Contact tracing for COVID-19: current evidence, options for scale-up and an assessment of resources needed

April 2020

Summary

Contact tracing is an effective public health measure for the control of COVID-19. The prompt identification and management of the contacts of COVID-19 cases makes it possible to rapidly identify secondary cases that may arise after transmission from the primary cases. This will enable the interruption of further onward transmission. Contact tracing, in conjunction with robust testing and surveillance systems, is central to control strategies during de-escalation. Contact tracing has been a key part of the response in several Asian countries that have successfully reduced case numbers.

It is possible to scale up contact tracing by adapting traditional contact tracing approaches to available local resources and by using a number of resource-saving measures. This document outlines a number of resource measures including the use of well-trained non-public-health staff and volunteers; repurposing existing resources such as call centres; reducing the intensity of contact follow-up and using new technologies such as contact management software and mobile apps.

Background

On 9 January 2020, China CDC reported a novel coronavirus (SARS-CoV-2) as the causative agent of an outbreak of pneumonia cases first reported in Wuhan, China. SARS-CoV-2 began spreading extensively across EU/EEA countries during the second half of February 2020 and on 11 March 2020, the Director-General of WHO declared the COVID-19 outbreak a pandemic. Most EU/EEA countries have experienced widespread community transmission and have implemented a range of control measures in response. The information included here on contact tracing is intended to inform strategic planning for the de-escalation phase.

The incubation period for COVID-19 is five days, with a range of between one and 14 days [1]. The most common symptoms are fever, fatigue and a dry cough. An infected person can already start transmitting the virus up to 48 hours before the onset of symptoms (pre-symptomatic) and for up to two weeks. In the early stages of the disease, there is a particularly high concentration of the virus in secretions and therefore risk of transmission [1]. The disease is mainly spread from person to person through inhalation of respiratory droplets from an infected individual (cough, sneeze). Transmission can also occur if a person touches their eyes, nose, or mouth after touching a surface contaminated with virus-containing droplets, which can remain viable for up to several days [1]. Some people are infected without developing symptoms at any point and, although the risk of transmission is lower, they are still able to transmit the infection.

What is contact tracing?

Contact tracing is a core public health intervention that plays an important role in the control of COVID-19. ECDC has produced technical guidance relating to this measure which is available on the ECDC website [2]. The aim of contact tracing is to rapidly identify potentially newly infected persons who may have come into contact with existing cases, in order to reduce further onward transmission. Contact tracing consists of three steps:

- **contact identification**: to identify persons who may have been exposed to SARS-CoV-2 as a result of being in contact with an infected person;
- **contact listing**: to trace and communicate with the identified contacts, and to provide information about suitable infection control measures, symptom monitoring and other precautionary measures such as the need for quarantine;
- **contact follow-up**: to monitor the contacts regularly for symptoms.

Evidence base for contact tracing

Existing evidence related to the current COVID-19 outbreak shows the importance of contact tracing, both as a method for containing the virus where there are a limited number of cases and as an effective tool in the context of widespread transmission. Contact tracing will be very important during the de-escalation of current public health measures in order to avoid an increase in transmission.

Singapore and several provinces in China were able to limit the size of their initial outbreaks through widespread testing, contact tracing and quarantine, and these efforts remain key to their ongoing containment of the virus [3,4,5]. Contact tracing resulted in the identification of many new cases, often before symptom-onset, and reduced the time from symptom-onset to isolation substantially, thus decreasing the likelihood of sustained transmission [6,7]. Contact tracing was also effective at helping to reduce the spread of the disease during the period of ongoing widespread transmission in China and South Korea [3],[8],[9]. Although the evidence suggests that contact tracing in several Asian countries was effective in containing the virus, the actual effect of the contact tracing is difficult to quantify as it was accompanied by other control measures taken at the community and individual level, such as the banning of gatherings and stay-at-home orders.

