



COVID-19 Living Rapid Review
Transmission Risk & Activities/Settings
Expedited Draft Summary #4
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Question

What is the risk of COVID-19 transmission associated with different activities (e.g., dining, exercising etc.) or settings (e.g., educational, hospitality etc.) and what factors contribute to risk (e.g., type of contact, number of contacts, time within the risk environment)?

How does transmission risk of common activities alter with background population prevalence of SARS-CoV-2 and population vaccine coverage?

Methods

A detailed peer-reviewed search strategy was developed by an information specialist in consultation with the review team. Electronic databases searched include MEDLINE and Embase. The initial search was conducted September 29, 2021, and updated on October 26, 2021, December 20, 2021, and January 20, 2022. No search update was performed in November due to librarian absence. The searches will continue to be updated monthly for a limit of six months.

All reviewers independently conducted a training exercise based on 50 articles for title and abstract screening and 10 articles for full-text review before beginning study selection to ensure agreement between reviewers. One reviewer independently screened titles and abstracts and then full-text studies for relevant articles. For data extraction, all reviewers completed a training exercise based on 5 articles before beginning data extraction. One reviewer independently extracted data from included studies with a second reviewer verifying study inclusion and extracted data. Critical appraisals and analyses of the included studies have not been completed and will be available in the final manuscript.

Findings

For transmission risk of settings and activities, we present a visual summary of evidence in Table 1 and detailed individual study information further below.

The initial search retrieved 10,318 references and the October update added an additional 398 references, the December update added 930 references, and the January update added 357 references for a total of 12,003 references included in the search. To date, we have reviewed 11,640 of the 12,003 references with 363 titles and abstracts remaining to be screened. Of the 11,640 references, we have reviewed 968 full-text articles of which **94 have been included. 13 new studies** have been added since the previous report (see Version 3, 14 December 2021) and have been used to complete this expedited draft summary. Newly added items are highlighted in green throughout the report.

Table 1: Visual summary of evidence for transmission risk of COVID-19 and different settings and activities

Setting & Activity	References	Risk Level as reported by study author(s)	Preventative Measures	Time Period Studied
Accommodations				
Chalet	Previous ¹	High	NR	February 2020
Shared housing (e.g., dormitories)	Previous ^{2,3}	Low ² , High ³	masking, disinfection, accessibility of alcohol pumps	July 2020 – May 2021
Shelters/Social housing	New ⁴	Unclear ⁴	NR	May - August 2021
Business				
Conference	Previous ⁵	High	social distancing	March - April 2020
Education				
Nursery/Kindergarten	New ⁴ Previous ⁶⁻¹⁵	Unclear ⁴ Low ⁶⁻¹⁵	Hand hygiene, mask wearing (adults)	June 2020 – August 2021
Primary schools	New ⁴ Previous ^{6,7,9-25}	Unclear ⁴ Low ^{6,7,9-25}	face masks; distancing; screening, handwashing, hybrid education, improved ventilation, bubbles	January 2020 – August 2021
Secondary schools	Previous ^{5,7,9-12,14-16,18-20,22-26}	Low	face masks; distancing; screening, handwashing, hybrid education, improved ventilation, bubbles	January 2020 - February 2021
Events and entertainment				
Social events ^a	New ⁴ Previous ²⁷⁻³⁵	High	social distancing	May – June 2020
Weddings	Previous ^{5,36}	High	social distancing, public awareness of epidemic prevention and control	March - April 2020
Hospitality venues	Previous ⁵	High	social distancing	March - April 2020

Setting & Activity	References	Risk Level as reported by study author(s)	Preventative Measures	Time Period Studied
Shopping	New ⁴ Previous ^{28,37}	Unclear ^{28,37} Low (except convenience stores) ⁴	social distancing, public awareness of epidemic prevention and control	January 2020 – August 2021
Healthcare				
Community healthcare	Previous ³⁸	Low	face masks	June 2020
Hospitals	New ^{39–44} Previous ^{27,28,37,45–64}	Unclear ^{27,28,37,47,58,59,61,62,64} , Low ^{43,50–52,54,56,57,60} , High ^{39–42,44–46,48,49,53,55,63}	face masks, hand hygiene, staff training, PPE, restricting visitors, environmental cleansing and disinfection, quarantine, testing, shorter shifts	March 2020 – March 2021
Specialty care ^b	Previous ^{49,65,66}	Low ⁶⁵ , Unclear ^{49,66}	face masks, hand hygiene, PPE, environmental cleansing and disinfection, quarantine	February 2020 – June 2020
Primary care	Previous ⁶⁷	High	Social distancing, wearing PPE, testing and contact tracing	March 2020 – June 2020
Healthcare workers (transmission to household)	Previous ^{58,68}	High	hand hygiene, face masks, physical distancing	March 2020 – June 2020
Healthcare workers (transmission to patients)	Previous ⁶⁰	Low	face masks and other infection control policies	October 2020 – April 2021
Healthcare workers (transmission from patients)	New ⁶⁹	Unclear ⁶⁹	PPE	March – May 2020
Residential and long-term care	New ^{70,71} Previous ^{5,31,35,58,60,67,72,73}	High	face masks, hand hygiene, restricting visitors, physical distancing,	January – September 2020; March – April 2020

