

FOCUS ON

Backward Contact Tracing



May 2021

Key Messages

- Backward contact tracing (BCT) is a method of contact tracing which aims to find primary or source cases of COVID-19 and other cases that are linked to that source. Modelling studies have shown that BCT results in finding 2-3 times more cases than forward contact tracing alone.
- BCT can be applied when a case does not know where the illness may have been acquired. Key elements for implementation include developing the type of questions administered, assessing timeliness of follow-up, recommending testing of identified contacts and effective communication with cases and contacts regarding potential risk of exposure.
- BCT is more effective as part of public health case and contact management when community transmission is low to moderate.

Introduction

The purpose of this document is to provide a conceptual overview of backwards contact tracing (BCT) which is also referred to as source or acquisition investigation, reverse, retrospective or bi-directional contact tracing. It also provides operational considerations for public health units (PHUs) for inclusion of BCT into their case and contact management for COVID-19. It is not intended to be a replacement of current provincial public health guidance: [Management of Cases and Contacts of COVID-19 in Ontario \(PH CCM\)](#).¹

Key features of this document include:

- Overview of BCT
- Considerations for use of BCT
- Considerations for public health units to adapt BCT to their case and contact management processes

Methods

This document is informed by a review of current literature on BCT and existing knowledge products from the Public Health Agency of Canada and the World Health Organization in addition to consultations with local public health units in Ontario, British Columbia Centre for Disease Control and Montreal Public Health.

Terminology and Definitions

Monitored setting is used in this document to refer to settings in which public health preventive measures are in place to mitigate case and contact exposures and to which there is generally expected to be a high level of oversight and adherence to these measures. In addition, these settings have setting specific protocols for the management of cases and outbreaks. These may include, but are not limited to, long-term care facilities, hospitals, schools and workplaces.

Minimally-monitored setting is used to describe informal settings such as private gatherings, weddings, parties, and some religious events, where there is minimal to no oversight of use of preventive measures.

Super-spreader events are events that involve a greater level of transmission than would be expected.

Primary case and index case is the “source” or original case from which an index cases acquired their illness. Primary cases are often identified retrospectively whereas the index case is the first case reported to public health.

Background

Forward contact tracing (FCT) which is also known as standard and conventional contact tracing is the main method by which public health agencies interrupt transmission of SARS-CoV-2, by identifying and quarantining close contacts of identified cases.

Assessing potential acquisition in the 14 days prior to a case’s symptoms (or positive specimen collection if asymptomatic) is also a routine component of case management for COVID-19, as specified in the [Management of Cases and Contacts of COVID-19 in Ontario](#).¹ However, assessing all possible acquisition sources can be time-consuming and may be low yield for identifying the most likely actual source of infection.

It is purported that while FCT is the priority approach that should be undertaken during case investigations, the use of BCT could maximize the number of exposed individuals/other cases identified and can contribute to controlling ongoing chains of transmission.

Overview of BCT

BCT involves tracing the exposure history of an index case in order to identify the primary case, and the other secondary cases from that primary case, presuming that they have yet to be identified. More succinctly stated, BCT seeks to find the “source” of the virus that infected the index case and potentially other cases that are linked to that source, thereby breaking the chain of transmission. It is done by focusing on targeted acquisition history to significant events where exposure to COVID-19 most likely occurred.

BCT has been employed by other jurisdictions such as Japan and Korea²⁻⁴ where it has been reported to result in higher case finding due to identification of primary cases that are more likely to have been the source of several other cases, and wouldn't have been discovered through FCT.

Overdispersion Effect

The likelihood of secondary transmission from a case of COVID-19 is thought to vary significantly, where some cases do not transmit further, while other cases infect a large number of secondary cases. Therefore, the overall effective reproductive number (i.e., the number of secondary cases from a primary case) does not fully represent the risk of transmission from a single case.

Overall in the pandemic, a small proportion of cases is thought to be responsible for the majority of transmissions, therefore transmission is said to be ‘overdispersed’⁵ (See [Figure 1](#)). Overdispersion also means that any individual index case is less likely to be the primary case to multiple secondary cases, but rather their primary case is more likely to be the source of multiple secondary cases.

BCT tries to capitalize on this phenomenon by identifying cases or events with a higher likelihood of transmission and where multiple individuals were likely exposed. Therefore, the identification of these primary cases or events with higher transmission profiles should lead to detection of more cases and or clusters.

