Coronavirus Disease 2019 (COVID-19)

Operational Considerations for Adapting a Contact Tracing Program to Respond to the COVID-19 Pandemic

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Who is the intended audience of this document?

This document is for CDC country offices, ministries of health, sub-national public health authorities, and other implementing partners in non-US settings. While select adaptations may be relevant for any jurisdiction, the document focuses on adaptations that might be especially useful in low- and middle-income countries.

Document Rationale

Contact tracing is a key component of controlling transmission of infectious diseases. Contact tracing for the current COVID-19 pandemic however, is distinct from that undertaken for other diseases (e.g., Ebola, HIV, TB) because in nearly all countries the number of cases and contacts has outpaced the capacity of the public health system to quickly notify and quarantine all contacts and isolate all cases.

As a result, contact tracing programs will need to prioritize activities to ensure that human and financial resources are utilized most effectively. Necessary adaptations will depend not only on setting, but also will need to adapt over time, to best suit the current epidemiology of the outbreak. Measures that are feasible when there is one case or even one cluster of cases, may not be feasible once hundreds or thousands of new cases are reported a day. The following document outlines considerations for modifying contact tracing protocols to maximize efficient use of limited resources.

Within the following document, these adaptations are grouped into the following four categories:

1. **Workforce Adaptations** (i.e., who will do the case investigations and contact tracing) à Ideally existing staff from the public health agency in country (e.g., Ministry of Health, National Centers for Disease Control, Field Epidemiology Training Program) would be able to implement these efforts. This document will review ways to build the workforce if this is not feasible with current staff.

2. **Epidemiologic Adaptations** (e.g., which contacts will be followed) à Ideally all cases will be investigated, all contacts will be listed, and then all contacts will be quarantined and monitored for 14 days after last exposure to a potentially infectious person. This document will review how to prioritize activities and contacts if this is not feasible.
3. **System Adaptations** (e.g., how will cases and contacts be notified and monitored) à Ideally all cases and contacts will be contacted directly by public health officers, either in person or by phone. This document will review ways to improve the process if this is not feasible.
4. **Financial, Logistical, and Operational Adaptations** (e.g., what resources will be available to support the system designed) à Ideally, financial, human, and logistical resources for contact tracing would be sufficient to meet the need. This document reviews how to adapt when these resources are limited.

These adaptations however have trade-offs. In some settings and under some circumstances, contact tracing may not be sufficient to contain transmission. This is particularly true in settings of widespread community transmission, and of particular concern for this pandemic given the role of asymptomatic transmission. In such as context, national or sub-national stay-at-home orders may need to be reissued, such that the whole population will be asked to quarantine (except for essential workers). The CDC COVIDTracer is a useful tool to determine modeled trajectory of COVID-19 cases under different contact tracing scale-up scenarios, to help determine an appropriate scale-up of contact tracing efforts.

Contact tracing is the focus of this document. However, contact tracing programs cannot operate in isolation. Contact tracing works to help contain an outbreak when integrated into a robust response that includes implementation of community mitigation measures (including but not limited to maintaining physical distancing in public places, limiting outings, avoiding large gatherings, wearing cloth face coverings, washing hands often, and cleaning high-touch surfaces routinely), as well as isolation of cases and testing.

Key Terms

It is important to clarify the usage of several terms as relevant for the current COVID-19 pandemic. In this document:

A *contact* is defined as **someone who had any contact with an infected person** (probable or confirmed COVID-19 case) while they were infectious – starting from 2 days before illness onset (or, for asymptomatic clients, 2 days prior to positive specimen collection) until the time the patient is isolated.

Close contact is defined by CDC as someone who was **within 6 feet of an infected person for at least 15 minutes** starting from 2 days before illness onset (or, for asymptomatic clients, 2 days prior to positive specimen collection) until the time the patient is isolated. The World Health Organization (WHO) additionally includes

persons with direct physical contact with a probable or confirmed case, direct care for a patient with probable or confirmed COVID-19 disease without using proper personal, and other situations as indicated by local risk assessments.

Isolation refers to a strategy used to **separate people *infected* with the SARS-CoV-2 virus** (those with and without symptoms) **from people who are not infected**. The term is used here to refer to people who are isolated at home, a community care center (i.e., isolation shelter), or a health facility. In the home, anyone with COVID-19 symptoms or who has been diagnosed with the disease should separate themselves from others in the home to reduce the risk of transmission to others in the household and should stay home until it is safe for them to be around others. This also includes people who have signs and symptoms consistent with COVID-19, for whom test results are not yet or will not be available.