Setting & Activity	References	Risk Level as reported by study author(s)	Preventative Measures	Time Period Studied
			enhanced cleaning	
Hospitality				
Cruise ships	Previous ⁷⁴	High	ship based quarantine, enhanced health measures and access to onshore quarantine and isolation facilities	March 2020 – April 2020
Tour guides	Previous ⁷⁵	High	NR	January – March 2020
Waiter or bartenders	Previous ⁷⁵	Low	NR	January – March 2020
Cooks	Previous ⁷⁵	Low	NR	January – March 2020
Restaurants	New ⁴ Previous ^{34,37}	Low ⁴ High ^{4,37}	contact tracing and quarantine, and early introduction of social distancing measures	January 2020 – August 2021
Household				
Family home	New ⁷⁶ Previous ^{29,37,64,77}	Unclear ⁷⁶ High ^{29,37,64,77}	public awareness of infection and control, hand hygiene, self-isolation	January 2020 – October 2020
Specialized services				
Dental	Previous ⁷⁸	Low	PPE	May – October 2020
Personal care services ^c	Previous ³⁴	Medium	contact tracing and quarantine, and early introduction of social distancing measures	January – June 2020
Sports and activities				

Setting & Activity	References	Risk Level as reported by study author(s)	Preventative Measures	Time Period Studied
Golf	Previous ⁷⁹	Low	Social distancing, testing	July - December 2020
Sports	New ⁴ Previous ^{20,80-82}	Low ^{4,80} , High ^{20,81,82}	quarantine for infected individuals, face masks, physical distancing, hygiene measures	August 2020 – August 2021
Camp ^d	Previous ^{83,84}	Low	screening, daily temperature checks, masks, hand hygiene, physical distancing, small cohorts, scheduled site cleanings, and staff COVID-19 education and workplace training	March – August 2020
Transportation				
Bus or metro	Previous ³⁷	High	public awareness of epidemic prevention and control	January 2020 – March 2020
Flight travel	New ^{4,85} Previous ^{37,64,86-89}	High ^{37,64,86-88} , Low ⁸⁹ , Unclear ⁴	post-flight quarantine, contact-tracing, distancing, masks	January 2020– August 2021
Car sharing	New ⁴ Previous ^{64,90}	High ^{64,90} , Low ⁴	masking	January 2020- August 2021
Modes of transportation	New ^{4,91} Previous ^{27,31}	Unclear ^{4,27} , Low ³¹ , High ⁹¹	Masking	January 2020 – August 2021
Workplaces				
Construction labour	Previous ^{28,75,92}	High	NR	January – March 2020
Domestic housekeepers	Previous ⁷⁵	High	NR	January – March 2020

Setting & Activity	References	Risk Level as reported by study author(s)	Preventative Measures	Time Period Studied
Drivers (e.g., car, taxi, van)	Previous ⁷⁵	High	NR	January – March 2020
Drivers (e.g., bus, train)	Previous ⁷⁵	Low	NR	January – March 2020
Meat and poultry processing plant	Previous ⁹³	Unclear	masking, testing, ventilation, physical barriers, distancing, disinfection	June-September 2020
Personal care workers	Previous ⁷⁵	Low	NR	January – March 2020
Receptionists	Previous ⁷⁵	Low	NR	January – March 2020
Salesperson	Previous ^{75,94}	High	Social distancing, masking	January – May 2020
Religious professionals	Previous ⁷⁵	High	NR	January – March 2020

^a Social events are defined by the study authors and may include but is not limited to any social activity with one or more individuals such as dating, getting together with a neighbor or friends, banquet, dinner, karaoke, community gatherings, or birthday parties.

^b Speciality care includes specific settings outside a general hospital setting (e.g., dialysis unit, physical therapy, outpatient care)

^c Personal services may include hair salons, beauty parlors, nail salons, spa, etc.