Figure 1: Overdispersion Effect



Figure 1. The primary case in this illustration is located at the centre of the diagram (dark purple). The case infects multiple individuals (index cases in light red). A proportion of the index cases will in turn infect secondary cases (in orange). Not all primary or index cases will lead to secondary cases (uninfected individuals in grey). Therefore, identification of those specific primary cases or situations that can lead to multiple secondary cases is important for breaking chains of transmission.

Evidence for the effectiveness of BCT is limited and stems mostly from a modelling study.⁵ In this study, BCT plus FCT identified 2-3 times more cases compared to FCT alone⁵ (See [Figure 2](#)).

Significant assumptions underpinning this and other modelling studies include:

- The degree of overdispersion of COVID-19;
- The proportion of primary cases identified through BCT; and
- The ability of a given public health agency to trace and follow-up with contacts.

While there is emerging consensus for the overdispersion of COVID-19 transmission⁵, the latter two are likely to be highly variable and a function of local epidemiological trends and capacity of the health agency for contact follow-up.

Figure 2: Backward and Forward Tracing Combined

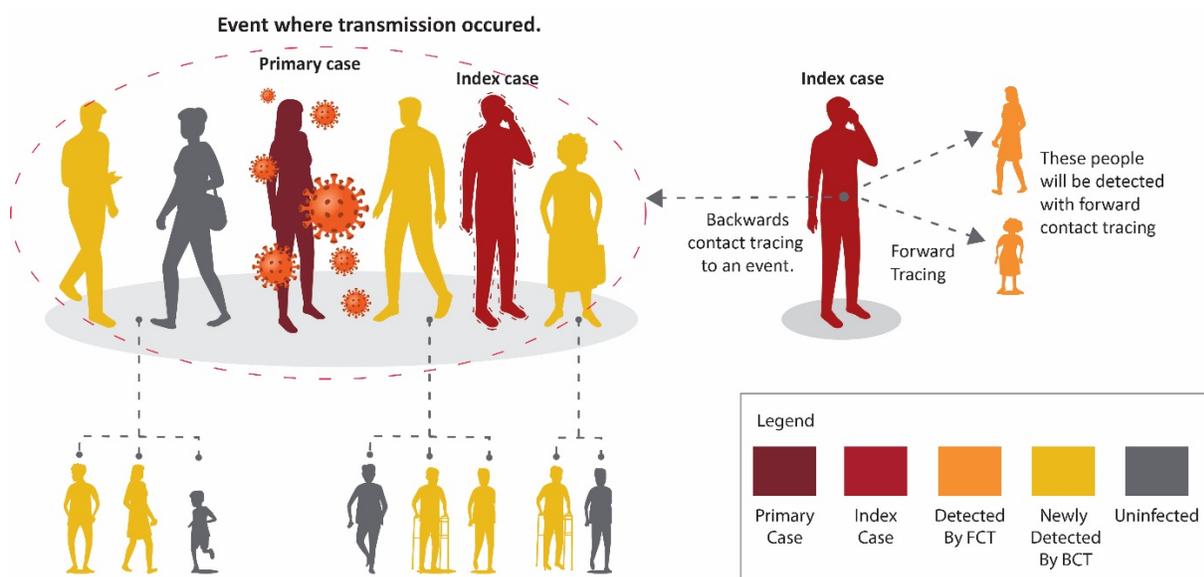


Figure 2. The figure shows an index case (in light red) that is traced by BCT to a group of 5 people at an event. The primary or source case (in dark red) infected the index case and an additional 3 cases (in yellow). The three newly detected cases are also traced by BCT to 5 additional cases (in yellow). The index case is also traced by FCT to two new cases (in orange). In this example 4 times the number of cases was detected by BCT than FCT alone.

Transmission Settings or Events

Based on studies conducted in Japan and Korea, clusters of cases of COVID-19 with higher transmission profiles are said to occur under three particular conditions. These together are referred to as the “3 C’s”.^{2-4,6}

1. Closed spaces with poor ventilation.
2. Crowded places with many people nearby.
3. Close contact settings.

This may include people having conversation in close-proximity (<2 metres) to each other. This also includes settings where two metre distancing is maintained, but where activities that increase the risk of spread (e.g., singing, shouting or heavy breathing such as during exercise) are occurring.

