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## Outdoor Winter Dining during the COVID-19 Pandemic

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**Primary inquiry:** How can outdoor dining spaces be adapted for colder weather in a way that does not exacerbate COVID-19 transmission or other safety risks associated with temporary enclosures?

**Summary statement:** Regardless of whether dining occurs indoors or outdoors, dining out heightens the risk of COVID-19 transmission, and this risk is primarily due to spending time unmasked with another individual whose health status is unknown. The first and most important means to decrease the risk of dining out is to dine with members of one's own household or bubble. Beyond this baseline risk, there are numerous innovative means to mitigate the risks specific to patio dining, which include the risk of COVID-19 transmission from other tables, and the risk of carbon monoxide exposure due to the inappropriate use of fuel-burning patio heaters.

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### Background

During the COVID-19 pandemic, outdoor dining has become a key factor in the survival of the restaurant industry,<sup>1</sup> allowing establishments to continue serving clients by expanding their "floor space" into outdoor spaces (often streets, parking lanes, and lots) to satisfy physical distancing requirements. Over the summer, many recommendations for safer dining on patios<sup>2</sup> were developed and have been generally successful in boosting the food service industry while avoiding major outbreaks. In addition, outdoor dining appears to bolster consumer confidence, with many members of the public indicating that they feel

safer eating outdoors than in.<sup>3</sup> Therefore, as winter begins, a number of cities have created new regulations to extend “patio season” by allowing winterized patios.

However, outdoor winter dining poses a number of new challenges. The first is to create a comfortable and enjoyable outdoor space where food can be served. Because some form of shelter or enclosure is typically necessary for outdoor winter dining, the second challenge is to create comfortable environments without exacerbating the risk of COVID-19 transmission or introducing other health or safety threats. Recent media coverage has demonstrated the ways in which businesses are struggling to balance the need for customer experience against public health requirements for safe patio spaces and the expense that comes with creating such spaces.<sup>4</sup>

This field inquiry sought to clarify some of the challenges and potential solutions to promote safe outdoor winter dining by using the following multi-pronged approach:

- Expert consultation with specialists in environmental health, indoor air quality, and occupational health to clarify the potential challenges associated with winterized patios, not all of which are health-related. These experts were also asked to comment on other risks or problematic practices observed in the field or in guidance documents.
- A rapid review of any pertinent academic or NCCEH resources.
- A grey literature search for existing North American guidelines or resources.

## Expert consultation

Based on dialogue with environmental health experts within the NCCEH and partner agencies and other professionals (NCCEH collaborators), a number of potential challenges related to outdoor winter dining were identified:

- Enclosure, decreased ventilation, and the potential for increased COVID-19 transmission;
- Trying to fit more people into an outdoor space (i.e., non-compliance with physical distancing requirements) and the potential for COVID-19 transmission;
- Increased risk of fire and carbon monoxide (CO) exposure due to the misuse of fuel-burning heaters;
- Structural safety of temporary structures during inclement weather or heavy/wet snow fall;
- Egress in case of an emergency;
- Obstructing other users’ rights of way, particularly people with disabilities.

This rapid review focused on the health risks related to COVID-19 and carbon monoxide exposure as the two factors most relevant to environmental health.

## Rapid review of academic and grey literature

A rapid literature review was conducted to ascertain whether outdoor patio dining, specifically, has been implicated in COVID-19 transmission, and any literature regarding temporary enclosures and ventilation. EBSCOhost, Web of Science, and Google Scholar were used to search for articles using the following keywords: tents, enclosures, patios, restaurants, outbreak, COVID-19, transmission, ventilation, aerosol, airborne, and carbon monoxide. Very little information was available to speak directly to the risk of COVID-19 or other indoor air hazards in temporary shelters, enclosures, or tents. Although some regions have been forced to create field hospitals for the COVID-19 crisis,<sup>5</sup> these structures typically have dedicated HVAC systems and are not equivalent to restaurant patios. A grey literature search using Google and key words directed at outdoor winter dining returned a number of guidance documents from various jurisdictions in North America.

### ***What is the risk of transmission within vs. between parties in a restaurant setting?***

SARS-CoV-2, the virus that causes COVID-19, has the potential to be transmitted via a number of different modes, some of which may be concurrent.<sup>6</sup> Currently, all available public health evidence suggests that being in close contact with an infected individual creates the highest risk of transmission, and that the large majority of cases can be traced to a known case.<sup>7</sup> The Public Health Agency of Canada defines close contact as providing care for a sick person without consistent use of PPE, being within 2 m of a symptomatic or pre-symptomatic person for more than 15 minutes (cumulatively), or having direct contact with that person's infectious body fluids without PPE (e.g., being sneezed on).<sup>8</sup> Thus, close contact includes both touching and transferring the virus into one's own eyes, nose, or mouth, as well as inhaling or contacting their respiratory secretions after they have been expelled as droplets and aerosols. Because proximity is critical to the vast majority of infections, it is assumed that the larger respiratory droplets carry the greatest risk. The risk of close-range droplet transmission can be mitigated by using masks,<sup>9</sup> physical barriers that fully separate the breathing zones of those interacting<sup>10</sup> and, of course, physical distancing.

