

OCC-COVID WEBINAR SERIES

Science, Solutions and Success Stories



Tools in the Toolbox:

Carbon dioxide (CO₂) Monitoring and Risk Calculators

10 December 2021

Kevin Hedges, Ph.D., CIH, COH
khedges@ohcow.on.ca

Occupational Hygienist
OHCOW Eastern Clinic

[Board Member Workplace Health Without Borders \(International\)](#)



Occupational
Health Clinics
for Ontario
Workers Inc.

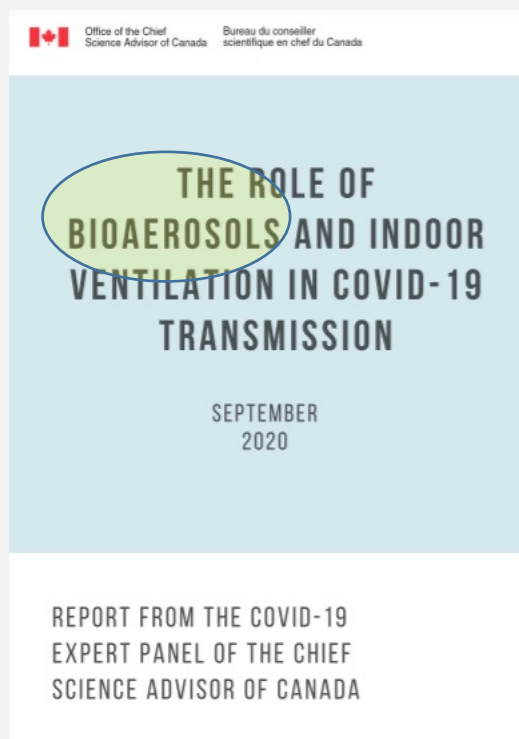
Centres de
santé des
travailleurs (ses)
de l'Ontario Inc.

Prevention Through Intervention

SARS-CoV-2

It's airborne!





HOME > ALL AUDIO > ROB SNOW INTERVIEWS

LISTEN: COVID-19 is airborne, scientists agree - Dr. Jennifer McDonald on The Rob Snow Show May 18, 2021

Dr. Jennifer McDonald from The Ottawa Hospital joins Rob to discuss a new scientific study calling on governments around the world to prioritize indoor air quality standards to fight infectious diseases like COVID-19.

<https://ottawa.citynews.ca/all-audio/rob-snow-interviews/listen-covid-19-is-airborne-scientists-agree-dr-jennifer-mcdonald-on-the-rob-snow-show-may-18-2021-3789105>

Occupational Health Clinics for Ontario Workers Inc.
Prevention Through Intervention



Home

COVID-19

Content

Authors

CMA Members

Subscribers

Commentary

Mitigating airborne transmission of SARS-CoV-2

Sarah Addleman, Victor Leung, Leyla Asadi, Abdu Sharkawy and Jennifer McDonald

CMAJ July 05, 2021 193 (26) E1010-E1011; DOI: <https://doi.org/10.1503/cmaj.210830>

Article

Metrics

Responses

PDF

KEY POINTS

- Short- and long-range aerosol inhalation, or airborne transmission, of SARS-CoV-2 has been recognized by international public health agencies.
- Canadian public health guidance and policies should be updated to address this mode of transmission.
- Ventilation is a key mitigation measure against airborne transmission, and recommendations and funding should be provided to business and schools for assessments and upgrades.
- Guidelines for personal protective equipment in health care settings and essential workplaces should be revisited, with the goal of implementing more widespread use of N95 respirators.
- Addressing airborne transmission requires the expertise of interdisciplinary teams to inform solutions that can end this pandemic faster.

<https://www.cmaj.ca/content/193/26/E1010>

3 December 2021 Risk assessment for SARS-CoV-2 variant:
Omicron VOC-21NOV-01 (B.1.1.529) UK Health Security Agency

3 December 2021 Risk assessment for SARS-CoV-2 variant: Omicron VOC-21NOV-01 (B.1.1.529)			UK Health Security Agency
Indicator	Red, amber or green status*	Confidence level	Assessment and rationale
Transmissibility between humans	Amber	Low	At least as transmissible as currently circulating variants Omicron is transmitting rapidly and successfully. Increased transmissibility compared to Delta is biologically plausible with the presence of furin cleavage site and nucleocapsid changes associated in vitro with advantages for replication, as well as extensive changes to the RBD. Structural modelling suggests that the mutations present may increase human ACE2 binding affinity to a much greater extent than that seen for any other variant. Phylogeny suggests a recent emergence. Data from South Africa suggests that Omicron has a pronounced growth advantage there. However, this may be due to transmissibility or immune escape related, or both.
Infection severity			Insufficient data
Naturally acquired immunity	Red	Low	Mutations suggestive of reduced protection from natural immunity and limited supporting epidemiological evidence Based on experience with other variants, laboratory data on individual mutations, and structural modelling, the mutations present are very likely to reduce antibody binding and include changes in all 4 neutralising antibody binding sites in the RBD and also in antigenic sites in the S NTD. T cell epitope data is awaited. Analysis from South Africa suggests a reduction in protection from previous infection, including from recent Delta infection. There is no convalescent sera neutralisation data and no relative risk of reinfection analyses as yet.
Vaccine-derived immunity	Red	Low	Mutations suggestive of reduced protection from vaccine derived immunity, no supporting evidence The mutations present are likely to reduce antibody binding and include changes in all 4 RBD neutralising antibody binding sites. T cell epitope data is awaited. There is no vaccinee sera neutralisation data and no epidemiological data on vaccine effectiveness.
Therapeutics	Red	Low	Mutations suggestive of reduced effectiveness of a treatment in UK clinical use The mutations present are likely to reduce the binding of most available therapeutic monoclonal antibodies, based on structural modelling. On the same basis, they are unlikely to affect current small molecule antivirals. However, there is no laboratory or clinical data to support these predictions at present.

"In case after case, a precautionary approach would have made a difference,

said Possamai. "We were not only late in moving in that direction, but there was a real lack of transparency."

<https://t.co/VD5uSNtYeY>

Omicron ?

[CBC News](#) • Posted: Oct 17, 2020



Probable Transmission of SARS-CoV-2 **Omicron Variant** in Quarantine Hotel, Hong Kong, China, November 2021, Gu et al. 2021.

*We report detection of severe acute respiratory syndrome coronavirus 2 Omicron variant (B.1.1.529) in an asymptomatic, **fully vaccinated traveler** in a quarantine hotel in Hong Kong, China. The Omicron variant was also detected in a fully vaccinated traveler staying in a **room across the corridor from the index patient**, suggesting transmission despite strict quarantine precautions.*

It is not known whether these detected mutations might have affect the effectiveness of existing vaccines and virus transmissibility. However, detection of Omicron variant transmission between 2 fully vaccinated persons across the corridor of a quarantine hotel has highlighted this potential concern.

Airborne transmission across the corridor is the most probable mode of transmission.

Emerging infectious diseases. 2021 Dec 3;28(2). Pre-print. <https://pubmed.ncbi.nlm.nih.gov/34860154/>

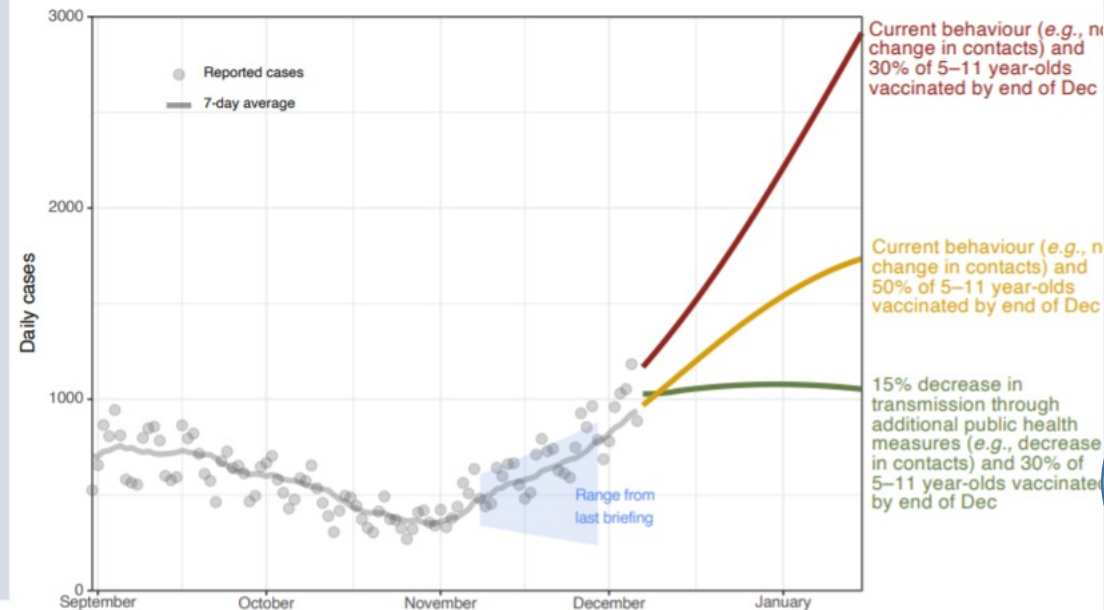
Occupational Health Clinics for Ontario Workers Inc.

Prevention Through Intervention

Cases continue to rise substantially, even without Omicron. To flatten the curve, we need to reduce transmission by increasing vaccination and public health measures.

Figure shows predictions based on a consensus across models from 4 scientific teams.

- All scenarios assume continuing current public health measures.
- All scenarios include vaccinating kids 5-11 years of age, but differ on the proportion of kids vaccinated by end of December.
- Different models use different approaches and assumptions.
- Omicron not included in these scenarios, and would likely worsen these projections.



Predictions informed by modeling from McMasterU, PHO, WesternU, YorkU
Data (Observed Cases): covid-19.ontario.ca

8

Additional public health measures

https://covid19-sciencetable.ca/wp-content/uploads/2021/12/Update-on-COVID-19-Projections_2021.12.07_English-1.pdf

Tools in the Toolbox:

Simple Solutions for a “COVID-Safe” season

Carbon dioxide (CO₂) Monitoring and Risk Calculators

- 1) Introduce carbon dioxide monitoring as a tool in the tool box.
- 2) Provide an overview of “risk assessment calculators” from complex to simple.
- 3) Focus on **simple calculators** that everyone can use.
- 4) Provide some guidance and solution (s) that we can all apply.

Carbon Dioxide Concentrations vs. Health Effects & Indoor Air Quality (IAQ)			
CO ₂ ppm	CO ₂ in % of Air	Duration	Effects
350 - 500 ppm	0.035% - 0.05%		Typical outdoor CO ₂ level - 0.3% by volume
600	0.06%	Hours/undefined	reduced mental performance for some
1,000	0.10%	Hours/undefined	reduced test scores common in classrooms
1,200	0.12%	Hours/undefined	Indoors indicates poor fresh-air ventilation
2,500	0.25%	Hours/undefined	Significantly reduced mental performance for some
3,000-3,500	0.3%	6+ hrs.	Perceived reduced IAQ w/ bio effluents present Regulation in some Provinces put that limit at 3,500 ppm for 8 hours
5,000	0.5%	6+ hours	Reduced mental performance, found in some classrooms Prior NASA SMAC CO ₂ limit for long term space voyage (okay) Regulation in some Provinces use that as a limit for industrial or other workplaces (with a duration threshold of 8 hours)
10,000	1%	minutes +	Drowsiness
12,000	1.2%		Headache complaints
20,000	2%	min. to hrs.	Awareness of poor IAQ
Above 20,000	> 2%	min. to hrs.	Heaviness in chest, difficulty breathing, possible acidosis after several hours
30,000	3%	minutes	Breathing rate doubles]
50,000	5%	minutes	Breathing rate 4 x normal, threshold of toxicity
Above 20,000	> 5%	minutes	Toxic, unconsciousness, death

Courtesy of Dr. Stephane Bilodeau

Carbon dioxide



< 600 ppm best

1,000 ppm

0.10%

Hours
undefined

reduced test
scores
common in
classrooms



1) Beware of getting elevated concentrations from your own breath. Should measure CO₂ at a distance at least 2 metres from any person. (Todd Irick, Occupational Hygienist OHCOW, pers comm).

