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(ARCHIVED) Risk Assessment Approach for COVID-19 Contact Tracing

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Introduction

This document is a resource companion to the [Management of Cases and Contacts of COVID-19 in Ontario](#)¹ in terms of decision-making on whether contacts are “high” or “low” risk of exposure to a case. The purpose of this document is to support Public Health Unit (PHU) staff involved in case investigation with an understanding of background information on assessment of factors that support risk determination.

Background

Risk assessment of case/contact interactions requires integration of the factors outlined in this document based on the information received from the case (and contact, as applicable), and the judgment of the case investigator. There are some factors or combinations of factors that may receive more weight in terms of decreasing the risk for contacts, but all factors need to be considered together.

There are factors, such as hand hygiene for the case and contact and environmental cleaning, which are important for prevention of infection. However, the extent to which they can be assessed or how much they contribute to the risk assessment of a specific case/contact interaction is uncertain and therefore these are not addressed in this document.

It is recognized that risk assessment decisions can be challenging, and each scenario is unique and each investigator may not come to the same conclusion regarding risk of an exposure. This document aims to provide background information on an evidence-informed approach for new investigators learning to apply the risk assessment process.

Methods

Expert consensus among the communicable diseases, infection prevention and control and environmental and occupational health staff at PHO was used to develop the framework of relevant factors to assess as part of the risk assessment, as well as develop example scenarios for applying the risk assessment framework.

Existing knowledge products from PHO and evidence summaries from the World Health Organization and Public Health Agency of Canada were used for supporting literature on the risk of each factor.

Results

Approach to risk assessment

Once contacts are identified, contacts need to be categorized into two groups based on Table 8 of the [Management of Cases and Contacts of COVID-19 in Ontario](#).¹

- Contacts with high risk of exposure who require [self-isolation](#)² (quarantine).
- Identifiable individuals/groups of contacts with low risk of exposure who require notification of their exposure for [self-monitoring](#).³

Exposures are only considered to have occurred if the contact was with the case during the case's period of communicability which is generally defined as 2 days (48 hours) before the onset of the case's symptoms and until the case is cleared from isolation. [See Management of Cases and Contacts of COVID-19 in Ontario](#)¹ for guidance on period of communicability and clearance from isolation.

Self-isolation of contacts with high risk of exposure is an essential part of case and contact management, as individuals can transmit SARS-CoV-2 before they develop symptoms of COVID-19. However, self-isolating for 14 days from last exposure can have significant impacts on someone's life, so it should be only be applied to those at high risk of exposure.

When assessing the risk of exposure, consider the factors that were in place that lowers risk of exposure by virtue of the control (e.g., physical barriers separating the case and contact), versus measures where the effectiveness may vary by individual compliance (e.g., correct use of personal protective equipment (PPE)).

- There is a tendency to focus on PPE, which can be an important and effective factor, but highly user dependent.
- There is also a tendency to confuse PPE with source control measures (i.e., non-medical masking and face coverings) and the role these play in preventing transmission.

In the health care setting, where health care providers are trained on the appropriate use of PPE, the appropriate and consistent use of PPE for the nature of the interaction is sufficient to consider the health care worker as “low risk” of exposure.

- Eye protection and masking (surgical/procedure mask or respirator if there was an aerosol-generating medical procedure) is sufficient PPE to consider as a “low risk” of exposure.
- While a gown and gloves are part of Droplet and Contact precautions, covering the mouth, nose and mucous membranes is the critical PPE factor.

In community (non-health care settings) there is generally no one specific factor that makes an exposure “high risk” versus “low risk”; the overall exposure scenario needs to be considered to identify the factors present and to assess how each factor and the combination of factors are likely to increase and decrease the risk in the situation.