Quarantine refers to a strategy used to **keep someone who might have been *exposed* to COVID-19, but does not know if he or she is infected, away from others**. Quarantine helps prevent spread of disease that can occur before a person knows that he or she is infected. People in quarantine should stay home, separate themselves from others, monitor their health, and follow directions from their local public health authorities.

Case Investigator refers to someone who will interview the case, elicit names and contact information of the contacts to be monitored, and provide guidance and resources to support people who are in isolation. They may also be the person who initially notifies a patient of a positive test result.

Contact Tracer refers to someone who will notify contacts of their exposure and monitor them for 14 days. They will describe quarantine to the contacts, help connect contacts with social services and other support as needed, and commonly be the primary public health person for contacts to answer questions and address concerns.

For the purpose of this document, these two distinct roles are referenced. However, the roles and responsibilities of case investigator and contact tracer may overlap in some settings, and may change over the course of the response. For example, in some contexts, case investigators may be the ones who initially notify contacts of their exposure; this is commonly the case for household members of the case. In addition, these roles may have different titles in different places.

Figure 1. Summary of Operational Considerations for Adapting Contact Tracing Programs

The following figure summarizes the four areas of consideration outlined in the document and key questions to be answered in adapting contact tracing, as needed, to the COVID-19 pandemic response in a given jurisdiction. Each question is explored in detail in the following text.

Workforce Adaptations

- Can staff roles be re-evaluated to fill gaps?
- Can additional staff be recruited?
- Can additional staff be quickly trained?
- From where and how should staff be recruited?

Epidemiology Adaptations

- Can higher impact activities (e.g., notification of cases and close contacts) be prioritized?
- Can turnaround time for test results be reduced in order to reduce the number of contacts that need to be traced?
- Can monitoring of close contacts be prioritized?
- Can close contacts be further prioritized for follow-up, such as those in congregate settings?
- Can the duration and/or frequency of follow-up be revised?
- Can a household unit be traced and monitored together?
- Can the testing strategy for contacts be modified?

Systems Adaptations

- Can SMS, apps, or other technology or software be used to support remote follow-up?
- Is self-monitoring an option?
- Can digital tools be used to improve efficiency of contact tracing?
- Will digital proximity (bluetooth enabled applications) be adopted?
- Can digital tools be used to monitor workforce performance and support enhanced data utilization?

Financial, Logistical and Operational Adaptations

- Can financial resources be reallocated or used more efficiently to support a scale-up?
- Are logistical and operational supports for contact tracers in place to support a scale-up?
- Are logistical and operational supports for isolated and quarantined individuals in place to support a scale-up?
- Can local organizations and networks support the government public health authority?

Workforce Adaptations

Ideally existing staff from the public health agency in country (e.g., Ministry of Health, National Centers for Disease Control, Field Epidemiology Training Program) would be able to implement these efforts.

However, the human resource demands of contact tracing in the context of the COVID-19 pandemic may outstrip the capacity of existing staff. Evaluate current capacity against projected need. This will involve two steps: (1) Reviewing staff rosters to determine how many staff are currently available, and (2) using calculators to determine how many staff will be needed, given the current outbreak epidemiology. Calculators are listed in the resource section at the end of this document under Workforce Calculators. In reviewing staff rosters, ensure they are updated to reflect staff who: are currently available to support the COVID-19 efforts full-time; have recently been trained; or may be unable to participate because they are at risk for severe illness.

If the currently available staff are insufficient, consider the following:

- ***Can staff roles be re-evaluated to fill gaps?*** One of the quickest adaptations may be to repurpose existing staff or shift their tasks – for example, from contact tracing efforts for other disease control programs, or community outreach roles that are not currently being performed or prioritized. Ensure everyone is used to their full capacity. Someone who originally had just one role as a contact tracing team supervisor may also need to do daily follow-ups with contacts. Identifying contacts (during the case investigation) and notifying them are the highest-priority activities; if you find that a large proportion of cases and contacts are not being notified quickly, you may have to shift efforts from contact monitoring to these higher priority activities. This shift may require some retraining of contact tracers.

- ***Can additional staff be recruited?*** Consider what kinds of workers could have the right skills. Some ideas include medical/nursing students, community health workers, teachers, high school or university students, faith and community leaders, and social workers. Staff supporting community-level mobilization and education programs previously may be well positioned to support this work (e.g., community health workers). Determine whether the same people will be used for both case investigation and contact tracing. If not, would they be cross-trained so they could quickly transition between roles based on need? What are the minimum qualifications for each type of position? These staff will need to receive specialized training to provide them with basic principles of epidemiology, surveillance, and risk communication.

