Occupational Health Clinics for Ontario Workers Inc. (OHCOW)

Part 1: Science & Solutions. Session 1: Covid-19 Transmission: Taking Stock of the Science. July 7th 12:30 -2pm. Session 2 July 8th 12:30 -2pm: Solutions: The Hierarchy of Prevention/Control Banding. The Role of Infectious Dose and the Hierarchy of Prevention (Controls) for COVID-19

August 26 – 27, 2020.

There is much we don't know about the transmission of SARS-CoV-2, the virus that causes COVID-19. We know it can spread from an infected person's sneeze or cough. But what do we know about transmission via speech and exhaled breath? How long do infectious particles linger in the air? How far can they travel? This workshop will delve into the rapidly evolving science on the transmission of the virus that causes COVID-19, as part of a larger body of COVID-19 related work from the National Academies.

Note: Since the symposia held on 7 & 8 July, The National Academies of Sciences Engineering Medicine have provided an update on the latest evidence for airborne transmission. See: Airborne Transmission of SARS CoV-2.

Questions / Answers (from chat window) from session 1 & 2 combined.

Face Coverings

Session 1 (1). What is the evidence for face coverings working so well? Especially for the smaller particles?

Dr. Linsey Marr - *There are laboratory studies, including from my own group, showing that face covering materials can block anywhere from 5% to 80% of the sub-micron particles that are hardest to remove. Additionally, from https://www.ucsf.edu/news/2020/06/417906/still-confused-about-masks-heres-science-behind-how-face-masks-prevent:*

"There are several strands of evidence supporting the efficacy of masks.

One category of evidence comes from laboratory studies of respiratory droplets and the ability of various masks to block them. An experiment using high-speed video found that hundreds of droplets ranging from 20 to 500 micrometers were generated when saying a simple phrase, but that nearly all these droplets were blocked when the mouth was covered by a damp washcloth. Another study of people who had influenza or the common cold found that wearing a surgical mask significantly reduced the amount of these respiratory viruses emitted in droplets and aerosols.

But the strongest evidence in favor of masks come from studies of real-world scenarios. "The most important thing are the epidemiologic data," said Rutherford. Because it would be unethical to assign

people to not wear a mask during a pandemic, the epidemiological evidence has come from so-called "experiments of nature."

A recent study published in Health Affairs, for example, compared the COVID-19 growth rate before and after mask mandates in 15 states and the District of Columbia. It found that mask mandates led to a slowdown in daily COVID-19 growth rate, which became more apparent over time. The first five days after a mandate, the daily growth rate slowed by 0.9 percentage-points compared to the five days prior to the mandate; at three weeks, the daily growth rate had slowed by 2 percentage-points.

Another study looked at coronavirus deaths across 198 countries and found that those with cultural norms or government policies favoring mask-wearing had lower death rates.

Two compelling case reports also suggest that masks can prevent transmission in high-risk scenarios, said Chin-Hong and Rutherford. In one case, a man flew from China to Toronto and subsequently tested positive for COVID-19. He had a dry cough and wore a mask on the flight, and all 25 people closest to him on the flight tested negative for COVID-19. In another case, in late May, two hair stylists in Missouri had close contact with 140 clients while sick with COVID-19. Everyone wore a mask and none of the clients tested positive."

Session 2 (34). 34. What about in non-healthcare settings? Should face coverings be used for source control and can a surgical/procedural mask be used as a form of PPE? Again, in non-healthcare settings.

Dr. Simon Smith: My feeling is that surgical masks can be source control but do not provide adequate inhalation protection against all but directly impacting droplets. The Canadian Standard referenced in the presentation (CSA / CSA – Z94.4 – 18, Selection, use, and care of respirators) also has selection guidance for respiratory protection for biological aerosols in non-healthcare settings, where account is taken of the observation that indoor ventilation rates in non-healthcare settings are generally lower.

Surgical mask

Session 1 (15). A surgical mask is considered 60, 120, 180 microns? Does the 60 count or simply a procedure mask?

Dr. Kevin Hedges: A surgical mask is a loose-fitting, disposable device that creates a physical barrier between the mouth and nose of the wearer and potential contaminants in the immediate environment. In the US Surgical masks are regulated under 21 CFR 878.4040. Surgical masks are not to be shared and may be labeled as surgical, isolation, dental, or medical procedure masks. They may come with or without a face shield. These are often referred to as face masks, although not all face masks are regulated as surgical masks. Surgical masks are made in different thicknesses and with different ability to protect you from contact with liquids. These properties may also affect how easily you can breathe through the face mask and how well the surgical mask protects you. If worn properly, a surgical mask is meant to help block large-particle droplets, splashes, sprays, or splatter that may contain germs (viruses and bacteria), keeping it from reaching your mouth and nose. Surgical masks may also help reduce exposure of your saliva and respiratory secretions to others. **While a surgical mask may be effective in blocking splashes and large-particle droplets, a face mask, by design, does not filter or block very small particles in the air that may be transmitted by coughs, sneezes, or certain medical procedures.**

Surgical masks also do not provide complete protection from germs and other contaminants because of the loose fit between the surface of the mask and your face. Surgical masks are not intended to be used more than once. If your mask is damaged or soiled, or if breathing through the mask becomes difficult, you should remove the face mask, discard it safely, and replace it with a new one. To safely discard your mask, place it in a plastic bag and put it in the trash. Wash your hands after handling the used mask.

See: https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/n95-respirators-surgical-masks-and-face-masks

There are 3 classifications under ASTM International standards:

Level 1 (low) - venous pressure splash
Level 2 (moderate) - arterial pressure splash
Level 3 (high) - high-velocity procedures, orthopedic surgery
Unlike N95 respirators, medical masks are looser in fit. As a result, they do not provide the same level of filtration nor do they provide an effective face seal.

29. Surgical masks are not considered as PPE but as source control so I can't understand how HCW will be protected especially if a patient coughs to Dr. Conly?

Dr. John Conly- *Airborne transmission of SARS-CoV-2 may occur during medical procedures that generate aerosols ("aerosol generating procedures") for which N95 respirators are recommended as a component of PPE. The use of surgical masks have been used in the routine care of COVID-19 patients in our jurisdiction as per PHAC/WHO recommendations and we have had great acceptance with these recommendations and did not see any transmission events in an estimated 5544 continuous person hours of HCW exposure to 132 inpatient COVID + pts on our medical wards.*

Face shield vs Mask

Session 1 (3). What is the difference in wearing a face shield compared to wearing a face mask with regard to the degree of becoming infected by covid-19?

From a paper by Lindsley et al 2014 (NIOSH) on the effectiveness of face shields against simulated cough droplets:

"Face shields can substantially reduce the short-term exposure of health care workers to large infectious aerosol particles, but smaller particles can remain airborne longer and flow around the face shield more easily to be inhaled. Thus, face shields provide a useful adjunct to respiratory protection for workers caring for patients with respiratory infections. However, they cannot be used as a substitute for respiratory protection when it is needed." Lindsley et al (2014).

See:

https://pubmed.ncbi.nlm.nih.gov/24467190/

Session 1 (37).Has there been any studies on the effectiveness of face shield as a potential "source control"?

Dr. Linsey Marr *-Face shields block large droplets but do not provide much protection against aerosols (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4734356/). There have not been studies on the effectiveness of face shields for COVID-19.*

Efficacy of masks vs respirators

Session 1 (18). While mechanistic studies indicate blockage of virus transmission, there are 14 plus randomized clinical trials of the effectiveness of masks and respirators with objective disease outcome that have not found any statistically significant prevention of disease transmission. Given that these were RCT studies would these not seriously question the mechanistic studies?