2) No one (to my knowledge) has correlated CO₂ with particle concentrations (Dr. Lisa Brosseau pers comm).

3) The biggest problem with relying on CO₂ as a surrogate for ventilation is that it **tells you very little about air patterns in a room**, which are much more important than people seem to recognize. If there are dead or recirculating zones (as in the Guanghzu restaurant), the number of air changes will not have any impact on that (Dr. Lisa Brosseau pers comm).

CO₂ monitoring limitations (beware)

- not representative of risk related to non-airborne transmission pathways
- doesn't account for re-circulated air that has undergone filtration
- doesn't consider other control measures, such as the use of masks as source control, nor the use of respiratory protection, nor contributions of CO₂ from other sources.

Notwithstanding, if the limitations are well understood, a precautionary approach supports the use of CO₂ monitoring as a useful and relatively low-cost tool to make real-time assessments of relative infection risk, which should lead to improvements being made to improve ventilation in indoor spaces.

OzSAGE

Measurements should be taken at multiple locations within a room or space and repeated periodically during the time the room or space is occupied.

A building wide system with central reporting and monitoring is desirable in all spaces with high occupancy, including healthcare, schools, aged-care and critical workplaces.

OzSAGE

Recommandations gouvernementales concernant l'aération et la mesure du CO₂



GOVERNEMENT

*Liberté
Égalité
Fraternité*



**MINISTÈRE
DES SOLIDARITÉS
ET DE LA SANTÉ**

*Liberté
Égalité
Fraternité*



**MINISTÈRE
DU TRAVAIL,
DE L'EMPLOI
ET DE L'INSERTION**

*Liberté
Égalité
Fraternité*



**MINISTÈRE
DE L'ENSEIGNEMENT
SUPÉRIEUR,
DE LA RECHERCHE
ET DE L'INNOVATION**

*Liberté
Égalité
Fraternité*



**MINISTÈRE
DE L'ÉDUCATION
NATIONALE,
DE LA JEUNESSE
ET DES SPORTS**

*Liberté
Égalité
Fraternité*

Taux CO₂ < 600 ppm



Taux CO₂ < 800 ppm



800 < Taux CO₂ < 1000 ppm



Taux CO₂ > 1000 ppm



NEW ZEALAND | Education
Covid 19 Delta outbreak: Ministry of Education
ordering air purifiers, CO2 monitors for schools
2 Dec, 2021 10:52 PM

In New Zealand the ministry
also planned to bring in carbon
dioxide monitors as part of a
"ventilation toolkit" for schools.

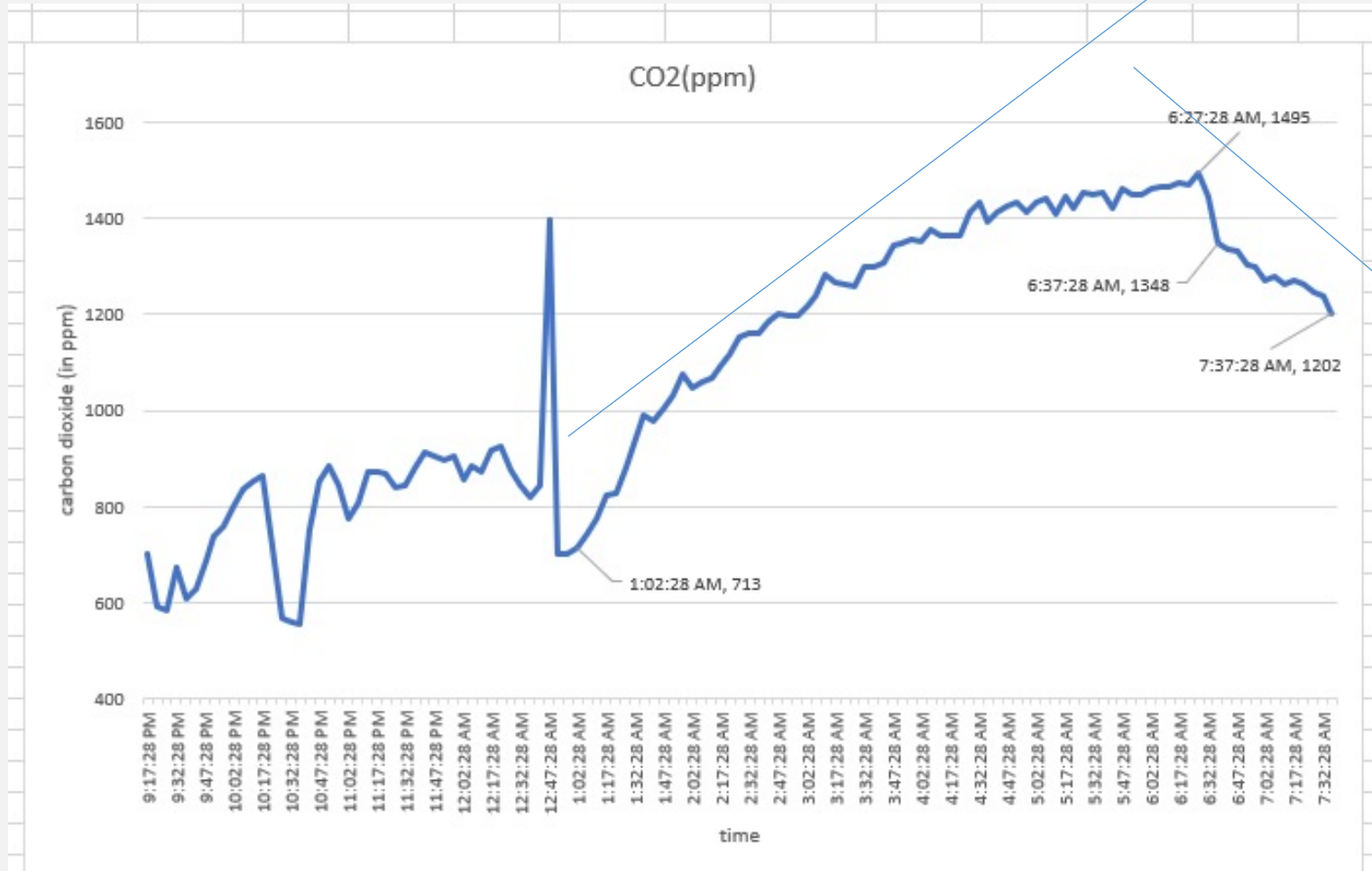
<https://www.nzherald.co.nz/nz/covid-19-delta-outbreak-ministry-of-education-ordering-air-purifiers-co2-monitors-for-schools/RD5L2QKV4YH3ZIBKRMB5R2ZW3U/>

Those monitors are already being trialled; Niwa announced yesterday CO2 monitors were temporarily being installed in 18 classrooms across three schools, to help the Ministry of Education see how classrooms are being used and the impacts on ventilation.



Niwa principal scientist for air quality, Dr Ian Longley, installs an air monitoring device at Epuni Primary School in Lower Hutt. Photo / Niwa - Rebekah Parsons-King

Suggestions for occupational hygienists, engineers, HVAC technicians and other!



Looking at, and analysing information from **decay curves**, is another useful way to **estimate ACH**

Using decay curves from continuous monitoring to estimate (ACH) from each curve over consecutive days

Risk Tools

How do we rank and show where improvements are absolutely necessary.

We must treat higher risks first.

- More comprehensive tools requiring specialist (technical) input.
- Simple tools that we can all use to keep our families safe etc.



Webinar

Modelling infection risk from indoor aerosol exposure to SARS-CoV-2

A platform to summarize risk assessment tools

Europe-Asia Option	November 30, 2020	6am UTC
US-Europe Option	December 2, 2020	5pm UTC

Modeling Infection Risk from Indoor Aerosol Exposure to SARS-CoV-2 Tools Summary

This two-part webinar series provided a platform for developers to summarize their risk assessment tools so that they may be better understood and compared by potential users in the ISIAQ community. [Read about the tools.](#)

ISIAQ Modeling Infection Risk from Indoor Aerosol Exposure to SARS-CoV-2 Tools Summary

https://www.isiaq.org/docs/Risk_Tool_Webinar-Tools_summary.pdf

Tool	Link	Comments
<u>COVID-19 Infection Risk Manager</u> Prezant, B., Ongsono, D., Palmer, K. Publication Reference or Web Reference	https://vue-covid-product.web.app https://covid-risk-manager.web.app	Description including video and white paper & calculator). Compartment model (single zone) for calculating concentration in air, Wells-Riley for calculating risk of infection. A point estimate of risk of infection is provided in the output, as well as the number of infections arising based on the occupancy specified. Time to re-occupancy is provided based on reduction in airborne concentration by 99% based on exponential dilution law.
<u>COVID-19 Aerosol Transmission Estimator</u> Prof. Jose L. Jimenez, University of Colorado-Boulder, USA Publication Reference or Web Reference	http://tinyurl.com/covid-estimator https://doi.org/10.1111/ina.12751	The estimator is a box model of dispersion of contaminants indoors (virus-containing aerosols and CO2 from exhaled breath), that predicts the average indoor concentration of both for a given indoor activity. The size of the space, ventilation and air cleaning, occupancy, number of repetitions of the event, and activity are specified by the user.
Harvard-University of Colorado Boulder <u>Portable Air Cleaner Calculator</u> for Schools Joseph Allen, Jose Cedeno-Laurent, Shelly Miller	https://tinyurl.com/portableaircleanertool	Quick 'rule of thumb' selection guide for portable air cleaners Look for portable air purifier with HEPA filter Look for high clean air delivery rate Avoid add-ons (e.g., ionizers, ultraviolet lights)
Fate and Transport of Indoor Microbiological Aerosols (FaTIMA) W. Stuart Dols and Brian Polidoro	https://www.nist.gov/services-resources/software/fatima https://doi.org/10.6028/NIST.TN.2095	The web-based tool Fate and Transport of Indoor Microbiological Aerosols (FaTIMA) allows for the determination of the indoor fate of microbiological aerosols associated with ventilation, filtration, deposition and inactivation mechanisms.

[Airborne risk infection calculator](#)

The [QUT](#) International Laboratory for Air Quality and Health has made available a downloadable [Airborne Infection Risk Calculator](#) (AIRC tool). More generally, the target users are the technical professionals working to minimize the risk of airborne disease transmission by implementing the **five-step framework** outlined by Morawska et al. (2020):

1. Use engineering controls to reduce the risk of airborne infection;
2. Use existing systems to increase ventilation rates (outdoor air change rate) and enhance ventilation effectiveness;
3. Eliminate air-recirculation within ventilation systems so as to just supply fresh (outdoor) air;
4. Supplement ventilation with filtration systems to capture airborne microdroplets; and
5. Avoid over-crowding

More detail around how to use the calculator is provided here in the [manual](#).



Ventilation Checklist (COVID-19)

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.



Project

City "Reduced Probability of Infection" (CityRPI) for indoor airborne virus transmission

 Ali Katal ·  Leon Wang ·  Maher Albettar

Goal: CityRPI (<https://cityrpi.web.app/>) is a web-based platform for estimating the possibilities and risks of airborne transmission of COVID-19 in indoor spaces. CityRPI is developed by a team led by Dr. Liangzhu (Leon) Wang at Concordia University Building Environment (CUBE) Lab. The indoor airborne infection risk could be reduced by different strategies, including wearing a face mask, improving indoor ventilation condition (more outdoor air, add a duct filter to your HVAC system, using a portable air purifier), staying less time (to reduce possible exposure time), and reducing the number of occupants in a space. The website provides a tool to compare these different strategies. As a building owner or user, you can find the most to the least effective strategies to reduce the risk of infection in your building.

<https://cityrpi.web.app/>



^ March 12 – Airing It Out: Ventilation Solutions and Tools at a Critical Time

Building on our "[Air](#)" on the Side of Caution session, this sequel offers further guidance around ventilation solutions and tools to help control the COVID-19 virus in workplaces.

