

COVID in cold environments: risks in meat processing plants

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Cold food processing facilities have been featured as particularly high-risk environments for COVID transmission, with outbreaks localized to these plants occurring in the US, UK, Germany, Australia and other countries. This note examines what factors – environmental and social – may be contributing to this higher risk and proposes some approaches to risk mitigation. Specifically:

- Recent research indicates that temperature and humidity can affect COVID transmission risk: dry, cold environments see greater transmission.
- COVID is more likely to be transmitted indoors, where air circulation may be less robust. Mechanical ventilation (often referred to as heating, ventilation and air conditioning (HVAC)) systems that are well designed and maintained can be an important factor in preventing COVID from spreading indoors by increasing clean air flow and maintaining indoor conditions (temperature and humidity) that discourage virus survival.¹
- When indoors, people are often closer together than they might be outside. This is common in food processing facilities where physical distancing has not traditionally been a feature, either on the production lines or in staff break/relaxation areas.[†]
- In addition to temperature and ventilation, factors that may impact COVID transmission in indoor facilities include person density, line speeds, implementation of the recommended suite of public health prevention measures and worker conditions (e.g., encouraging reporting symptoms, providing paid sick leave and ensuring medical support for those who are ill).

Critically, the COVID pandemic has played a role in revealing and underscoring societal inequities. Some of these have been highlighted in the context of cold food processing plants, where there have been cases of crowded workplaces, inadequate prevention measures and poor working conditions (both physical and regarding employment terms). Businesses in this sector can go a long way to reducing the risk of COVID transmission by:

- reducing crowding (e.g., by staggering shifts, slowing line speeds, creating “pods” of work shifts who only ever work with each other);
- ensuring universal public health precautions (i.e., requiring face masks, ensuring the placement of adequate hand washing stations, accommodating necessary physical distancing and enabling isolation of people who are ill);
- improving the operation and safety of ventilation systems; and
- establishing employment conditions that minimize the dependence on subcontracting and other forms of indirect employment, pay attention to the living and travel circumstances of the workforce, maintain constant communication with worker representatives, incentivize the reporting of symptoms and provide support to workers who are ill.

Early recognition of outbreaks in all contexts, but particularly in those that have been identified as high risk like cold food processing facilities, requires strong local surveillance systems. Local health authorities, businesses and trade unions need to work in partnership.⁸ Businesses should engage with their

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[†] NB: Meat, poultry and fish processing are more labor intensive and have less automation on production lines than other food processing performed in cooler temperatures (e.g., dairy). As such, it has been easier to observe physical distancing in non-meat and fish processing sites without large investments in engineering controls. This does not mean that other cold food processing plants and cool stores are risk free (e.g., see COVID cases transmitted in the Americold facilities in Auckland).

communities in reducing COVID transmission, cooperating with authorities when closures are required and supporting employees who feel ill and require paid leave and/or medical care.¹⁰

Ambient temperature and humidity impact on COVID transmission

Dry, cold environments have been documented to encourage greater COVID transmission. A review of 14 studies examining the role of ambient conditions on the transmission of COVID indicate that:²

- Weather conditions appear to influence the transmission of COVID, although evidence is not sufficient nor sufficiently consistent to allow causation to be inferred;
- Higher temperatures are associated with fewer cases;
- Higher relative or absolute humidity is associated with fewer cases;
- Dry conditions seem to favour viral spread; and
- Exacerbating effects include high levels of pollution and low wind speed.

Ventilation and COVID transmission

HVAC is an important factor in preventing COVID from spreading indoors. The evidence has driven the following recommendations/conclusions:

- Air conditioning, ventilation, or other climate control systems that are well-maintained and operated should not increase the risk of transmission.¹ If designed and well maintained, HVAC systems can increase *clean* air flow, which may reduce transmission risk; if not well-maintained, they can contribute to transmission by recirculating contaminated air and/or could create indoor conditions (temperature and humidity) that support virus survival
- Natural ventilation (i.e., fresh air circulating) is considered safest. If using HVAC, it may be best to run it at maximum outside airflow for 2 hours before and after spaces are occupied. Total airflow should be maximized in occupied spaces.
- If HVAC systems are not well maintained and operated, there are *two potential mechanisms through which it could contribute to virus transmission*: the system itself could recirculate contaminated air; and/or could create indoor conditions (temperature and humidity) that support virus survival.
- Care should be taken if HVAC systems are set to “cold” temperatures (below 70 F/ 21C)⁵ and “dry” humidity settings (below 40%) as these are optimal conditions for the virus.^{6,7}
- Buildings with central HVAC systems should use the most efficient filters. In healthcare facilities, a HEPA filter captures viruses effectively.⁸ However, air filtration should only be as high as possible *without diminishing airflow*.
- Clean-to-less-clean air movements can be generated by positioning supply and exhaust air diffusers and/or dampers and adjusting zone supply and exhaust flow rates to establish measurable pressure differentials. Staff should work in “clean” ventilation zones that do not include higher-risk areas (e.g., visitor reception or exercise facilities).