OHCOW – There are RCTs that show the opposite along with systematic literature reviews and meta analyses which are inconsistent. One thing that most studies agree on and a limitation is that the epidemiological evidence is poor. The other issue has to do with personal protective equipment which may work in the laboratory but may not work in the work in a real situation at the workplace. An analogy is provided by John Oudyk, Occupational Hygienist OHCOW. If we prescribe hearing protection to reduce the exposure to noise by 20dB(A) and then we test in the field that the noise exposure reduction is really only 10dB(A). This indicates poor training on the correct use of personal protective protection and poor fit and the same can be applied to respirators. Surgical masks don't provide face fit and hence as there is no seal airborne coronavirus will follow the inhaled air through the path of least resistance which is through the gaps next to the mouth and nose.

Session 2 (16). When Dr. Conly referred to HCWs who wore N95 respirators - did you investigate and ask the workers (not their employer) what intensive training, testing and drilling their employer provided them on donning and doffing, fit-testing, seal checking, care, use and limitations etc. and what education on the employer's respiratory protection program did workers get? Can you share proof of that as I don't see those reassurances referenced in these studies? These are crucial questions to ask all the HCWs who you study as most HC employers do a terrible job of training testing and drilling as above which would if that is the case be a source of exposure if workers aren't trained properly. But employer failures are not a reason to provide only a surgical mask. Also what air changes were studied in all of the studies you rely on? Why risk worker safety - ramp up until the science is certain which it in no way is and ramp down only when there is true scientific certainty.

Dr. John Conly *-Droplet and contact – Multiple studies have demonstrated compliance with the use of gloves, gowns and medical masks or N95s as indicated for AGPs were adequate to prevent transmission for SARS-CoV-1. HCW transmission events have been associated with inconsistent or improper PPE use for SARS/MERS-CoV outbreaks. In our setting in dealing with SARS-C0V-2, we used intensive and extensive training to HCWs to ensure they were well indoctrinated in all aspects of donning and doffing of PPE. Multimodal strategies were utilized including the use of written documents, posters, on-site training, pictograms, videos, websites, buddy training and the use of "apps" which were IoS and Android compatible which could be used as a personal digital assistant. Indeed health care worker safety is of the utmost importance and it is a shared responsibility on the part of the employer and the employee.*

Dr. Kevin Hedges: *On the question of considering the hierarchy of controls (HOC), indoor ventilation is very important especially in regions / locations / facilities where there is "higher transmission". Masks also provide "source control". There are Ontario Provincial guidelines on "Face Coverings and Face Masks". In Ontario, including Ottawa and Toronto, masks are required in public indoor establishments. In a recent paper by Talib Dbouk and Dimitris Drikakis (16 June 2020) "On* ***respiratory droplets*** *and face masks" it is stated:*
"Face mask filters—textile, surgical, or respiratory—are widely used in an effort to limit the spread of airborne viral infections. Our understanding of the droplet dynamics around a face mask filter, including the droplet containment and leakage from and passing through the cover, is incomplete".
"It is also shown that the use of masks will reduce the airborne droplet transmission and will also protect the wearer from the droplets expelled from other subjects. However, many droplets still spread around and away from the cover, cumulatively, during cough cycles. Therefore, the use of a mask does not provide complete protection, and social distancing remains important during a pandemic. The implications of the reduced mask efficiency and respiratory droplet transmission away from the mask are even more critical for healthcare workers".

Dr. Lisa Brosseau *– Cloth face coverings may limit the emission and inhalation of larger droplets but are unlikely to have any impact on the emission or inhalation of smaller respirable particles. The filters are very inefficient and they do not fit.*

Dr. Kevin Hedges: *In summary wearing of masks / face covering provides another barrier of protection for source control.*

Session 1 (31). Dr. Conly, if indeed the virus cannot be inhaled, why do you need N95 for AGMP?

Dr. John Conly *- Airborne transmission of SARS-CoV-2 may occur during medical procedures that generate aerosols ("aerosol generating procedures") for which N95 respirators are recommended as a component of PPE.*

Session 1 (40). My only question and I've had trouble communicating here, and I don't want to repeat something that has already been asked. Wearing masks protects other people from us but how do we protect ourselves from what's in the air? Thanks!

Dr. Linsey Marr*- Masks can also protect the wearer*.

Session 2 (7). In the webinar yesterday, Dr. Conly said that he had evidence and experience showing that HCWs wearing surgical masks to care for COVID patients were not infected. Can you comment on this, in light of what is known about the effectiveness of surgical masks in comparison to N95's and other approved particulate respirators? Do you think that good ventilation in hospitals, in light of Dr. Brosseau's comments on infectious dose, may explain this?

Dr. Lisa Brosseau: The studies that have compared surgical masks to respirators (clinical studies) for influenza, most of which have not had a control group. Where the conclusions have been that these two types of equipment are equivalent it is likely that the respirators were not fit tested nor worn. It is likely that surgical masks didn't work resulting in similar levels of performance. With no control group a comparison cannot be made without a surgical mask or respirator.

Therefore conclusions cannot be made on the interventions without a control group. The rates of illness may be similar to rates where surgical masks or respirators are not worn during seasonal influenza. There is not much evidence that surgical masks provide any kind of protection. Surgical masks are not respiratory protection, they do not fit, and their filters do not work very well. Lisa has measured the filter efficiency of surgical masks and they are "all over the place" but none would come close to what we would expect from a respirator filter. There is very little chance that surgical masks. There is very little chance that they provide very much protection. There is no anecdotal or clinical evidence that surgical masks are appropriate.

Dr. Simon Smith: *Looking at the working hours and have no control over people becoming infected outside work or whether the worker is wearing the respirator properly. By comparison it is like trying to test by "making a person wear a seat belt one day a week" if seat belts are effective in reducing road accidents / injuries. There is so little control over this kind of study. There have been multiple studies and when statistical methods have been applied there is not a good conclusion. Sometimes papers have claimed that there is no difference and then the authorities have grabbed onto this information and taken it to policy.*

Deborah Gold: *A lot of studies were reviewed in writing the ATD and differences were shown. In some ways this has become more of a political issue and less of a science issue. We know as industrial hygienists, we know what it takes to prevent the entry of particles into the respiratory tract and we would never get someone to grind silica or work with lead in a surgical mask because we are going to inhale lead particles or silica or any other airborne hazard that someone may be exposed to. This should be sufficient but there are clinical studies that do demonstrate the difference.*

Dr. John Cherrie: *If you were going to send your mother or daughter into an area where they are going to do aerosol generating procedures would you choose a surgical mask or a respirator. Without exception people will choose a respirator because conservatism is built in. You want to ensure that you can get the best protection.*

Dr. Lisa Brosseau: *many hospitals have better rates of ventilation and most other workplaces do not. There has been very good work on TB in hospital settings and there are CDC guidelines. There is no talk about surgical masks. TB and surgical masks are not a discussion item – not in health care. See CDC TB guidelines. The analogies between TB and SARS-CoV-2 are very appropriate. The solutions for TB are relevant for today.*