In terms of the effectiveness of methods, evidence from China suggests that the earlier cases can be identified and contacts traced the more likely the epidemic is to be controlled [10]. Evidence from Singapore has also highlighted the role of pre-symptomatic transmission in the overall outbreak dynamics, suggesting that control of the pandemic requires prompt quarantining of close contacts to prevent onward transmission [11]. A combination of approaches, such as the use of mobile data and network searches, was used in China to track and trace contacts. These methods were considered effective for promptly identifying individuals at risk of infection [12]. In Vietnam, where extensive efforts are being made to isolate cases and trace and quarantine their contacts, the use of artificial intelligence is now being considered in order to further improve contact tracing and the management of potentially infected patients [13]. New Zealand has also managed to control the outbreak using aggressive traditional contact tracing supplemented by other measures [14], [15]. From the healthcare perspective, the experience in China also indicates that contact tracing in the hospital setting, when accompanied by testing and quarantining, can provide effective nosocomial control [16].

Data from contact tracing can contribute to a better understanding of the epidemiology of COVID-19, providing valuable information on transmission and attack rates, supporting the identification of key settings where transmission is occurring and facilitating a greater understanding of the effectiveness of different mitigation measures, such as physical distancing.

Countries should adapt their public health response according to the local epidemiological situation and available resources. Even if not all contacts of a case can be identified and traced, contact tracing can still help reduce transmission when implemented in combination with other measures, such as physical distancing [17,18,19].

For countries that have enforced strict physical distancing measures to interrupt the chains of transmission, case finding measures, including contact tracing, are a priority once the physical distancing measures are lifted, in order to reduce the risk of further disease escalation. During lockdown periods, before physical distancing measures are lifted, it is suggested that countries could review existing public health systems to determine the optimal implementation of reinforced contact tracing measures. It should also be ensured that sufficient testing capacity and robust surveillance systems are in place [2].

Scaling up contact tracing

Traditional contact tracing by following up cases and contacts using public health staff is resource intensive. However, there are alternative methods that can be used to increase efficiency.

A. Using non-public-health staff and volunteers

This approach, which has already been adopted by several countries, is based on the idea of using trained non-public-health staff (e.g. staff working in other areas of the public service, or volunteers such as students, retired healthcare professionals, NGO workers, etc.) to carry out contact tracing activities. Moving some tasks away from

public health professionals to a different group can enable the number of contacts followed to be scaled up. The staff can be tasked with interviewing cases to obtain a list of contacts and following up these contacts to provide information on self-quarantine and physical distancing, the monitoring of developing symptoms and advice on what to do if symptoms develop. New staff should be fully supervised and received comprehensive training which could be provided in-person or online. The use of non-public-health staff or volunteers for contact tracing in complex settings such as healthcare facilities may not be appropriate as these settings may require more specialist public health input.

B. Repurposing existing resources

This approach involves re-purposing existing resources to help with contact tracing efforts. One example is the use of call centres or national hotline services that have already been set up for other purposes. Existing staff can be repurposed to undertake contact tracing and/or be re-enforced by volunteers, with all new staff fully trained in contact tracing processes and data protection issues and adequately supervised. Other locations can also be used as call centres provided that staff have laptops and phones.

C. Reducing the intensity of follow up of contacts

Current ECDC guidelines identify two type of contacts [2]. High-risk exposure contacts who have spent 15 minutes or more in close proximity to (2 metres or less) or in a closed environment with a case, and low-risk exposure contacts who are still at risk but who have not been exposed to a case for as long (consult the ECDC guidelines for further definitions of these categories). The guidelines recommend that both types of contacts receive an initial phone call with instructions on self-quarantine or physical distancing measures, ways to reduce transmission (e.g. hand hygiene and respiratory etiquette), information on COVID-19 compatible symptoms to look out for and advice on what to do if symptoms develop. High-risk exposure contacts are then followed-up actively with daily phone calls, emails, and/or text messages until the risk of developing symptoms is over.

As the number of cases increase, the number of contacts will also increase and this intensity of follow-up activities may not be feasible. Options for changing the intensity of follow-up are listed below.

- Instead of an initial phone call, all or some contacts (e.g. low-risk exposure contacts) can be notified by text message or pre-recorded voicemail, with full instructions on what to do and a phone number to call if they have questions.
- Instead of a daily follow up phone call, high-risk exposure contacts can receive a text message every day, or no follow-up if the instructions given initially are clear.
- Instead of following up all contacts, the tracing of high-risk exposure contacts and contacts who are healthcare workers or work with vulnerable populations should be prioritised.[20].
  - Prioritising the follow-up of cases in specific settings (e.g. long-term care facilities, prisons, refugee camps, etc.) is important in order to mitigate the impact on vulnerable populations.
  - Contact tracing should also be prioritised for contacts who are healthcare workers or work with vulnerable populations.