  Ideally, contact tracing staff will be connected to the community, have high emotional intelligence (i.e., be sympathetic and able to emotionally connect with contacts/cases) and culturally respectful, and speak relevant languages. Consider recruiting from lower risk groups, (i.e., people who are less likely to become seriously ill if they get infected, such as young people and those without underlying medical conditions). Good supervision is essential for training and quality assurance. Staff who were previously acting as contact tracers may need to transition into

supervisors, which may require additional training, shadowing, and mentorship.

- ***Can additional staff be quickly trained?*** Training will be necessary for newly recruited contact tracers. CDC has created a package of materials with job aids and standard operating procedures developed by jurisdictions within the United States, but these materials will need to be translated for context and language. Additional training resources are listed at the end of this document. The Public Health Foundation maintains the TRAIN Portal which contains a wide variety of training tools for different aspects of the response.

  Some key questions to ask when planning a contact tracing program are: Where will you find trainers? Does your country have a Field Epidemiology Training Program, whose residents and/or graduates might be used? Would the Ministry of Health (MoH) be willing to collaborate on a "training of trainers" or "cascade" model for rapid scale-up? Can the trainings be completed remotely, if necessary, or socially distant if remote training is not possible? Or a combination?

  If you anticipate the need for large-scale training, you may want to consider national or regional training institutions able to support remote training. Periodic refresher training, particularly as new guidance and recommendations are released, is recommended. Assessment of training is also recommended and can be done through pre- and post-testing and interim knowledge checks, for continuous quality improvement. Feedback from trainees after they have been on the job for a few weeks can also be helpful to improve training quality and address any gaps or confusion.

- **Where should staff be recruited from?** Because the epidemiology of an outbreak can shift rapidly, identifying which regions need additional staff can be a challenge, especially in countries with decentralized health systems. Consider the minimum number of staff required for case investigation/contact tracing in each jurisdiction as well as surge support plans. In many places, staff maintained at the national or regional levels can be deployed (or remotely reassigned) as surge support. Using surge staff may help reduce the number of staff in all jurisdictions who need to be recruited and trained. Such approaches may depend on the mobile phone and/or internet access in the country. Maintaining up-to-date estimates on the amount of time required for case investigation and contact tracing in each jurisdiction will be valuable to ensure staffing plans keep up with the evolution of the outbreak. That time may vary radically across jurisdictions, given differences in modality (in-person vs. remote) and distances/transportation time.

Epidemiologic Adaptations

Ideally all cases will be investigated, all contacts will be listed, and then all contacts will be quarantined and monitored for 14 days after last exposure to a potentially infectious person.

Evaluate whether it is currently possible to interview all cases, to list all contacts, notify all contacts, and monitor all contacts throughout their quarantine. Review current surveillance data to assess whether this is possible with currently available staff. This is a question to return to often as there may be factors that increase capacity (e.g., recruitment and training of more staff) and factors that may increase demand (e.g., increased transmission, shifting hot spots). In most settings, jurisdictions have been able to scale contact tracing efforts during Phase 2 of the pandemic, however adaptations may be required in many settings in Phases 3 and 4. As case counts increase, more clusters are confirmed, and cases are reported in more geographic locations resources may become strained – it may be necessary to prioritize activities to optimize resources to ensure they are used to maximum efficiency (e.g., interrupting as many transmission chains as feasible with available resources). During phase 4 for of the pandemic – during which widespread local transmission is reported – many jurisdictions may only be focus on the highest priority cases and contexts (e.g., those in institutionalized settings, health care settings, or other settings with the potential to be super-spreader events). Plans for adaptation during Phases 2-3 should be put in place in all settings in case a jurisdiction notices poor performance in contact tracing metrics prior to widespread community transmission.

The four phases of the pandemic proposed by WHO are as follows, but phases may be different within a country:

- **Phase 1**: no cases;
- **Phase 2**: one or more cases, imported or locally detected;
- **Phase 3**: cases cluster in time, geographic location, and/or by common exposure;
- **Phase 4**: larger outbreaks of local transmission.