Dr. Kevin Hedges: *Even though the study by Loeb et al. 2009 "Surgical Mask vs N95 Respirator for Preventing Influenza Among Health Care Workers, A Randomized Trial", found little difference between the use surgical masks and respirators - there are a number of limitations to this study. Compliance with the intervention could not be assessed for all participants. Only 1 room entry was recorded per observation and the auditor did not enter the isolation room to assess whether the participant removed the respirator protection. It was also not determined whether participants acquired influenza due to hospital or community exposure. The results of this study are misleading and it is well known in the occupational hygiene community that respirators provide much better personal protection from inhalation to airborne viruses. In addition the Institute of Occupational Medicine (IOM) notes that: Mass*

adoption of face coverings is an essential part of a control approach to minimise transmission of COVID-19. Mandatory use is now required in many situations. However where use is not mandated, merely recommended, there is partial compliance due partly to a limited understanding about the differences and functions of face coverings, facemasks and respirators. The Institute of Occupational Medicine (IOM), Society of Medicine (SOM), British Occupational Hygiene Society (BOHS) and the Chartered Institute for Ergonomics & Human Factors (CIEHF) have developed a downloadable and printable guide for employers and the public to help identify and understand the use of face coverings, facemasks and disposable respirators. They are urging people to share and print this poster so people across the UK understand the differences between face coverings, facemasks and respirators. See: Minimise the spread of COVID 19; understanding the use of face coverings, face masks and respirators. The IOM also have a downloadable poster where it is clear that surgical masks are designed to protect others. The IOM also state: Respirators are required in health care settings for use in aerosol generating procedures (AGP) or when working in high risk acute care. Respirators are recommended as additional protection in other occupational settings where the risk assessment indicates that ***aerosol transmission is possible****. In addition * Higher levels of protection may be achieved using other forms of respirator including re-usable half masks and powered air purifying respirators (PAPR). ** Non-valved respirators will protect others by reducing transmission of droplets by the wearer. We now know that aerosol transmission is possible from coughs, sneezing etc. The number of health care workers (HCW) is disproportionately high. The ventilation could vary between hospitals and some COVID19 patient wards may not be isolated, under negative pressure and with at least 12 air changes per hour (ACH) although this should be verified.*

Session 2 (24). Question for Lisa and Deeg: Do they agree with the 100% filtration for N95s because of virus being in a droplet?

Dr. Lisa Brosseau: *N95 filters will collect SARS-CoV-2 aerosols with very high efficiency. Well above 95% at all particle sizes that are generated by humans.*

Deborah Gold: *Generally the limiting factor on filtering face piece is the seal.*

Dr. Simon Smith: unless I made a mistake, I believe I said efficiency was "close to 100%" for the particle sizes expelled. 100% filtration could not be assumed. Many droplets are 1 micron and larger. Testing of N95s is at 0.3 micron given these are hardest to filter. Naked SARS-CoV-2 is 0.1 microns but this ignores the water droplet (and salts, proteins, etc). Certainly can be as large as 80-100 microns or larger. There are many more droplets in the range of 1-10 microns per cough or even compared to 80-100, etc. - this observation adds to the discussion on Q.24

Opinion on N95 vs what many vendors are marketing as K95 or KN95?

a. KN95's are not regulated the same as N95 in Ontario as they are not as effective and is not a one size fits all. It is difficult to get a good seal or fit. They are used for source control mostly.

b. Particularly KN95 with ear loops don't seem to pass fit-tests very readily. Ear loop masks are not respirators per se. A respirator needs to straps (high and low) to achieve good fit

N95 is a performance classification under NIOSH, the KN95 type is a classification under the Chinese standard GB2626. There are a lot of these KN95-type being offered in North America due to shortage of regular N95-type products, as regulatory authorities have broadened their acceptance of non-NIOSH

products. For KN95 products. The basic filtration requirements are the same as N95 types, but there are some key issues. NIOSH requires submission of a quality plan as part of the product approval, and also conducts audits through site visits and anonymously purchasing products and checking their performance. Sometimes companies are asked to "withdraw" their certification as a result. My understanding is that the Chinese certification does not include such quality checks, and so product may be variable, or sometimes good samples are selected for submission which may not present the general level quality. There is also the issue of fit: even if products are of good quality and meet all requirements of the KN95 level, there is a difference head shape between Asian and Caucasian heads. There is information on studies here:
http://people.scs.carleton.ca/~c_shu/pdf/appliedergonomics_2010-comparison_between_chinese_and_caucasian_head_shapes.pdf
This can result in even well-performing product conforming to the GB standard still not fitting some people in Canada well. Beyond that, with large-scale imports of less familiar equipment, there is also the possibility of counterfeiting in which products are marked as meeting standards and/or being from a reputable manufacturer when they are not.

Session 2 (31). Comment – Dr. Conly's statement was based on recent clinical experience; he specifically said that N95s were used in aerosol generating procedures.
Session 2 (33). I am not 100% aware of the evidence that Dr Conly is referring to but there are published data of exposure with a COVID-19 positive patients and difficult intubation that none of the HCW caring for the patients with surgical mask only were infected. Refer to: Annals of Internal Medicine.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6993921/

Dr. Lisa Brosseau: *There are also data showing that healthcare workers wearing surgical masks were infected by SARS-CoV-2.*

Dr. Kevin Hedges: Also see the following study.

https://academic.oup.com/cid/article-abstract/65/11/1934/4068747

Session 2 (35). Comment - The surgical mask vs N95 respirator studies, especially the ones by Loeb and Seto, are being used by PHAC and WHO as bedrocks to their arguments.

> Refer to: https://pubmed.ncbi.nlm.nih.gov/19797474/
> https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7112437/

Dr. Kevin Hedges: See science blog from NIOSH. https://blogs.cdc.gov/niosh-science-blog/2020/04/09/masks-v-respirators/

Although not a scientific publication provides a good synopsis of the situation from a doctor in London.
> https://www.docjon.org/post/the-evidence-for-airborne-transmission-of-covid-19-and-why-who-cdc-and-phe-advice-should-change

Meta-analysis by Chu et al. 2020.
> https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31142-9/fulltext

Session 2 (36). Should there be papers and studies that address the studies heads-on, summarizing the arguments set out today by our excellent experts.

OHCOW – See the link at the start of this document which provides the most up to date information.

Note: Since the symposia held on 7 & 8 July, The National Academies of Sciences Engineering Medicine have provided an update on the latest evidence for airborne transmission. See: Airborne Transmission of SARS CoV-2.

Powered Air Purifying Respirators (PAPRs).

Session 2 (20). If PAPRs are so easy to use and present less physiological burden, as well as capable of being worn for 8 hours, wonder how many Canadian hospitals are using them? Yesterday, Dr. Conly talked only about N95s.

Session 2 (22). Have not seen any PAPRs in Ontario hospitals, most focus on N95.

Session 2 (23). In U.S., even large hospitals typically only have a handful of PAPRs, reserved for very high risk procedures.

Dr. Simon Smith: *see Q.20*

Dr. Simon Smith: There is certainly scope for using them, and some US hospitals have adopted them with success and good acceptance by the clinical staff. Loose-fitting PAPRs offer the wearer relief from the effort of breathing against the resistance of a filter, greater comfort with no tight seal and some cooling, and those with transparent hoods offer visibility of the mouth to aid hearing-impaired patients. They also suit people who cannot be fitted with other types or respirator, and people with beards. Loose-fitting PAPRs do not need to be fit-tested.

There are some considerations with use of PAPRs also. They run on rechargeable batteries so a maintenance programme has to be sustained to ensure charging prior to use and appropriate identification and control of batteries as they may lose the ability to hold charge well as they age. Appropriate doffing to avoid cross-contamination may take practice, and if headtops are not disposable, there are decontamination/sterilization requirements.

However, the main challenge to wider adoption has stemmed from a performance standards issue under NIOSH – for a feature which has been in place for the last 25 years until this April. While there are multiple gradations of performance level for negative pressure and particulate disposal filters (N, R, P types and 95, 99, 100 (99.97%) efficiencies), since 1995, there has only one level in the standard for PAPRs – and this was designed to suit heavy industry. This meant that approval of every particulate filtering PAPR included a severe clogging test with silica dust – during 4 hours of operation in a high concentration dust environment, the units had to deliver airflow above set minima. This is a hard and imprecise test to perform, and one that made strong demands of filter design and battery power. There is no exposure to comparable high dust levels in healthcare workplaces, but for NIOSH approval, all particulate PAPRs still had to meet this heavy industry performance requirement – and so the devices

were bigger, heavier and importantly more expensive than the healthcare workplace actually required. This has contributed as a barrier to greater uptake of this kind of equipment.