The above measures will save staff resources, although they may reduce the effectiveness of contact tracing.

D. Using technology

Contact tracing management software

The use of supportive IT software is a key aspect of managing the contact tracing process and data analysis as the numbers increase. Several countries use the specific contact management software Go.Data that has been developed by WHO [21]. This software allows for the registration of cases and their contacts, thereby facilitating the contact and follow-up of contact persons. Several countries are using other software solutions. Ireland's contact management software also has functionalities that helps direct calls to staff members.

Analyses of data from contact tracing can provide key information to inform more effective response measures. Go.Data facilitates the analysis of contact tracing data, visualises chains of transmission between cases and relations between cases and contacts by category, and can export anonymised contact tracing data for sharing or detailed analysis in different software.

Web-based applications

UK (England) has used a web-based tool where cases were asked to enter details of their movements and contacts were advised according to their exposure. The information from this tool fed into their main contact tracing management software which was also used to manage information gained from those cases who were followed up by phone.

Mobile contact tracing applications ('apps')

The use of technology such as mobile apps to support contact tracing offers many possibilities, however manual contact tracing remains the main method of contact tracing and mobile apps should complement and support this process. The use of mobile apps can never be the only method used as not all of the population will have downloaded the mobile contact tracing app and penetration in some key populations (e.g. the elderly) will be low. Modelling has shown the added value of using this type of technology to support manual contact tracing efforts [22]. Mobile technology has now been used in many countries and in Singapore, for example, people can download the voluntary app 'Trace Together' [23]. The app collects data via Bluetooth on which devices have been

in close proximity to the user during a specified time period. This data is initially stored on the user's phone. However, if a user tests positive for COVID-19, they provide their consent to sending the stored data to the health authorities who can, in turn, contact the individuals whose phones have been identified as having been in contact with that particular user (e.g. via phone message.)

Although there are some key data and privacy issues that require careful consideration, the use of mobile contact tracing apps for contact tracing offers several benefits:

- they do not rely on the memory of the case (who may be very ill at the time of interview);
- they allow contacts unknown to the case to be traced (e.g. fellow passengers who sat close on a train);
- they can potentially speed up the process;
- they may facilitate further follow-up of contacts by health authorities via a messaging system. A symptom-checker feature could facilitate this, although it is not essential.

Several initiatives to establish mobile contact tracing apps are ongoing in Europe and elsewhere, some of which use GPS technology instead of Bluetooth. Some initiatives allow for the user's contact details to be transferred to public health authorities, with their consent, while others work on a completely anonymous basis. The latter option raises concerns as public health authorities cannot call the contact person, which has been cited as valuable since people often have many questions and concerns. There are some possibilities which enable the contact person to voluntarily share their phone number with health authorities. Another option could be to include a hotline number in the message so that contacts can call to obtain more information. At the very least, public health authorities should be in charge of the content of the messages that are sent out to contacts.

It is also important to note that not all individuals in a community will be able or willing to use mobile contact tracing apps. This will probably be the case for the elderly and other vulnerable populations. Additionally, healthcare workers will probably not carry their mobile devices with them at work. It is therefore advisable that any mobile contact tracing app be introduced and applied as an additional support to traditional, standard contact tracing systems coordinated by public health authorities. This will also allow public health authorities to have more control of the process and be able to tailor the messaging and follow-up to different types of contacts.

The European Commission together with the eHealth Network and ECDC, has published guidance on the use of such contact tracing apps to ensure cross-border interoperability and safeguard data protection [24,25].

Resources required for contact tracing

Validation of ECDC resource estimations

ECDC's guidance on resource estimation for contact tracing, published in March 2020, provides an indication of the resources needed for contact tracing related mainly to the containment scenario [20]. These estimates were reviewed by EU/EEA countries through semi-structured telephone interviews and via an email questionnaire during April 2020.

