2023

Panic or Panacea?

Masking and indoor air quality control to reduce COVID absenteeism

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Executive Summary

COVID-19 has changed the landscape of employment, causing significant negative socioeconomic impacts for individuals and companies alike. With the "back to normal" approach taken by many governments and employers, return-to-office (RTO) policies have now become the most popular solution. High levels of absences and decreased workforce productivity and efficacy are problems inherent to RTO policies in the time of COVID. Increased absences lead to skeleton crews, teams who can only manage the bare minimum. If an employee is unlucky enough to end up with long COVID, they will be much less effective than their counterparts, suffering from symptoms like fatigue, persistent cough and shortness of breath, and brain fog (Statistics Canada, 2022a). While RTO policies have little to no basis in reality (Zitron, 2023), employers are determined to see them through. Thus, an alternative solution must be implemented: masking and clean air policies, which will drastically reduce absenteeism, increase employee safety and productivity, and save money.

Introduction

The rise of the COVID-19 pandemic has changed lives in a wide variety of ways. 2020 saw the rise of "Work from Home" jobs in industries that could support this change to flatten the curve. Front line workers in "essential" fields were required to mask and get vaccinated to stop the spread. In May of 2023, the WHO declared the global emergency to be over, leading governments to determine that COVID-19 is over. Various studies since the beginning of the pandemic suggest that this is not the case. With the debilitating effects of not only long COVID but asymptomatic multisystemic COVID-related damage creating an increasingly disabled population, a masking policy at in-person workplaces is crucial.

The Impact of Long Covid

According to a Statistics Canada survey in 2022, long-term symptoms affect 14.8% of Canadian adults who previously tested positive for COVID-19 or suspected an infection (Statistics Canada, 2022a). This means that around 1.4 million Canadian adults or 4.6% of the Canadian population aged 18 years and older are dealing with this condition.

Of these long-term symptoms, fatigue was the most reported (72.1%), with cough (39.3%) second, shortness of breath (38.5%) third, and brain fog (32.9%) fourth (Statistics Canada, 2022a).

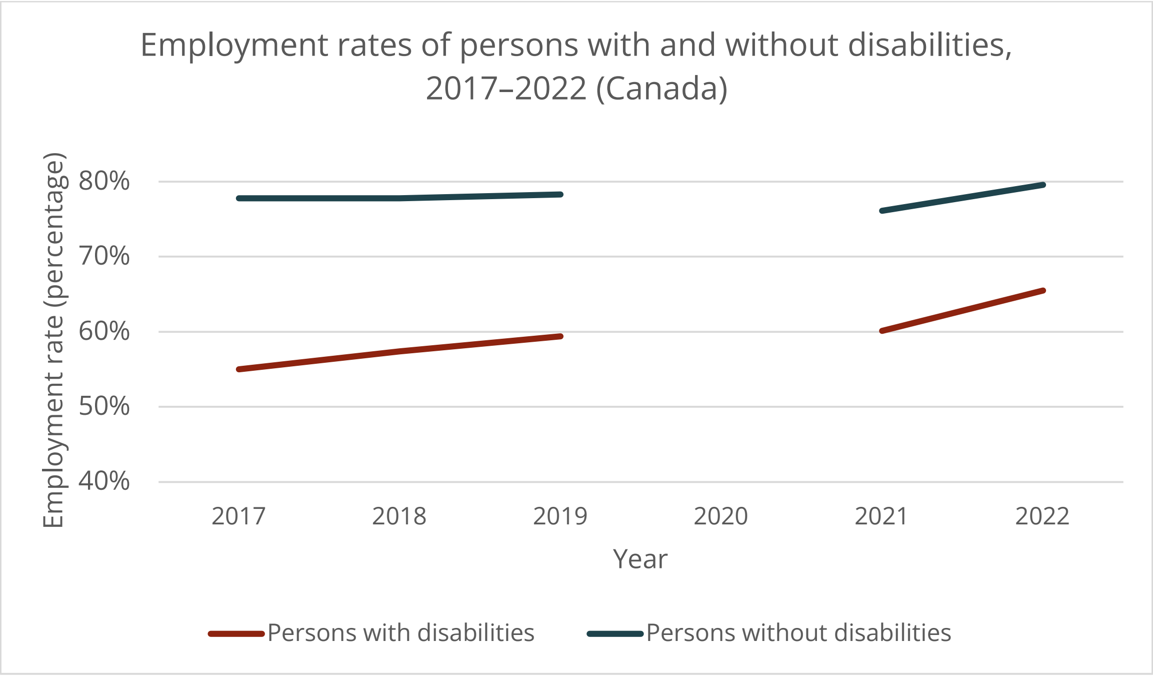
Of Canadians who tested positive or suspected that they had COVID-19, just over one third (34.2%) described their symptoms as mild or having little to no impact on daily life (Statistics Canada, 2022b). 43.9% reported moderate symptoms, and 16.7% stated that their symptoms were severe (Statistics Canada, 2022b). The remaining 5.2% stated that they had no symptoms (Statistics Canada, 2022b).