Moderator: Dr. Kevin Hedges, OHCOW

Evaluation, Monitoring and Mitigation of SARS-CoV-2 Airborne Transmission Risks in Cities and Buildings

Dr. Liangzhu (Leon) Wang,
Concordia University

[VIEW SLIDES](#)

Strategic Safety Measures to Mitigate Indoor Risk of Viral Transmission

Thomas Smith, 3 Flow

[VIEW SLIDES](#)

More Important than Ever: Air Treatment in the Age of COVID-19

Dr. Jeffrey Siegel, University of
Toronto

[VIEW SLIDES](#)

Success Story: Putting Knowledge Into Action to Get Air-Purifiers in School

Dr. Sarah Addleman, Aerosol
Transmission Coalition

The four sessions above are all available in this one video:



Evaluation, Monitoring and Mitigation of SARS-CoV-2 Airborne Transmission Risks in Cities and Buildings Dr. Liangzhu (Leon) Wang, Concordia University <https://www.ohcow.on.ca/events/occ-covid-webinar-series/#1633725590142-163b4634-9dcb>



AIHA CDC <https://www.backtoworksafely.org/cdc> <https://www.cov-irt.org/exposure-assessment-tool/>



SARS-CoV-2 Exposure Assessment Tool

This simple-to-use tool, released as a Beta version, allows users to estimate a group-wide relative exposure to SARS-COV-2 associated with various activities. The tool facilitates understanding of the relative importance of factors that contribute to increased exposure. It incorporates both scientific principals and recent findings regarding virus characteristics to assess relative exposure based on the key mechanistic and epidemiological factors. NOTE: The developers of this tool are in the process of submitting a peer-reviewed article for publication in the Journal of Occupational and Environmental Hygiene (JOEH).

[LEARN MORE →](#)

AIHA Feedback/Questions Find a Consultant Search GET UPDATES →

Back to Work Safely Pandemics Resource Center What is Occupational Health & Safety?

Occupational
Health Clinics
for Ontario Workers



Centre de Santé
des Travailleurs(ses)
de l'Ontario

A Guide to the Classroom Ventilation Posting Spreadsheet

John Oudyk MSc CIH ROH

Occupational Hygienist

November 12, 2021



Classroom Ventilation Calculation Tool

Unlisted

Please watch you will find this useful for your child's school and classroom (ventilation)

Risk Tools

How do we rank and show where improvements are absolutely necessary.

We must treat higher risks first.

- More comprehensive tools requiring specialist (technical) input.
- Simple tools that we can all use to keep our families safe etc.

Ontario COVID-19 Regional Risk Tool:

Risk Legend

Minimal risk – low to absent community transmission

Controlled risk – some sporadic community activity – controlled occasional minor outbreaks

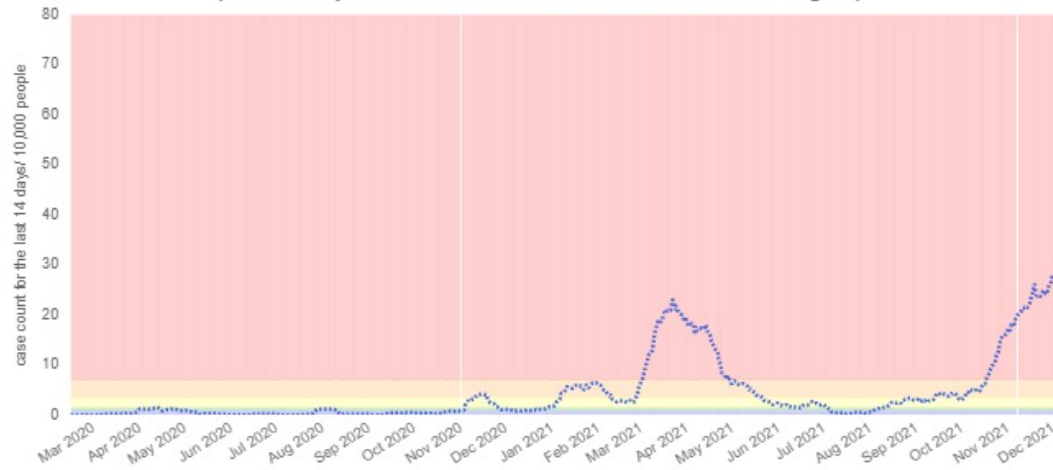
Some community risk – regular sporadic activity – controlled occasional larger outbreaks

Wider community risk – regular activity – periodic outbreaks

High risk – uncontrolled community transmission &/or outbreaks



COVID-19 infection rates in different regions of Ontario
(Click on a public health unit to show the data for that region)



Regional Risk Table At A Glance

Rank	Region Public Health Unit (PHU)	Regional Infection Risk Level*	ON Framework Category**
1	Algoma Public Health Unit	High risk	CONTROL
2	Sudbury & District Health Unit	High risk	CONTROL
3	Timiskaming Health Unit	High risk	CONTROL
4	Windsor-Essex County Health Unit	High risk	CONTROL
5	Kingston, Frontenac and Lennox & Addington Public Health	High risk	CONTROL
6	Simcoe Muskoka District Health Unit	High risk	CONTROL
7	Chatham-Kent Health Unit	High risk	CONTROL
8	Haldimand-Norfolk Health Unit	High risk	CONTROL
9	Southwestern Public Health	High risk	CONTROL
10	West County Health Unit	High risk	CONTROL
11	Hastings and Prince Edward Counties Health Unit	High risk	CONTROL
12	Thunder Bay District Health Unit	High risk	CONTROL
13	Lambton Public Health	High risk	CONTROL
14	Huron Perth District Health Unit	High risk	RESTRICT
15	Eastern Ontario Health Unit	High risk	RESTRICT
16	Region of Waterloo, Public Health	Wider community risk	RESTRICT
17	Niagara Region Public Health Department	Wider community risk	RESTRICT
18	Halton Region Health Department	Wider community risk	RESTRICT
19	Middlesex/London Health Unit	Wider community risk	CONTROL
20	Wellington-Dufferin-Guelph Public Health	Wider community risk	RESTRICT
21	Renfrew County and District Health Unit	Wider community risk	RESTRICT
22	Ottawa Public Health	Wider community risk	RESTRICT
23	Hamilton Public Health Services	Wider community risk	RESTRICT
24	York Region Public Health Services	Wider community risk	RESTRICT
25	Dufferin Region Health Department	Wider community risk	PROTECT
26	Grey Bruce Health Unit	Wider community risk	PROTECT
27	Toronto Public Health	Wider community risk	RESTRICT
28	Peterborough Public Health	Wider community risk	PROTECT
29	Peel Public Health	Wider community risk	PROTECT
30	Leeds, Grenville and Lanark District Health Unit	Wider community risk	PROTECT
31	Halliburton, Kawartha, Pine Ridge District Health Unit	Some community risk	PROTECT
32	Northwestern Health Unit	Some community risk	PROTECT
33	North Bay-Perry Sound District Health Unit	Some community risk	PROTECT
34	Porcupine Health Unit	Some community risk	PREVENT

* These tools translate Reported case data published by [Public Health Ontario](#) as a 14 day rolling count (divided by population to create a rate per 10,000 people) to understand and compare Ontario regional SARS-CoV-2 transmission risk. Recent numbers can be delayed and are less reliable, particularly over weekends, so risk may be underestimated.

** The Ontario Framework Category is an estimation of the official provincial colour-coding as explained in [COVID-19 Response Framework: Mapping Ontario Safe and Smart](#) (see slide 8) based only on the weekly incidence rate per 100,000, but absent the other factors considered locally (e.g. % positivity of daily tests, the reproductive number (R) – the number of new cases traced from each known case), the number and status of outbreaks, trend in cases without an age connection, hospital and ICU capacities, and PHU capacity for contact tracing). We are also not able to assign "Grey – Lockdown" since this category is based on a judgement call by local authorities. Therefore the ON categories assigned in this table may not necessarily align with the official version but are provided for translation and reconciliation with Prevention Tips below.

Sudbury & District
Health Unit

<https://www.ohcow.on.ca/covid-19/regional-risk-tool-tips/#risktable>



Important notice for preventing COVID-19 outbreaks.

Avoid the “Three Cs”!

- 1. Closed spaces** with poor ventilation.
- 2. Crowded places** with many people nearby.
- 3. Close-contact settings** such as close-range conversations.



One of the key measures against COVID-19 is to prevent occurrence of clusters.
Keep these “Three Cs” from overlapping in daily life.



Japan avoided a lockdown by telling everyone to steer clear of the 3 C's.



Safe Indoor Air (Ventilation)

Recommendations

OZSAGE

Members of the OzSAGE Safe Indoor Air Working Group (in alphabetical order)

Professor Brendan Crabb
Professor Con Doolan
Mrs Kate Cole
Professor Geoff Hanmer (chair of working group)
Professor Guy Marks (member of OzSAGE Executive)
Dr Andrew Miller
Professor Jason Monty
Distinguished Professor Lidia Morawska (member of OzSAGE Executive)
Dr Charitha de Silva



Version 1.02
Monday, 6 September 2021

Page 1 of 8

Overarching Principles

High risk can be identified with: **The three V's and T** (any of these is a red flag, and more than one indicates higher risk):

Venue: Multiple people indoors, where social distancing is often harder.

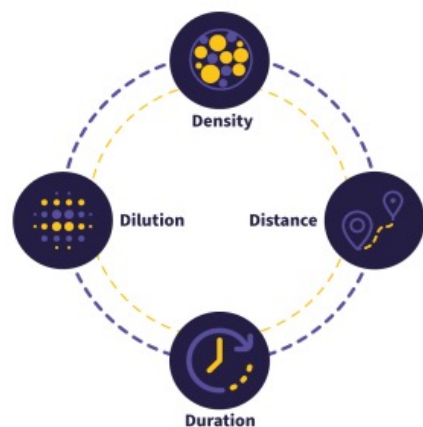
(poor) Ventilation: Staying in one place with limited fresh air.

Vocalization: Talking, shouting or singing will increase aerosolization of the virus.

Time: The amount of time spent in the venue in relation to the risk. Less time is better.



CARE



Vaccination and human diagnostic are critically important.

Given that a primary **transmission route for COVID-19 is airborne**, medical mitigation strategies **MUST** be complemented with environmental control solutions to reduce the risk of transmission.

This is a **holistic approach that is more comprehensive.**

*Duration/Density = Risk Factors | Dilution/Distance = Risk Mitigation Factors

AIHA® Feedback/Questions Find a Consultant Search GET UPDATES →

[Back to Work Safely](#) [Pandemics Resource Center](#) [What is Occupational Health & Safety?](#)

Pandemics Resource Center

This educational initiative was funded by a cooperative agreement with the Centers for Disease Control and Prevention (Grant #1 NU50CK000583-01-00) to the American Industrial Hygiene Association (AIHA).

<https://www.backtoworksafely.org/cdc>

*Duration/Density = Risk Factors | Dilution/Distance = Risk Mitigation Factors

How to determine and assess your risk.

Reducing exposure to an airborne virus is the most important thing you can do in reducing its spread.



Viruses that transmit as airborne particles - such as the viruses that cause COVID-19 and measles - pose a significant risk as they can travel long distances - up to 20 to 30 feet - and stay active in the air for at least 4 hours.

Consider the 4Ds to determine the risk category:

Risk Factors



Duration

How long will the employee or others be indoors?
The longer time spent indoors, the more the air becomes filled with invisible airborne particles.



Density

How many people are in the space, how many are not vaccinated, how many people are sick and not showing signs, and how many are not wearing masks? As these numbers increase, so does the risk.



Dilution

Being outdoors is relatively safe compared to being indoors thanks to how easy it is to dilute the virus due to more open space, moving air, and the aid of sunlight to stop the virus.



Distance

How far or near are people around one another?
People with COVID-19 exhale a high amount of viral particles, which is why being close to an infected person increases the risk of infection for you.

Risk Mitigation Factors

The Control Banding (CB) approach is extremely useful, especially where there is uncertainty about the risk, and when figuring out where to assign additional controls.