After many years of deliberation, this last April NIOSH announced two additional categories of particulate PAPR approval – PAPR100-N and PAPR100-P. These do not have the onerous dust test requirement, and correspond roughly to N100 and P100 negative pressure classes, with testing at powered air flow rates. There are also some additions to existing PAPR test requirements such as evaluations of communication ability while worn, low flow warnings and a new type of fit measurement for approval. Details are at this site: Approval Tests and Standards for Air-Purifying Particulate Respirators.

This change may well result in smaller, lighter and cheaper PAPRs which means they may be more widely available and used. Some companies have already obtained approvals.

Session 2 (27). 27. Ontario had PAPRs during ebola...some hospitals had a few but not maintained...Berkeley supposedly developing cost effective "recipe"

https://engineering.berkeley.edu/news/2020/04/readily-deployable-respirators-could-help-frontline-healthcare-workers/

Dr. Simon Smith: – *thank you for the link*.

Comments:

This is an interesting development and one that can be discussed further. (I once proposed a "$99 PAPR challenge" to industry colleagues to stimulate ideas for improving respiratory protection in developing countries). However, the design as shown is interesting, but one point of concern is that it seems to be relying on a commercial in-line ventilator filter, and these normally operate at quite low flow rates. This has a remarkably small filter cross-sectional area compared with general PAPR filters, with two consequences:

a) The resulting airflow resistance will be high, which will reduce the flow output and shorten battery life, as well as perhaps not providing the hood with a high airflow. This would increase the chance of ingress of contamination (for instance if the wearer inhales sharply and overcomes the provided airflow).

b) The filtration efficiency will decrease at higher airflow rates. Although it may have very high efficiency at its normal flow rating, this will drop at elevated flow.

NIOSH approval would be mandatory for use in an Ontario workplace for situations where respiratory protection was required. The minimum flow level for NIOSH approval of a loose-fitting PAPR is 170 litres per minute (6 cubic feet/min). Does this system look like it can achieve that?

I wouldn't want to be dismissive of good ideas and with some changes this may be an alternative option but may run into performance challenges and regulatory barriers as it is.

Contamination (decontamination) of respirators / surgical masks

Session 1 (38). With the move to prolonged/extended use of PPE (procedure masks, disposable N95 respirators & faceshields), is there any data looking at the effectiveness of that PPE and the possible self-innoculation with accidental contamination of clean areas/surfaces?

OHCOW - the virus can last for days on respirators and so self-infection while donning, doffing or adjusting PPE is always a risk. Many researchers however, seem to think that SARS-CoV-2 is not efficiently transmitted via indirect contact transmission.

The science of transmission and direct contact exposure via aerosols is getting stronger:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7182754/pdf/main.pdf

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7151430/pdf/main.pdf

In addition the European Centre for Disease Prevention and Control Eu-CDC (https://www.ecdc.europa.eu/en/covid-19/latest-evidence/transmission)

Notes that **Transmission of COVID-19 –**

> "Currently available evidence indicates that COVID-19 may be transmitted from person to person through several different routes. In the scoping review published by La Rosa et al [1], the human coronaviruses primary transmission mode is person-to-person contact through respiratory droplets generated by breathing, sneezing, coughing, etc., as well as contact (direct contact with an infected subject or indirect contact, trough hand-mediated transfer of the virus from contaminated fomites to the mouth, nose, or eyes). Infection is understood to be mainly transmitted via large respiratory droplets containing the SARS-CoV-2 virus. Transmission through aerosols has also been implicated but the relative role of large droplets and aerosols is still unclear. Indirect transmission through fomites that have been contaminated by respiratory secretions is considered possible, although, so far, transmission through fomites has not been documented".
>
> La Rosa G, Bonadonna L, Lucentini L, Kenmoe S, Suffredini E. Coronavirus in water environments: Occurrence, persistence and concentration methods - A scoping review. Water Research. 2020 2020/07/15/;179:115899 (1).

Session 2 (26). Behavioural Researcher to everyone: Many supplier associates in US took EUA approach to sterilizing used masks for multiple reuses. Can you speak to how the electrostatic charge withstands that cleaning process?

Session 2 (28). I would like to know more around the impact the various reprocessing methods ((i.e Sterilised by US EPA Advanced Sterilization Products (ASP)) have on used masks/respirators efficiency.

Session 2 (30). What about reprocessing of N95s. Our facility is recycling them.

Session 2 (37). Sterilization reprocessing and its effect on electrostatic charge?

Dr. Simon Smith: There have been several methods proposed – a review of guidance recommendations and some studies is here:

https://www.cebm.net/covid-19/extended-use-or-re-use-of-single-use-surgical-masks-and-filtering-facepiece-respirators-a-rapid-evidence-review/

There are slides from a webinar covering this from various expert perspectives here:

https://static1.squarespace.com/static/5e8126f89327941b9453eeef/t/5eb7193a9f56f9201fdf1af7/1589057878041/N95+FFR+Decon+%26+Reuse+International+Outreach+Webinar.pdf

The organisation N95 Decon would likely be open to direct enquiries as well.

In general, methods that involve direct contact with liquids (such as bleach or alcohol solutions) were unsuitable, those that used modest heat/steam, UV and vapour treatments were not found to result in diminished filter efficiency.

Deborah Gold: This study indicates that original EUAs for disinfection protocols may have overestimated the number of times it can be done before affecting respirator effectiveness.

https://www.medrxiv.org/content/10.1101/2020.04.11.20062018v1.full.pdf

Session 2 (29). Is it acceptable to disinfect hoods between fit testing or should each person have their own hood?

Dr. Lisa Brosseau: There has not been much evaluation of the impact of decontamination on respirator fit.

Dr. Kevin Hedges: Each person should be assigned their own hood.

Session 2 (44 & 45). If I put a cloth mask or surgical mas in a UV chamber, will it disinfect adequately?

Dr. Simon Smith: See part of the reference in Q.26 – If UV-C light is used, its effectiveness depends on it reaching all of the contaminated surfaces of the mask. Therefore, so re-positioning may be necessary.

Personal Protective Equipment (PPE) hair covering

Session 1 (12). Why is hair not covered as suggested PPE because it can be a fomite? I think Carolina was referring to health care workers? That if there is fomite transmission, why not have hair coverings? Mask, shield, gloves, gown are standard PPE...why not a hair cover so you don't transfer the virus from patient to patient. I work in the OR and we always wear head covering but when we go to other areas to intubate Covid patients, hair coverings are not recommended. Seems wrong.

OHCOW - China hair coverings are included in the PPE for healthcare workers attending COVID patients – the enquirer has a valid concern.

Session 1 (33). For classroom settings, would it be best if the students and instructor wore hats as a head covering to reduce contamination points?

OHCOW – Although hair coverings should be considered in health care (higher risk) settings similar to what was used in China, contamination of the coronavirus via this type of contact may be neglible.

Plastic shields / screens

Dr. Lisa Brosseau: CDC has said that contact transmission is really not a very important mode of transmission. Plastic shields - splash guards - may or may not be effective. Smaller particles are very capable of traveling on air currents. You need to measure or model the impact of a barrier or shield on stopping aerosols from traveling from source to receptor.

