

Identifying COVID-19 Cases and Social Groups at High Risk of Transmission: A Strategy to Reduce Community Spread

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As of December 2020, the coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), continued throughout the United States. The initial COVID-19 pandemic response in most areas focused on mitigation measures—stay at home, social distancing, hand hygiene, face coverings, and limitations on indoor gatherings. However, starting in early summer 2020, many states relaxed some mitigation restrictions and reopened various businesses and other sectors of society. At the same time, many states began implementing a containment strategy of testing, case investigation, contact tracing, and isolation or quarantine. Routine community-based case investigation and contact tracing are usually successful in limiting transmission by isolating infected people and quarantining named contacts. Occasionally, however, people infected with SARS-CoV-2 may interact with many other people at group events, resulting in considerable undetected transmission. Little information or guidance is available to assist community-based contact-tracing programs in developing strategies and interventions to address these group exposure events. In this commentary, we propose a containment strategy that emphasizes the identification of cases at high risk of transmitting the virus to others through their interactions in social gathering groups.

For decades, public health programs have used containment strategies to reduce community spread of tuberculosis, HIV, sexually transmitted diseases, and other communicable diseases. For these conditions, the availability of chemoprophylaxis or treatment for identified cases and contacts helps slow and sometimes stop the spread of disease. Although such measures do not yet exist for SARS-CoV-2, widespread evidence suggests that containment strategies can limit communitywide transmission.¹⁻⁶

High Risk of SARS-CoV-2 Transmission in Social Groups

Important elements of successful communicable disease control include the timely identification and investigation of cases, their contacts, and people exposed in group settings, especially

those at high risk of transmitting to others. Through this process, investigators can pinpoint infection sources and discover and disrupt transmission chains. An analogy is found in syphilis control. Modeling and observational studies on syphilis suggest that interventions focused on people in core transmission groups with numerous sexual contacts and at high risk of transmission can substantially reduce disease spread and, in some instances, when applied to those people at the highest risk, can eliminate communitywide syphilis transmission.^{7,8}

The same principle can be applied to COVID-19 control.⁶ In the absence of mitigation efforts, each person infected with SARS-CoV-2 will infect, on average, 2 or 3 other people.^{9,10} However, infectivity is not evenly distributed. Many infected people will infect no one, whereas a small proportion will infect considerably more than 3 other people.¹¹ This small group of infectious people can transmit the virus to numerous others, especially in crowded indoor spaces, sometimes resulting in substantial communitywide transmission¹²⁻¹⁶ from a “superspreading event”⁶ (ie, an event where an infectious person spreads infection to numerous other people). These superspreading events are not restricted to COVID-19 and have been reported in previous coronavirus outbreaks (ie, severe acute respiratory syndrome and Middle East respiratory syndrome) and for other communicable diseases.^{6,17}

Although superspreading events are not fully understood, these events have major implications for COVID-19 containment strategies and for prioritizing and deploying resources.⁶ To be most effective, containment strategies must recognize

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that not all cases have equal epidemiological importance, and strategies should be designed to identify infected people who participate in social gathering groups resulting in a high risk of transmission and community spread.

Reviewing Guidance for Case Investigation and Social Gathering Group Exposures

We reviewed Centers for Disease Control and Prevention (CDC) comprehensive guidance for COVID-19 case investigation and contact tracing¹⁸; as of December 2020, the guidance did not explicitly assess transmission risk, especially in social group settings. CDC recommended collecting information about exposures and provided guidance for group exposures among stable populations such as residence (eg, nursing homes, congregate living facilities) and employment (eg, health care workers, jails, factories). However, little has been said about the risk of transmission at social group events, which are mostly one-time events, or about interventions to limit transmission in these settings. The CDC case investigation report form asks about exposure during the past 14 days, but the only social gathering–related variable on the form was “community event/mass gathering.”

We propose that guidance would be more effective if transmission risk were explicitly defined and used routinely to assess risk among COVID-19–infected people and their social

groups. The social group gathering determination is important because high risk of transmission (HRT) in this context is based on an infected person’s pattern of contact with others in the group, rather than higher virus transmissibility per contact, which is difficult to ascertain. Furthermore, we recommend programmatic actions needed to manage infected HRT people and their social groups to decrease community transmission risk.