If it is not possible to list, notify, and monitor all contacts, consider the following adaptations:

- ***Can monitoring of close contacts be prioritized*?** In many settings, only close contacts are being monitored. Sample definitions for close contacts in the box below include CDC and WHO recommended definitions as well as definitions used in national guidance from select countries. Monitoring close contacts should require fewer resources than monitoring all contacts. Further differentiation among close contacts (e.g., household contacts, healthcare setting contacts) may also be considered. Factors to consider when defining contacts and evaluating risk include proximity, the duration of exposure, whether the case has symptoms (e.g., coughing likely increases exposure risk), and whether either the case or contact were wearing an N95 respirator (which can efficiently block respiratory secretions from contaminating others and the environment). It will be important to discuss how contacts will be classified, which will be monitored, and whether there will be any prioritization by type of exposure.

CDC Contact Definition

For COVID-19, a close contact is defined as any person who was within **2 meters**, or 6 feet, of an infected person for at least 15 minutes starting from 2 days before illness onset (or, for asymptomatic patients, 2 days before positive specimen collection) until the time the patient is isolated (or until the end of the infectious period if not isolated before then).[1,2]

Other people who could potentially be defined as close contacts:

- Household contacts living/sleeping/eating in the same home, or sexual partners of a case
- Healthcare workers who have had a breach in PPE or have not worn it while exposed to a case (either directly, with bodily fluids, or with a laboratory specimen)
- People in closed settings, such as long-term living facilities, and other high-risk congregational/closed settings (e.g., prisons, shelters, hostels) where a case has been identified
- Known/identifiable contacts of a case in other group settings (places of worship, indoor workplaces, private social events)
- Passengers on an aircraft sitting within 2 seats (in any direction) of the case, travel companions, anyone providing care, or crew members working in the same section
- People who used other public or shared transportation with a case

In some countries, contacts of contacts (i.e., secondary contacts) and potentially the contacts of *those* contacts (i.e., tertiary contacts) are also being listed and monitored. Preliminary data suggest that this approach does identify new cases, but the yield, or proportion of new cases identified, is lower for each additional ring of contacts. Identifying and monitoring cases and their contacts should be prioritized over identifying and monitoring secondary contacts (contacts of the contacts) and tertiary contacts (contacts of the secondary contacts).

- ***Can higher-impact activities be prioritized?*** Contact tracing involves several different activities that are not equivalent in terms of their anticipated yield or impact on mitigating transmission. Ideally, all of these activities are part of a robust contact tracing program. However, where resources are limited, you may have to prioritize activities. If so, those ranked higher on the following list should be prioritized:
  1. Identification and isolation of cases in institutional or congregate settings
  2. Identification and isolation of other cases (those not in institutional or congregate settings)
  3. Notification and quarantine of close contacts
  4. Notification and quarantine of selected other contacts more likely to be infectious (e.g., prioritizing the contacts of a case who is still symptomatic over contacts of an asymptomatic case or case for whom symptoms have resolved)

5. Monitoring of close contacts daily for 14 days
6. Notification and quarantine of all other contacts
7. Monitoring (tracing) of other contacts daily for 14 days

Identification of cases (whether or not they were previously contacts) is the highest-priority activity to ensure they know about the need to self-isolate and receive resources, such as food, water, masks, and hygiene and sanitation products. If notification of all cases is not currently occurring, identify whether you can shift resources (e.g., move contact tracers to be case investigators) or automate some of the lower priority activities (e.g., ask some or all contacts to self-monitor so contact tracers can focus on notification).

- ***Can turnaround time for test results be reduced?*** Ideally, testing capacity allows for quick testing of all suspected cases, contacts or otherwise. Consider whether resources can be employed such that the public health entity organizing case investigation and contact tracing is notified of lab results within 24 hours of specimen collection. Under this scenario, it may be possible to focus on listing and monitoring of only contacts of confirmed cases. However, in many contexts, laboratory capacity is overwhelmed by the current pandemic. It may be advisable to list and trace contacts of probable cases who have not yet (or potentially will not) receive test results. This approach will have large implications for the number of contacts that need to be listed and followed, especially during influenza season. Testing protocols should ensure that specimens from symptomatic contacts or other people with COVID-19-like symptoms are prioritized, as well as those collected most recently. Protocols should also prioritize specimens from people who are more likely to be infectious, as opposed to specimens from asymptomatic contacts and those with lower risk exposures.