Transmission over distances somewhat longer than 2 m have been observed and are thought to be mediated by smaller respiratory aerosols that have been allowed to accumulate (due to lack of ventilation) or are being pushed around by drafts or turbulent air.<sup>11</sup> Thus, enhancing ventilation (or at minimum ensuring that existing ventilation is functioning properly) is recommended to reduce the risk of short-range aerosol transmission.<sup>12</sup> However, ventilation or air cleaning devices are unlikely to have any effect on reducing the risk of close-range droplet transmission.

This information is important in the context of restaurants to understand who is being protected from whom and how. Diners in the same party are interacting without a mask for an extended period of time and are at high risk of infection if one member is ill and

shedding the virus in their respiratory particles (within-party transmission). In an enclosed space, diners may also be exposed to the aerosols of other physically distanced parties (between-party transmission). However, the risk of transmission is much lower in this case because aerosols must accumulate to the point where there are sufficient numbers to establish an infection, something that can be at least partially mitigated through ventilation and air cleaning devices. In a restaurant setting, the principal public health concern is to protect one party from infecting another. Hand-washing and limiting the numbers at any one table should help to decrease the risk of transmission within dining parties, but some enhanced degree of risk is inevitable when interacting in this way.

### ***Is outdoor dining associated with a known risk of COVID-19 transmission?***

When dining is moved outdoors (with no enclosure), the risk of short-range aerosol transmission between parties is effectively nullified by natural dilution ventilation. During the warm season, some jurisdictions required completely open environments to maximize this effect, excluding even the use of awnings or roofs.

However, being outdoors does not nullify the risk of close-contact transmission within parties due to the interchange of respiratory particles (both droplets and aerosols) while people are seated and speaking together for an extended period. The limited research to date suggests that COVID-19 transmission is less likely in outdoor environments, but may still occur and is likely associated with crowding. Nishiura et al.<sup>13</sup> found that close contacts that occurred in an indoor environment were almost 19-fold more likely to result in transmission than close contacts that occurred outdoors. The study analyzed a number of clusters that occurred in February 2020, prior to public health measures being instituted in Japan, and one of the clusters examined was an outdoor festival during which people gathered in food service tents, among other locations. Weed and Foad<sup>14</sup> conducted a systematic review of Nishiura et al. and a number of other studies looking at outdoor transmission and concluded that the risk of outdoor transmission is generally low, although this may not hold true for large crowds that spend time “milling around” together. In the US, a recent study found that COVID-19 cases were more likely to report having visited a restaurant, bar, or coffee shop within the previous two weeks, but the study did not distinguish between indoor vs. patio or outdoor seating.<sup>15</sup> Thus, it appears that although being outdoors may greatly reduce the risk of COVID-19 transmission, this may not be strictly true for restaurant patios where people are stationary together, particularly if operators crowd more patrons into the outdoor space, or if the patio has been partially or fully enclosed.

### ***COVID-19 and enclosed outdoor dining***

During the winter, partial or full enclosure may be necessary to protect clients from the elements and allow food to retain heat. There are two undesirable conditions to be avoided. The first is “tight” enclosure with limited air exchange that increases the risk of

particle accumulation and short-range aerosol transmission between parties; this risk is often noted in the various outdoor dining guidance documents available. However, it is equally undesirable to create drafty conditions. For example, lowering two opposite walls of a tent (as opposed to two adjacent walls) can result in funneling wind through the structure, and increases the likelihood that respiratory particles will be transferred among parties.

The amount of enclosure required to provide thermal comfort varies geographically, and how that enclosure is configured will impact the risk of both droplet and short-range aerosol transmission. One option is to treat the patio space as an indoor space and manage it with a mechanical ventilation system that meets the standards for indoor spaces. However, this option may not be feasible for a variety of reasons (e.g., cost, space available on the public right of way, etc.).

It is also important to note that temporary outdoor structures are still ventilated, but it is natural or passive ventilation, which is dependent on the velocity of air flows moving against the enclosure, the material of the enclosure, and the gaps/spaces through which air can leak. Thus, ventilation rates will vary with outdoor conditions, and this lack of control is a key issue in being able to provide a safe environment for diners.