These three conditions make it easier for the virus to spread especially if they overlap. Therefore, it is important to trace backwards in order to identify the setting where exposure to the primary case may have occurred.

Considerations for Use of BCT

BCT can be applied to all cases, but is most effective when applied to situations where additional secondary cases are likely to be identified. In addition, BCT is most effective when it can identify situations where public health measures can be applied in a timely manner to break chains of transmission.

Situations in Which BCT May Be Applied

- When there is no known exposure for the case (i.e., case does not know where the illness may have been acquired).
- When the case identifies in their acquisition history that they attended minimally monitored settings where one or more of the 3 C's may have occurred, for example:
 - Extended family gathering;
 - Dinner party;
 - Exercise or musical group ;
 - Personal training or services (where the provider has many other clients); or
 - Religious ceremonies and gatherings.

Situations in Which BCT May Not be Necessary to Apply

- Where the exposure to a case is known (e.g., when a household member is a case). However, BCT may be applied to the initial case in the household.
- Where the case is a part of an outbreak. For example:
 - In monitored settings such as hospitals in which there is a high likelihood of preventive measure adherence (e.g., hospitals).
 - Setting specific outbreak protocols should be applied.
- In monitored settings where public health management will already be employed to investigate and manage transmission risk. Setting specific guidance should be applied. Depending on PHU capacity, these include:
 - Congregate living settings;
 - Schools;
 - Child care centers; or

- Workplaces.
- In settings where direct communication to individuals potentially exposed in the setting is generally not possible/not feasible (e.g., co-riders on public transit, shoppers in a store)
- Lower risk exposures settings where the 3 C's are not evident, such as outdoors where physical distancing, masking and other preventive measures have been maintained.

Situations Involving Variants of Concern (VOC)

Currently there are no specific guidance for the application of BCT when VOC cases are identified. However, BCT can be part of a containment strategy for VOCs (e.g., if the public health goal is containing spread of a particular VOC in a given setting/population), as well as part of a broader COVID-19 mitigation strategy in jurisdictions where community transmission of some VOCs is already established.

Considerations for Adapting BCT

Assessing Local Context

BCT is more effective as part of public health case and contact management when community transmission is low to moderate due to:

- Increased public health capacity to apply BCT.
- Increased likelihood of cases recalling most likely source(s) of acquisition.
- Generally associated with looser public health measures are employed or minimally monitored settings or scenarios where wider transmission may occur.

BCT can be challenging to implement when community transmission is high and when health units have limited capacity for case and contact management. Challenges may also arise when strict public health measures are in place, as cases may not be willing to disclose that they have engaged in behaviours or been in exposure settings that are not recommended under public health restrictions.

Scaling BCT Implementation

BCT can be scaled by adjusting the criteria used to determine which cases and their associated settings should be prioritized for applying BCT (See Algorithm in [Appendix A](#)). The criteria below may be adapted according to the capacity and context of the individual health unit:

- Determine the number and type of cases eligible, the details of their exposure settings and scenarios to investigate as part of BCT. This will help identify the most likely source of acquisition and potential sources that carry higher risk for spreading to multiple individuals.
- Scale to include all or some settings with one, two, or three of the 3 C's settings criteria.

Examples:

- Private gathering with more than individuals.
- Home-based hair and nail salons (scale based on client list, and consider personal service provider as potential source case to clients).

- All weddings (may scale depending on venue – e.g., outdoor vs indoor, guest size, and duration of event).
- All funerals (may scale to include funerals where food was served, guest size, duration of event).
- All other religious/cultural gathering events (e.g., bat mitzvah, baptism. May scale depending on venue, size and duration).
- Include settings that are specific to local context.

Examples:

- Private clubs
- Sports club (e.g., hunting, hockey, golf)
- Cultural events and celebrations
- Select a time-frame of the index case’s incubation period to investigate (e.g., in the past 7, 10 or 14 days prior to symptom onset or positive specimen collection). Prioritization of exposure events that occurred more recently allows for timely public health intervention; however, is less complete than use of full 14 days.
- Select the method of communication to provide to potentially exposed individuals/groups identified through BCT, including client-led vs public health-led communication.