Ventilation / fans

Session 1 (2). If there are fans in a room, is that make the risk "better" or "worse"? (For example, I've seen fan in the hallway of a building & fans at TSA airport checkpoint). Elaborating on my prior question about FANS, some places are using them to "air out" their rooms/spaces, but does that actually spread the virus more?

Dr. Linsey Marr -*It really depends on how the fans are oriented relative to outdoor air and people in the room.*

A-*Fans: in a closed environment (i.e. no ventilation) all that they would do is prevent particles from settling and keep them suspended so it would make things worse. The key things is good ventilation: lots of air changes, no air recirculation*

Session 2 (3). Could you have dead spots in the occupied area where concentrations are higher? Ventilation rates may be different in the bathroom and the sleeping area?

Dr. Lisa Brosseau: I suppose bathrooms could have higher concentrations, but the amount of time someone spends in that space would mean that the air concentrations would likely be lower in these spaces.

Session 2 (16). A question on my mind...if there is not adequate air cleaning in a room, does a patient potentially rebreathe their own virus in the air, and therefore increase the viral load into their lungs?

Dr. John Cherrie: *The contamination in the air is constantly in flux; new virus exhaled by the patient, virus lost to the outside air, virus depositing on surfaces and resuspension of virus from surfaces. It is irrelevant whether virus is rebreathed by the patient, their viral load is much greater than is present in the air.*

Localised exhaust ventilation (ventilated head boards).

Session 2 (14). The headboard is providing less than 40 f/m. Seems too low to be effective.

Dr. John Cherrie: *We are concerned that the low velocity is likely to be a limitation when there is more active emission, e.g. in coughing, and we plan to look at improving on the NIOSH design. One option is to introduce an air curtain at the entry that provides some resilience to the containment.*

Session 2 (15) A similar headboard vent system was used at Sunnybrook to control anesthetic gases in recovery.

Dr. John Cherrie: Thanks Loralee

Session 2 (17). Question for John Cherrie: How long do you expect your study about efficacy to take?

Dr. John Cherrie: We are developing our model to evaluate novel control measures, and this will be available in the next couple of months. This can be used to assess different options that might be introduced. However, the ventilated headboards and dental projects are not yet funded and will not produce any concrete results for at least a year – lessons to learn for the future and sadly not to provide solutions for the second subsequent waves of this pandemic.

Session 2 (19). Are there any Ventilation Head Boards commercially available?

Dr. John Cherrie: No. You can follow the link on my slide to the NIOSH blog that provides DIY instructions to make the systems.

Dentists.

Session 2 (18). In Dentistry in Nova Scotia they are allowing for surgical masks for AGP's and only suggest having ventilation looked at.

Dr. John Cherrie: Sadly, this is not unusual. I suspect that if there is a second wave or a local outbreak, dental surgery will again be paused. We do not really have a safe system of work for dentistry.

Air purifiers / portable air cleaners

Session 1 (35). Providing care in a room with limited air exchanges. How to best address this when providing spirometry. Does a HEPA/UV unit helpful in this setting? How do I assess the rate of air exchanges?

OHCOW - A HEPA/UV unit will probably be of some benefit. In all cases the Hierarch of Controls approach should be applied. By analogy Schools for Health provides some useful information. A new downloadable calculator developed by experts at Harvard T.H. Chan School of Public Health's Healthy Buildings program can help determine how powerful an air purifier must be to help keep classrooms safe from the coronavirus.

When considering UV disinfection it is important that close attention be made to the risk that may result from using UV. The American Industrial Hygiene Association (AIHA) Coronavirus Outbreak Resource Center has provided a white paper – Occupational Safety and Health Guide for Surface Disinfection Practices using Germicidal Ultra Violet Radiation.

Nevertheless, where there is a likelihood of exposure for an extended period, fit-tested N95 at minimum along with all the other PPE. I assume the question are assessing air exchange rate is straight-forward.

Dr. Lisa Brosseau: *I strongly recommend we avoid ozone generating air cleaning. A portable air cleaner should have a filter, preferably one that collects particles with high efficiency.*

Dr. Kevin Hedges…….

Session 2 (5). Would portable air cleaners be useful in places like offices, nail salons, physiotherapy, etc.? If so, what kind, because we want to avoid ozone generating ones?

Dr. Lisa Brosseau: I strongly recommend we avoid ozone generating air cleaning. A portable air cleaner should have a filter, preferably one that collects particles with high efficiency.

Deborah Gold: *The California Air Resources Board sets standards for air cleaners including limits on ozone generation. You can access this at:* https://ww2.arb.ca.gov/our-work/programs/air-cleaners-ozone-products/california-certified-air-cleaning-devices

Session 1 (39). Was the absence of virus in air in studies related to indoor air control measures (flow rate)?

Dr. Linsey Marr- If *the ventilation rate of the room is very high, as in most hospitals, then the virus will be very diluted in air. Thus, to have a chance of capturing virus, you have to sample a very large volume of air.*

Session 1 (34). I would like to know more about risks to office workplaces, especially those with no windows and not the best ventilation systems, especially those offices located in GTA or hotspot areas?

OHCOW – In line with the Hierarchy of Controls (HOCs), the ventilation system should be assessed.

This Ventilation Checklist (COVID-19) can be used as a guide to assess the suitability of ventilation in the workspace/building that are to be occupied. To complement the guidance by OHCOW and (Harvard School of Public Health and Healthy Buildings, 2020)

Source: Reference: Schools for Health, Risk Reduction Strategies for Reopening Schools, June 2020, Principal Author / Corresponding Author – Assistant Professor Dr. Joseph Allen.

The following provides more detail and focus around engineering controls and ventilation:

American Industrial Hygiene Association (AIHA) "Reducing the Risk of COVID-19 Using Engineering Controls (August 11, 2020).

The American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) "Coronavirus (COVID-19) Response Resources from ASHRAE and others".

41. Dr. Conly – when long term care personal support workers spend extended periods, in intimate range of suspect/confirmed patient in closed rooms with poor ventilation..why would respiraator not be endorsed?

Dr. John Conly *- The application of contact and droplet precautions with the use of gloves, gowns, surgical masks, eye protection, appropriate donning and doffing, refraining from facies and mask touching, adequate disinfection, use of dedicated single use equipment sand appropriate hand hygiene should be adequate for the care of most long term care residents.*

Introducing a HEPA Air Cleaner in each room, on Germ mode may help substantially with air clearing?

Dr. Lisa Brosseau: *I strongly recommend we avoid ozone generating air cleaning. A portable air cleaner should have a filter, preferably one that collects particles with high efficiency.*

Humidity

Session 1 (4). So am I correct in assuming the higher the humidity, the higher chance of transmission?

A- *I understood the best humidity level (according to ASHRAE, I think) is 40 - 60.*

Session 1 (4 b). How is Low RH, Medium RH and High RH defined?

Dr. Linsey Marr- *In my presentation, low RH is less than 40%, medium is 40-85%, and high is above 85%.*

A-*Depends on context and application for influenza survival is enhanced for RH < 40%*

Session 1 (4c). Can you ask Linsey the question about humidity, in particular, what we should aim for. Thanks.

Session 1 (4d). translating into indoor setting; what humidity setting should one set?

Dr. Linsey Marr- *Based on what we know about the seasonality of other respiratory viruses, in terms of virus survival and immune response, we might aim for 40-60% RH indoors.*

Session 1 (25). If dry environments can reduce the size of particles, how does this translate to workplaces such as aircraft which have extremely low humidity rates? Keeping in mind that aircraft also benefit from very high air circulation rates, which often pass through a hepa filter?