COVID-19: Control Banding Can Identify Infection Risks and Interventions

1

CONTROL BAND = EXPOSURE LEVEL X HOURS PER DAY

Exposure Level	Hours Per Day		
	0-3 hr	3-6 hr	> 6 hr
Unlikely Exposure Minimal contact with sources	A	A	A
Possible Exposure Numerous contacts with potential sources	B	B	C
Likely Exposure Close contact with infected sources	B	C	C

2

PRIORITIZE SOURCE AND PATHWAY CONTROLS TO MINIMIZE EXPOSURE

Band	Control	Source	Pathway	Receiver
	A		Do these first!	Do these next
B		Do these first! May need several	Do these next May need several	Only if necessary*
C		Do these first! May need multiple	Do these next May need multiple	May be prudent

*May require input from a health and safety professional.

3

EXAMPLES

Source Controls

LIMIT NUMBER OF SOURCES OR TIME SPENT IN SHARED SPACES

- Vaccination.
- Identify & eliminate sources with frequent COVID-19 testing and isolation.
- Face coverings for public or patients (not workers).
- Redesign workplace or job to limit sources & contact time.

Pathway Controls

LIMIT MOVEMENT OF INFECTIOUS PARTICLES FROM SOURCE TO RECEIVER

- Separate and enclose the source or receiver.
- Increase distance between source and receiver.
- Remove, replace and clean the air to lower particle concentrations.

Receiver Controls

LIMIT RECEIVER'S INHALATION OF INFECTIOUS PARTICLES

If source and pathway controls do not limit concentration and time, provide fit-tested respirators for medically-cleared workers and a respiratory protection program.

For scenarios demonstrating control banding and more fact sheets, scan the QR code to access the ACGIH website.

ACGIH formed the [Pandemic Response Task Force](#).
Led by Dr. Lisa Brosseau



What about selection of filtering facepiece respirator (FFR).

Table 1. Time to Infectious Dose for an Uninfected Person (Receiver)*

		Receiver is wearing (% inward leakage)				
		Nothing	Typical cloth mask	Typical surgical mask	Non-fit-tested N95 FFR	Fit-tested N95 FFR
Source is wearing (% outward leakage)	Nothing	100%	75%	50%	20%	10%
	Typical cloth mask	15 min	20 min	30 min	1.25 hr	2.5 hr
	Typical surgical mask	20 min	26 min	40 min	1.7 hr	3.3 hr
	Non-fit-tested N95 FFR**	30 min	40 min	1 hr	2.5 hr	5 hr
	Fit-tested N95 FFR	1.25 hr	1.7 hr	2.5 hr	6.25 hr	12.5 hr
	Fit-tested N95 FFR	2.5 hr	3.3 hr	5 hr	12.5 hr	25 hr

*The data for % inward and outward leakage of cloth and surgical masks were derived from a study by Lindsley et al (2021). Data for non-fit-tested N95 FFRs come from a study by Brosseau (2020). Data for fit-tested N95 FFRs are derived from the OSHA-assigned protection factor of 10 for half-facepiece respirators. Also, times were established before wide circulation of the more transmissible Delta variant.

**FFR = filtering facepiece respirator; N95 = not oil-proof, 95% efficient at NIOSH filter test conditions

COMMENTARY: What can masks do? Part 1: The science behind COVID-19 protection. CIDRAP

<https://www.cidrap.umn.edu/news-perspective/2021/10/commentary-what-can-masks-do-part-1-science-behind-covid-19-protection>



Time required to reach infectious dose inhaled by the vulnerable person

Wild vs **Delta** strain

Vulnerable person is wearing

		Nothing	Cloth	SM	SM, fit	N95	N95, fit
Infectious person is wearing	Nothing	10 min 4 min	14 min 6 min	20 min 8 min	50 min 20 min	1.7 hours 41 min	16.7 hours 6.8 hours
	Cloth	17 min 7 min	24 min 10 min	33 min 13 min	83 min 34 min	2.8 hours 68 min	28 hours 11 hours
	SM	20 min 8 min	29 min 12 min	40 min 16	1.7 hours 41 min	3.3 hours 81 min	33 hours 14 hours
	SM, fit	50 min 20 min	71 min 29 min	2 hours 41 min	4.2 hours 1.7 hours	8.3 hours 3.4 hours	83 hours 34 hours
	N95	1.7 hours 40 min	2.4 hours 58 min	3 hours 81 min	8.3 hours 3.4 hours	17 hours 6.8 hours	167 hours 68 hours
	N95, fit	16.7 hours 6.8 hours	24 hours 10 hours	33 hours 14 hours	83 hours 34 hours	167 hours 68 hours	1667 hours 677 hours

SM - surgical mask; SM, fit - surgical mask with fit enhancing brace;

N95 - N95 or similar respirator; N95, fit - a fit tested N95 respirator

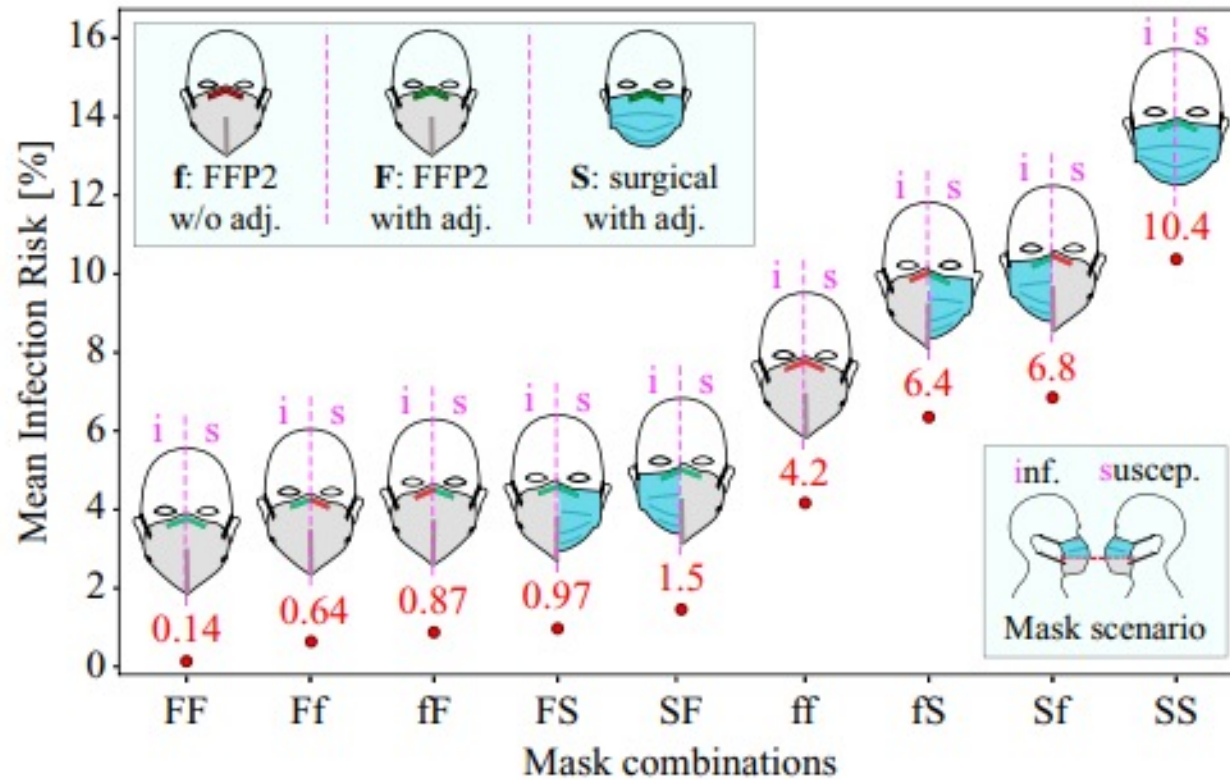


Fig. 6. Mean risk of infection in mask scenarios with different mask combinations for a duration of 20 min. The horizontal axis shows the combination of masks used by the infectious and susceptible with two characters; the first character corresponds to the type of mask worn by the infectious, and the second character corresponds to that of susceptible. Mask types and fittings are abbreviated as follows: f, FFP2 mask without adjustment (Fig. 2, case *i*); F, FFP2 mask with adjustment (Fig. 2, case *ii*); S, surgical mask with adjustment (Fig. 2, case *v*). Other parameters used for generating results shown in this plot are $f_d = 1.0$, $d_{0,max} = 50 \mu\text{m}$, $w = 4$, viral load $\rho_p = 10^{8.5}$ virus copies per mL, and $ID_{63.21} = 200$.

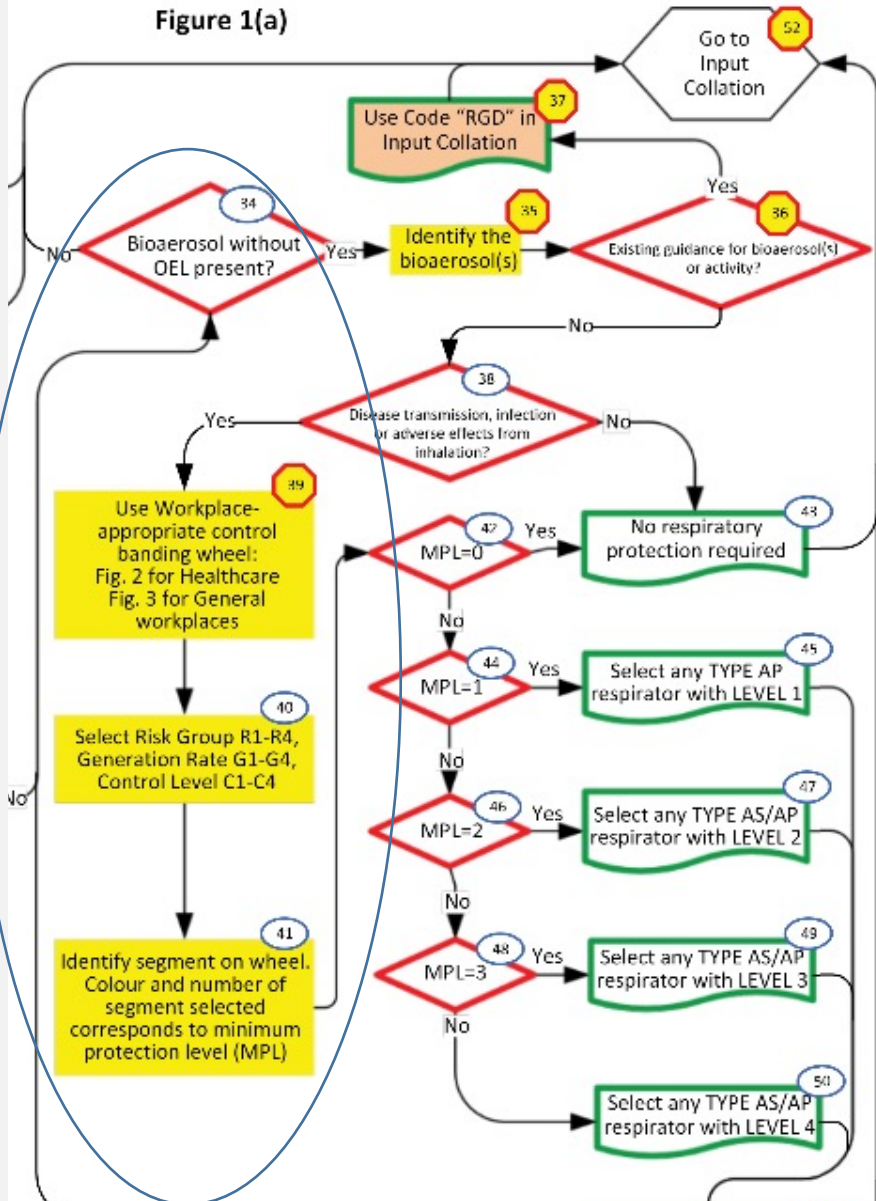
Bagheri et al. 2021

An upper bound on one-to-one exposure to infectious human respiratory particles | PNAS

PNAS December 7, 2021 118 (49) e2110117118;
<https://doi.org/10.1073/pnas.2110117118>



