Digital tools for COVID-19 contact tracing

Annex: Contact tracing in the context of COVID-19
2 June 2020

Background

Contact tracing is an essential public health measure and a critical component of comprehensive strategies to control the spread of COVID-19. Contact tracing breaks the chains of human-to-human transmission by identifying people exposed to confirmed cases, quarantining them, following up with them to ensure rapid isolation, and testing and treatment in case they develop symptoms. When implemented systematically and effectively, these actions can ensure that the number of new cases generated by each confirmed case is maintained below one.

In the context of COVID-19, contact tracing requires identifying persons who may have been exposed to a person with COVID-19 and following them up daily for 14 days from the last point of exposure.[1] Since COVID-19 transmission can occur before symptoms develop, contacts should remain in self-quarantine during the 14-day monitoring period to limit the possibility of exposing other people to infection should they become ill.

Critical elements in the implementation of contact tracing include community engagement and public support; careful planning and consideration of local contexts, communities, and cultures; a workforce of trained contact tracers and supervisors; logistics support to contact tracing teams; and well-designed information systems to collect, manage, and analyse data in real-time.[1]

Challenges for contact tracing include incomplete identification of contacts, inefficiencies in paper-based reporting systems, complex data management requirements, and delays in steps from identification of contacts to isolation of suspected cases among contacts. Digital tools can play a role in overcoming some of these challenges when part of a sufficiently resourced contact tracing programme. Digital tools for contact tracing can only be effective when integrated into an existing public health system that includes health services personnel, testing services, and manual contact tracing infrastructure.[2]

Classification of digital tools for contact tracing and key considerations

In response to the COVID-19 pandemic, many digital tools have been developed to assist with contact tracing and case identification. These tools include outbreak response, proximity tracing, and symptom tracking tools, which can be combined into one instrument or used as stand-alone tools.

Outbreak response tools are designed for public health response personnel involved in contact tracing activities and outbreak investigations. They encompass the management of complex relational data of cases and their contacts through electronic data entry of case and contact information. Outbreak response tools can be used to facilitate all aspects of contact tracing, including case investigation, listing and monitoring of contacts, and automating analysis and performance monitoring. Because contacts may have links to multiple cases, and may become cases that generate further contacts, effective outbreak response tools need to manage dynamic relationships between cases and contacts. Outbreak response tools should be optimized for the workflow of field workers conducting contact tracing as well as providing functionality for supervisors to monitor the implementation of contact tracing. The Go.Data software application,[3] created by WHO with partners of the Global Outbreak Alert and Response Network, was designed specifically for field workers and has been implemented in many countries for COVID-19.

Proximity tracing tools, also known as proximity tracking tools, use location-based (GPS) or Bluetooth technology to find and trace the movements of individuals to identify people who may have been exposed to an infected person. The risk of exposure to COVID-19 depends on the probability of coming into close (less than 1 metre) or frequent contact with people who may be infected. However, proximity by itself is not a complete assessment of exposure, since exposure may vary independently of proximity, such as being in an enclosed vs. open-air space. For these reasons, more evidence is needed on the effectiveness of proximity tracing tools for contact tracing, and on the feasibility and thresholds required for implementation at scale.

Proximity tracing tools can be categorized as either centralized or decentralized, meaning that contact history can either be processed centrally, typically by a health authority, or by individual devices. Privacy concerns about the disclosure of personal data need to be addressed before using such tools. The potential contribution of proximity tracing tools depends on widescale adoption of the same tool, which in turn depends on people having a suitable smartphone that is always charged and working, has a reliable connection to a mobile network, and is always accessible to them. Overreliance on proximity tracing tools may result in the exclusion of contacts such as children or people who do not have a suitable device. Proximity tracing is often conflated with 'contact tracing', but as previously mentioned, contact tracing is an established public health practice, while proximity tracing is a new technique for aiding contact tracing.[4]

Symptom tracking tools use applications designed to routinely collect self-reported signs and symptoms to assess

disease severity or the probability of infection due to COVID-19. These tools may also be helpful when integrated into the contact tracing process, especially in settings where there are physical or security barriers to in-person visits by contact tracing teams. Additionally, symptom tracking tools could augment in-person visits by receiving reports from contacts of confirmed cases more than once a day. However, there are challenging aspects to symptom tracking tools that must be carefully considered, such as limited specificity and positive predictive value[1] for respiratory infections, the potential for misdiagnosis or non-diagnosis of other illnesses, and the need for users to know how to take action and seek medical attention if there are indications of serious illness. When integrating symptom tracking tools into contact tracing, robust safeguards are required to ensure appropriate follow-up actions are taken if a contact does not self-report for a predetermined number of days. For these reasons, self-reporting of symptoms can never fully replace the need for dedicated contact tracing teams.