Some differences were noted in relation to the calculations concerning staff time per activity. A summary of the updated estimates for these activities obtained from countries is presented in the table below

Table 1. Contact tracing - updated resource estimates

Activity	Range of estimates from country interviews	Notes
Interview case, create list of contacts	45 min– –1 hour	Up to two hours for complex cases
Call each contact	3.5 min – 20 min	Reduction in time reported as staff gain experience
Average number of contacts per case	• 2–3 close contacts during lockdown • 7–20 close contacts pre-lockdown	Sometimes contacts can be larger groups of people (e.g. plane, school or work contacts)
Time needed to train new staff	4–20 hours	Topics covered: disease epidemiology; the contact tracing process; how to conduct interviews (practical examples and exercises) and data protection issues.

Contact identification, contact listing, and contact advice

- *Interview the case* – the average time was estimated to be between 45 minutes and one hour, with one country suggesting it sometimes took up to two hours. This is usually done by staff in one call.
  - One country reported that when the case is first informed of their positive result, they are alerted to the fact that that they will be called soon afterwards by someone to interview them about people they have been in contact with. Asking the case to start listing their contacts in advance can shorten the duration of the call where staff collect information.
- *Create the list of contacts and classify the contacts into high- and low-risk exposure* – this is done during the interview by the same staff interviewing the case. Data are then entered directly into the database or electronic information system, either by the interviewer or by an administrative team later. Most countries use Excel files or even a paper-based approach for contact tracing. Three countries reported that they have used Go.Data at national level and several other countries are exploring its use. In one country a web-

based tool has been developed where many cases were not interviewed, but were instead directed to a website where they were asked to enter details of their movements. Contacts were then advised, depending on their exposure. These data were subsequently pulled into the case management system.

- *Interview by phone with the contacts* – average time per contact estimated to be between 3.5 and 20 minutes. This call is to inform the contacts of their exposure and give them information about self-quarantining, hand hygiene, monitoring for symptoms and what to do if they develop symptoms. This is often done by non-public health staff, with supervision from someone with a public health background.

Testing of contacts

- All countries reported testing symptomatic contacts in hospitals or at local testing facilities. In some instances contacts were tested at home (e.g. elderly or vulnerable people or people living in rural areas). One country reported that they send a driver to pick up the person and take them to a testing facility if they lack transport or are housebound, or they send a team (consisting of two public health professionals and a driver) to test the person at home. Some countries also test asymptomatic contacts in closed settings, for example in nursing homes where there has been a confirmed case or if the contact is a healthcare worker. Asymptomatic close contacts have also been tested in some regions where there has been sufficient testing capacity.

Follow-up of contacts

- High-risk contacts are asked to self-quarantine for 14 days following their last exposure. One country reported that the families of the contacts or the low-risk contacts are also asked to quarantine. The length of quarantine for healthcare workers was reported to depend on the spread of the outbreak and is weighed against the need to maintain services, with one country reporting a reduction in quarantine from 14 to seven days as the situation escalated. Monitoring activities vary by country and depend on the spread of the outbreak, ranging from daily active follow-up by phone call or text message, to less frequent active follow-up (every other day or once a week) or no active follow-up (the contact calls the public health team if they develop symptoms).

Adapting resources according to the local situation

In scenarios where there are low numbers of cases, contact tracing is usually undertaken using existing public health structures (local public health teams involved in communicable disease control who have experience in contact tracing.) Even with a limited number of cases, contact tracing can be resource-intensive, especially in situations where physical distancing is limited and the number of contacts for each case is high.

When traditional contact tracing is still possible, all cases are usually interviewed within 24 hours of being diagnosed and the interview is generally conducted over the phone if the case is at home or face-to-face (by infection control staff) if the case is in hospital. All contacts are listed, receive a phone call and are actively followed up on a regular basis. All symptomatic contacts are tested. Testing is also often offered to asymptomatic contacts who work with vulnerable populations (e.g. healthcare workers), or are vulnerable themselves. High-risk exposure contacts are followed up by means of a daily phone call until 14 days has passed since their last exposure. Where resources are available, contacts with a low-risk exposure may also be actively followed up.

This traditional approach to contact tracing may still be feasible in a containment scenario or de-escalation phase with few cases, but if there are high numbers of cases and contacts requiring follow-up the situation becomes challenging, as most public health authorities have never undertaken contact tracing on such a large scale.