- ***Can close contacts be further prioritized for follow-up?*** If all cases and contacts are being *identified and notified*, but there is insufficient capacity to *monitor* all contacts, it may be necessary to prioritize contacts for follow-up. There are several approaches to consider:
  1. Can literate contacts with access to internet/phones be asked to self-report, such that only the subset who report symptoms or fail to report daily can be followed up by public health officers?
  2. Can contacts **at higher risk of becoming infected or having severe disease** (such as household members, older adults, and people with certain underlying conditions) be prioritized?
  3. Can contacts **in high-risk settings** (e.g., healthcare workers; contacts in prisons, urban slums, refugee/IDP camps, or nursing homes) or areas with newly confirmed transmission be prioritized?
  4. Can contacts be prioritized **by timing of exposure** (such as contacts of a case with a more recent symptom onset, versus a case with a symptom onset longer ago)?

- ***Can the duration and/or frequency of follow-up be revised?*** Daily monitoring of all contacts for 14 days may not be feasible. It may be necessary to reduce the frequency of follow-up (e.g., check-in every other day) or the duration of follow-up. Norway, for example, reduced their follow-up and home quarantine time from 14 to 10 days to save resources based on data that showed few contacts testing positive or

developing symptoms after the 10-day timeframe.[4] Replication of these findings in other contexts may be advisable before widespread adoption of this timeframe. In general, reducing the frequency rather than the duration may be more helpful in addressing resource constraints.

- ***Can a household unit be traced together?*** Often, many of a contact's household members may also be contacts, or it may not be feasible to quarantine contacts away from other members of the household. Under this scenario, it may be more efficient and feasible to consider the household as a single unit such that one contact tracer is assigned to monitor all household members at once during follow-up phone calls or home visits. It may be valuable to align the quarantine period for all household members. If the date of last contact with the case differs by a few days, consider use of the most recent date of any household member. Ensure that the household has enough food, water, hygiene materials, and other essential goods for the quarantine period.

- ***Can the testing strategy for contacts be modified?*** Testing of contacts has large implications for laboratory as well as contact tracing resources. If resources permit, jurisdictions should arrange for the testing of all monitored contacts, as appropriate. If positive, the contact will be referred to a case investigator. If negative, contacts should continue to self-quarantine for a full 14 days after last exposure and follow all recommendations of public health authorities. Where resources exist, testing should be performed as soon as symptoms develop for symptomatic contacts. Many jurisdictions are testing asymptomatic contacts at 14 days. In these jurisdictions, the purpose of testing asymptomatic contacts is case identification, not a release from quarantine requirement. Testing all contacts (or all close contacts) regardless of symptoms may increase sensitivity of a surveillance system, but this approach requires high availability of testing personnel, supplies (including assays and reagents), PPE, and lab staff.

System Adaptations

Ideally all cases and contacts will be contacted directly by public health officers, either in person or by phone.

Determine whether it is possible for public health officers to contact all cases and contacts directly or whether use of apps and other automation will be needed to ensure follow-up. Are there adequate staff to visit or call all cases and contacts? If in-person visits are necessary (for some or all notifications) because of limited connectivity or cultural preferences, are resources sufficient to support transportation and any recommended personal protective equipment for staff? If phone calls are being used for some or all notifications, are there sufficient phones and phone credit? In answering these questions, consider what method of notification is preferred, recognizing that different methods may be advisable for different sub-groups within a country and within different geographic areas.

If it is not possible for public health officers to contact all cases and contacts directly either in person or by phone:

- ***Can SMS, apps, or other technologies be used to support remote follow-up?*** – Depending on the context, is tracing by an app, messaging software (text or video), or by SMS both acceptable and feasible? It may be more appropriate to use these methods for some steps of the process than others (e.g., in-person contact for initial notification and then app/SMS for daily monitoring). This may allow tracers to follow more contacts and limit their own exposure risks. However, human interaction is valuable for building trust and providing knowledge and resources to help people maintain quarantine. Both the importance as well as the cost/logistics of in-person interactions are context-specific and may vary within a country.
- ***Is self-monitoring an option?*** Is daily follow-up (either in person or remotely) of each contact necessary, or would it be acceptable to implement a self-reporting tool that allows contacts to self-report symptoms (or lack thereof) each day. Self-monitoring may be an option if the target population is literate, has access to phones/computers, the approach is culturally acceptable, and defaulting from self-monitoring is anticipated to be low. Using this approach, a public health officer would still follow-up with contacts who report symptoms or fail to report symptoms or lack thereof. Such an approach would require a data system and data manager. There are SMS tools, apps, and other digital methods that allow contacts to self-monitor. Specific options are not listed here because of the rapidly changing landscape of tools.
- ***Can digital tools be used to improve efficiency of other components of the contact tracing process?*** Many software programs have been developed to improve the efficiency of case identification and contact tracing (referred to as case management tools in this overview of different considerations , which is developed for the United States but provides a useful summary of capabilities and purposes). These tools can automate many of the functions commonly done by public health professionals in addition to the self-monitoring functions noted above (e.g., anonymous notification of contacts of a potential exposure), and they can also help make other processes like prioritization and assignment of contacts more efficient. In considering software options, consider the capacity of the public health authority to maintain the system, capacity and connectivity of staff (core and newly trained staff) to use the system, and capacity and connectivity of the end users. Privacy and cultural acceptability of varying levels of intrusion should also be considered for any system adopted.