COVID in cold food processing plants

Cold food processing plants, and in particular slaughterhouses and cold food processing plants, are favourable environments for COVID transmission.^{9,10} In Germany, outbreaks in meat plants led to local lockdowns with the local R_0 rising to 2.88.¹¹

The increased risk is due to:

- A dense production of aerosols combining dust, feathers, and faeces being produced in the plants, and intense water use that carries materials extensively over surfaces.
- Crowded workplaces where physical distancing is difficult, both on the work floor and in break rooms. Workers often must speak loudly or shout, which has been shown to release more droplets and spread them further.¹²
- Metallic surfaces retaining live viruses for longer than other environments.^{7,13}

- The virus thriving in lower temperatures and very high or very low relative humidity.
- Other environmental issues that should be explored urgently, including the possibility of airborne spread¹⁴ and the role of air filtration systems—as implicated in the outbreak in the meat processing plant in Gütersloh, Germany.¹⁵
- Cold food processing companies should conduct urgent risk assessments, in conjunction with trade unions and workplace occupational health and safety representatives, and implement measures to prevent further outbreaks.^{9,10} Such prevention measures include:
 - mandating face coverings, handwashing and physical distancing;
 - introducing enhanced cleaning and disinfection regimens;
 - staggering start, finish, and break times;
 - grouping employees in “pods”, whereby a group of workers are grouped and will only work with each other to limit contact and potential transmission points;
 - reducing crowding by adding outdoor breakrooms;
 - installing barriers between workers, especially on production lines;
 - installing touch-free time clocks and foot operated door openers;
 - reducing speed of production which could both allow for physical distancing (including physical barriers between stations) and may also reduce the amount of particulate in the air, which reduces respiratory difficulties;
 - screening workers for symptoms on arrival at work;
 - encouraging workers not to attend if ill, declare their symptoms, and self-isolate (before and while awaiting the outcome of testing);
 - isolating people who develop symptoms while at work and providing adequate support for them to get tested and stay home if they continue to feel ill; and
 - incentivizing reporting by providing adequate sick pay for illness-related all work absences.
- Health education and infection prevention training for employees is critical. Materials for staff explaining COVID and the measures taken for prevention must be culturally appropriate and available in all local languages. Short videos, posters, social media groups and other similar innovative approaches, particularly those designed for specific language and/or ethnic groups, tailored to the targeted work environment have been met with great acceptance.

A note on hot, humid food processing

While this note focuses on cold food processing, in many cases food producers, particularly meat producers, have both cold, dry environments and also very hot, humid environments (e.g., as part of abattoirs). COVID can be transmitted in hot, humid environments,²⁰ and appropriate precautions, including physical distancing, hand and cough hygiene and personal protective equipment remain critically important. However, implementing best practice in personal protective equipment in these very hot environments is challenging. For example, when wearing a mask, it is common for glasses to steam up, which can degrade vision quality which can increase the possibility of making mistakes when using sharp knives and other dangerous equipment. These employees need to be protected in their work environments, just as those in the cold processing, with institutionalized COVID-prevention measures and employment terms that encourage reporting and self-isolation when appropriate.

Conclusions

There is great interest in how ambient temperature and humidity affect COVID transmission. Data on these conditions are of interest for a number of reasons, from planning for cold and flu season during the pandemic to managing transmission in indoor, controlled environment facilities, in particular cold food processing facilities, where there is a particular challenge as the conditions required for maintaining food

safety are often those that are most conducive to COVID transmission (e.g., guidelines advocate below 10C/50F in processing and below 3C/37F in storage).

At the same time, it is often the case that food safety standards call for more physical cleaning and disinfection than required to kill COVID. If food safety hygiene standards are combined with added standards for inter-personal infection issues specific to COVID, it could provide extra layers of protection. Putting these combinatorial COVID (i.e., human infectious disease mitigation) and food hygiene safety measures in place can also lay the foundation for legacy infection, prevention and control strategies that may translate to influenza and other diseases having less impact on the sector.

In summary:

- Temperature and humidity affect COVID transmission risk: dry, cold environments see greater transmission. This does not, however, mean that protective measures do not need to be taken in hot, humid working environments.
- COVID is more likely to be transmitted indoors, where people are often closer together and air circulation may be less robust.
- HVAC systems that are well designed and maintained can be an important factor in preventing COVID from spreading indoors by increasing *clean* air flow and maintaining indoor conditions (temperature and humidity) that discourage virus survival
- The conditions at cold food processing plants – environmental, employment, socioeconomic – contribute to COVID transmission.
- Workers with symptoms that could be COVID should be incentivised not to come to work. Staff with pre-existing conditions that increase their risk should be reassigned to less risky duties.
- Plants across the sector can reduce the risk of transmission by reducing crowding, ensuring universal public health precautions, improving ventilation, providing employment terms that incentivize reporting illness and provide support to workers who are ill.
- The meat processing sector and local health authorities should work together to have surveillance and response plans to identify cases early, isolate people with symptoms and track and trace all contacts.
- The pandemic is revealing longstanding inequalities in health, with migrant and other ethnic minority workers facing a high risk of infection.^{16,17} The Leicester, UK outbreak, for example, exposed the overcrowded working conditions and ultra-low wages experienced by some groups.¹⁸
- Early recognition of outbreaks requires strong local surveillance systems. Local health authorities, businesses and trade unions need to work together.¹⁹ Businesses should engage with their communities in reducing COVID transmission, cooperating with authorities when closures are required.³ To support this kind of cooperation and partnership, it is critical to find opportunities for engagement before and during outbreaks. For example, simulations of “pressure tests” where businesses and public health units run through a scenario (facilitated by experts) have anecdotally been reported to be remarkably beneficial to both sides, building mutual understanding and trust.

End notes

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