With increasing numbers of cases, an adapted model is needed. Public health staff can be supplemented by people who do not have public health backgrounds, such as government employees from other areas, medical students or volunteers. Some countries have used military cadets. This staff should be properly trained by public health personnel in areas such as basic epidemiology, public health mandate, health communication, ethics and data protection. They should be supervised by public health staff. With increased numbers of staff, the contact tracing operations require a greater degree of coordination and it is recommended that staff with management experience work alongside public health staff. Ireland set up an operation like this within two and a half weeks.

In a situation with a large number of cases it may not be possible to sustain contact tracing with active follow-up of all contacts and it may be necessary to reduce the intensity of interactions. Instead of calling contacts, it may be possible to provide the initial information through a text message, although direct communication by phone was considered by several countries to be very valuable. With regard to following up contacts on a daily basis for active monitoring, some countries have stopped doing this as numbers have increased, while others are working on alternative solutions, such as sending a text message to contacts asking whether they have developed symptoms. Only contacts who report symptoms, or who did not respond to the text message, receive a follow-up phone call. Some countries are beginning to use different technologies (e.g. mobile phone apps, websites for cases to enter data on contacts etc.) to help scale up their contact tracing efforts.

Case studies

The following case studies are examples of the resources for contact tracing strategies relating to three different scenarios: a low number of daily reported cases (10); a medium number of daily reported cases (250); and a high number of daily reported cases (1 000). These studies are intended to provide a rough guide rather than precise estimates and countries can choose strategies from all scenarios and adapt accordingly. Countries with a decentralised contact tracing process may use these examples as a guide for resources needed at regional level.

The following assumptions, based on information gained during the country interviews, were used to make the calculations:

- Time to interview the case and list the contacts: 45 min
- Time for initial call to each contact: 10 min
- Number of contacts per case: 10 to 30
- Hours worked per day by staff: 8 hours.

Many countries reported that during 'lockdown' periods the number of contacts was reduced for each case. This guide aims to help countries estimate the resources needed for contact tracing during de-escalation and when lifting lockdown measures. It is difficult to obtain a precise estimate of the number of contacts per case for this scenario so calculations included a low estimate (10 contacts per case) and a high estimate (30 contacts per case), resulting in a range of resources needed in terms of staff. Countries are encouraged to not only trace and follow-up high-risk exposure contacts ('close contacts'), but also to undertake more extensive contact tracing in order to contain further spread wherever possible. More extensive contact tracing results in a higher number of contacts per case so we recommend planning for the higher estimated number of contacts per case.

Case study A: ten reported cases per day

Overall setup:

- Contact tracing mainly carried out by public health staff.
- Some staff are trained to use contact management software (e.g. Go.Data).

Intensity of follow-up

- All cases are interviewed by phone or face-to-face (for hospitalised patients).
- All contacts receive an initial phone call.
- Close contacts receive a daily follow-up call.

Testing

- Contacts who are symptomatic are directed to local testing locations.
- Contacts who are unable to travel by themselves to testing locations may need to be tested by other means, such as an outreach testing team, or transported to a testing location.
- Testing of asymptomatic contacts can be considered, if resources allow. Priority should be given to healthcare workers, staff in long-term care facilities or contacts who belong to vulnerable groups.

Staff resources:

- Between three and seven full-time staff members are needed to interview 10 cases a day and to make the initial call to each of their contacts.
- An additional 10–21 staff members are needed to provide close contacts with a daily follow-up call. This assumes that 10–20 close contacts per case will receive daily follow-up calls, for an average of 10 days after their last contact with the case (but this will vary depending on how many contacts are identified per case and how many of these are close contacts).

Other resources:

- Contact management software.
- Additional staff are required for data entry, data management and data analysis using contact management software such as Go.Data.
- Testing resources have not been specifically estimated as most contacts will be tested through existing local testing structures. Some additional resources may be needed for symptomatic contacts who cannot travel as transport may have to be provided to testing locations or a team sent to test them at home.

Case study B: 250 reported cases per day

Overall setup:

- Contact tracing led and supervised by public health staff (in person or remotely) but largely carried out by non-public health staff or volunteers who receive training.
- Staff work in a set-up similar to a call-centre, or possibly remotely.