Identifying Infected People With a High Risk of Transmission and Associated Social Groups

The primary public health objective of COVID-19 containment efforts is to reduce transmission. Infected people interacting in social groups could have a disproportionately large effect on communitywide transmission. To identify HRT social groups, case investigators should collect information to determine whether an infected person has had recent close contact with multiple people in a social group setting. During the case investigation, an investigator could administer a simple screening question, such as: “During the past 14 days, have you had close contact with 5 or more people in social gathering or other group settings such as a party, celebration, religious service, club, bar, restaurant, fitness center, or any

Table. Health department COVID-19 intervention staff members, procedures, and outcomes in evaluating a high risk of transmission (HRT) social and other event group gathering, by source and spread group transmission type, template, December 2020

Staff member	Procedure	Outcome
Case investigator	Screen each case for HRT group exposures	HRT group identified
	Collect basic event data	Event leader identified
	Determine group type ^a	Group type determined
	Spread: elicit named contacts	Contact tracing
	Source group: refer to intervention specialist	—
	Alert contact tracer team lead	—
	Alert intervention specialist	—
Contact tracer team lead	Coordinate contact tracing among spread group	—
	Locate unnamed contacts ^b	Additional contacts traced
Intervention specialist	Coordinate overall investigation	—
	Alert outbreak prevention team	—
	Coordinate source group investigation	—
	Contact event group leader	Event leader contacted
	Contact all source group members	Possible cases identified
	Screen for symptoms/administer COVID-19 test	More cases investigated
	Collect event transmission risk data	Risk factors identified
	Complete/analyze summary reports	Risk patterns identified

Abbreviations: —, no outcome; COVID-19, coronavirus disease 2019.

^aThe index case exposure is either a source of infection group determined by the estimated average incubation period from days of symptom onset or a spread contact group determined by the index case’s infectious period.

^bUnnamed means that the contact was enumerated but the name and/or locating information was not initially available from the routine contact elicitation process and requires more inquiry.

other group?” If yes, the investigator should collect information to assign HRT status to the case based on the group exposure and collect information about the event, setting, and dates to assist in further investigation (Table). In the sample screening question, the value selected for the group size (≥ 5 people) could be adjusted based on available resources and local COVID-19 epidemiology. In addition, we defined close contact as a general interpretation of contact likely occurring at an HRT social gathering or event.

From the perspective of the case investigator, an HRT social group index case has attended an HRT group event that can be either the source of the index case's infection after exposure to an infectious person at the event (hereinafter, source group) or an event attended by the index case during their infectious period, when they are at risk for spreading infection to numerous group members (hereinafter, spread group). The objective of a source group investigation is to identify new cases. The source of infection person (ie, the person infectious with SARS-CoV-2) in the group who infected the index case may also have infected other group members during the event. At the time of the index case investigation (usually 7-10 days after the group event), these possible infected other group members (“new COVID-19 cases”) will have symptomatic, presymptomatic, or asymptomatic infections and may have recently exposed others at home or in the community and started new transmission chains. These new cases should be promptly investigated and isolated, and their contacts should be traced and quarantined. As an example, a source group event by definition would occur during the 14-day period preceding the index case interview date, which covers the incubation period range (3-11 days; average, 5-7 days from the onset of symptoms [day = 0]) (Figure).¹⁹⁻²¹ Events that occur during the index case's average incubation period (ie, 5-7 days) are most likely to be source events, whereas events that occur near the outer incubation period (ie, 10 or 11 days) have a lower probability of being a source event and

may warrant evaluation and intervention only if the event was large or other factors suggested the event could be a superspreading event. Furthermore, if the index case reports that his or her likely infection source was an exposure within the average incubation period (ie, 5-7 days) to a known or highly probable infected person not participating in the group event, then a source group investigation may not be necessary.

The objective of a spread group investigation is to identify more exposed contacts. The index case in a spread group exposed and possibly spread infection to group members at the social event. In our example, people in the spread group would likely have been exposed to the virus during the index case's infectious period—2 days before onset of symptoms until interview/isolation (Figure). During the process of eliciting information on named contacts, information about other unnamed contacts can be obtained. Named contacts should be designated as HRT contacts, and contact tracers can also ask HRT contacts to identify additional previously unnamed contacts likely exposed at the group event.

Although the incubation period can rarely be as short as 3 days, social gathering group events that take place on the investigation timeline on day -3 from the symptom onset date are unlikely a source of infection group. Therefore, we recommend following the spread group approach, which is to classify all group members as exposed contacts and initiate contact tracing. Monitoring symptoms and test results among group members may eventually show a pattern indicating the more likely group type.

To increase the probability that HRT infected people and associated social groups will not be missed, we recommend HRT group screening for all cases by including a required HRT data element (HRT status: yes, no, unsure/unknown) in the investigation form. The HRT classification can link HRT cases, contacts, and social groups; allow monitoring of HRT metrics; and initiate prompt program operations assessment.