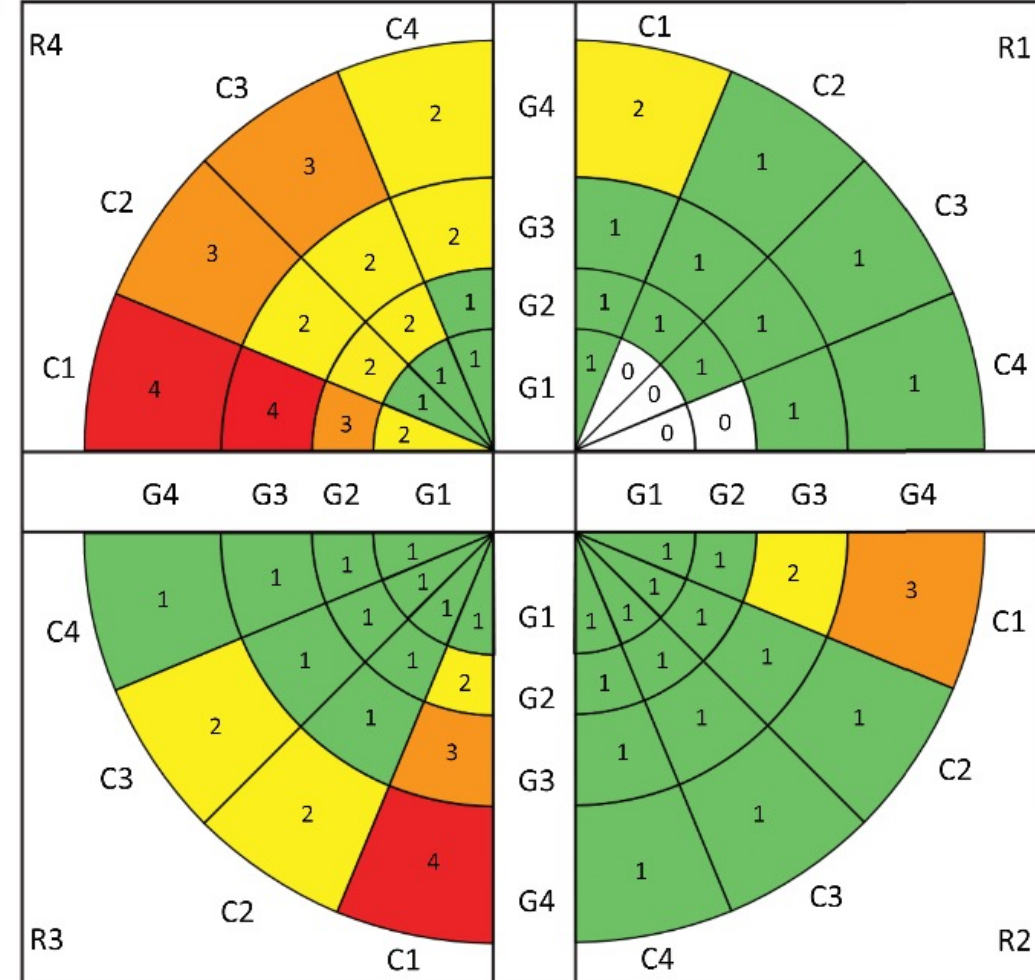
Figure 1(a)



Control banding approach for bioaerosols in general workplace environments

(See Clauses 7.3.4.2 and 7.3.4.3.4 to 7.3.4.3.8, Figure 1, and Annex K.)

General workplace environments	
Risk group	
Agents not associated with disease or serious adverse health effects in healthy adult humans	R1
Agents associated with human disease or adverse health effects that are rarely serious and for which preventive or therapeutic interventions are usually available	R2
Agents associated with serious or lethal human disease or adverse health effects for which preventive or therapeutic interventions might be available (high individual risk but low community risk)	R3
Agents likely to cause serious or lethal human disease or adverse health effects for which preventive or therapeutic interventions are not usually available (high individual risk and high community risk)	R4
Generation rate	
Low release of bioaerosol / pathogen — vacuuming with a HEPA filter	G1
Medium release of bioaerosol / pathogen — soaking then shovelling	G2
High release of bioaerosol / pathogen — misting then shovelling	G3
Very high release of bioaerosol / pathogen — dry sweeping	G4
Control level	
Indoor — poorly ventilated ACH ≤ 1	C1
Indoor — ventilation 1 < ACH ≤ 4 Outdoor — no wind	C2
Indoor — ventilation 4 < ACH ≤ 6 Outdoor — low wind	C3
Indoor — ventilation > 6 Outdoor — moderate wind	C4

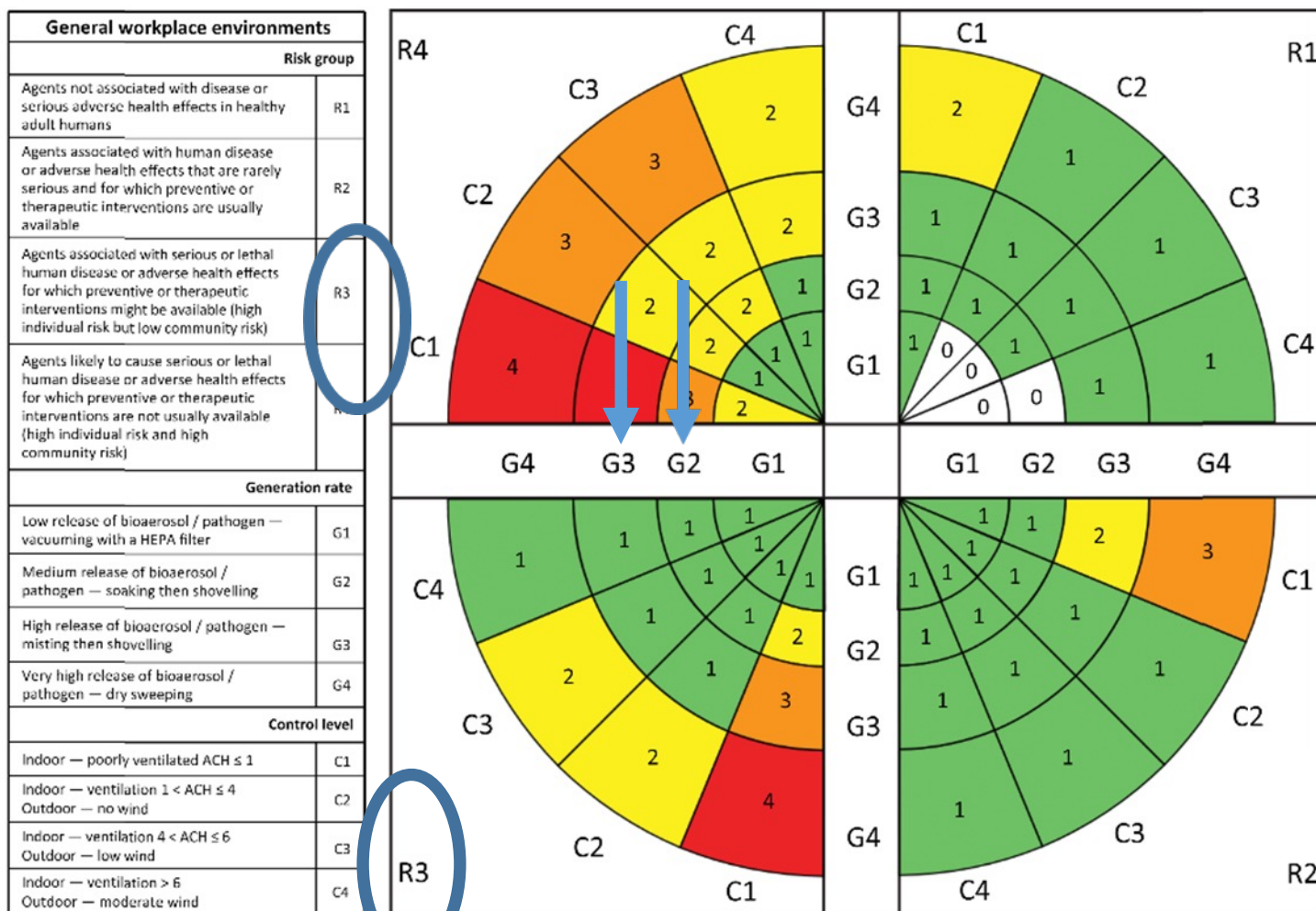


CAN / CSA Z94.4.18 **National Standard of Canada** – Selection Use and Care of Respirators



Control banding approach for bioaerosols in general workplace environments

(See Clauses 7.3.4.2 and 7.3.4.3.4 to 7.3.4.3.8, Figure 1, and Annex K.)



See also irsst tool

Acceptable level						Air-purifying options	APF
0	1	2	3	4	5		
					5	No air-purifying option available	10000
				4 to 5		Powered air-purifying full-facepiece Powered air-purifying helmet/hood with SWPF study	1000
			3 to 5			Powered air-purifying half-facepiece Air-purifying (negative-pressure) full-facepiece	50
		2 to 5				Powered air-purifying loose-fitting facepiece/visor Powered air-purifying helmet/hood without SWPF study	25
	1 to 5					Air-purifying (negative-pressure) half-facepiece (including filtering facepieces)	10
						No respiratory protection required	<1

<https://www.irsst.qc.ca/en/institute/medias/news-releases/id/281/support-tool-for-choosing-respiratory-protection-against-bioaerosols-in-the-workplace>



Tools in the Toolbox:

Simple Solutions for a “COVID-Safe” season

Focus on **simple calculators** that everyone can use.



COVID-19 Risk Calculator

Gain an understanding of how to reduce the risk of COVID-19 transmission in indoor environments using affordable control strategies.



HARVARD T.H. CHAN
SCHOOL OF PUBLIC HEALTH



Translate

<https://covid-19.forhealth.org/covid-19-transmission-calculator/>



HEALTHY BUILDINGS FOR HEALTH | COVID-19 | For Health Professionals

Home Research News COVID Path Forward COVID-19 Risk Calculator

for calculating the risk of COVID-19 transmission, which estimates potential infection risk based on several factors and transmission pathways. This tool is based on our peer-reviewed paper in the [Proceedings of the National Academy of Sciences of the United States of America](#).

1. ROOMS & PEOPLE

Room Size 100 m² Small Large Hide factors

The floor area of the room: 100 m² The height of the room: 3 m

Time Spent in Room (5 hour(s)) 1 hour 10 hours Show factors

Activity Type: Sitting/reading Light activity Moderate activity Intense activity I don't know Show factors

2. RISK REDUCTION

Face Cover Usage: Not Likely Very Likely I don't know Show factors

Type of mask used: Cloth masks Surgical masks N95 masks Double masks I don't know Show factors

Personal Habits: Poor Excellent I don't know Show factors

Room Cleaning: Poor Excellent I don't know Show factors

Social Distancing: None Perfect I don't know Show factors

Natural Room Ventilation: Windows Closed Windows Open I don't know Show factors

HVAC System: Low High I don't know Show factors

Air Cleaning and UV Disinfection System: Poor Excellent I don't know Show factors

RESULTS

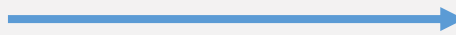
The scenario data you've entered result in the following risk profile:

11% ESTIMATED TRANSMISSION RISK

RELATIVE TRANSMISSION CONTRIBUTION

- Far-field Aerosol: 21%
- Near-field Aerosol and Droplet: 71%
- Flomite and indirect droplet contact: 8%

RECALCULATE [Disclaimer and Terms of Use](#)



N95 face (covering very likely)
Reduced 11% transmission risk to $\leq 1\%$

for calculating the risk of COVID-19 transmission, which estimates potential infection risk based on several factors and transmission pathways. This tool is based on our peer-reviewed paper in the [Proceedings of the National Academy of Sciences of the United States of America](#).