Staff are trained to use contact management software (e.g. Go.Data), or call management software.

Intensity of follow-up:

- All cases are interviewed by phone or face-to-face (e.g. for some hospitalised patients).

- All contacts receive an initial phone call.
- Contacts receive daily follow-up phone calls or messages (see staff resources below).

Testing:

- Contacts who are symptomatic are directed to local testing locations.
- Testing of asymptomatic contacts can be considered if resources allow. Priority should be given to healthcare workers, staff in long-term care facilities or contacts who belong to vulnerable groups.

Staff resources:

- Between 76–180 staff to call cases and make the initial call to each contact. These can be non-public-health staff.
- Core team of public health staff to supervise staff.
- Managerial staff to coordinate call centres and overall processes.
- IT staff to support contact management software and resolve issues.
- The resources needed to provide a daily call to high-risk contacts have not been estimated. Calling all contacts every day will probably not be manageable with high case numbers and this should be done less frequently or via an automated messaging system where only those contacts reporting symptoms or not responding receive a call. This has not yet been implemented anywhere and it is difficult to estimate the staff resources needed.

Other resources:

- Various locations for use as call-centres – can be any location where staff can sit with laptops and phones, at a safe distance from one another.
- Contact management software.
- Laptops and phones for staff.
- Additional staff are required for data entry, data management and data analysis through contact management software such as Go.Data. Software may be used to send and receive messages for daily follow-up of contacts.
- Website with information and frequently asked questions specific for contact tracing. Staff to prepare training materials and provide training.
- Resources for testing are not estimated here as contacts will be tested via existing local testing structures.

Case study C: 1 000 reported cases per day

Overall setup:

- Contact tracing led and supervised by public health staff (in person or remotely) but largely carried out by non-public health staff or volunteers who receive training.
- Staff work in set-ups similar to call-centres or possibly remotely.
- Staff are trained to use contact management software (e.g. Go.Data) or call management software.
- A web-based tool is used for cases in order to directly enter information on the people they have been in contact with and their phone numbers. Contact persons are then either contacted by phone or via an automated text message. This can be used for cases who are willing and able to use a web-based tool and well enough to use one (estimated to be around 50%).

Intensity of follow-up:

- All cases are offered the option of entering information about their contacts into a web-based tool. Cases who are unable to use this tool, or who are considered to be at high risk of spreading the infection to a large number of people or to vulnerable people receive a phone call.
- Contacts receive a message with information either through the web-based tool or by phone. The web-based tool helps automate the classification of high and low-risk contacts and facilitate notification and communication with contacts.
- No daily follow-up of contacts beyond initial call. Contacts are directed to a website with frequently asked questions.

Testing:

- Contacts who are symptomatic are directed to local testing locations.
- Testing of asymptomatic contacts can be considered if resources allow. Priority should be given to healthcare workers, staff in long-term care facilities or contacts who belong to the vulnerable groups.

Staff resources:

- Between 151 and 359 staff to call cases and make the initial call to each contact for those not using the web-based tool. These can be non-public-health staff.
- Core team of public health staff to supervise staff.
- Managerial staff to coordinate call centres and overall processes.
- IT staff to support contact management software and resolve issues.

Other resources:

- One or more locations that can be used as call-centres - this can be any location where staff can sit with laptops and phones at a safe distance from one another.
- Contact management software.

- Laptops and phones for staff.
- Additional staff are required for data entry, data management and data analysis using contact management software (Go.Data) or call management software. Software may be used to send and receive messages to contacts for daily follow-up.
- Some additional IT staff time may be required to manage the web-based tool for cases registering their contacts.
- Website with information and frequently asked questions specific for contact tracing.
- Staff to prepare training materials and provide training.
- Resources for testing are not estimated here as contacts will be tested via existing local testing structures.

Contact tracing in healthcare settings and long-term care facilities

In all scenarios, contact tracing in healthcare settings and long-term care facilities needs to be carried out separately and these activities are not included in the above estimates. In hospitals, contact tracing is generally done by hospital infection prevention and control staff.

Training materials, tools and procedures shared by countries

ECDC consultation with all EU/EEA countries and with experts from various non-EU countries including Australia, the Republic of Korea and Singapore has identified a range of different training materials that are already available or can be shared upon request to ECDC. These are summarised in Table 2. Please email ecdc.info@ecdc.europa.eu to request the materials not published.