Slightly under half (47.3) of Canadians who reported having long COVID had symptoms for one year or longer (Statistics Canada, 2022b). 21.3% of this group stated that symptoms either often or always limited daily activities (Statistics Canada, 2022b).

About three in four working Canadian adults and students with long COVID (74.1%) missed an average of 20 days of work or school because of symptoms (Statistics Canada, 2022b).

Persons With Disabilities in the Workplace

As seen in the table below, the employment rate of persons with disabilities has increased significantly since 2019. While persons without disabilities saw their employment rate remain the same, decreasing between 2019 and 2021 and then increasing in 2022 to above the average from 2019 to 2019, persons with disabilities saw their rate increase from the previous baseline established in 2021 to unprecedented heights in 2022. This increase could be attributed to a range of factors, from an increase in the number of persons with disabilities to an increase in the number of persons with disabilities who need to work due to the cost-of-living crisis. Regardless of the reason, this vulnerable population is more present than ever in the workforce, and their safety must be considered when considering a return-to-office mandate.



(Government Of Canada, 2023)

On Distancing and Vaccination

Following the Swiss Cheese Model is the most effective way to prevent transmission of airborne pathogens (*Peterborough Public Health*, n.d.). While distancing and vaccination are effective, the most effective method of prevention is a combination approach, layering as precautions as possible. While avoiding crowded spaces and social distancing may be difficult in small or populated office environments, wearing a respirator is possible in every environment and situation, and is especially effective when combined with air filtration, which reduces the amount of rebreathed air (Eykelbosh, 2021).

The Importance of Masking

Current masking guidance for community settings does not apply to workplaces, per the Government of Canada guidance on COVID-19 mask use: "This advice is intended for the general public and is not intended for occupational health purposes, including health care settings" (Public Health Agency of Canada, 2020).

As Canadians have long since abandoned cloth masks in favour of blue medical masks, the efficacy of the latter requires examination. According to (Health Canada, 2020), "Unlike [filtering facepiece respirators (FFRs)], medical masks are looser in fit. As a result, they do not provide the same level of particulate filtration." It is inappropriate to consider the use of blue medical masks, due to the primary concern being airborne transmission.

FFRs do not function like a coffee filter, but through a process like static electricity; just as a balloon rubbed on hair will stick to your head, so too do small particles become stuck to a respirator (Allain, n.d.). Because viral particles are so small, a filter with an electrical charge is much more effective at capturing them than a filter without a charge.

The Importance of Indoor Air Quality

While there are many ways of enhancing air quality, such as far-UV and upgrading HVAC systems, these are costly undertakings in terms of both time and money. The best solution would ideally be cheap, easy to implement, and scalable. Air filtration has two important components: measuring the quality of the air to determine filtration needs, and the filtering mechanism itself.

For measuring air quality, there are two metrics: carbon dioxide parts per million (CO^2 ppm) and $PM_{2.5}$, with CO^2 ppm being a measure of how stale the air is as a result of exhalations not being exchanged rather than merely circulated, and PM2.5 being a measure of small particulate matter present in the air, usually as a result of pollution (Health Canada, 2012). Pollution is less of an issue than CO^2 in this case, so a small, cheap monitor such as the Aranet4 HOME, which issues warnings when CO^2 levels get too high, is a solid option.