^d Includes indoor/outdoor and summer camps

Descriptive summaries of newly added studies

Accommodations

Shelters/Social housing

[Refer to Grant et al. under Nursery/Kindergarten]

Education

Nursery/Kindergarten

Grant et al.⁴ carried out a nationwide case-control study in France to assess settings and activities associated with SARS-CoV-2 infection. 12634 (8644 Delta and 3990 non-Delta) infected adults were recruited between May and August 2021, when the delta variant was the dominant variant circulating in France. 5560 controls were matched by age, sex, region, population density and calendar week. The authors failed to find differences in the settings and activities associated with Delta versus non-Delta infections. In individuals under 40 years, attending bars (aOR=1.9, 95% CI: 1.6- 2.2) or parties (3.4, 95% CI: 2.8-4.2) was associated with an increased risk of infection. In those 40 years and older,

increased risk of infection was associated with having children who attend daycare (1.9, 95% CI: 1.1-3.3), kindergarten (1.6; 95% CI: 1.2-2.1), primary school (1.4, 95% CI: 1.2-1.6) or middle school (1.3; 95% CI: 1.2-1.6). Across both age groups, activities/settings associated with an increased risk of infection included living in shelters or social housing (2.3, 95% CI: 1.2-4.3), having children attended by a childminder (1.6; 95% CI: 1.3-2.0); carpooling with family and friends (1.3, 95% CI: 1.2-1.4), travelling by taxi (1.5, 95% CI: 1.2-1.8), subway travel (1.2, 95% CI: 1.0-1.4), travel by national train (1.3, 95% CI: 1.1-1.6) or airplane (1.7, 95% CI: 1.3-2.2), travel overseas (1.3, 95% CI: 1.1-1.6), attending a private ceremony (1.7, 95% CI: 1.4-2.2), and shopping in convenience stores (1.3, 95% CI: 1.2-1.4). Activities not associated with an increased risk of infection included public transportation (except subway), car-sharing platforms, visits to cultural places, shopping areas, hairdressers, beauty salons, sporting activities, and restaurants.

Primary schools

[Refer to Grant et al. under Nursery/Kindergarten]

Events and entertainment

Social events

[Refer to Grant et al. under Nursery/Kindergarten]

Healthcare

Hospitals

Costa et al.³⁹ conducted a cross-sectional study that evaluated the presence of anti-SARS-CoV-2 IgG/IgM antibodies in healthcare workers (HCW) at the Central and the Outpatient Institutes of Hospital das Clínicas. A 52-question survey evaluating educational level, professional category, transportation to work, housing, household contacts, comorbidities, smoking status, medications, influenza vaccination status, PPE use, known prior COVID-19 infection, and respiratory symptoms was administered. The seroprevalence was 14% and factors associated with being infected with SARS-CoV-2 were lower educational level (aOR of 1.93; 95% CI 1.03-3.60), using public transport to work (aOR of 1.65; 95% CI 1.07-2.62), and working in cleaning or security (aOR of 10.1 ; 95% CI 3.40-26.9). Study authors found that the distance from home to work, use of public transportation, and residing in poorer neighbourhoods were associated with infection. In conclusion, the findings suggest the possibility of an important role of community SARS-CoV-2 transmission among HCWs.

Leeman and colleagues⁶⁹ conducted a retrospective cohort study on healthcare workers and patients in general medical and elderly inpatient wards in an English district hospital. The study evaluated two different outbreak periods of COVID-19 (March 2020 and April 2020). 72 of 153 patients were confirmed to be COVID-19 cases, with 45 of these cases associated with healthcare. In healthcare workers infection was associated with exposure to a COVID-19 patient with respiratory symptoms, irrespective of proximity (aOR= 3.81, 95% CI: 1.6.3–8.87). Non respiratory exposure was significant within 2.5 metres (aOR=5.21, 95% CI: 1.15–23.48). The authors recommended improved social distancing and further examination of bed distance for infection control.

Ran et al.⁴⁰ conducted a retrospective cohort study evaluating the risk factors and behaviours associated with the development of COVID-19 in HCWs in the designated hospital of Wuhan University. Seventy-two HCWs with acute respiratory illness were retrospectively enrolled to analyze the risk factors. The high-risk department, longer duty hours, and suboptimal hand hygiene after contacting with patients were found to be linked to COVID-19.

Zabarsky et al.⁴¹ conducted a prospective cohort study to evaluate the exposure history of healthcare personnel with COVID-19 in an acute care hospital during a 4-month period. Between March 15, 2020, and July 15, 2020, the exposure history of personnel with COVID-19 infection or asymptomatic carriage was examined. The study authors found that 25% of healthcare personnel testing positive for SARS-CoV-2 had a higher-risk exposure at work (more than 15 minutes of exposure within 6 feet of a symptomatic or pre-symptomatic individual), including 18 exposures to COVID-19 patients and 6 to infected personnel. Higher-risk exposures to co-workers with COVID-19 often involved lapses in compliance with masking in nonpatient care areas such as nursing stations and staff work or break rooms.