One NCCEH collaborator noted that the design and use of outdoor structures/enclosures should account for changing weather conditions and how they might affect passive ventilation. For example, enclosures can be re-configured (or “buttoned up”) on windy days to reduce draftiness, while still allowing sufficient air flow. In contrast, it may be necessary to reduce enclosure (remove all side panels) on still days to promote air flow. Because outdoor eating areas are also heat sources (from heaters, from hot food, and from the diners’ bodies), it may be possible to take advantage of the stack effect, a passive mechanism in which warm air rises and can be allowed to escape through roof vents. In enclosures with heaters positioned near the floor and vents in the roof, the stack effect may help to carry smaller particles up and out of the tent, although this is not expected to function as effectively as mechanical ventilation.

Diners also play a role in comfortable outdoor dining. One NCCEH collaborator suggested that operators communicate directly with their patrons regarding weather conditions and the need to dress for current conditions. This might include adding a weather widget to the restaurant’s website, or adding a reminder to dress warmly to apps used for booking reservations. Such a mechanism may also be useful to warn diners of patio closures if weather conditions become hazardous. By communicating better and relying on not one but a mix of heating strategies (enclosure, electric heating, warm clothing, etc.), diners are most likely to achieve thermal comfort.

## Existing guidance on safe outdoor winter dining

A number of jurisdictions have already produced guidance documents for outdoor winter patios, the most detailed of which were reviewed for this inquiry. These included documents from New York City,<sup>16</sup> Chicago,<sup>17,18</sup> Philadelphia,<sup>19</sup> Colorado,<sup>20</sup> Edmonton,<sup>21</sup> Toronto,<sup>22</sup> and Winnipeg.<sup>23</sup> The key areas addressed within these guidance documents included structural safety and weather, guidance on the tradeoffs between degree of enclosure, occupancy, and ventilation requirements, restrictions on heat-generating devices, and other safety or emergency matters. This inquiry focused on defining enclosure and COVID-19 requirements for temporary outdoor spaces, as well as options for safely heating these structures.

### ***When does an outdoor temporary structure become an indoor environment?***

A clear understanding of when an outdoor space becomes an indoor space is a critical factor in assessing the COVID-19 transmission risk. The number of ways in which a temporary outdoor structure can be configured creates a challenge in determining whether to treat these structures as indoor or outdoor environments, and what number of occupants can be permitted. Colorado's Department of Public Health and Environment classifies temporary outdoor structures according to the presence of a roof, the number of walls, and the configuration of wall panels (whether they are adjacent or opposite to each other), based on a reasoned judgement as to whether or not this configuration will impede or permit air flow.<sup>20</sup> For example, a structure with a roof and two adjacent walls is considered "indoor," whereas structures with a roof and two non-adjacent walls, or two adjacent walls and no roof, are considered "outdoor." The potential role of drafts in carrying droplets between parties is not considered. In addition, Colorado DPHE provides its operators with occupancy limits that scale to current community transmission risk.

Other jurisdictions have defined an indoor space in simpler terms. The Province of Manitoba deems a space to be enclosed or indoor if more than 25% of its floor area is covered by an impermeable barrier, and more than 50% of its perimeter is more than 50% enclosed. New York City defines a partial enclosure as two walls, and full enclosure as four, but a full enclosure can only have 25% occupancy. The New York guidance also mentions single-party structures but indicates that they must have "adequate ventilation."

### ***How can outdoor spaces be safely and efficiently heated?***

The guidance documents identified here provided a number of options for heating temporary structures. In most cases, only electric heaters are permitted for use inside of tents, as long as the appropriate fire and electrical safety measures are in place (e.g., using certified installers and equipment, keeping heaters away from tent walls/combustible materials and the exits, avoiding tripping hazards, etc.). Although electric heaters are not without risk, fuel-burning heaters are unsafe to use within enclosures as they generate

carbon monoxide (CO), an odourless, colorless, and highly toxic gas that creates a life safety risk for both patrons and employees.<sup>24</sup> Although one document mentioned using propane heaters outside the tent and then “pumping the heat in,” one expert involved in discussions with the NCCEH noted that this strategy is risky as combustion products may still enter the tent. In general, a number of inquiries to the NCCEH and its partners have indicated that fuel-burning patio heaters are being used improperly due to lack of knowledge, as well as lack of safer options (e.g., short supply of electric heaters).

There are a number of resources that public health practitioners can use to help operators establish safer patio heating. WorkSafeBC has produced technical resources on CO risks generally,<sup>24</sup> as well as a risk advisory on the use of fuel-burning heaters on outdoor patios.<sup>25</sup> The Technical Standards and Safety Authority has produced a set of safety guidelines for using fueled heaters,<sup>26</sup> including keeping the heaters and fuel tanks outside, keeping the units stable and secure from tampering, and other precautions.