- ***Will proximity applications be adopted?*** In addition to the software to improve the efficiency of the public health activities, new apps have been piloted in select countries that use Bluetooth or GPS cell phone technology to identify potential contacts (referred to as 'proximity tracking' in this overview of different considerations). These tools allow for automated notification of potential contacts who were in physical proximity of a case.

  These tools are new and are still subject to limitations: (1) they require widespread adoption of the app such that both the case and all contacts have the app downloaded and enabled; (2) they are thought to identify many false-positives (notifying people who would not meet the public health definition of a contact); (3) many data privacy and data integrity issues must be considered; and (4) they may increase the workload of public health officers. They notify a contact of potential exposure but do not replace the role of public health personnel for support, assistance, and monitoring throughout quarantine. In settings where there are

concerns about ability to implement core contact tracing efforts (i.e., notification of all cases and close contacts), investigators may wish to deprioritize proximity tracking tools.

- ***Can digital tools be used to monitor workforce performance and support enhanced use of data?*** Analysis and data use for workforce management as well as decision making can be challenging as the contact tracing systems expand. Systems may be needed to track progress in identifying, interviewing, and quarantining contacts as well as to monitor the performance of tracing staff. A contact tracing team supervisor may want to know how well their tracing team members are doing in daily follow-ups and track any issues for continuous quality improvement.

Financial, Logistical, and Operational Adaptations

Ideally, financial, human, and logistical resources for contact tracing would be sufficient to allow public health agencies to enact all components of a robust contact tracing program without consideration of resource limitations.

Evaluate whether it is possible to provide all financial, logistical, and operational support to the program envisioned, to map what resources gaps may already exist (or may be anticipated) to inform what is feasible within a jurisdiction. Review your budget and other appropriated funds to evaluate what financial resources are available to support expanding contact tracing. Based on how contact tracing will work locally, determine what transportation, supplies (e.g., tablets, phones, computers) and other logistical support may be needed and evaluate whether these items are currently available or can be procured.

If financial, logistical, and operational resources are insufficient, consider the following adaptations:

- ***Can financial resources be reallocated or used more efficiently to support the contact tracing program?*** In parallel with considering which adaptations are feasible and appropriate, consider their costs—specifically, the logistical and operational costs to create and maintain a contact tracing database, provide transportation and supplies to contact tracing teams, train staff, print materials, host a physical space for training or making calls that allows physical distancing, and pay for supplies and social support services for isolated and quarantined people.

  There are also considerable human resource costs for hiring, training, managing, transporting and paying a large number of staff. Given the scale of the effort, additional funding may be necessary. In addition, consider more efficient use of existing resources —servers used for routine surveillance; a call center hosted by the MoH; and staff, facilities, and technology that the Emergency Operations Center (EOC) or MoH already has on hand.

  Because travel can present some of the highest expenses associated with contact tracing, consider assigning contract tracers to their home communities to minimize

costs while also increasing acceptability and understanding of community contexts. Transitioning to remote methods of contact tracing (where appropriate, as discussed under 'System Adaptations' above) may also help reduce costs.

- ***Are sufficient logistical and operational support for contact tracers in place*?** Discuss ways to make sure contact tracers and isolated/quarantined people have the right supplies. For contact tracers doing in-person follow-up, consider what transportation and supplies they may need. In general, contact tracers should practice physical distancing (staying 2 meters away from cases/contacts, including staying outside of the homes of cases/contacts), wear cloth face coverings, and have enough soap and/or alcohol-based hand rub. Additional protective equipment may be considered but is not required if social distancing is practiced. For people doing remote (e.g., by phone) follow-up with cases and contacts, internet access and/or phone credit (and potentially a phone) for contacting people will likely be necessary. Use of paper forms and/or tablets should be reviewed. If paper forms are used, systems need to be in place to compile and archive the completed investigation forms. If electronic methods are used, systems need to be in place to ensure data security in transmitting and storing information.
- ***Are logistical and operational support for isolated and quarantined people in place to support the contact tracing program*?** Supplies for people under isolation or quarantine are important to a successful contact tracing program. Asking people to isolate or quarantine without providing wrap-around social services will be ineffective, and perhaps unethical.