1. ROOMS & PEOPLE

Room Size 100 m² Small Large Hide factors

The floor area of the room: 100 m² The height of the room: 3 m

Time Spent in Room (5 hour(s)) 1 hour 10 hours Show factors

Activity Type: Sitting/reading Light activity Moderate activity Intense activity I don't know Show factors

2. RISK REDUCTION

Face Cover Usage: Not Likely Very Likely I don't know Show factors

Type of mask used: Cloth masks Surgical masks N95 masks Double masks I don't know Show factors

Personal Habits: Poor Excellent I don't know Show factors

Room Cleaning: Poor Excellent I don't know Show factors

Social Distancing: None Perfect I don't know Show factors

Natural Room Ventilation: Windows Closed Windows Open I don't know Show factors

HVAC System: Low High I don't know Show factors

Air Cleaning and UV Disinfection System: Poor Excellent I don't know Show factors

RESULTS


The scenario data you've entered result in the following risk profile:

$\leq 1\%$ ESTIMATED TRANSMISSION RISK

RELATIVE TRANSMISSION CONTRIBUTION

- Far-field Aerosol: 9%
- Near-field Aerosol and Droplet: 57%
- Flomite and indirect droplet contact: 34%

RECALCULATE [Disclaimer and Terms of Use](#)



Centers for Disease Control and Prevention

CDC 24/7: Saving Lives. Protecting People™

COVID-19

Home

Your Health

Vaccines

Cases & Data

Work & School

Healthcare Workers

Health Depts

Science

More

Home

Your Health

About COVID-19

Variants of the Virus

Symptoms

Testing

Prevent Getting Sick

Protect Yourself

Get a Vaccine

Masks

Cleaning Your Home

Improving Ventilation in Your Home

Interactive Ventilation Tool

If You Are Sick

Specific Groups of People

Activities, Gatherings & Holidays

Travel

Archive

Interactive Ventilation Tool

Updated Nov. 24, 2021

Print

Small particles that people breathe out can contain virus particles, including the [virus that causes COVID-19](#). If a guest visits your home, [improving ventilation \(air flow\)](#) can help prevent virus particles from accumulating in the air. Good ventilation, along with [other preventive actions](#), like staying 6 feet apart and correctly wearing masks, can help prevent you from getting and spreading COVID-19.

How can I decrease the level of virus particles during and after a guest visits my home?

Select the options below to see how particle levels change as you adjust ventilation settings.

(To create additional scenarios, including to adjust the length of the visit and size of the home, see the expanded model from the [National Institute of Standards and Technology](#).)

HVAC Operation

Off/Not applicable

Filter (Skip If no HVAC system)

Premium

Portable HEPA Air Cleaner

No

Open Window

No

0% particle reduction achieved in your home by using ventilation.

The risk of getting COVID-19 varies according to individual susceptibility and the number of virus particles to which a person is exposed. The **fewer** virus particles in the air, the better.

You can decrease particles even more by continuing to ventilate for an extra hour after the visitor leaves.

POOR VENTILATION

IMPROVED VENTILATION

Model assumptions

Download Data [CSV – 2 KB]

Facebook

Twitter

LinkedIn

YouTube

Last Updated Nov. 24, 2021

Content source: National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases

Interactive Ventilation Tool

Select the options to see how particle levels change as you adjust ventilation settings.

<https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/interactive-ventilation-tool.html>

My COVID-19 VISIT RISK CALCULATOR



HOW SAFE WILL VISITING OR GATHERING WITH OTHERS BE DURING THE COVID-19 PANDEMIC?

Vaccination programs against COVID-19 are well underway. However, COVID-19 remains an important public health issue as it continues to spread in communities across Canada, especially with the emergence of variants of concern. As a result, careful assessment before deciding to visit, gather, or meet with others remains vitally important.

Using the best available scientific evidence and the input of leading experts in infectious diseases, public health and epidemiology, this website has been developed by Ryerson University's National Institute on Ageing (NIA) to help people of different ages and states of health better understand the factors that affect the risk of getting COVID-19 when visiting or gathering with others. Many of these same factors also apply to the risk of getting other respiratory infections like influenza.

Please take the next 3 minutes to answer this website's short online risk calculator questions, based on your own personal understanding of the risk factors being discussed. If you're unsure of what to select, choose the most applicable response or try to better assess the details surrounding the visit or gathering that you're planning. Every visit, gathering and meeting is different, so it's important to re-assess your risk level and your comfort level with risk as your situation changes. The tool can be re-visited at any time for a fresh assessment to help inform your next decision to gather or visit with others.

Upon submitting your answers, a personalized report will be generated to help you understand the level of risk associated with your planned visit or gathering, as well as give you tips on how to try and make your proposed visit or gathering as safe as possible for the remainder of the COVID-19 pandemic.

Note: Please always abide by local public health guidelines, and only consider gatherings that are currently allowed where you live.

The information you provide to access and use this website is collected anonymously for the purpose of providing you information about your possible level of risk of getting COVID-19 and to make improvements to this tool.

So if You're Ready, Let's Get Started!

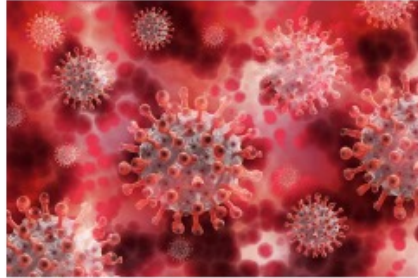
☐ I'm not a robot

[Privacy](#) [Terms](#)

https://covidvisitrisk.com/riskscore-english.html?utm_source=sudbury.com&utm_campaign=sudbury.com%3A%20outbound&utm_medium=referral

SOFTWARE

ViPER - Virus Particle Exposure in Residences



The web based tool Virus Particle Exposure in Residences (ViPER) allows users to compare an individual scenario against multiple "what if" scenarios related to particle exposure associated with a contagious visitor in the home. ViPER is a single zone indoor air quality and ventilation analysis tool developed by the National Institute of Standards and Technology (NIST) for evaluating an occupant's relative exposure to virus laden particles exhaled by a temporary contagious visitor inside the home. There's also an option to

evaluate the change in particle concentration. Behind the user interface of the tool is a database of 1,296 CONTAM simulation results, where each scenario is a variation on a set of input parameters such as home size, visit duration, and portable air cleaner speed, as well as mechanical ventilation and HVAC strategy. CONTAM (<https://www.nist.gov/services-resources/software/contam>) is a leading indoor air quality modeling software tool also developed at NIST. For modeling capabilities that extend beyond ViPER, consider using Fatima (<https://www.nist.gov/services-resources/software/fatima>) or CONTAM.

[Click here to access the ViPER Tool](#)

USES

The information of this webtool could support decisions that would help reduce exposure to a 1 µm particle generated by a contagious visitor. This webtool does not define levels of exposure considered to be safe or healthy, nor consider the impacts of these controls as part of broader risk reduction strategies that might be implemented by a resident.



Indoor air quality, Environment, Air / water / soil quality and Environmental health

Version

1.0

Type of Software

Web Application

Last Updated

2021 11 22

NIST Author

Brian Polidoro

Stephen Zimmerman

Lisa Ng

William Stuart Dols

Steven Emmerich

ORGANIZATIONS

Engineering Laboratory

Building Energy and Environment Division

Indoor Air Quality and Ventilation Group

SYSTEM/PLATFORM REQUIREMENTS

Current Browser: Firefox, Chrome, Edge, Safari

DOWNLOAD INFORMATION

<https://pages.nist.gov/CONTAM/2025/webapps/ViPER/>

CONTACT

FOR MORE INFORMATION, CONTACT:

Stephen Zimmerman
stephen.zimmerman@nist.gov
(301) 975-4277

<https://www.nist.gov/services-resources/software/viper-virus-particle-exposure-residences>



A Guide for Covid-19 Risk in Your County

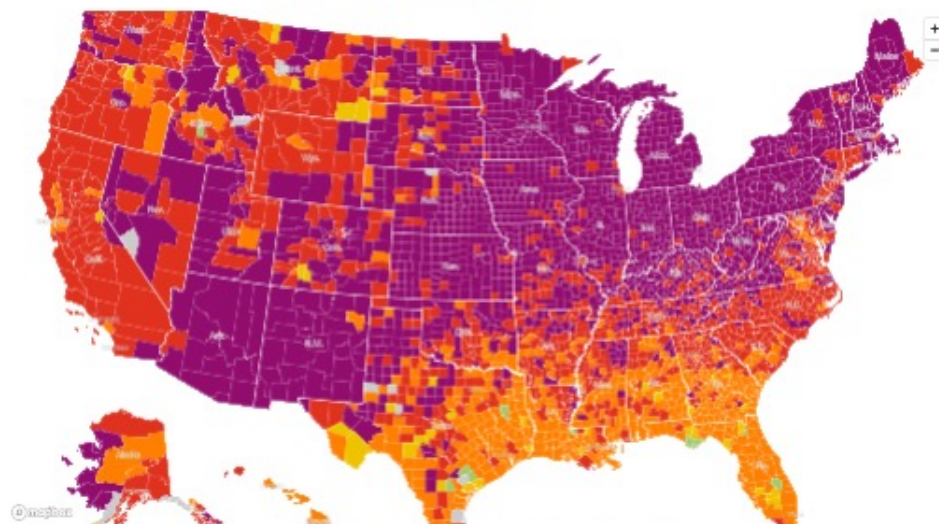
By Eleanor Lutz, Atlas Authority, Charlie Demer, Albert Bao, Rick Harris and Gabriel Blomfield
Updated Dec. 9, 2020

A majority of United States counties were experiencing very high or extremely high Covid-19 transmission in early November, according to an analysis of coronavirus case and testing data by The New York Times and public health experts. This means that unvaccinated people in those counties are at **very high** risk or higher. Vaccinated people are at lower risk.

The map below shows the current risk for unvaccinated people in each county, and will be updated regularly.

Covid-19 risk for unvaccinated people is based on cases and test positivity.

LOW MODERATE HIGH VERY HIGH EXTREMELY HIGH



Sources: Covid-19 risk assessment by The New York Times and Resolve to Save Lives based on reported cases and test positivity data. Read more below.

The Times published county-specific guidance for common activities to help you lower your personal risk of getting Covid-19 and to help you protect your community. This advice was developed with public health experts at Johns Hopkins Bloomberg School of Public Health and [Resolve to Save Lives](#), an initiative of Vital Strategies.

"Providing transparent, real time information about what people's risks are is empowering," said Dr. Tom Frieden, who is a former director of the Centers for Disease Control and Prevention and the president and C.E.O. of Resolve to Save Lives. "You want to know how hard it's raining Covid."