Table 1 gives examples of the specific uses and functions of digital tools for contact tracing, and specific considerations for implementation, including opportunities and challenges for each type of digital contact tracing tool.

Table 1: Digital tools and their uses for COVID-19 contact tracing

Tool category	Characteristics and use	Considerations for implementation, opportunities and challenges
Outbreak response tools	• Outbreak response tools are designed for public health response personnel involved in contact tracing activities and outbreak investigations • Outbreak response tools facilitate all elements of contact tracing activities, from case investigation to identification, listing and tracing of contacts to data management and analysis. They are especially useful for initial localized outbreak response, early cluster investigations, and limited populations. Some may have monitoring dashboards • Set up relational databases linking lists of contacts to line lists of cases, allowing the incorporation of information from various sources (contact tracing, laboratory, case notification, etc.) • Allow for tailored case investigation forms, contact listing forms, and contact follow-up forms to be set up. • Enable electronic data capture by contact tracers directly through smartphones or tablets • Streamline the data flow and data management process, by avoiding data entry errors, pushing the information automatically through the system, reducing processing time, and improving timeliness of analysis and monitoring • Software packages may allow for automated and semi-automated analytical outputs	• Open access and open source software allow for increased transparency, and continuous improvement of tools • Incorporation or linkage to case data is required to relate contacts and cases • Standardized data formats/data dictionaries and reporting templates are needed to link case-based line lists with contract tracing data and laboratory testing data • Different roles and responsibilities should be incorporated in outbreak response tools to mirror the data collection and data verification process (such as field data collectors, team lead for data collectors, and epi lead functions taking care of data quality, reducing data entry errors, duplicate removal and data approval) • Where possible, the implementation of new outbreak response tools should augment, rather than replace, existing electronic surveillance tools • Tools should optimally be designed for field staff and run on smartphones or tablets that can synchronize across mobile and internet networks
Proximity tracing / tracking tools	• Using either GPS location or Bluetooth signals, proximity tracing tools can help identify contacts by identifying when individuals have been in close physical proximity and have had prolonged contact with a case. • Location-based tools are based on GPS location of users. They may be used to identify people who have been in the same location as cases, to facilitate contact identification	• Proximity tracing tools require individuals to have a charged smartphone and to always carry it; necessary updates to changes in people's case status may require mobile network connectivity. People who do not have smartphones may be excluded from approaches that rely heavily on proximity tracing tools. As such, proximity tracing tools do not replace the need for rigorous contact identification and listing, but could augment such activities, particularly in public spaces and other settings where contact identification remains challenging.

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[1] The probability that individuals identified as ill through symptom tracking tools actually have COVID-19

Tool category	Characteristics and use	Considerations for implementation, opportunities and challenges
	• Linkage to other information systems can provide users direct notifications of contact events with confirmed cases, testing locations, or other helpful information such as where to access masks • Other location-based apps have been developed that preserve anonymity by not linking to other databases, but still maintaining the ability to provide location-based information for contact tracing • Bluetooth signaling between devices enables users to know if they have been in close proximity to a case without providing location information. Data can help contact tracers identify potential contacts of cases	• GPS or Bluetooth wearable devices could potentially be developed for people without smart phones or to increase consistent use • There are many privacy issues regarding the disclosure of location history, case and contact status, and possibly other personal data. Privacy concerns and data protection need to be carefully considered with location-based approaches • Proximity tracing tools do not directly provide information about exposures, which may vary independently of proximity, such as being in an enclosed vs. open-air space. • A critical mass of the population needs to use proximity tracing tools for optimally identifying potential contacts • Proximity tracing tools are suitable for use in increasing intensity of transmission, from clusters to community transmission • Bluetooth-based tools should be able to send, receive, and record Bluetooth signals even in background mode (when the phone is locked). • Companies have developed joint API that allows cross platform functionality using Bluetooth communication, which has previously been a barrier. • Location-based proximity tools can be used to identify locations with a high concentration of confirmed cases, and hence provide some assessment of transmission risk • Proximity tracing tools could potentially have other uses, such as monitoring public health measures (for example physical distancing)
Symptom tracking tools	• In the context of contact tracing, symptom tracking tools may be useful to help daily monitoring of contacts • Used for self-checking and self-reporting of signs and symptoms by people through mobile phone apps or SMS technology. • Can have value when traditional in-person contact tracing capacity is not possible • It can be used to generate syndromic data at population level, and allows for real-time monitoring of self-reported syndromic data • Self-reporting symptom tracking tools require the data to be integrated with other surveillance and monitoring data	• Using symptom tracking tools for contact tracing requires careful consideration of data ownership and of privacy and data protection • Can be useful if contacts cannot be seen daily due to access issues, or to complement in-person visits by contact tracing teams • Could be considered in scenarios where the number of contacts exceeds the capacity of contact tracing teams • Is dependent upon how individuals assess their own health and is difficult to provide verification or validation • Self-assessment questions and algorithms must consider up-to date evidence on the most sensitive and specific symptom combinations to achieve best possible sensitivity and specificity • Symptom tracking tools have limited ability to offer differential diagnoses, and as such must be used with caution to not increase the risk of adverse clinical outcomes for diseases not encompassed in the tool • Symptom tracking tools need to be integrated with health care systems so that users have a clear referral pathway if medical attention is required • Interpretation of the data is limited due to uncertainty in the reporting denominators, potentially low specificity due to other respiratory pathogens, and limited positive predictive value, especially in low-incidence settings • Some tool developers are exploring extensions beyond user self-report of signs and symptoms to include monitoring of breathing patterns using microphones in smart phones and the integration of wearable devices that monitor parameters such as oxygen saturation • Written consent should be obtained before sharing health-related data