HEPA filters are a key aspect of achieving high indoor air quality (IAQ) (Public Health Agency of Canada, 2021), though any filter rated MERV-13 or above may be sufficient for smaller spaces (Public Health Ontario, 2022). Though there is an abundance of air filtration systems on the market, a cost-effective and simple implementation is a Corsi-Rosenthal box, which consists of a box fan acting as the taped-on roof to four walls of taped-together HEPA (or ERV-rated) filters. Corsi-Rosenthal boxes are more effective than some of the more expensive filters available (Grundig et al., 2021), making them a sufficient option when money is tight.

The Cost of Health

When purchased from a reputable supplier of high-quality industrial and commercial equipment and supplies, a box of 440 individually wrapped N95 respirators can cost between $525 and $905 (*3M™ Aura™ Health Care Particulate Respirator and Surgical Mask,1870+, N95, 440 per Case*, n.d.; *3M™ Aura™ Particulate Respirator 9205+, N95, 440/Case*, n.d.), for a cost of $1.19 to $2.06 per day per employee.

Air filtration units intended for use with HEPA filters (sometimes in conjunction with MERV-rated filters) can cost anywhere from $213 to $5450 (*Newest Products*, n.d.). The filters themselves, which should be replaced every three to six months, depending on the size of the filtration unit, the space being filtered, and the amount of time the filters are being used, can cost between $85 and $363 (*Newest Products*, n.d.).

At a cost of USD$249 (CAD$345) (*Aranet4 HOME - Aranet*, n.d.), the Aranet4 HOME is cheap, readily available, and easy to install. Intended as a portable unit, the CO^2 monitor can be mounted or placed on any surface, making it effective for use as part of an array in a larger building, such as on individual desks, or mounted on a wall in a small office. The battery lasts approximately one year on the low end or seven years on the high end (Aranet, 2021) and can be replaced, though this varies with temperature and cannot be used to estimate the lifetime of the device itself.

These numbers mean that one month of costs associated with one employee, assuming three months of use from a HEPA filter and one year of use from a filtration unit and CO^2 monitor, can range from $112 to $666, as seen here:

	Low	High	Median
Respirators	36	62	49
Filtration unit	18	454	236
HEPA filters	29	121	75
CO^2 monitor	29	29	29
TOTAL	112	666	389

Below, these costs are amortized over one year of employment, which is still likely an underestimate as the filtration unit and CO^2 monitor last for longer, though there is not enough certainty to extrapolate beyond this point.

	Low	High	Median
Respirators	434	752	593
Filtration unit	340	5450	2832
HEPA filters	852	1452	1152
CO^2 monitor	345	345	345
TOTAL	1971	7999	4922

Factoring in the cost of minimum wage labour ($16.55) for a full 40-hour week, the monthly cost of one employee is approximately $2 877 per month (using an equation based on the payroll standard of days in the year rather than weeks or months = 16.55 * 40 / 7 * 365 / 12). The cost for a year uses the same equation as the last total, excluding one step (16.55 * 40 / 7 * 365), meaning a total of approximately $34 519.

Based on the reasonable assumption that an employee creates more value than their total remuneration (Tucker et al., 1978), a day of labour lost due to an absent employee costs a company at least as much as that employee's wages.

The table below compares the estimated costs associated with the proposed safety measures, and the wages of one employee.

	Monthly	Yearly
Employee	2 877	34 519
High	112	1971
Low	666	7999
Median	389	4922

The following table shows the potential costs contextualized as a percentage of each employee's wages for the month and year:

	Monthly	Yearly
Employee	2 877	34 519
High	3.89 %	5.71 %
Low	23.15 %	23.17 %
Median	13.52 %	14.26 %

What Does It All Mean?

The above data and calculations have demonstrated that with the COVID-19 pandemic still raging on, distancing and vaccination are valuable tools best used in conjunction with masking and indoor air quality control. These measures protect assets in the form of both labour and cash flow. Reducing absenteeism is critical in the current economy, and limits the losses incurred by missing labour hours. With a return-to-office policy that incorporates the use of respirators, CO^2 monitors, and HEPA filters, your employees and your company can maintain synergy and grow in tandem, embracing a new normal of prosperity in health and wealth.