Depending on the circumstances of the exposure, the case investigator may give more weight to certain factors and/or combinations of factors. The risk of exposure may be reduced, and generally considered “low risk” of exposure, by:

- Consistent use of a tall, wide barrier sufficient to prevent droplet spread with no openings to separate the case and contact (e.g., a customer served behind a plexiglass barrier); OR
- Being very far apart, i.e., consistently much more than 2 metres apart (e.g., talking to a neighbor standing across the street); OR
- Combinations of personal protective equipment (PPE)/source control:
 - A contact who is trained in PPE use who consistently and correctly wears a surgical/procedure (medical) mask and eye protection (i.e., goggles or face shield), similar to the health care setting context.
 - A contact who is consistently and correctly wearing a non-medical mask and face shield (considered PPE) when the case is also masking for source control.

Factors that exist on a continuum (e.g., duration of exposure) can be more challenging to assess compared to more dichotomous factors (e.g., indoors vs outdoors). Although it is intuitive that the longer the exposure the greater the risk, even brief exposures have resulted in transmission, and there is limited evidence to support a minimum duration of exposure under which the risk is negligible. The application of “cut-off” values for factors that exist on a continuum can help to prioritize contact follow-up for those above the “cut-off” value for the risk factor. For example, “15 minutes” has been

used by the Public Health Agency of Canada and others as an example of a time cut-off for the duration of exposure, although there is no specific evidence to support this as a cut-off value.

Risk assessments require integration of the various factors outlined in this document. Each situation will be unique and require consideration of the various factors and ranges of responses. How these factors are assessed and integrated will also be influenced by how the information is provided by the case and contact, the risk perceptions and tolerance of the case investigator and the weight they give to the various factors.

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Information on elements of the risk assessment

CASE

Symptoms of case at the time of interaction:

- Respiratory symptoms (coughing and sneezing) increase the risk of respiratory droplet spread through the increased production and increased speed at which respiratory droplets are expelled compared to talking.⁴ Respiratory symptoms also increase the risk of contamination of the surrounding environment, increasing the potential risk of spread through virus on surfaces and on the hands of the case.
- Case viral load is highest around the time of symptom onset (any symptoms) and the 1-2 days prior to symptom onset.⁵
- Asymptomatic and pre-symptomatic cases have been associated with transmission, likely through talking and/or breathing. Evidence suggests that although they can still be infectious, those who never develop symptoms (always asymptomatic) are less likely to transmit SARS-CoV-2 compared to those who eventually develop symptoms (pre-symptomatic).⁶ However, at the time of case follow-up, determination of being always asymptomatic may not be available.

Activities that increase risk of respiratory spread

Singing, yelling and loud talking may generate more respiratory droplets and propel droplets further than normal speaking, thereby increasing the risk for those nearby.

Face coverings for source control at time of interaction

- Use of a medical or non-medical mask as a form of source control may limit the spread of respiratory droplets from the case to the contact and into the environment, reducing the risk of transmission.
- Consistent and appropriate use of the mask during the interaction(s) with the contact should be assessed (e.g., was the case wearing their mask over their mouth and nose at all times when with the contact).
- Non-medical masks should be at least two layers and fit snugly to the face.⁷
- Masks with an exhalation valve do not provide source control.
- It is possible that a medical (surgical/procedure) mask or N95 respirator offers improved source control compared to non-medical masks if they fit better and/or have more ability to block droplets. Assessment of quality of medical or N95 masks used in the community (non-health care setting) can be difficult to assess through case interview.
- In theory, the addition of a face shield with a mask may improve source control, although no evidence is available to support this.⁸
- A face shield alone may offer some source control, but it is expected to be less than a mask as the face shield is open on the bottom and sides.

NATURE OF INTERACTION

Distance from contact

- Maintenance of physical distancing measures (>2 metres) for the entire duration of exposure decreases the risk of transmission.
- Some limited evidence suggests physical distancing between 1-2 metres may also reduce risk of transmission.⁹
- Physical distancing of 2 metres does not eliminate the risk of transmission particularly during activities, such as heavy breathing during exercising or if the case was talking loudly, yelling, or singing.^{4, 10}
- Maintaining physical distancing (2 metre distance) may be insufficient if the case and contact are within a crowded, confined, indoor space for prolonged periods of time without other prevention measures.⁶

Barriers between the case and contact

- Barriers, such as plexiglass or plastic sheet barriers, between the case and contact can reduce the risk of transmission by blocking respiratory droplets.
- The more complete the barrier (i.e., no openings) and the taller and wider the barrier, the more protection it is likely to offer.