To visit a detailed page showing the risk level and specific

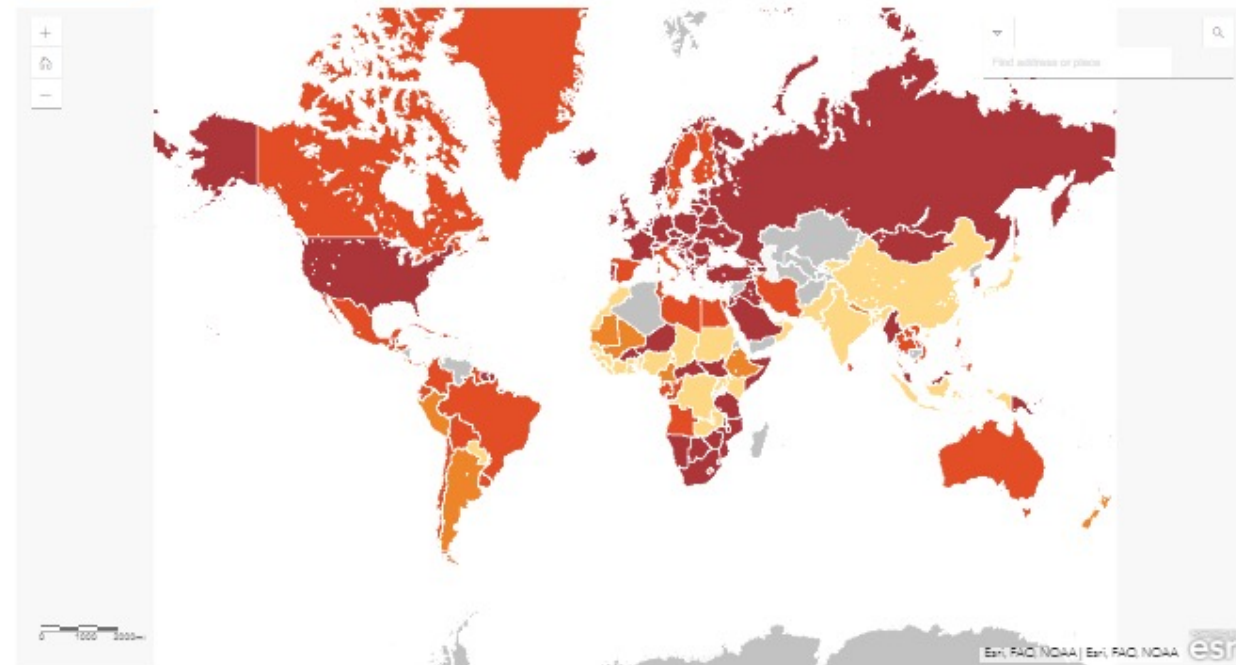
<https://www.nytimes.com/interactive/2021/us/covid-risk-map.html>



COVID-19 Travel Recommendations by Destination

Updated Dec. 6, 2021, 12:00 AM Languages Print

[Return to Travel](#)



Risk Assessment Level for COVID-19

- [Level 4: COVID-19 Very High](#)
- [Level 3: COVID-19 High](#)
- [Level 2: COVID-19 Moderate](#)
- [Level 1: COVID-19 Low](#)
- [Level Unknown: COVID-19 Unknown](#)

Travelers Prohibited from Entry to the United States

With specific exceptions, noncitizens who have been in certain countries during the past 14 days may not enter the United States, either as immigrants or nonimmigrants. For more information, visit [Travelers Prohibited from Entry to the United States](#).

Level 4: COVID-19 Very High

<https://www.cdc.gov/coronavirus/2019-ncov/travelers/map-and-travel-notice.html>

Opinion: How to assess the covid-19 risk from holiday gatherings? Here are four things to consider.



Turkeys on a farm in Oxford, Pa., on Nov. 10. (Photo: Alex Bloomberg/Getty)



Dr. Laura S. Wen
Contributing columnist

November 10, 2021 at 1:51 p.m. EST



MOST READ OPINIONS

1. Vaccination status of attendees. The main reason this holiday season is dramatically different from last year's is the availability of coronavirus vaccines. A vaccinated person is six times less likely to be infected with covid-19 compared with an unvaccinated individual. Events with only vaccinated people will have lower risk than those with attendees of mixed vaccination status.

Level of vaccination also matters. Children 5 to 11 years old are newly eligible to get their shots. Unless they participated in clinical trials, younger kids are unlikely to have received both doses before Thanksgiving. Those with partial vaccination have inadequate immunity and should be considered at similar risk as the unvaccinated. On the other end of the spectrum, people who have received boosters are even better protected than those who were inoculated more than six months ago. I'd feel more comfortable gathering with individuals who are not only vaccinated but also boosted.

[Sign up for The Checkup With Dr. Wen, a newsletter on how to navigate the pandemic and other public health challenges]

2. Level of community transmission. Most of the United States is in a lull in the coronavirus, though there are major differences across regions. Parts of the South and Southeast that were hit particularly hard by the delta wave are experiencing a respite, while covid-19 is surging in areas such as the Mountain West. In Montana, 44 percent of intensive-care beds are filled with covid-19 patients, and Colorado has reactivated its crisis standards of care.



I've likened the vaccine to a good raincoat. It will keep you dry in a drizzle, but in a downpour, you could get wet unless you also have an umbrella. The higher the rate of infection in your community, the more likely you will encounter covid-19. Just as you would consult the weather forecast with your exact location, you should also look to the CDC's website for updated information on local infection levels. If your county's rates are low, you could attend a large gathering with few precautions; if they are high, you might not go without more layers of protection, such as masking and testing.

3. Medical risk of household. If everyone in your household is vaccinated and generally healthy, the risk is relatively low. But living with immunocompromised family members or unvaccinated young children is a very different situation. Because the vaccines provide such excellent protection against severe disease, many who are inoculated and in good health can reasonably decide that they don't want to limit social interactions. Others will make more conservative choices to protect medically frail loved ones.

4. Setting of the gathering. Outdoor settings remain by far the safest option. Indoor masking is an effective protective measure, too. If it's unclear from the invitation, I would ask about the proportion of indoor vs. outdoor activities. This is particularly important when food and drink are involved. An event that supposedly requires masks but also has people eating and drinking indoors is not as safe as one where food and drink are served outdoors only.

Ontario COVID-19 Regional Risk Tool:

Risk Legend

Minimal risk – low to absent community transmission

Controlled risk – some sporadic community activity – controlled occasional minor outbreaks

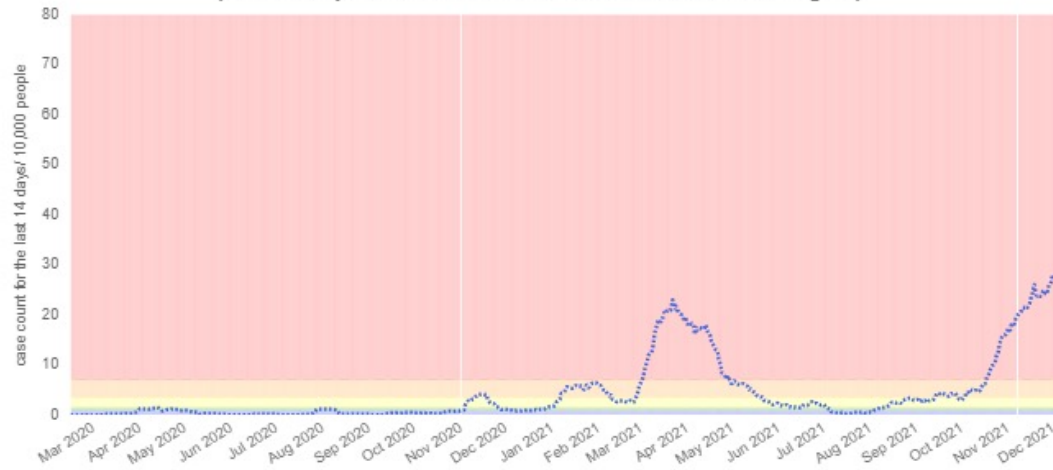
Some community risk – regular sporadic activity – controlled occasional larger outbreaks

Wider community risk – regular activity – periodic outbreaks

High risk – uncontrolled community transmission &/or outbreaks



COVID-19 infection rates in different regions of Ontario
(Click on a public health unit to show the data for that region)



Regional Risk Table At A Glance

Rank	Region Public Health Unit (PHU)	Regional Infection Risk Level*	ON Framework Category**
1	Algonquin Public Health Unit	High risk	CONTROL
2	Sudbury & District Health Unit	High risk	CONTROL
3	Timiskaming Health Unit	High risk	CONTROL
4	Windsor-Essex County Health Unit	High risk	CONTROL
5	Kingston, Frontenac and Lennox & Addington Public Health	High risk	CONTROL
6	Simcoe Muskoka District Health Unit	High risk	CONTROL
7	Chatham-Kent Health Unit	High risk	CONTROL
8	Haldimand-Norfolk Health Unit	High risk	CONTROL
9	Southwestern Public Health	High risk	CONTROL
10	West County Health Unit	High risk	CONTROL
11	Hastings and Prince Edward Counties Health Unit	High risk	CONTROL
12	Thunder Bay District Health Unit	High risk	CONTROL
13	Lambton Public Health	High risk	CONTROL
14	Huron Perth District Health Unit	High risk	RESTRICT
15	Eastern Ontario Health Unit	High risk	RESTRICT
16	Region of Waterloo, Public Health	Wider community risk	RESTRICT
17	Niagara Region Public Health Department	Wider community risk	RESTRICT
18	Halton Region Health Department	Wider community risk	RESTRICT
19	Middlesex/London Health Unit	Wider community risk	CONTROL
20	Wellington-Dufferin-Guelph Public Health	Wider community risk	RESTRICT
21	Renfrew County and District Health Unit	Wider community risk	RESTRICT
22	Ottawa Public Health	Wider community risk	RESTRICT
23	Hamilton Public Health Services	Wider community risk	RESTRICT
24	York Region Public Health Services	Wider community risk	RESTRICT
25	Dufferin Region Health Department	Wider community risk	PROTECT
26	Grey Bruce Health Unit	Wider community risk	PROTECT
27	Toronto Public Health	Wider community risk	RESTRICT
28	Peterborough Public Health	Wider community risk	PROTECT
29	Peel Public Health	Wider community risk	PROTECT
30	Leeds, Grenville and Lanark District Health Unit	Wider community risk	PROTECT
31	Halliburton, Kawartha, Pine Ridge District Health Unit	Some community risk	PROTECT
32	Northwestern Health Unit	Some community risk	PROTECT
33	North Bay, Parry Sound District Health Unit	Some community risk	PROTECT
34	Porcupine Health Unit	Some community risk	PREVENT


* These tools translate Reported case data published by [Public Health Ontario](#) as a 14 day rolling count (divided by population to create a rate per 10,000 people) to understand and compare Ontario regional SARS-CoV-2 transmission risk. Recent numbers can be delayed and are less reliable, particularly over weekends, so risk may be underestimated.

** The Ontario Framework Category is an estimation of the official provincial colour-coding as explained in [COVID-19 Response Framework: Mapping Ontario Safe and Smart](#) (see slide 8) based only on the weekly incidence rate per 100,000, but absent the other factors considered locally (e.g. % positivity of daily tests, the reproductive number (Rt) – the number of new cases traced from each known case), the number and status of outbreaks, trend in cases without an age connection, hospital and ICU capacities, and PHU capacity for contact tracing). We are also not able to assign "Grey – Lockdown" since this category is based on a judgement call by local authorities. Therefore the ON categories assigned in this table may not necessarily align with the official version but are provided for translation and reconciliation with Prevention Tips below.


Sudbury & District
Health Unit

<https://www.ohcow.on.ca/covid-19/regional-risk-tool-tips/#risktable>

International good practices

 **OzSAGE** [WHO WE ARE & AIMS](#) [OUR PATIONS](#) [SUMMARY](#) [OUR PRINCIPLES](#) [MEDIA RELEASES](#) [NEWS](#) [CONTACT US](#)

Who We Are



OzSAGE is a multi-disciplinary network of Australian experts from a broad range of sectors relevant to the wellbeing of the Australian population during and after the COVID-19 pandemic.

OzSAGE formed in response to the current Australian epidemic, meeting for the first time on August 16, 2021. In the midst of many competing expert opinions, OzSAGE offers well-researched and robustly debated independent expert advice. We do this to inform the common national goal of achieving an exit strategy from this pandemic with the best possible health, social and economic outcomes. Members of OzSAGE are not paid and provide their time without remuneration and without a political agenda.

Members have experience, expertise and frontline roles in public health, infectious diseases, virology, immunology, epidemiology, virology, clinical disciplines (intensive care, emergency medicine, infectious diseases, paediatrics, paediatric intensive care, occupational medicine, mental health, allied health, and multiple other subspecialties), Aboriginal health, engineering, built environment, occupational hygiene, laboratory science, basic science, research and development, behavioural and social science, multicultural engagement, communications, law, computer and data science, public policy and economics.


[FULL MEMBER LIST](#)

Our Aims

- be an additional resource for federal and state governments, opposition, business, community and non-government agencies in Australia.
- formulate independent advice on public health, health systems and other policy matters relevant to COVID-19 control, with diverse and multidisciplinary perspectives.
- provide decision support, underpinned by the best scientific evidence, modelling and other research, to inform the choice between policy alternatives.
- provide rapid advice during urgent public health events.
- assist with the safe opening up of Australia.

<https://ozsage.org/who-we-are/>

Occupational Health Clinics for Ontario Workers Inc.
Prevention Through Intervention



World Health Network

[Home](#) [Summit](#) [Projects](#) [Resources](#) [CAG](#) [Contact](#)

HOW TO HAVE A SAFER HOLIDAY

Download and use this checklist to help you plan a safe holiday for you and your family.