Dr. Linsey Marr *-At RH below 85%, which covers most indoor environments, droplets shrink to approximately the same size, whether in a very dry environment such as an aircraft or in a public building. Humidity has a larger effect on virus survival and immune response.*

UV Light

Session 1 (19). Please reflect on UV light? Unfortunately the third presenter did not have a chance to talk about UV light, would be very interesting to hear about personal and professional use of UV lights. Thank you!

OHCOW - As previously discussed:

When considering UV disinfection it is important that close attention be made to the risk that may result from using UV. The American Industrial Hygiene Association (AIHA) Coronavirus Outbreak Resource Center has provided a white paper – Occupational Safety and Health Guide for Surface Disinfection Practices using Germicidal Ultra Violet Radiation.

Session 1 (30). Can you expand on the UV + fan solution for the "classroom" slide?

OHCOW - See previous.

Session 1 (32). Could UV light be used more effectively and cheaply than air exchange?

OHCOW - Control options should be considered together. We do not recommend lowering the air exchange rate. UV might provide supplemental protection if it is provided safely.

Virus survival on surfaces

Session 1 (5). I have a question about virus survival on surfaces. Cardboard is seen as having a lower survival time but I wonder about sampling methods. If a swab is used on a porous surface, won't it have a lower recovery rate than a swab on a non-porous surface?

With regard to virus survival on surfaces:

See: Stability of SARS-CoV-2 in different environmental conditions, Chin et al. April 2020, Stability of SARS-CoV-2 on Critical Personal Protective Equipment, Kasloff et al. 2020, Stability of SARS-CoV-2 on environmental surfaces and in human excreta, Liu et al. 2020, Effect of Environmental Conditions on SARS-CoV-2 Stability in Human Nasal Mucus and Sputum, Chin et al. 2020, Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1, van Doremalen et al. 2020.

With regard to sampling we refer you to Sporometrics who should be able to answer this question see:

Viruses

Viral Analyses

- SARS-COV-2 (COVID-19 VIRUS) ANALYSIS
- AIR SAMPLE ANALYSIS OF SARS-COV-2 (COVID-19 VIRUS)
- SARS-COV-2 (COVID-19 VIRUS) ANALYSIS FOR ENVIRONMENTAL SURFACES

Testing / Analysis

Session 1 (6). How can patients & physicians know that the IgG/IgM tests that they are getting are testing the "correct" strain of coronavirus? (vs. non-SARSCov2 or cross-reactivity?)

A-*Serology cross reactivity: a serious problem which is under study. Gold standard is neutralization serology assay which is totally specific but requires virus culture*.

Session 1 (7). So how long should folks wait for a test after exposure if we want to maximize the potential for the true positive result?

OHCOW - For PCR nose/throat swab test - Since you're already shedding virus before you're symptomatic, as soon as possible, if you are symptomatic. If you've just been exposed and have no symptoms, we suggest you wait a few days (4?).

Dr. Pravesh…..

Bsaed on current literature most will become symptomatic in around day 5, therefore if one wishes to randomly test exposed the best yield will be be between days 5 to 7

Contact lenses

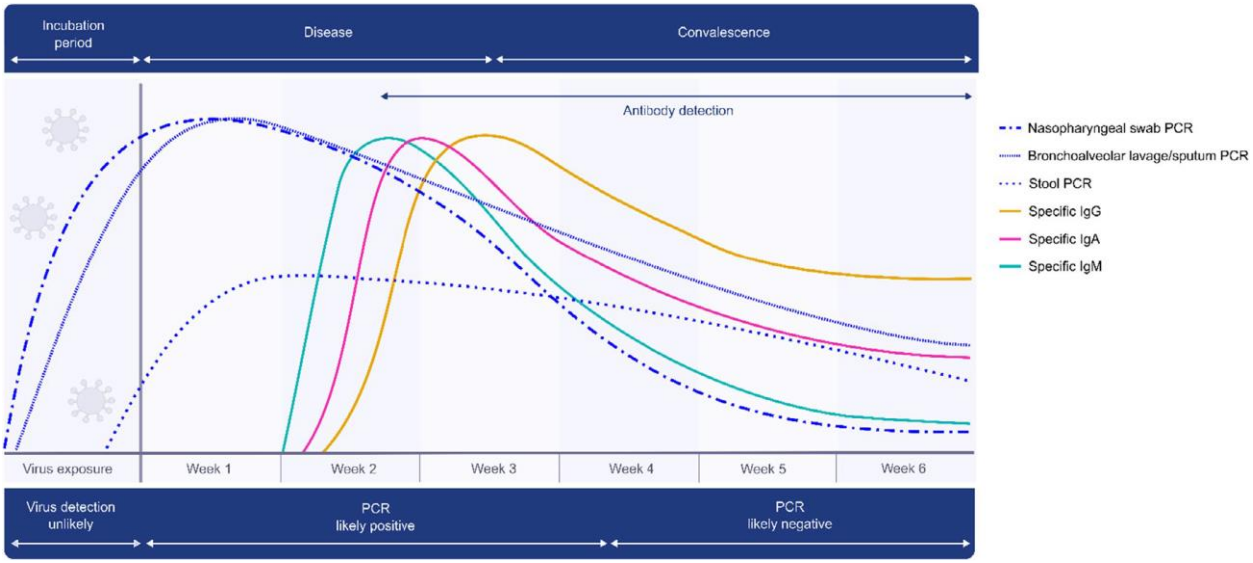
Session 1 (8). When I first saw the plastic data, I was wondering are Contact Lenses in the eyes a potential surface that could be contaminated with virus (either through air or wearer's hands)?

OHCOW - The conjunctivae of the eye are probably more of a concern, hence the reason for goggles when you're working with patients. I don't think contact lenses make much of a difference but if your hands are contaminated then any contact with the eye is a potential transmission source.

Antibodies

Session 1 (9). How are antibodies used to treat patients and how long does it take to show an effect?

Dr. Pravesh Jungden -



Diagnosis of SARS-CoV-2 infection through different diagnostic tests over time according to incubation period, disease onset, clinical disease, and convalescence

See https://www.researchgate.net/profile/Rodrigo_Jimenez-Saiz2/publication/342165769_A_compendium_answering_150_questions_on_COVID-19_and_SARS-CoV-2/links/5f168b824585151299ad5a51/A-compendium-answering-150-questions-on-COVID-19-and-SARS-CoV-2.pdf

What is the time of seroconversion and duration of IgM and IgG responses against SARSCoV-2?

From previous SARS studies, it is known that the median seroconversion time for detectable IgG was 17 days after infection. Detectable levels of SARS-specific IgG and neutralizing antibodies persisted for up to 720 days. This suggests that there is antibody mediated protection from SARS-CoV recurrent infection for up to 2 years. There are inconsistent reports o n t he humoral response to SARS-CoV-2. One study with 285 COVID-19 patients reported that SARS-CoV-2 virus-specific IgG and IgM peaked 17-19 days and 20-22 days after symptom onset, respectively. On the other hand, another study of 26 hospitalized COVID-19 patients showed that seroconversion could take up to 50 days. These discrepancies may be

related to the time of SARS-CoV-2 diagnosis or the clinical characteristics of each cohort and warrant additional studies.

Virus load

Session 1 (10). Have there been studies of virus load versus patient symptom experience?

Dr. John Conly *– Please see the study by Van Kampen et al. Shedding of infectious virus in hospitalized patients with coronavirus disease-2019 (COVID-19): duration and key determinants. medRxiv preprint doi: https://doi.org/10.1101/2020.06.08.20125310.this version posted June 9, 2020*

Aerosol transmission

Session 1 (11). Dr. Conly, what is your take on yesterday's letter to the WHO? Why are infectious disease specialists so steadfast in opposing aerosols as an important transmission route, and the use of the precautionary principle, as recommended by Justice Archie Campbell? Just trying to understand.