  Consider providing the following items to cases in isolation: washable cloth face covering (or masks, as available), gloves, digital thermometer, alcohol-based hand rub, soap, and household disinfectant, as well as COVID-19 health education materials (translated into the appropriate language) and instructions for cleaning and disinfecting the home.

  If the full household is under quarantine or the person under quarantine lives alone, food, water, financial support, and other hygiene or sanitation tools may needed. Review which of these will be directly provided by the government public health authority. Consider whether any can be provided in collaboration with local communities, civil society including faith-based organizations, or non-governmental organizations. In some contexts, these organizations may be positioned to donate this support, whereas in others it will be necessary for the government public health authority to fund these services, but local organizations may be able to get and deliver them.

  Finally, consider whether locations for isolation and quarantine will be available for people who cannot safely isolate away from household members or who may live in institutional settings (e.g., prisons or homeless shelters). The appropriateness and feasibility will vary by context.
- **Can local organizations and networks support the government public health authority?** For some contacts, such as those linked to a religious gathering or place of employment, it may be appropriate to work with faith leaders, event organizers, or supervisors to support efforts to educate cases and contacts about COVID-19. Public health should still do the initial notification and contact tracing. However, these groups may be able to provide social services and education. Such collaboration can help reduce the workload for contact tracers. The following table,

adapted from the Washington State Department of Health, provides some examples.

Contact Type	Description	Follow-Up Action by Public Health
Named Contact	Household member, including partner of confirmed case	Call directly and provide guidance
Employer	Lab-positive case works at a restaurant	Call manager or supervisor of the case directly and provide guidance to that person
Healthcare facilities	Lab-positive case works at a hospital	Call Infection Prevention or healthcare manager and provide guidance
Small/private groups	Everyone in the small group can easily be contacted	Call the event organizer/host/manager and provide guidance
Large groups	Everyone in the large group can receive individual public health follow-up or event organizer can send information to individuals	Contact event organizer and provide guidance
Public exposure site	No way to find out who was present at the public location	Inform site management personnel of new public exposure (date and time of exposure) and notify site manager of pending public announcement

Balancing Adaptations

Which adaptations are most appropriate will differ by jurisdiction depending on the local epidemiology and available resources, and may change over time as the pandemic progresses. Available evidence is insufficient to characterize the likely impact of any adaptation, or combination of adaptations, on transmission. Any of the adaptations described may impact the overall effectiveness of a program in interrupting transmission, though the impacts of each adaptation will vary.

However, select adaptations may have a greater impact on the resource demands on a contact tracing program. In particular, two adaptions are anticipated to have the greatest impact on resource requirements: (1) Deciding to trace all *high-risk* contacts (rather than all contacts) will likely dramatically reduce the total number of contacts requiring tracing. (2) Deciding to focus on *notification* of contacts, and therefore deprioritizing ongoing monitoring will save resources. Deprioritizing may mean allowing for self-monitoring (potentially supported by technology), allowing for follow-up monitoring by phone or text message, reducing the frequency or duration of follow-up, or determining it is fully infeasible with available resources. Each of these various options will likely have different epidemiologic as well as resource implications.

Monitoring and Evaluation

Assuming a scale-up of contact tracing together with other mitigation efforts is sufficient to control an epidemic, how does a program or country know whether its adaptations are warranted or effective? Interruption of transmission requires that all steps in the process – from when an index case becomes infectious through to when their contacts are successfully quarantined for the required timeframe – happen efficiently and effectively. Each step is an important link in the chain. As this document focuses on case identification, contact notification, and quarantine of contacts, the indicators will focus on those same steps (noted in orange in the figure below). Separate indicators will be needed for the other steps.

*note on the figure: case should isolate at time of specimen collection, not in first orange rectangle.

Research is ongoing about which indicators best reveal whether contact tracing is effective at stopping or limiting the spread of COVID-19. The indicators below have been used in response to other large-scale outbreaks to help measure aspects of a contact tracing program: whether contacts are not only known and registered, but also notified, quarantined, and followed or monitored. The goal of a successful contact-tracing program is to ensure new cases come from registered contacts. Target percentages are not included here due to the current lack of evidence specifically from COVID-19 on which to base these.