Table 2. List of materials collected

Type of material	Title	Description	Provided by	Link
Video	COVID-19: How Singapore does contact tracing	A short video (6:58 minutes) that explains how contact tracing is undertaken and the methods and teams involved.	Ministry of Health Singapore	https://www.straitstimes.com/multimedia/a-guide-to-singapores-covid-19-contact-tracing-system
Online course	Introduction to Go.Data – field data collection, chains of transmission and contact follow-up.	This briefing package provides an orientation to the purpose, benefits and utilization of Go.Data, consisting of 7 modules with a narrated walkthrough of the key features of the Go.Data web-based platform and mobile application.	WHO	https://openwho.org/courses/godata-en
Training material for an online course	COVID-19 Contact Management Programme (CMP) - training plan and education resources	Comprehensive package of training material used to organise an online training course of eight modules (four hours and 25 minutes) consisting of three main elements: self-directed learning resources; facilitated learning session and introduction to the COVID 19 Case Tracker.	Ireland (Health Service Executive)	Not published. Stored in the ECDC repository.
Training material	A standard operating procedure (including pre/post interview checklist, interview script to be followed, email template to send to the contact after interview, Q&A); three presentations (COVID-19 epidemiology, COVID-19 contact tracing principles, conducting interviews); six scenarios for role-play interviews; one exercise for identifying contacts of a case on a plane.	The material supports the organisation of a three-hour training course with the following learning objectives: - Understand the basic epidemiology and clinical characteristics of COVID-19 - Understand the place of contact tracing in pandemic control - Perform contact tracing for COVID-19 using the ACT REDCap software for data capture - Create strategies to overcome four common challenges faced when interviewing COVID-19 cases.	Australia (National Centre for Epidemiology and Population Health (NCEPH), Australia National University)	https://extranet.who.int/goarn/partner-resources-content/320?combine=contact+tracing&technical_stream=All&type_of_capacity_building_resource=All
Training material	Two PDF presentations: - Epidemiology and disease control - Mapping case activity and tracing contacts	The presentations have been developed for the Field Epidemiology Training Programme (FETP) and include infographics and educational comic strips.	Singapore (Ministry of Health, National Centre for Infectious Diseases, Saw Swee Hock School of Public Health)	Not published. Stored in the ECDC repository.
Guidelines and info material	NA	National guidelines and information material to support systematic contact tracing. The materials is in Danish.	Denmark	To be published on http://www.sst.dk/

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References

1. European Centre for Disease Prevention and Control (ECDC). Rapid risk assessment: Coronavirus disease 2019 (COVID-19) in the EU/EEA and the UK – eighth update 2020 [8 April 2020]. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-rapid-risk-assessment-coronavirus-disease-2019-eighth-update-8-april-2020.pdf

2. European Centre for Disease Prevention and Control (ECDC). Contact tracing: public health management of persons, including healthcare workers, having had contact with COVID-19 cases in the European Union – second update 2020 [8 April 2020]. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/Contact-tracing-Public-health-management-persons-including-healthcare-workers-having-had-contact-with-COVID-19-cases-in-the-European-Union%E2%80%93second-update_0.pdf

3. World Health Organization (WHO). Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) 2020 [cited 1 March 2020]. Available from: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf

4. World Health Organization (WHO). Pandemic Influenza Severity Assessment (PISA): A WHO guide to assess the severity of influenza epidemics and pandemics. Geneva 2017. Available from: https://apps.who.int/iris/bitstream/handle/10665/259392/WHO-WHE-IHM-GIP-2017.2-eng.pdf?sequence=1

5. Pung R, Chiew CJ, Young BE, Chin S, Chen MIC, Clapham HE, et al. Investigation of three clusters of COVID-19 in Singapore: implications for surveillance and response measures. The Lancet. 2020. Mar 28;395(10229):1039-1046

6. Chen W, Wang Q, Li Y, Yu H, Xia Y, Zhang M, et al. Early containment strategies and core measures for prevention and control of novel coronavirus pneumonia in China. Zhonghua yu fang yi xue za zhi [Chinese Journal of Preventive Medicine]. 2020;54(3):1.