Implementing BTC

GATHERING EXPOSURE DETAILS

Determine the list of questions case investigators will use for cases in whom BCT will be applied, to identify events, situations or potential source cases of interest. Prepare a list of questions for gathering exposure details from the case. Examples of questions are as follows:

- In the 14 days prior to your infection, did you attend an indoor gathering where there were five or more other people there?
- In the 14 days prior to your infection, did you visit or attend any settings that were indoors, where people were crowded or close by, or where people may have had close contact, such as:
 - Social gatherings at home such as family get together, lunch with friends or birthday party?
 - Social gatherings outside of the home such as a bar, nightclub or restaurant?
 - Public event, such as meeting, rally, concert, sports game or event, theatre or group trip?
 - In-person religious or spiritual group activities such as a service at a place of worship, wedding or funeral?
 - Indoor recreational facilities such as a gym, or other fitness venues?
 - Personal service settings such those providing as nail, salon, hair, or massage services?

[Appendix B](#) provides additional examples of potential questions for case investigators. Consider the use of memory tools to assist cases identify potential exposures in their incubation period, such as:

- Digital, paper daily records and calendars
- Credit card statements
- Review of social media postings

FOLLOW-UP AND COMMUNICATION WITH POTENTIAL SOURCES AND SECONDARY CASES

- Once potential sources and acquisition settings of the index case are identified, individuals or groups who attended those setting should be notified of their potential risk for having been exposed to SARS-CoV-2 and advised of actions to take.

These individuals or groups are NOT close contacts of a case, as they have not been exposed to a known case, and do not require quarantine. Their risk is that they may have been in a setting where COVID-19 spread occurred, and BCT follow-up informs them of that risk. In most circumstances, identified individuals or groups should be advised to get tested.

- Determine who will lead communication with potential sources or secondary cases. This may be led by either the PHU or the case, depending on the type of exposure setting or the capacity of the PHU. PHU led communication be more feasible for situations that include but are not limited to: situations where the PHU can work with event coordinators and organizers who have a list of attendees, an organizer with contact information for participants, or a proprietor or vendor for recreational activities or personal services.

Case led communication to fellow attendees is more likely to be feasible for: Hosts and attendees of private gatherings such as house parties, dinners, social outings and small scale group activities. [Appendix C](#) provide examples of scripts that may be used for case-led communications.

COMMUNICATION MEDIUM

PHUs may conduct outreach via letters, email, text or media advisory depending on the size of the event and the number of contact that may be linked to that event. PHUs may also encourage cases to support PHU-led outreach by sharing notifications via social media platforms.

Case-led communication may be delivered by telephone call, email, text, chat rooms or social media based applications, depending on the contact information available. Cases may be provided template text from the health unit to provide to contacts that includes key messages, URL linkages to web-based Covid-19 information and follow-up materials.

MESSAGING FOR POTENTIAL SOURCES AND SECONDARY CASES

One or more COVID-19 case(s) have been linked to the event they attended. Attendees are being notified that they attended an event where COVID-19 spread may have occurred. Ask attendees whether they have had any symptoms compatible with COVID-19 in the 14 days following the event, and provide information on symptoms.

Advise to get tested for COVID-19 if:

- they have had any symptoms in the 14 days since the event, even if they no longer have symptoms OR if it is now >14 days since the event/situation, AND/OR
- the event was ≤ 14 days from when they were notified, even if they have not had any symptoms.

PUBLIC HEALTH MESSAGE EXAMPLE:

If you are receiving this message, then you have been identified as having been in attendance at “EVENT NAME” on “DATE, TIME” (OR, “SETTING NAME”). Cases of COVID-19 have been linked to this event/setting, but at this time no known cases were at the event/setting while they were infectious.

All attendees are being notified as you may have been exposed to COVID-19. Your local public health authority recommends the following:

- *Get tested if you have or have had any of symptoms of COVID-19, and stay home until the results become available.*
- *Get tested if the event was within the last 14 days. If you have not had any symptoms, you do not need to stay at home until the results are available.*
- *If the event was >14 days ago and you have not had any symptoms, you do not need to get tested.*

Continue to follow all local public health guidance.

MEASURES TO IMPLEMENT IF ADDITIONAL CASES ARE IDENTIFIED

If more cases are now linked to the identified potential source event or setting of the index case, this may qualify as a cluster or outbreak and further public health investigation and management should be undertaken.