Dr. John Conly *- Exposure to microorganisms and the development of invasive infection is a complex process and is a part of infectious diseases epidemiology. Not all exposures lead to transmission and invasive infection. Exposure occurs when a host comes into contact with an infected source or contaminated environment. The probability of transmission followed by invasive infection depends on many factors including host susceptibility, presence of host receptors, receptivity of host receptors, inoculum, pathogen viability virulence of the pathogen, and the effectiveness of the hierarchy of controls used to prevent the transmission event and the development of infection. With respect to SARS-CoV-2, no studies have been able to demonstrate viable virus in fine aerosols and many basic virologists and infectious diseases epidemiologists think it will be extremely difficult to demonstrate replication and infection competent virus to be able to enable transmission in the airborne mode to any significant extent.*

Session 1 (13). Does Dr. Conly agree that health care workers providing close range contact care of a COVID patient who is coughing or sneezing can inhale small infectious particles that can remain suspended in the air (I'm not talking about airborne illnesses like measles or TB)?

Dr. John Conly *- Particles of a variety of sizes are expelled from the human airway during coughing, sneezing, talking and medical procedures. Respiratory droplet transmission can occur when a person is in close contact (within 1 metre) with an infected person who has respiratory symptoms (e.g. coughing or sneezing) or who is talking or singing; in these circumstances, respiratory droplets that include virus can reach the mouth, nose or eyes of a susceptible person and result in inoculation and the development of invasive infection. Indirect contact transmission involving contact of a susceptible host with a contaminated object or surface (fomite transmission) may also occur. Differentiating inhalation versus droplet contamination as a means of transmission at close range is difficult to ascertain.*

Session 2 (25). What is the typical droplet size you referred to?

Dr. Kevin Hedges: *Dr. Lisa Brosseau provided a longer webinar through Workplace Health Without Borders (International). People produce a wide range of particles from < 1 µm to > 500 µm from speaking and coughing. Similar size distributions between 1 – 2 µm and 100 – 200 µm. People are highly variable in the number of particles they generate. People generate more particles when sick than when well. Some people are "super-spreaders". Speech also generates small particles and concentrations are higher as people talk more loudly. Singing especially can generate a lot of particles. Refer also to the webinar provided by Dr. Linsey Marr "Transmission Taking Stock of the Science" (SARS-CoV-2 Droplets and Aerosols) - SARS-CoV-2 is about 0.12 µm in size.*

Different transmission routes

Session 1 (20). How to study whether restaurant workers are transmitting it from their hands to the food, utensils, or healthcare workers sneezing/talking/breathing onto food as they prepare or serve it?

OHCOW – So far the literature hasn't been definitive suggesting any COVID infections due to food contamination.

23. Can droplets that land on the floor become air born again?

Dr. Linsey Marr -*Yes, in theory the droplets could dry out, and virus could be resuspended by people walking past. We know this happens with particulate matter pollution.*

Session 1 (27). Can we conclude SARS COV2 is Droplet or Airborne?

Dr. Linsey Marr -*It is probably both.*

Dose

Session 1 (21). Does the initial dose affect the medical outcome of the patient?

OHCOW - Generally we look for a dose-response relationship which we don't know much about for SARS-CoV-2 yet. The emission estimates for infected persons seem to range at least 10 orders of magnitude and there are a host of identified personal risk factors that might make one more susceptible. The infectiousness of different strains of the SARS-CoV-2 virus also differ significantly. There are also a host of environmental factors that could influence the dose.

Dr. Pravesh Jungden - The first law of toxicology states that the "poison in in the dose". One can safely extrapolate that the higher the exposure dose, the more likely one is to acquire the infection. To date I am not aware of any studies that looked at exposure dose and clinical outcome. The main risk factor for significant adverse outcomes is age. The others being co morbid medical conditions (e.g diabetes, obesity, asthma etc.). Exposure dose has not been established as a risk factor for adverse clinical outcomes.

Are men at a greater risk of SARS-CoV-2 infection?

Given that the human ACE2 protein is encoded on the X chromosome, this may be relevant for male-female differences in outcomes, particularly in men with rare ACE2 coding variants as they will express those variants in all ACE2-expressing cells compared to a mosaic pattern of expression in women. Men may also have differences in certain innate antiviral responses compared with female counterparts. Outcomes in COVID-19 can be worse (~1.5-4 times worse) in terms of mortality, ICU admissions,

hospitalizations, and case identifications for men than for women. Mortality in women can be lower by 30% up to age 60 in certain (but not all) countries. Outcomes after 60 years of age seem to continue unbalanced between the sexes.

Session 2 (21). Regarding probability calculations for effective dose, over what time period of accumulating virions should we be concerned? It would seem that total number of virions exposed to over months/years/lifetime would not be important compared to the accumulation in a given hour or at a single moment for a particular exposed person (such as the hotel room cleaner). Put another way, at what time interval does the body "forget" it was exposed to.

Dr. Kevin Hedges: *We do not have an answer to this question.*

Session 2 (4) A question for Lisa during Q&A - is infectious dose an acute exposure or a chronic exposure? Does the body manage the virions over time or will an infectious dose over a week or a month have the same risk as an infectious dose over a day?

Dr. Lisa Brosseau: *We do not know if SARS-CoV-2 infection is due to acute or chronic exposure. As far as I know the animal exposure and human epidemiology studies have not been done that would elucidate this. We need animal studies with a relevant species (probably non-human primates) to elucidate how infection occurs for SARS-CoV-2.*

Session 2 (11). Have any virion calculations been done related to potential fecal load as well as exhalation risk?
Dr. Lisa Brosseau: *We are not aware of any.*

Session 2 (6). How do we apply these calculations to congregate settings to clearly mandate occupancy limits besides distancing only?

Dr. Lisa Brosseau: *The calculations can also be used where there are more than one occupant.*

Fog

17. In the film industry, atmospheric fog and haze is used in closed environments and it designed to suspend in the air. Could this suspension contribute to CoV2 transmission? Workers are concerned and there is not research on this.

Dr. Linsey Marr *-I don't think that this should affect airborne transmission. If anything, the fog and haze might remove virus from the air and accelerate its deposition on the floor, in which case there should be careful attention to cleaning of the floor.*

Schools / Universities

Session 1 (24). Sick Kids hospital in Toronto released an opinion paper stating masks should not be used in schools. I'd appreciate an opinion from the panel.

Session 2 (38). What needs to be done in schools?

Session 2 (41). What might help in the classrooms?

Dr. Kevin Hedges: The Harvard TH guidance reference provided in the following discussion does recommend mask wearing and provides the following:

See Q 39 and answer including, in addition, see also the Centers for Disease Controls and Prevention, Schools and Child Care, and Colleges and Universities.

- Have students wear face masks as much as possible, especially when in hallways or bathrooms or in proximity to students from other classes
- Train students and staff on how to wear and care for masks
- Ensure masks meet effectiveness criteria
- Build in time throughout the day where students and staff don't have to wear masks
- Allow teachers to wear transparent face shields when teaching at the front of the room and face masks when working more closely with students.

Dr. Lisa Brosseau: Re-opening schools has a lot of issues. Dorms. Classrooms. Needs input from industrial hygienists.

Session 2 (39). How may you arrange seating in classrooms to make it more effective in preventing the spread of viruses?

Dr. Kevin Hedges: *Sick Kids Hospital in Toronto has released SickKids recommendations for school reopening. The hierarchy of controls (HOC) and the guidance notes ventilation (along with other categories of control) as being important in Minimizing Individual and Public Health Risks.*

The guidance notes: "When children are in the classroom, to the extent possible, efforts should be made to arrange the classroom furniture to leave as much space as possible between students". It is important that kids do not return to school until community transmission is low. In fact the Children's Hospital of Eastern Ontario (CHEO) and Sick Kids Hospital have recommended that Schools shouldn't reopen until (after summer) - Fall.