Indoor/outdoor environment

- Outdoor environments are lower risk than indoor environments due to increased ventilation resulting in dispersion and dilution of droplets and aerosols, the presence of natural ultraviolet light, and ability to physically distance.⁶
- Smaller, confined indoor environments with poor ventilation increase the risk of transmission, compared to larger spaces with adequate ventilation.¹¹ The amount of fresh (outdoor) air intake into the indoor space (e.g., having a window open) and a properly functioning ventilation system will reduce the risk of transmission.¹²

Duration of interaction, repeated and cumulative interactions

- There is insufficient evidence^{1, 13} to quantify the risk associated with increasing amounts of time spent at <2 metres distance. Prolonged interactions will increase the risk of exposure compared with transient or brief encounters (few seconds to few minutes). Repeated and cumulative interactions will increase the risk of exposure, such as several short (few minutes each but cumulatively prolonged) interactions with coworkers in the case's period of communicability.
- Transmission rates among household contacts (several hours/ongoing close contact exposure) range between 10% to 40%; whereas a report found a 7% transmission rate from sharing a meal (approximately one hour), and 0.6% from passing interactions while shopping (seconds to minutes).^{11, 14, 15, 16} A report of an outbreak in a crowded office setting (call centre) found a 43.5% attack rate amongst those in the same area.¹⁷

- Prolonged exposure in a confined, crowded, poorly ventilated, indoor environment, with physical distancing (>2 metres), may increase the risk of transmission.

Physical interaction (e.g., hug, shaking hands)

- Close physical interactions and physical touching increase the risk the contact is exposed to respiratory droplets from the case.¹⁸ Passing of objects between the case and contact may pose a risk to the contact if the case contaminated the object. Few case reports have described transmission of SARS-CoV-2 through contaminated surfaces or objects. Passing of items may also indicate inadequate physical distancing (<2 metres) during the exposure.
- SARS-CoV-2 has been found in semen and feces, and it is not clear yet whether it can be transmitted through sexual activity. Guidance on risk reducing measures to take during sexual activity is available.^{19, 20} Consider application of measures that reduce the risk of spread from person-to-person via physical contact and respiratory droplets used during sexual encounters.^{19,20}

CONTACT

Use of facial coverings, including personal protective equipment

- PPE (surgical/procedure mask and eye protection) to cover the mucous membranes of the face (mouth, nose and eyes) will limit droplets landing on the contact's mucous membranes and may also limit the inhalation of respiratory droplets. PPE has been shown to be effective in protecting the worker in health care settings.^{21, 22} There is less evidence on the effectiveness of PPE used in the wide range of non-health care, community settings where PPE may now be recommended for use.²²
- PPE needs to be worn appropriately and consistently during the exposure period to provide protection. Training of the wearer increases the likelihood of appropriate use. Inappropriate removal of PPE may result in contaminating oneself when touching contaminated PPE (with droplets from the case on the outer surface) for removal. The wearer needs to perform hand hygiene after PPE removal to reduce the risk of contamination after removing PPE.
- Use of eye protection (goggles or face shield) decreases the risk of acquisition from some respiratory viruses (e.g., SARS and MERS), however the contribution of eye protection to preventing acquisition of SARS-CoV-2 is uncertain.
- Medical masks typically have more consistent construction, and many have fluid resistant outer layers to prevent exposures from droplets.²²
- Consistent and appropriate use of a medical mask and eye protection by the contact lowers the risk of exposure to the contact.
- Non-medical masks are worn for source control. The extent to which non-medical masks protect the wearer is not known, and may be influenced by construction, fit, and appropriate use and handling, including while removing the mask.
- The benefit of using a face shield alone by the contact is unknown and expected to be lower than wearing a surgical/procedure (medical) mask as the face shield is open on the sides and bottom leaving room for exposure to respiratory droplets or aerosols.