7. Bi Q, Wu Y, Mei S, Ye C, Zou X, Zhang Z, et al. Epidemiology and Transmission of COVID-19 in Shenzhen China: Analysis of 391 cases and 1,286 of their close contacts. medRxiv. 2020.

8. Choe YJ. Coronavirus disease-19: Summary of 2,370 Contact Investigations of the First 30 Cases in the Republic of Korea. medRxiv. 2020.

9. Moradi H, Vaezi A. Lessons Learned From Korea: Covid-19 Pandemic. Infection Control & Hospital Epidemiology. 2020 Apr 3:1-2.

10. Xiong P, Xu K. How to deal with 2019 novel coronavirus (COVID-19): a public health practice from the Centers for Disease Control and Prevention in Zhanggong District, Ganzhou City, China. Infection Control & Hospital Epidemiology. 2020 Apr 6:1-5.

11. Wei WE. Presymptomatic Transmission of SARS-CoV-2—Singapore, January 23–March 16, 2020. MMWR Morbidity and Mortality Weekly Report. 2020;69.

12. Ruan L, Wen M, Zeng Q, Chen C, Huang S, Yang S, et al. New measures for COVID-19 response: a lesson from the Wenzhou experience. Clinical Infectious Diseases. 3 April 2020.

13. Nguyen THD, Vu DC. Summary of the COVID-19 outbreak in vietnam-Lessons and suggestions. Travel Medicine and Infectious Disease. 2020:101651.

14. Baker M, Kvalsvig A, Verrall A, Telfar-Barnard L, Wilson N. New Zealand's elimination strategy for the COVID-19 pandemic and what is required to make it work. The New Zealand Medical Journal. 2020;133(1512):10.

15. Verrall A. Rapid Audit of Contact Tracing for Covid-19 in New Zealand: Wellington, Ministry of Health; 2020. Available from: https://apo.org.au/sites/default/files/resource-files/2020-04/apo-nid303350.pdf

16. Fang Y, Zhang S, Yu Z, Wang H, Deng Q. Shenzhen'Experience on Containing 2019 Novel Coronavirus-Infected Pneumonia Transmission. QJM: An International Journal of Medicine. 3 April 2020. hcaa112.

17. Hellewell J, Abbott S, Gimma A, Bosse NI, Jarvis CI, Russell TW, et al. Feasibility of controlling 2019-nCoV outbreaks by isolation of cases and contacts. medRxiv. 2020.

18. Peak CM, Kahn R, Grad YH, Childs LM, Li R, Lipsitch M, et al. Modeling the Comparative Impact of Individual Quarantine vs. Active Monitoring of Contacts for the Mitigation of COVID-19. medRxiv. 2020.

19. Keeling MJ, Hollingsworth TD, Read JM. The Efficacy of Contact Tracing for the Containment of the 2019 Novel Coronavirus (COVID-19). medRxiv. 2020.

20. European Centre for Disease Prevention and Control (ECDC). Resource estimation for contact tracing, quarantine and monitoring activities in the EU/EEA 2020 [11 March 2020]. Available from: https://www.ecdc.europa.eu/en/publications-data/resource-estimation-contact-tracing-quarantine-and-monitoring-activities-covid-19

21. World Health Organization (WHO). About Go.Data. Geneva 2020 [15 April 2020]. Available from: https://www.who.int/godata/about

22. Ferretti L, Wymant C, Kendall M, Zhao L, Nurtay A, Abeler-Dörner L, et al. Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing. Science. 2020.

23. Zheng Z. Covid-19: Singapore invents world's first nationwide contact tracing app: Mothership; 2020 [20 March 2020]. Available from: https://mothership.sg/2020/03/trace-together-covid/

24. eHealth Network. Mobile applications to support contact tracing in the EU's fight against COVID-19, Common EU Toolbox for Member States 2020 [updated 15/04/2020]. Version 1.0. Available from: https://ec.europa.eu/health/sites/health/files/ehealth/docs/covid-19_apps_en.pdf

25. European Commission. Communication from the Commission Guidance on Apps supporting the fight against COVID 19 pandemic in relation to data protection 2020/C 124 I/01. Official Journal of the European Union. 2020;63:1-9.