In addition "Science "Journal provides a global scan: -" School openings across globe suggest ways to keep coronavirus at bay, despite outbreaks".

Leading practices that incorporates indoor air quality and improvements in ventilation come from Harvard TH Chan School of Public Health which incorporates risk reduction strategies for reopening schools. Schools for Health COVID19. Harvard have produced risk reduction strategies for reopening schools (June, 2020). Risk Reduction Strategies for Reopening Schools provides educational information to help inform teachers, staff and parents about the risk from infection to COVID19 and ensure the health and safety for all occupants. The caveat is "that the report is in no way intended to override or supersede guidance from government and health organisations. It provides leading / best practice information up to and including June 2020. What makes this document "stand-out" is that it establishes and reinforces a culture of health and safety – "shared responsibility"! Also provided is a "framework" from which to form a COVID-19 response team and plan. The framework is "multi-layered" and goes beyond the traditional outdated Canadian "Public Health Guidance" by recognizing that transmission of coronavirus can and will occur from aerosols than are both < 5µm and > 5µm in diameter. This in turn

reinforces the importance of increased ventilation to reduce the risk of "Aerosol Transmissible Disease" COV-19, infection from both close and long range aerosol (airborne) transmission. For the assessment and improvements recommended for indoor air quality, prioritized control strategies include additional ventilation, filtration, and supplemental air-cleaning and verifying system performance regularly. A prioritization schematic (p.31) has been provided for engineering controls. A decision tree (p.34) also provides a useful process flow diagram.

Reference: Schools for Health, Risk Reduction Strategies for Reopening Schools, June 2020, Principal Author / Corresponding Author – Assistant Professor Dr. Joseph Allen.

The assist in assessing ventilation the Occupational Health Clinics for Ontario Workers Inc. have provided a ventilation checklist. Following the Hierarchy of Controls, ventilation and filtration provided by HVAC systems can reduce the airborne concentration of SARS-CoV-2 and thus the risk of transmission through the air. This Ventilation Checklist (COVID-19) can be used as a guide to assess the suitability of ventilation in the workspace/building that are to be occupied.To complement the guidance by OHCOW and (Harvard School of Public Health and Healthy Buildings, 2020) the following provides more detail and focus around engineering controls and ventilation:

> American Industrial Hygiene Association (AIHA) "Reducing the Risk of COVID-19 Using Engineering Controls (August 11, 2020).
>
> The American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) "Coronavirus (COVID-19) Response Resources from ASHRAE and others".
>
> Read-only versions of ASHRAE standards (accessed 12 August, 2020).

To complement ventilation "air purifiers" may also be considered.

Harvard TH Chan also provides a downloadable report "A Portable Air Cleaner Purification Report" and downloadable "Portable Air Cleaner Purification Calculator".

See also the Centers for Disease Controls and Prevention, Schools and Child Care, and Colleges and Universities

In Ontario there is a Framework for opening the Province.

Ontario has established an Approach to reopening schools for the 2020-2021 school year.

Session 2 (43). What controls could be placed into universities that will be going back to classrooms in Sept?

For Universities the regional requirements will prevail but I would say that (indoors) in public areas all employees, students, visitors and contractors be required to wear a face covering in common areas and there may be exceptions which should be specified by the university such as where they are actively engaged in an athletic or fitness activity where in any case should preferably be carried out outdoors and where indoors the ventilation should be inspected and appropriate / effective.

Dr. Kevin Hedges: See Q41 and answer and also refer to the American Society of Heating and Air-Conditioning Engineers - ASHRAE coronavirus resources site. It is important that an assessment of the ventilation is conducted to assess the adequacy of ventilation and provide upgrades where necessary.

Session 2 (32). Do we know how many air exchanges are needed per hour to clear the air? For example, in a classroom, if one person has Covid, how many air changes per hour would be needed?

Comment - See this link for ACH and Airborne Contaminant Removal
https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1

Airplanes / flying

26. The airline industry is now selling middle seats, some PHAC folks are saying its okay as airplanes have very good ventilation systems. How safe are people flying on planes if everyone is wearing face coverings?

Dr. Linsey Marr *-It's definitely safer if everyone is wearing face coverings, but whether it's safe or not safe depends on one's own definitions.*

Risk of transmission to waste water plant treatment workers

Session 1 (36). Is there a risk of transmission to waste water treatment plant workers?

Dr. Linsey Marr *-Perhaps a small risk under certain conditions, as this has been shown for other viruses.*

Miscellaneous

Session 1 (14). Webex recordings do not include chat sidebar. Will this be saved and included for download as well? ***A-*** *Yes*

22. Would each presenter explain how they work with occupational health specialists, like hygienists, and what attention do they pay to their recommendations?

Dr. Linsey Marr - I collaborate with Dr. Julian Tang, who is a clinical and academic virologist at the University Hospitals of Leicester. I rely on him heavily for knowledge about infection control in healthcare settings.

Session 2 (8).ATD = Aerosol Disease Transmission. In California it's just called the ATD standard (regulation is what we'd use in Canada). ATD = Aerosol Transmissible Disease Standard - build into CAL / OSHA regulations they recognize aerosol transmissible diseases (airborne route) which is very important

BBP = blood-borne pathogens, a standard passed by the federal US Occupational Safety and Health Administration (OSHA). It applies to most workplaces all that are covered by OSHA and state OSHA plans.

For details about the ATD standard in California, see
https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/Pages/ATDStd.aspx

Session 2 (9). 9. Is there any discussion of the immunological mechanism that might shed some light?

Dr. Kevin Hedges: Not that we are aware of.

Session 2 (10). Have wondered about **congregate living rules** based on cohort washroom use too.

Dr. Lisa Brosseau: These same calculations can be done for public washrooms if you know the ACH.

Session 2 (11). Have any virion calculations been done related to potential fecal load as well as exhalation risk?

Dr. Lisa Brosseau: We are not aware of any.

Session 2 (12). I wonder the risk associated with public washrooms, it would be harder to control and determine no? Considering wouldn't know who is using those public washrooms.

Dr. Lisa Brosseau: These same calculations can be done for public washrooms if you know the ACH.

Session 2 (13). Do we think that previous pandemic planning was based on regional/national vs global thus altering requirements/lack of supply?

Dr. Lisa Brosseau: I have participated in pandemic influenza pandemic planning for many years. There were written plans for the federal government, states, healthcare organizations, etc. As far as I can tell, most of those plans have been ignored by many politicians during this pandemic. I think that many public health professionals and pandemic plans have been ignored.

Comment - *In the US there was a 30% cut in public health workers and cuts in preparedness programs as well over the last decade and beyond. See National Association of County Health Officials (NACCHO) website for details and also Trust for America's Health has a referenced report on the cuts.*

Session 2 (40). For those interested see: **security guards, grocery store staff, meat processing workers and cleaning/janitorial workers**. There are fact sheets at: there are fact sheets at http://mflohc.mb.ca/info-sheets/One about cleaning/disinfecting and workers' rights (in Canada) at http://mflohc.mb.ca/covid-19/

As an additional compendium answering 150 questions on COVID-19 and SARS-COV-2 see the following:

https://www.researchgate.net/profile/Rodrigo_Jimenez-Saiz2/publication/342165769_A_compendium_answering_150_questions_on_COVID-19_and_SARS-CoV-2/links/5f168b824585151299ad5a51/A-compendium-answering-150-questions-on-COVID-19-and-SARS-CoV-2.pdf