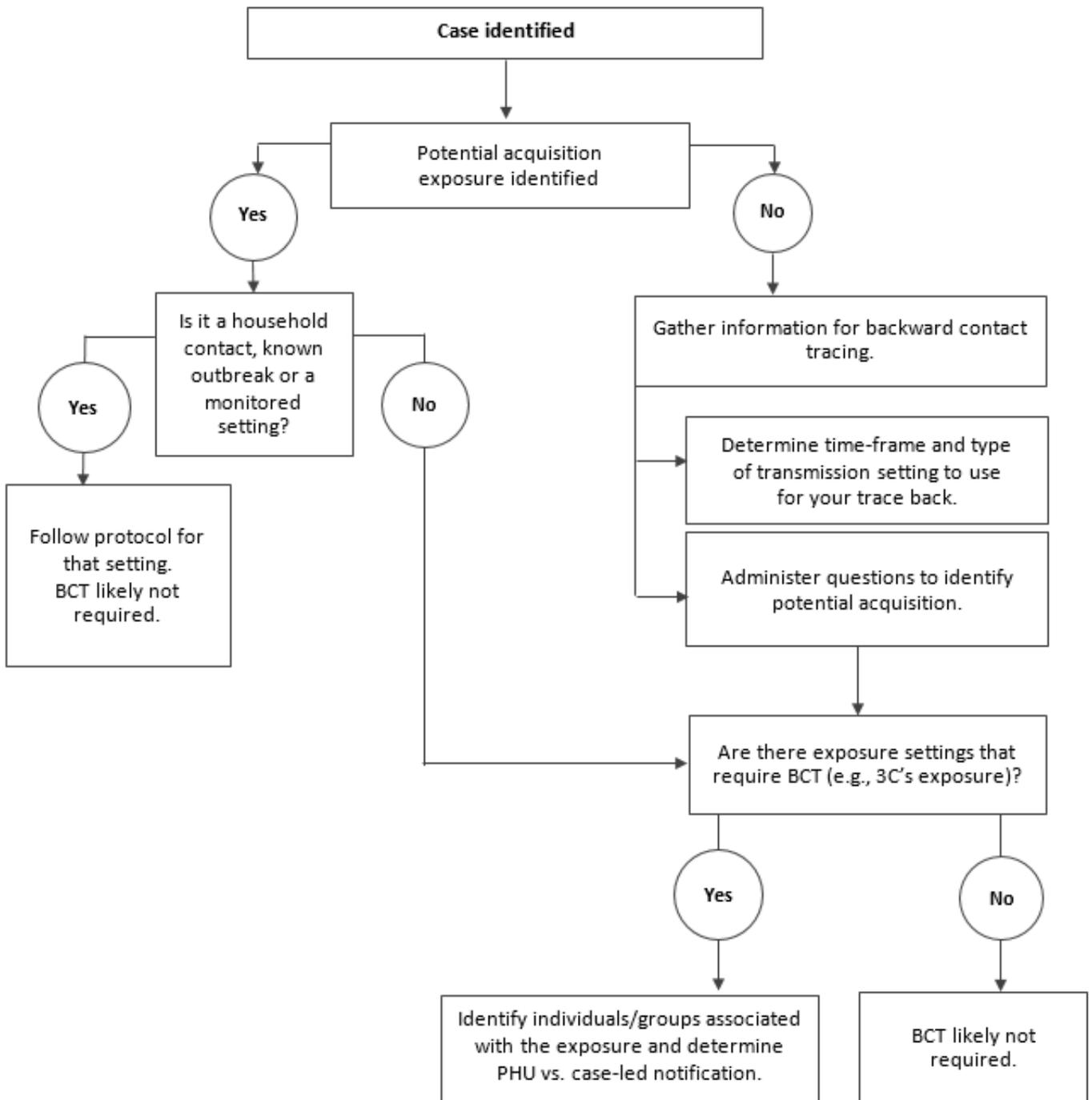
Evaluating BCT

Successful implementation of BCT is dependent the health unit’s ability to act quickly to identify and stop the chain of transmission. A combination of testing, quarantine and isolation measures is required. As the outbreak evolves, creative approaches will be required to successfully identify and break the chain of transmission.