Opportunities and challenges of integrating digital tools into contact tracing

Opportunities

Although contact tracing can be successfully implemented without digital technologies, implementation on a large scale can be facilitated by the use of such tools. Digital tools offer an opportunity to strengthen contact tracing capacity for COVID-19. For example, in 2019, contact tracing performance for Ebola virus disease in the Democratic Republic of the Congo significantly increased with the implementation of the Go.Data contact tracing software.[5]

Operational advantages of well-designed digital tools for contact tracing include improved data quality, being able to trace larger numbers of contacts in a shorter time period, the ability to provide analysis and real-time situation awareness, and the ability to perform coordination and management of contact tracing teams. Moreover, digital tools can provide important information for monitoring and evaluation of the contact tracing approach.

Challenges

Although several countries and areas have deployed digital tools for their COVID-19 response, there is currently limited evidence to evaluate the effectiveness and impact of these tools. As such, digital tools should not be considered as 'single solutions' for contact tracing, but rather as complementary tools. Additionally, the implementation of digital technologies in contact tracing carries the potential to do harm through privacy breaches, provision of incorrect medical advice based on self-reported symptoms, and the systematic exclusion of some members of society who cannot access such technologies. It is therefore important to have sufficient regulatory oversight of digital tools for contact tracing.

Ethical issues surrounding privacy, security, transparency and accountability also need to be considered throughout the design and implementation of digital tools for contact tracing.[4]

Marginalized and disadvantaged groups will be more likely to be excluded, particularly in low- and middle-income settings. In humanitarian and conflict settings, mobile phones can present opportunities for theft and violence.

The timing of introduction of digital tools for contact tracing also needs careful consideration; ideally, the tool should be introduced during the preparedness phase in trainings. During response, refresher training can facilitate the timely launch of digital contact tracing.

Digital tools also incur developer costs, hardware and software costs, training costs, and require continuous user support.

Conclusions

Digital tools offer opportunities to strengthen contact tracing for COVID-19. Digital tools should be considered a way to augment and optimize contact tracing rather than a replacement of contact tracing teams. As such, it is necessary to have a clear understanding of the steps and requirements of the contact tracing process and clearly identify which are being optimized by digital tools.

Integration of digital tools for contact tracing needs to carefully identify and address technical, cost, and ethical issues.

WHO recommends that users of digital tools should participate on a voluntary basis and that written consent is always obtained. Privacy concerns about the disclosure of personal data need to always be addressed. Data processing agreements must disclose which data are transmitted to third parties and for what purpose.

Further research is needed to assess the effectiveness of digital tools for contact tracing, and on the feasibility and thresholds required for implementation at scale.

WHO encourages public health authorities to conduct evaluations of their digital tools for contact tracing to contribute to the global knowledge base about new technologies in public health. This should be further supported by the use of standard performance indicators through which different digital tools and approaches can be assessed.

References

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5. World Health Organization. Speeding up detection to slow down Ebola: smartphone app is game-changer for contact tracing in hotspots in the Democratic Republic of the Congo (News) (https://www.afro.who.int/news/speeding-detection-slow-down-ebola-smartphone-app-game-changer-contact-tracing-hotspots , 18 September 2019).

WHO continues to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication

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