C-19 Tracker/Tracer Apps: Optimising for Effectiveness, Fairness, Transparency, and Accountability

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- Bluetooth (low energy) Fluphone, tracetogether, (joinzoe?)
- 2. Location Services (android/ios)
- 3. Cellular Provider (cell tower, CDR)
- 4. TfL (oyster, loop, congestion ANPR)
- 5. M-pesa use/like (feature phone)



- 1. Contacts~meters, intervals, duration, risk
- 2. Absolute location ~10m
- 3. Cell level loc (~100m) & velocity
- 4. waypoints (e.g. start/end journeys)
 - payment info on phone...

data ownership/control

1. On the phone

- 1. could upload to NHS/PHE
 - 1. singapore&korean "accidentally" disclosed
- 2. contact trace (secure map imei>person)
 - 1. warn contacts (privad style)
- 2. In cloud (if user consent default)
 - 1. ask google/apple
- 3. Telco data subject to Lawful intercept/wiretap
- 4. TfL journey only GDPR:-)



- 1. On phone: warn user & contact tracing
 - 1. @NHS: epidemic SIR parameter tune
 - 2. Self reporting symptoms v. test

2. Approx contact tracing

- 1. @NHS help SIR estimation/bounds
- 2. Self reporting symptoms
- 3. sanity check 1&2, movement compliance
- 4. lockdown compliance... ...

Privacy of smart phone data

- Keep on phone
 - can still do warning & contact trace
 - if subject is tested +ve by NHS
 - +asked to give contact data (see later)
- If data logged to NHS
 - tune BLE algorithm params
 - better estimate "contact"/risk based on stage
 - both backtrack, but also reduce cascades
 - hotspot/superspreader event detect (restart local lockdown)



Susceptibility/Infectiousness/Recover

- by age/gender (both of infected and infector - kids->adults etc)
- pre- & asymptomatic carrier stats
- early detection of re-infection prob.
- i.e. duration of immunity stats.



- Model phase changes in infection, epidemic, pandemic
- predict recovery/treatments
- Model impact of interventions
 - Natural experiments' data
 - different interventions at different times in different countries

· : Later app proposals

- Store data in secure MPC (safetrace)
 - jana / share mind (not blockchain:)
 - or trust NHS not to be bozos(GDPR)
- test results service (back to work!)
 - (C-19 +ve, recovered, antibody, other?)
 - QR code (verified service/tamper evident) & parking permit card?

Who users services/data/analytics?

- We get warned about possible infection
- May get told about safe home/work.
- Epidemiology models massively better
- as we get over it we can go out
- we can then help (volunteer nhs/school/ care homes

Test workflow design challenge.

- cyberphysical system problem
 - (most) virus tests are 2 stage:
 - swab->pcr->result
- but also self test virus&for antibodies
 - verified results<->subject linkage.
 - need certified physical&digital result.

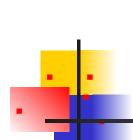
Third party access to results

- needs auth (biometric/picture id)
 - -ve, +ve,
 - -ve after +ve (or antibody)I,S,R
 - very like age (>18) verification
 - assurance...about confidentiality
 - assurance ... about no further use of data.



What about people without phones?

- contact trace classic already solves.
- sample bias needs mitigating ^
- can use census data with phone distr
- but do not need 60% phones to get some benefit from contact tracing app
- Turn into future surveillance tech
 - that's why we have GDPR & IPA



References

<u>Empirical Basis for Contact Tracing</u> <u>https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30357-1/fulltext</u>

isolation, testing, tracing, distancing https://www.medrxiv.org/content/10.1101/2020.04.23.20077024v1

<u>NHS App Source/Doc</u> <u>https://github.com/nhsx/COVID-19-app-Android-BETA</u>

Why Centralised https://paravirtualization.blogspot.com/2020/05/arguments-for-nhsx-centralised-approach.html

Decentralised Contact Tracing App/Design https://github.com/DP-3T/documents

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Test everyone https://www.sciencemuseumgroup.org.uk/testing-for-coronavirus/

Secure Antibody Certificates design https://arxiv.org/abs/2005.11833