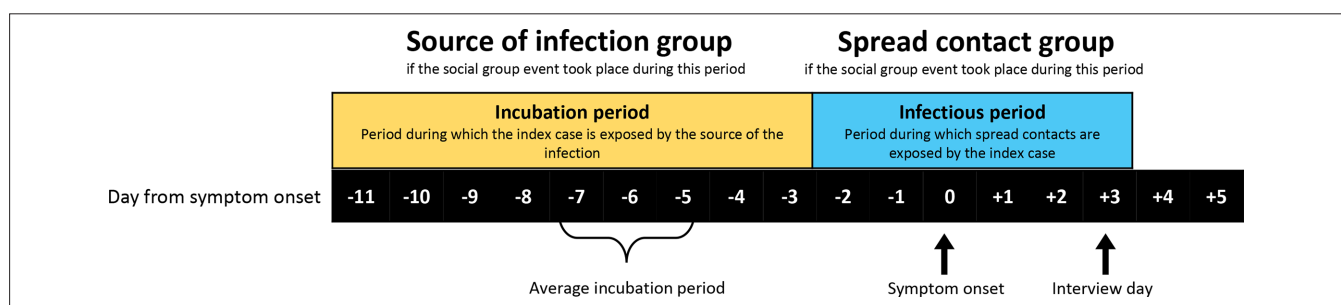


Figure. COVID-19 index case exposure at a social group event, by either a *source of infection group* determined by the estimated average incubation period from days of symptom onset or a *spread contact group* determined by the index case's infectious period, December 2020. A group contains ≥ 5 people. The average incubation period is 5-7 days from infection to symptom onset; an extreme range is 3-11 days.¹⁹⁻²¹ The infectious period is from 2 days before symptom onset to interview/isolation.¹⁸ The number of days is plus/minus from symptom onset or, if no symptoms, from date tested positive for SARS-CoV-2 (day = 0). Abbreviations: COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Interventions for HRT Social Groups

Early action is needed to prevent further transmission after social group events. The most important social group events to inquire about are events held indoors in crowded rooms with considerable loud talking, cheering, or singing (eg, bars, clubs, restaurants, parties, weddings, religious services)^{6,12-14,22} and in other gatherings in places such as fitness centers or gyms, theaters, celebrations, concerts, and student events. Because these gatherings are unstructured and diverse, an intervention specialist is needed to coordinate and deliver intervention services (Table).

For an HRT source group, all group members should be promptly interviewed and evaluated for recent past symptoms (possible source person) or current symptoms (new cases), and all members should be tested. A member who is currently experiencing symptoms or has had a positive SARS-CoV-2 test result is a new case in need of investigation, isolation, and contact tracing. For a spread group, all named contacts should be traced and attempts should be made to identify unnamed group contacts and alert them about the exposure, the need to quarantine, and the importance of promptly reporting symptoms or a positive test result. The contact tracer team lead should coordinate this process (Table).

For both source and spread group events, information relative to transmission within the group (eg, number of participants, event duration, event location, air circulation, social distancing, loud talking, cheering, singing, symptoms such as coughing, mask wearing) should be entered on a social group events investigation summary form for future risk pattern analysis (Table). If 2 or more people in the group receive a positive test result for SARS-CoV-2, most jurisdictions have an outbreak protocol to follow.

Discussion

COVID-19 containment is a complex undertaking that requires resources and coordination to investigate cases, elicit and find named contacts, arrange and monitor isolation or quarantine, identify outbreaks, and deliver group interventions. Most COVID-19 case investigations collect information from infected people about their living situation and workplace environment and have procedures for follow-up and interventions, as needed. However, only limited information is explicitly collected about social group events. We believe that more attention directed toward identifying and intervening in HRT social groups is warranted and can be accomplished by screening infected people for recent social group event exposures, prioritizing prompt investigation and follow-up, and using an HRT descriptor to facilitate communication among case investigators, contact tracers, and intervention and outbreak prevention personnel. This practice should identify more HRT social groups and prevent additional community spread of the virus. Furthermore, analysis of transmission risk factor data could be used to develop the profile of social group events that are likely

to have a high infection rate among group members and are at risk of becoming superspreading events.

Gathering actionable HRT group information is best accomplished by standardizing data collection. We recommend that HRT status be a required data element on case interview forms because it highlights the importance of identifying HRT social groups and encourages investigators to collect information carefully. Our proactive approach recommends investigating infection source groups to identify infected group members, expands follow-up of all exposed and possibly infected contacts in spread groups, and facilitates intervention services—all standard practice in communicable disease control. Following this approach and documenting investigative and intervention activities should improve service delivery and permit real-time program monitoring and evaluation.

Current COVID-19 case investigation and contact tracing will likely identify some HRT spread group events because the focus of this process is to elicit named spread contacts exposed to an infectious case. However, systematically implementing our approach would identify more HRT groups because it starts with the identification of an HRT group and would improve detection of initially unnamed contacts compared with routine contact elicitation. By contrast, for source group events, most likely few will be routinely identified because little investigation or intervention guidance is available to encourage such inquiry. Some source group symptomatic new cases may be identified through routine passive case reporting, whereas source group asymptomatic cases will likely not be tested, and the relationship with a source group may be unrecognized. In our review of CDC guidelines, we did not find intervention guidance on social gathering events, and we are unaware of any such guidelines published elsewhere.

When COVID-19 case incidence is high, as it is in many areas of the United States, adding a new intervention program as we propose can stress intervention team efforts, and making changes in program operations can be difficult. However, developing a framework for investigating HRT social group events can be useful now and even more so for the future, when incidence is reduced to levels where an intensive containment strategy can have the greatest impact.

Disclaimer

The conclusions in this article are those of the authors and do not represent the official position of the University of California, San Diego.

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