Spanish and French versions coming soon.

[English](#) [Deutsch](#)

<https://www.worldhealthnetwork.global/holiday-flyer/>

HOW TO HAVE A SAFER HOLIDAY

HOW TO HAVE A SAFER HOLIDAY CHECKLIST

- 1 Protect:**
Booster / Vaccination.
- 2 Plan:**
Small groups, few gatherings, big rooms.
- 3 Clean Air:**
COVID-19 is airborne. Choose big rooms + ventilation, filtration, and masks
- 4 Contacts:**
Strongly reduce contacts for 10 days before the holidays.
- 5 Test:**
Test yourself 10 days before the holidays, and have extra tests on hand, as guest or host.
- 6 Communicate:**
Establish and agree on the rules, talk with everyone about individual concerns.
- 7 Symptoms:**
Don't attend in person if you experience symptoms, even if your test is negative.
- 8 Test again:**
Test twice for the gathering. 6-12 hours ahead and right before you go in. Inform others about the result.

Note: These are recommendations. Make sure you are aware of the local policies as well.



HOW TO HAVE A SAFER HOLIDAY COUNTDOWN

- Dec Now-10**

Get your booster or get vaccinated

Reduced Risk*

 - Influenza 2x
 - Transmission 2x
 - Severe case 10x
 - Long Covid 2x

* Source: CDC
- Dec 14**

Strongly limit your contacts ahead of the holiday gathering

 - Wear proper masks (FFP2, KN95) for all social gatherings.
 - Time to take a test (more tests = more confidence)
 - If your test is positive you may still have enough time to recover for the holiday gathering.
 - Contacts: In particular, close contacts, crowded and indoor contacts must be avoided.
 - Note: If you test positive, promptly isolate, and notify contacts.

Reduced Risk:

 - Masked: 2-3x
- Dec 18**

Check for symptoms

 - If you are not feeling well, inform friends and family that you will not be able to attend or host the gathering, even if you test negative.
- Dec 22-23**

Get tested

 - Test on 22nd and 23rd and let people know about the results. The safer everyone feels, the more fun the gathering.
 - Make a sign reminding guests to keep their masks on in the bathroom.

Reduced Risk:

 - Rapid tests are very useful in identifying infectious people. Risk reduction: 2-4x
 - Combined with masks & ventilation/filtration, a negative test provides a great basis for a safer holiday

After the Event:

 - Protect your community!
 - Reduce social gatherings
 - Monitor for symptoms
 - Test twice (three times a week)
- Dec 11**

Prepare for Cleaner Air: Ventilation & Filters

 - Maximize fresh air intake with ventilation (1st) or windows (2nd).
 - Use CO2 sensor to monitor air quality (keep it under 700 ppm).
 - Opening windows in a room: How often and for how long? See appendix and CDC ventilation tool: <https://open.cdc.gov/datasets/air2019-room-checklist-getting-ready/>
 - Get air filters if ventilation or window opening is limited (True HEPA Commercial units or DIY). Don't forget the bathrooms!

Reduced Risk:

 - 3-5x with good ventilation or filtration



APPENDIX: Clean Air: Sars-Cov 2/COVID-19 is airborne: How you can decrease your risk of infection from indoor air.

- 1. MASKS:**
Well fitted, high-quality masks help prevent infection from inhaling aerosols containing this virus. FFP2 such as N95, KN95, or KF94 (projectn95.org), offer the best protection, compared to cloth masks which do not filter or fit as well, or medical/surgical masks which filter well but fit so loosely that they do not offer enough protection, though their fit can be improved with the addition of a mask brace (thebracer.com). Reusable elastomeric respirators with replaceable filters offer a more sustainable solution for frequent, lengthy use (evomask.com).
- 2. VENTILATION AND FILTRATION:**
Clearing the virus out of the air is also essential to reducing the risk of spreading infection when you gather indoors with others.
- Ventilation is exchanging indoor air with outdoor air.**
- A complete air exchange 5-6 times every hour, is best, but this is not always possible in homes compared to commercial buildings.
 - Ventilation can still be improved by assigning a "COVID Guardian" to open windows for ten minutes every hour.
 - Placing an exhaust fan in the window or keeping kitchen and bathroom exhaust fans running will also help.
 - Using an inexpensive CO2 monitor (Aranet5, Reichelt) to keep track of how much exhaled breath is in the indoor air can also alert you to when the windows need to be opened. The level should stay below 700-800 without HEPA filtration in use, or below 900-1000 with HEPA.
- Filtration is cleaning the indoor air using Portable Air Purifiers with true HEPA filters.**
- It is a good idea to use a portable HEPA filter device to remove the virus from indoor air even with good ventilation, but it is essential to use it when ventilation is limited.
 - At this time, only true HEPA (High Efficiency Particulate Air Filtration) is proven to be safe and effective. Non-HEPA electronic air cleaners, such as plasma generators, electrostatic precipitators, ozone emitters, ionizers, needle-point bipolar ionizers, and photoelectrochemical oxidation are not only unreliable, but may also be dangerous, as they emit ultrafine, easily inhaled, harmful particles associated with cancer, diabetes, and heart disease.
 - HEPA devices are available commercially. The manufacturer's information on the commercial units will tell you whether it is able to filter the room (Wired Guide, Stiftung Warentest).
 - You can readily and cheaply make a DIY unit. One unit should be sufficient for the average living room. Approximate costs US \$100, Europe \$300. Here's a comprehensive, easy to follow resource: <https://cleanaircrew.org/box-fan-filters/>
- 3. MORE! Here is a comprehensive set of resources on Ventilation, Filtration, and masks.**
<https://www.worldhealthnetwork.global/resources/#ventilation>

Disclaimer: The authors have no financial interests in any products and services for which links are provided. These are intended as a convenience and for informational purposes only, and do not indicate commercial endorsement.

APPENDIX: Contact Reduction and Essential Contacts.

- 4. WORK:**
About 10-days before the gathering: Reduce your contacts to essentials as far as tolerable. Go into home office if at all possible. Keep them short and always wear a high quality mask.
- 5. SCHOOL:**
If at all possible transfer to home-schooling by the 17th of December. Given the constellation in school (crowded, indoors, talking...) and the fact that most kids are not vaccinated yet, the school bears a very high potential for virus transmission. We strongly advise to assure your kids are well trained in wearing a mask.
- Disclaimer: The authors have no financial interests in any products and services for which links are provided. These are intended as a convenience and for informational purposes only, and do not indicate commercial endorsement.

APPENDIX: Tests

- 6. PCR:**
PCR Test, when done daily, can reduce the risk of virus transmission up to 90%. If you have easy access to a PCR perform a PCR test within three days before the gathering.
- 7. Rapid Test:**
Price, accessibility and delay to results render PCR often impractical. In this case take a rapid test at a test-centre or a Lateral Flow Tests (> LFT) each of the two days ahead of the gathering.
- ALWAYS:**
Take two rapid tests at the day of the gathering. One just before you enter the gathering and one 6-12h before. Choose high quality. When properly taken these can reduce the risk up to 75%.
- Disclaimer: The authors have no financial interests in any products and services for which links are provided. These are intended as a convenience and for informational purposes only, and do not indicate commercial endorsement.

Download PDF

<https://www.worldhealthnetwork.global/holiday-flyer/#English>

APPENDIX: Clean Air: Sars-Cov 2/COVID-19 is airborne: How you can decrease your risk of infection from indoor air.

1. MASKS:

Well fitted, high-quality masks help prevent infection from inhaling aerosols containing this virus.

FFP2 such as N95, KN95, or KF94 (projectn95.org), offer the best protection, compared to cloth masks which do not filter or fit as well, or medical/surgical masks which filter well but fit so loosely that they do not offer enough protection, though their fit can be improved with the addition of a mask bracer (fixthemask.com). Reusable elastomeric respirators with replaceable filters offer a more sustainable solution for frequent, lengthy use (envomask.com).

2. VENTILATION AND FILTRATION:

Clearing the virus out of the air is also essential to reducing the risk of spreading infection when you gather indoors with others.

Ventilation is exchanging indoor air with outdoor air.

- A complete air exchange 5–6 times every hour, is best, but this is not always possible in homes compared to commercial buildings.
- Ventilation can still be improved by assigning a “COVID Guardian” to open windows for ten minutes every hour.
- Placing an exhaust fan in the window or keeping kitchen and bathroom exhaust fans running will also help.
- Using an inexpensive CO2 monitor ([Aranet4](#), [Reichelt](#)) to keep track of how much exhaled breath is in the indoor air can also alert you to when the windows need to be opened. The level should stay below 700–800 without HEPA filtration in use, or below 900–1000 with HEPA.

Filtration is cleaning the indoor air using Portable Air Purifiers with true HEPA Filters.

- It is a good idea to use a portable HEPA filter device to remove the virus from indoor air even with good ventilation, but it is essential to use it when ventilation is limited.
 - At this time, only true HEPA (High Efficiency Particulate Air Filtration) is proven to be safe and effective. Non-HEPA electronic air cleaners, such as plasma generators, electrostatic precipitators, ozone emitters, ionizers, needle-point bipolar ionizers, and photoelectrochemical oxidation are not only unreliable, but may also be dangerous, as they emit ultrafine, easily inhaled, harmful particles associated with cancer, diabetes, and heart disease.
 - HEPA devices are available commercially. The manufacturer’s information on the commercial units will tell you whether it is able to filter the room ([Wired Guide](#), [Stiftung Warentest](#)).
 - You can readily and cheaply make a DIY unit. One unit should be sufficient for the average living room. Approximate costs US \$100, Europe \$300.
- Here’s a comprehensive, easy to follow resource: <https://cleanaircrew.org/box-fan-filters/>

3. MORE! Here is a comprehensive set of resources on Ventilation, Filtration, and masks. <https://www.worldhealthnetwork.global/resources/#ventilation>

Disclaimer: The authors have no financial interests in any products and services for which links are provided. These are intended as a convenience and for informational purposes only, and do not indicate commercial endorsement.

2. VENTILATION AND FILTRATION:

Clearing the virus out of the air is also essential to reducing the risk of spreading infection when you gather indoors with others.

Ventilation is exchanging indoor air with outdoor air.

- A complete air exchange 5–6 times every hour, is best, but this is not always possible in homes compared to commercial buildings.
- Ventilation can still be improved by assigning a “COVID Guardian” to open windows for ten minutes every hour.
- Placing an exhaust fan in the window or keeping kitchen and bathroom exhaust fans running will also help.
- Using an inexpensive CO2 monitor ([Aranet4](#), [Reichelt](#)) to keep track of how much exhaled breath is in the indoor air can also alert you to when the windows need to be opened. The level should stay below 700–800 without HEPA filtration in use, or below 900–1000 with HEPA.

Simple Solutions for a “COVID-Safe” season – Upgrade you mask to a respirator!

YouTube ^{CA} Search

PROTECT OUR PROVINCE

Dr. Jennifer McDonald

COVID is AIRBORNE, so Upgrade Your Mask
FILTER + FIT + FUNCTION

FILTER Effectiveness

Mask Type	Filter Effectiveness
3-Ply, Tightly Woven, Cloth Mask	Low
Surgical Mask 95PFE	Low-Medium
Ear-loop Respirators (95PFE, KN95, KF94)	Medium
N95, FFP2 Respirators	High
N99, FFP3 Respirators	Very High
Elastomeric P100 Respirators	Very High

FIT Effectiveness

Mask Type	Fit Effectiveness
Thin, tight-fitting cotton mask or nylon stocking over a surgical mask	Low
Ear-saver or hairclip to pull ear loops behind your head	Low-Medium
Ear-loop Respirator (95PFE, KN95, KF94)	Medium
Mask-fitter/brace	High
Head-band Respirator (N95, N99, FFP3)	High
Fit-Tested Respirator	Very High

FUNCTION: Make sure your mask is breathable and comfortable.

#FireBreakAB #popAB #COVID19AB

Dr. McDonald: Fit, Filter and Function of masks