Wang et al.⁴² conducted a cross-sectional study to identify the super-factors causing COVID-19 infection among medical staff in China. A total of 92 medical staff were enrolled and among all participant groups, the super factor identified by the network was wearing a medical protective mask or surgical mask correctly and touching the cheek, nose, and mouth while working was the super-factor in the infected group. High self-protection score was the main factor that prevented medical staff from contracting COVID-19 infection. Overall, the study authors found that the main factor contributing to COVID-19 infections among medical staff was touching the cheek, nose, and mouth while working.

Gagneux-Brunon et al.⁴³ conducted a cross-sectional study to observe the rate of infection with severe acute respiratory syndrome coronavirus-2 in HCWs who worked on wards dedicated to the care of patients with COVID-19 compared to HCWs who worked on non-COVID wards. The authors found that the infection rate was significantly higher among HCWs who worked on non-COVID wards. The study showed that care of patients with COVID-19 was not a risk factor for SARS-CoV-2 infection in HCWs and strengthening social distancing measures is important in healthcare settings.

Chatterji et al.⁴⁴ conducted a case-control study to identify factors associated with SARS-CoV-2 infection among HCWs in India. In a multivariate analysis, HCWs performing endotracheal intubation had higher odds of being SARS-CoV-2 infected and consumption of four or more maintenance doses of HCQ was associated with a significant decline in the odds of getting infected. In addition, the use of PPE was independently associated with the reduction in odds of getting infected with SARS-CoV-2. The study authors concluded that appropriate PPE use should be considered to protect HCWs against COVID-19.

Residential and long-term care

Kain et al.⁷⁰ conducted a longitudinal retrospective chart review of long-term care home COVID-19 outbreak in residents and staff in Ontario, Canada. The study authors used electronic medical records, public health records, staff assignments, and resident room locations to spatially map the outbreak through the facility. The main conclusions found were: (1) 84.5% had typical COVID-19 symptoms and only 15.5% of residents had asymptomatic infection; (2) there was a high attack rate of 85.8%, which appeared to be explained by a high degree of interconnectedness within the home exacerbated by staffing shortages; and (3) clustering of infections within multi-bedded rooms was common. Overall, the study found a relatively low percentage of asymptomatic residents. Despite the high attack rate and rapid spread, authors found that this could be explained by droplet and contact spread due to a high degree of interconnectedness in the home.

Fisman et al.⁷¹ conducted a retrospective cohort study to evaluate the trends and risk factors associated with COVID-19 death in long-term care (LTC) facilities in Ontario, Canada. The incidence rate ratio for COVID-19–related death in LTC residents was 13.1 (95% CI, 9.9-17.3) compared with community living adults older than 69 years, suggesting that COVID-19–related death among LTC residents was 13 times higher than that among community-living adults. The study authors concluded that early identification of risk requires a focus on testing, providing personal protective equipment to staff, and restructuring the LTC workforce to prevent the movement of COVID-19 between facilities.

Household

Family home

Afonso and colleagues⁷⁶ conducted a cross-sectional study in the city of Goiânia, Brazil, from March to October 2020. They evaluated the secondary attack rate in 267 children and adolescents aged 5-19 years old who were contacts of essential activities workers infected by SARS-CoV-2. The overall SAR was approximately 25% (n=67 secondary cases) of this sample, confirming the risk and the susceptibility of this group to household infection. A family with more than one infected adult, in addition to the index case, was a risk factor for greater transmissibility to children and adolescents. The authors concluded that dynamics of home transmission of the SARS-CoV-2 virus observed in reinforces the need for continuous surveillance in this population.

Sports and activities

Sports

[Refer to Grant et al. under Nursery/Kindergarten]

Transportation

Flight Travel

[Refer to Grant et al. under Nursery/Kindergarten]

Toyokawa et al.⁸⁵ conducted a cohort study to examine COVID-19 transmission on a domestic flight to Naha City, Japan. Fourteen confirmed and six probable cases were identified among the 146 passengers and flight attendants, resulting in a secondary attack rate of 9.7%. Independent risk factors for infection included not using a face mask (aOR=7.29, 95% CI: 1.86-28.6), partial face mask use (3.0, 95% CI: 0.83-10.8), and being seated within two rows from the index patient (7.47, 95% CI: 2.06-27.2).

Modes of transportation

[Refer to Grant et al. under Nursery/Kindergarten]

Zhong et al.⁹¹ conducted a cross-sectional study to explore the correlation between travellers departing from Wuhan before the Spring Festival and the extent of amplification of the outbreak of COVID-19 in China. Overall, the study authors found a strong correlation between travel volumes departing from Wuhan, Hubei Province before the Spring Festival, and the extent of amplification of the outbreak of COVID-19 in China in 2020, with 100 top cities.

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