Big Data Analysis

David Lazer,[1,2*] Ryan Kennedy,[1,3,4] Gary King,[3] Alessandro Vespignani[3,5,6]



https://www.nature.com/articles/nature07634.pdf;
https://mail.google.com/mail/u/0/?pli=1#inbox/QgrcJHrtpCxJdWwlqmsxCQXWggBVqMcnjSq?projector=1&messagePartId=0.2

Limitations of Digital Epidemiology

Considerable challenges to the use of digital data exist, including:

- Technical challenges (regarding the collection, storage and analysis of massively large datasets)
- Ethical & legal challenges (regarding data acess, data sharing & privacy)
- Methodological challanges
  - *Selective sampling:* Biased non-probability sample (e.g. Older people, children, persons from lower income and vurnerable populations are less likely to own smart phones)
  - *Measurement errors:* Sensitivty & specificity usually unknown (e.g. errors in contact tracing apps due to different devices' Bluetooth signal strength)

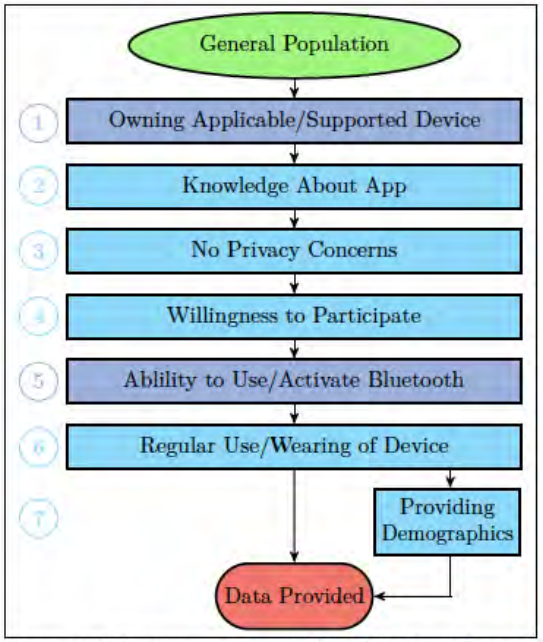


Figure 1. Selection processes in Digital Epidemiology using Smart Devices. Light blue nodes are similar to survey nonresponse, dark blue nodes are similar to undercoverage.

https://ojs.ub.uni-konstanz.de/srm/article/view/7726

Conclusion and the Way Forward

Traditional + Digital Epidemiology

Thank you for your attention

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Ministry of National Guard - Health Affairs

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