### ***What are the creative options for outdoor winter dining?***

Depending on climate, outdoor winter dining is a greater challenge in some regions than others. In August 2020, the City of Chicago launched [a community challenge](#) to gather and evaluate ideas to “stimulate and encourage safe outdoor dining and entertainment during cold weather in Chicago.” The competition received more than 600 entries, and included a variety of unexpected, innovative, and occasionally humorous ways to dine safely outdoors despite sub-zero temperatures and high winds.

The competition also provided insight, through the submissions, into the types of settings in which members of the public would most likely feel comfortable dining, given the pandemic conditions. A number of themes were evident:

- **Single-party enclosures.** The vast majority of dining solutions were pods, bubbles, domes, yurts, igloos, or cocoons designed to partially or fully enclose a single party of diners. This reflects the public’s desire to restrict social interactions to known persons only, while still enjoying a public setting. Single-party enclosures might also be more space efficient than multi-party structures with physical distancing and occupancy limitations. The key concern regarding these single-party structures is the potential for “airborne” transmission in small enclosed spaces.<sup>27</sup> However, it is important to note that people within the same party are spending time together unmasked and are exchanging droplets at close range. Ventilating said space would likely help to reduce humidity and to clear the air between consecutive dining parties, but is unlikely to prevent transmission in an unmasked face-to-face interaction. Whether or not members of a party are from the same family or close contact unit may also be a consideration.
- **Park and eat.** A number of submissions proposed dining in cars, a variation on the single-party enclosure, but with fewer cleaning and disinfection requirements.

- These submissions involved driving into some designated area (e.g., a re-purposed parkade or other large space), where customers could eat from one or multiple food service providers, usually while enjoying other forms of entertainment as well (concerts, movies, fireworks, etc.).
- **Convertible or modular designs.** For submissions that involved multi-party dining, designs were often convertible or modular, such that they could scale to party size or be moved or reconfigured to address physical distancing concerns.
  - **Creative means of warming diners.** The options suggested for warming diners were extremely varied, and ranged from well-known technological solutions (e.g., electric space heaters, radiant floor heating) to highly personalized options like electric blankets, heated tables/chairs, electric capes, and even personalized hot potatoes to tuck into one's pocket for later consumption. A bring-your-own-blanket solution was suggested by some competitors concerned about fomite transmission. However, a number of other submissions advocated for the use of CO-generating devices (natural gas or propane heaters) inside enclosures, highlighting once again the need to communicate clearly regarding the extreme hazard of CO in small spaces.
  - **Treating outdoor space like indoor space.** A number of submissions addressed COVID-19 transmission spaces by treating enclosed patios as an extension of the indoor space with equivalent heating and ventilation. This involved either a dedicated heating and ventilation system for the outdoor space, or modification to the restaurants existing system.
  - **Designs incorporating passive ventilation.** A number of entries proposed to use the stack effect to passively ventilate enclosures. In these submissions, air warmed by heaters near the floors, occupant body heat, or hot food is allowed to rise and pass through transoms or vents created in the roof of the enclosures, theoretically helping to clear accumulated aerosols.
  - **Designs incorporating "sterilization."** Several submissions included ultraviolet (UV) irradiation to "sterilize" surfaces after each party of diners had left, but the effectiveness of this solution would be dependent on the surfaces present and the maintenance of the UV unit.

## Summary

Whether or not food and drink establishments continue to operate is dependent on community transmission rates and subsequent public health interventions. However, while patios are allowed to remain open, there are a number of creative means to provide comfortable outdoor dining that should not increase the risk of transmission beyond that of an indoor restaurant. There are, however, a number of key risk communication issues for outdoor winter dining:



- Dining out heightens COVID-19 transmission risk because it requires unmasked, face-to-face interaction, and this risk exists both indoors and outdoors. Thus, the most effective way to reduce transmission risk while visiting any public space is to avoid close contact with those outside one's own "bubble"; in this case, restricting dining parties to members of one's own household.
- Single-party structures appear to be a popular and nearly ubiquitous option to prevent between-party transmission. Although use of single-party structures effectively eliminates this risk, it does not mitigate (and may slightly accentuate) the risk from those seated at the same table. Ventilating single-party structures is unlikely to eliminate the risk of close-contact transmission if one member of the party is infected, but may lessen the risk for subsequent diners by helping to clear accumulated respiratory particles.
- Tents or enclosures should be designed with passive ventilation in mind, and should allow for rapid reconfiguration to modulate airflow as weather conditions change. Passive ventilation via the stack effect may also help to move air through enclosures, although this should not be relied upon.
- Devices that generate heat via combustion should never be used in enclosed spaces. Operators should familiarize themselves with the risks of CO poisoning<sup>24</sup> and ensure that outdoor heating devices are used safely.<sup>26</sup>
- Operators may also wish to consider a mix of heating strategies, including some of the personalized options like bring-your-own-blanket (which reduces the risk of fomite transmission), as well as enhancing communication with patrons to ensure that they can dress for the weather.

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