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Appendix A: Flowchart for the Application of BCT



Appendix B: Examples of Case Interview Questions

The following are suggested supplementary questions that case investigators may consider when interviewing cases for BCT, when BCT is determined to be appropriate for the case. The investigator should gauge the case's willingness to provide details of their activities and the length of time available for the interview.

Exposure events described by cases may be prioritized according to their potential to be super-spreader events (e.g. an event where the 3 C's occurred and there are a large number of individuals exposed at the event). The likelihood that further details of attendees of the event can be obtained should also be factored into prioritization.

Case investigators must follow direction from their PHU as to prioritization of case follow-up and capacity for collecting additional information from cases.

In-Depth BCT Questions

With time permitting and a cooperative case, the investigator may wish to prompt the case's recall by reviewing routine and non-routine activities starting one day before onset of symptoms and working backwards to 14 days. Focus on weekend or holiday activities which may also fall outside of the case's normal routines.

1. I would like to review your activities in the past 14 days from (insert date to insert date) before you became ill. Do you have a calendar, cellphone or other device that can help you look back through your activities? (Y/N). Please take note of who you were with and where you were.
2. I would now like to work backwards through the past 14 days. Do you recall your activities on from the first day before you became ill working backwards to the 14th day before your onset of illness?
3. Does your normal routine include any activities where you would have been indoors and in close contact with more than five people from outside your household? This may include things like having coffee/a meal with family/friends, participating in an in-person class/activity, celebrated an occasion, exercise class?
4. Did you visit any place where less than five people were present (e.g. a business that is operated from a home- spa, nail or hair stylist) but where many people could visit on a given day?
5. Did you participate in any activities outside of your normal routine? If yes, can you describe them?
6. Do you use any apps on your phone regularly that may provide clues to your whereabouts? If you look through your phone, at some of those apps (e.g., map and location apps, dating apps, social networking apps), what events did you attend or people did you meet from <date> to <date>?
7. Did you attend any of the following gatherings in the past 14 days? See [List of Settings](#).

Minimalist BCT Questions

For cases that are eager to end the interview or that are more reluctant to provide exposure information, the number of questions administered should be kept to a minimum. Broad, catch-all questions that appear less intrusive are generally more suitable to ask. Select from the [list of settings](#) provided to prompt case. This may be used as an introductory statement. (e.g. we are interested in finding out about event such as XXX or substitute for any of the activities described in questions 1 and 2)

1. In the XX days before your symptom onset, did you participate in any activities where you would have been indoors and in close contact with more than five people from outside your household? This may include things like having coffee or a meal with family or friends, participating in an in-person class or activity, celebrated an occasion, exercise class?
2. Did you visit any place where less than five people were present (e.g. a business that is operated from a home such as spa, nail services or hair stylist) but where many people could visit on a given day?

List of Settings

- Social gathering at home such as family gathering, lunch with friends, birthday party?
- Social gathering outside of the home such as a bar, nightclub, restaurant?
- Public event, such as meeting, rally, concert, sports game or event, theatre, group trip?
- In-person religious or spiritual group activities such as a service at a place of worship, wedding, funeral?
- Recreational activities such as a gym, other fitness, art/music class, shopping, arcade, spa, hair/nail salon, ski hill, curling?
- Clubs- Scouts, Hockey
- Volunteer activity – local community groups,
- Ride-share/and or road trips – (mini-van)
- Other

Appendix C: Examples of Communication Scripts

These are examples of scripts for cases to use when communicating with potentially exposed individuals/groups:

1. On date/time, I hosted a/an (*event description*) at which you were present. I have since been advised by (name of health unit) that you may have been exposed to Covid-19 during that event.
 - If you have are showing symptoms of Covid-19, it is possible that you may have acquired it at this location. You should consult with your doctor, get tested and avoid contact with others.
 - If you do not have any symptoms, you should get tested now to make sure you have not been infected with Covid-19.
2. On date/time, I attended a/an (*event description*) that you hosted. I have now been informed that that it is possible that I was exposed to Covid-19 at your event.
 - If the case is comfortable disclosing that they have COVID-19:
 - Please know that I am not blaming you or making you responsible for my illness. I am contacting you so that you are aware. I am comfortable with you letting others that attended our get together know that I became infected because other people who were there may have become infected too.

Public health recommends that everyone that attended your function should get tested now for COVID-19. Particularly if anyone has symptoms or had symptoms since that event.

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