Final Recommendations

The implementation of an in-office mask and clean air quality directive is a viable and necessary business strategy. Specifically, a masking policy that requires respirators of N95 quality or higher is the recommended course of action. With the addition of CO^2 monitors and HEPA filters, this will result in better employee safety, fewer sick days taken, higher productivity and employee loyalty, and will contribute to the overall betterment of the workplace.

Glossary

CO^2: Carbon dioxide, a gas which is the primary component of all exhalations.

Corsi-Rosenthal box: A device consisting of four HEPA filters taped together to form a square, which are then taped to a box fan; this forces the fan to blow indoor air through the filters, resulting in a cheap, easily implemented filtration solution.

FFR: Filtering facepiece respirator; a high-quality piece of personal protective equipment which far outstrips the performance of a standard medical mask via a process akin to electricity.

HEPA: High-efficiency particulate absorbing filter; the most effective type of air filter, removing at least 99% of particles in the air.

IAQ: Indoor air quality; the degree of cleanliness of the air in areas such as offices.

Long COVID: A condition in which a person experiences long-term effects after the acute phase of a COVID-19 infection, lasting longer than 3 months.

MERV: Maximum efficiency reporting value; a type of filter that, while less effective than HEPA, can be used in situations where cost is a concern.

N95: A type of filtering facepiece respirator which protects the user from at least 95% of particles in the air.

$PM_{2.5}$: A measure of particulate matter present in the air; 2.5 is the size of the particles in micrometres.

ppm: Parts per million; used to measure the amount of carbon dioxide.

Swiss Cheese Model: A model used to describe the layers of protection which must be taken in any risky situation.

References

3M Aura Particulate Respirator 9205+ N95. (n.d.). eGrimesDirect. Retrieved November 12, 2023, from https://www.egrimesdirect.com/products/3m-aura-particulate-respirator-9205-n95

3M™ Aura™ Health Care Particulate Respirator and Surgical Mask,1870+, N95, 440 per case (CA). (n.d.). Retrieved November 12, 2023, from https://www.3mcanada.ca/3M/en_CA/p/d/v101271018/

3M™ Aura™ Particulate Respirator 9205+, N95, 440/Case (CA). (n.d.). Retrieved November 12, 2023, from https://www.3mcanada.ca/3M/en_CA/p/d/v101271017/

Allain, R. (n.d.). The Physics of the N95 Face Mask. *Wired*. Retrieved November 12, 2023, from https://www.wired.com/story/the-physics-of-the-n95-face-mask/

Aranet. (2021). *Aranet4*. https://cdn.bfldr.com/FS48XT6B/at/k9b9wjnv8f455crkp7846j/Aranet4_datasheet_v25_WEB.pdf

Aranet4 HOME - Aranet. (n.d.). Retrieved November 12, 2023, from https://shop.aranet.com/canada/product/aranet4-home

Brosseau, L. M., MacIntyre, C. R., Ulrich, A., & Osterholm, M. T. (2023, February 23). *COMMENTARY: Wear a respirator, not a cloth or surgical mask, to protect against respiratory viruses | CIDRAP*. https://www.cidrap.umn.edu/covid-19/commentary-wear-respirator-not-cloth-or-surgical-mask-protect-against-respiratory-viruses

Centers for Disease Control and Prevention. (2021, September 24). *Studies Show More COVID-19 Cases in Areas Without School Masking Policies | CDC Online Newsroom | CDC*. CDC Newsroom. https://web.archive.org/web/20210924175246/https:/www.cdc.gov/media/releases/2021/p0924-school-masking.html

Cowger, T. L., Murray, E. J., Clarke, J., Bassett, M. T., Ojikutu, B. O., Sánchez, S. M., Linos, N., & Hall, K. T. (2022). Lifting Universal Masking in Schools—Covid-19 Incidence among Students and Staff. *New England Journal of Medicine*, *387*(21), 1935–1946. https://doi.org/10.1056/NEJMoa2211029

Eykelbosh, A. (2021). *Can CO2 sensors be used to assess COVID-19 transmission risk?* National Collaborating Centre for Environmental Health. https://ncceh.ca/resources/evidence-briefs/can-co2-sensors-be-used-assess-covid-19-transmission-risk