- Use of a face shield in addition to a non-medical mask potentially reduces the risk of exposure to the wearer by blocking respiratory droplets, preventing contamination of the surface of the mask and preventing the wearer from touching the mask and their face.
- Combination use of a case wearing source control and the contact wearing some form of PPE likely lowers the risk of exposure.

Sample scenarios applying risk assessment

Scenario 1

A case reports taking a one-hour ride share ride on the day before he developed symptoms. He says he wore a cloth mask for most of the ride and sat in the back seat, and the driver also had a cloth mask on, but the driver intermittently pulled it down to answer phone calls during the drive. There was no one else in the vehicle. The windows were closed and the air conditioning was on. There were no other barriers between the front seat and the back seat of the vehicle. The driver did not get out of the car, and the case had no face to face interactions with the driver.

Assessment of Scenario 1

This example is meant to illustrate focusing on mask use by the case and the contact does not portray the full risk assessment. While the case did report source control masking that should lower the risk to the contact, the quality of the mask and appropriateness of mask use is unknown and dependent on the history provided by the case. In general, non-medical masks as source control have population level benefit for reducing COVID-19 transmission compared to when non-medical masks are not used. However, it is still unclear at this time, at the individual level, how well it prevents transmission from a known case to their contacts. Therefore, while there is expected to be some lessening of risk compared to not having source control at all, the use of a non-medical mask by the case needs to be taken in context with the overall situation.

The close (<2 metre) proximity in an indoor, closed, small environment for a prolonged duration of time and without PPE for the contact are the main factors that increase the risk of transmission in this scenario.

Scenario 2

A 53-year old woman with no symptoms tested positive for COVID-19 after seeking the test in order to visit her mother in a long term care facility. Her test was repeated the day after the first result was received and remained positive. This is now four days from her original test and she still has no symptoms. She sat across from her co-worker in a large open concept office including in the two days before her first positive test. There is a plexiglass barrier with no openings extending about one foot from seated height between their desks. Neither woman wore a mask. They passed each other in the hallway on occasion. Two days before the positive test they had about a five minute conversation in the bathroom where they were about 2 metres apart (at least two sinks were between them). They did not share any common objects.

Assessment of Scenario 2

The prolonged time period (2 working days) spent at <2 metres apart without source control or PPE for the case and contact, as well as the potential for other interactions in the workplace over the course of

the day (e.g., hallway, bathroom) increase the risk of exposure for this contact. The barrier may reduce the risk of transmission although there may be uncertainties as to how adequate a barrier it provided.

The cumulative time of exposure at <2 metre with an incomplete barrier are the main factors that increase the risk of transmission in this scenario.

Scenario 3

A 70-year old man with a positive COVID-19 test result had onset of his symptoms two days before being tested. The day before his test, he went to have his new suit (jacket and pants) adjusted at a clothing store. He was feeling a bit tired and run down and had a mild cough that started the day before. He also bought and tried on a shirt from the same salesperson. The whole interaction took about 30 minutes and took place in a large men's clothing store. The salesperson also helped the man when paying and there is a large barrier at the cash register with a small opening for transactions. The man wore a cloth mask and the salesperson wore a procedure mask and a face shield as per his store's policy. He carefully washed his hands with soap and water after adjusting the suit and helping the man try on his shirt.

Assessment of Scenario 3

While there was a prolonged interaction in close proximity when the case had a mild cough, the use of source control masking and use of non-medical mask and a face shield as PPE by the contact are the main factors that decrease the risk of transmission to the contact.

Limitations

Evidence on the risk reduction of each factor is still emerging and there is insufficient evidence at this time to provide a weighting to each of the factors or combinations of factors.

Conclusion

An approach to risk assessment framework should be applied to systematically assess the relevant case, contact and nature of interaction factors to determine the overall risk of an exposure.

While some factors may more definitively decrease or increase the risk of exposure, there is limited information to guide the relative contributions of combinations of factors on the overall risk of an exposure.

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