Indicator	Definition

Percentage of cases interviewed within 24 hours of identification to elicit contacts	# of cases interviewed within 24 hours of identification / # of cases identified in a 24-hour window The term ‘interviewed’ here refers to interviewing the case to collect information on their demographics and risk factors, eliciting a list of contacts, providing isolation instructions, and facilitating access to social support services.
Percentage of contacts notified and quarantined within 24 hours of identification	# of contacts notified within 24 hours of identification / # of contacts identified in a given day The term ‘notified’ here refers to notifying a contact of potential exposure, providing quarantine instructions, and facilitating access to social support services.
Percentage of contacts lost to follow-up	# of contacts not monitored for >2 consecutive days / # contacts under follow-up
Percentage of lab results shared with public health within 24 hours of specimen collection	# of specimens for which results are recorded within 24 hours of specimen collection / # of total specimens collected ‘Public health’ is defined as whatever entity is conducting case investigations to elicit contact lists.
Percentage of symptomatic contacts tested	# of symptomatic contacts tested / # of symptomatic contacts
Percentage of contacts followed up each day for 14 days from last exposure to an infectious case or until confirmed as a case	# of contacts followed for 14 days from last exposure of an infectious case or until confirmed as a case / # of total contacts
Percentage of cases not arising from contact list	# of cases who were not previously listed contacts / # of total cases

Among cases who were previously known contacts, percentage isolated within 24 hours of symptom onset	# of previously known contacts isolated within 24 hours after symptom onset / # cases previously registered as contacts
Among cases who were known contacts, percentage originally classified as close contacts	# newly confirmed cases among **close** contacts / # cases previously registered as contacts

ANNEX: COVID-19 Contact Tracing Resources and Tools

1. Contact Tracing Training Resources

- Public Health Foundation TRAIN: COVID -19 Training Resources
- John Hopkins University – COVID-19 Contact Tracing Training
- World Health Organization (WHO) – GO Training: Case Finding & Contact Tracing
- Association of State and Local Health Officials: Making Contact: A Training for COVID-19 Contact Tracers
- Africa CDC Webinar: Why case investigation and contact tracing is important in the management of COVID-19
- Washington State Department of Health: Contact Investigation Training

2. Contact Tracing Guidance and Tools

- WHO Contact Tracing in the Context of COVID-19
- CDC Training Case Investigators and Contact Tracers
- CDC Investigating a COVID-19 Case
- CDC Contact Tracing
- CDC Notification of Exposure: A Contact Tracer's Guide for COVID-19
- Africa CDC: PACT Tracing
- Africa CDC COVID-19 Contact Tracing Protocol for African Union Staff
- Africa CDC: Guidance on Contact Tracing for COVID-19 Pandemic
- WHO GOARN COVID-19 Knowledge Hub

3. Workforce Scale-up

- CDC Scaling Up Staffing Roles in Case Investigation and Contact Tracing
- CDC Training Case Investigators and Contact Tracers
- CDC COVID-19 Sample Training Plans for Contact Tracers, Case Investigators, and Supervisors

4. Workforce Calculators

- CDC COVIDTracer
- George Washington University Contact Tracing Workforce Estimator | Brief
- Prevent Pandemics Contact Tracing Workforce Estimator

5. Finance, logistics and operational support

- WHO Operational Planning Guidelines to Support Country Preparedness and Response: Pillar 3
- ECDC Resource estimation for contact tracing, quarantine and monitoring activities for COVID-19 cases in the EU/EEA2

6. Digital tools

- WHO Digital tools for COVID-19 contact tracing
- WHO Introduction to Go.Data: Field Data Collection, Chains of Transmission and Contact Follow-up
- CDC Digital Contact Tracing Tools

7. Data Use

- CDC Data Management for Assigning and Managing Investigations
- JHU Digital Contact Tracing for Pandemic Response: Ethics and Governance Guidance

8. Monitoring and Evaluation

- CDC Analyze Contact Tracing Encounters for Continuous Quality Improvement

9. Other Mitigation Measures

- CDC Hierarchy of Controls
- BRIDGE: Stacking best practices
- WHO Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19)
- CDC Living in Shared Housing
- CDC Households Living in Close Quarters – How to Protect Those That Are Most Vulnerable
- JHU How families and roommates can effectively self-quarantine, self-isolate
- American Medical Association: Ethical Use of Quarantine & Isolation

Footnotes

[1]https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing-comms.html

[2]The end of the infectious period is best understood to be 10 days from the onset of symptoms and at least 24 hours after recovery / resolution of symptoms. https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html

[3]https://www.fhi.no/en/op/novel-coronavirus-facts-advice/advice-to-health-personnel/home/?term=&h=1

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