Government Of Canada, S. C. (2023, August 30). *Employment rates of persons with and without disabilities, Canada, 2017-2022*. https://www150.statcan.gc.ca/n1/daily-quotidien/230830/g-a001-eng.htm

Grundig, T., Köksal, N., & Singh, A. (2021, February 6). *Is an $800 purifier best to clean your home's air? Marketplace tested 5 top brands and their claims | CBC News*. CBC. https://www.cbc.ca/news/business/portable-air-purifier-tests-marketplace-1.5900782

Health Canada. (2012, August 7). *Guidance for fine particulate matter (PM2.5) in residential indoor air*. https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidance-fine-particulate-matter-pm2-5-residential-indoor-air.html

Health Canada. (2020, October 20). *COVID-19 medical masks and respirators: For health professionals*. https://www.canada.ca/en/health-canada/services/drugs-health-products/covid19-industry/medical-devices/personal-protective-equipment/medical-masks-respirators/health-professionals.html

john. (2016, March 15). *The Two Types of White Paper Executive Summary*. CopyEngineer: B2B Copywriter - Specializing in Technology, Software and Aerospace. https://www.copyengineer.com/the-two-types-of-white-paper-executive-summary/

Kuehn, B. M. (2022). Masks Cut Secondary SARS-CoV-2 Infections by Half. *JAMA*, *327*(8), 711. https://doi.org/10.1001/jama.2022.1287

MacIntyre, C. R., & Chughtai, A. A. (2020). A rapid systematic review of the efficacy of face masks and respirators against coronaviruses and other respiratory transmissible viruses for the community, healthcare workers and sick patients. *International Journal of Nursing Studies*, *108*, 103629. https://doi.org/10.1016/j.ijnurstu.2020.103629

Minimum wage | Your guide to the Employment Standards Act | ontario.ca. (n.d.). Retrieved November 12, 2023, from http://www.ontario.ca/document/your-guide-employment-standards-act-0/minimum-wage

Newest Products. (n.d.). Air Filtration. Retrieved November 12, 2023, from https://airfiltration.ca/collections/newest-products

Ontario Design System. (n.d.). Retrieved November 12, 2023, from https://designsystem.ontario.ca/

Peterborough Public Health. (n.d.). Retrieved November 12, 2023, from https://www.peterboroughpublichealth.ca/your-health/home-health-and-safety/carbon-dioxide-co2/

Public Health Agency of Canada. (2020, October 13). *COVID-19 mask use: Advice for community settings*. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/about-non-medical-masks-face-coverings.html

Public Health Agency of Canada. (2021, April 12). *At home: Using ventilation and filtration to reduce the risk of aerosol transmission of COVID-19*. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/guidance-documents/guide-home-ventilation-covid-19-pandemic.html

Public Health Ontario. (2022). *Use of Portable Air Cleaners and Transmission of COVID-19*. 8.

Qian, Y., Willeke, K., Grinshpun, S. A., Donnelly, J., & Coffey, C. C. (1998). Performance of N95 Respirators: Filtration Efficiency for Airborne Microbial and Inert Particles. *American Industrial Hygiene Association Journal*, *59*(2), 128–132. https://doi.org/10.1080/15428119891010389

Rabin, R. C. (2022, November 10). Masks Cut Covid Spread in Schools, Study Finds. *The New York Times*. https://www.nytimes.com/2022/11/10/health/covid-schools-masks.html

SPI Health and Safety | 3M Aura 1870+ N95 Health Care Particulate Respirator and Surgical Mask, 440 per case 7100245716. (n.d.). SPI Health and Safety. Retrieved November 12, 2023, from https://www.spi.com/3m-aura-1870-n95-health-care-particulate-respirator-and-surgical-mask-440-per-case-rmu142

Statistics Canada. (2022a, October 17). *The Daily—Long-term symptoms in Canadian adults who tested positive for COVID-19 or suspected an infection, January 2020 to August 2022*. https://www150.statcan.gc.ca/n1/daily-quotidien/221017/dq221017b-eng.htm

Statistics Canada. (2022b, November 23). *The health outcomes of Canadians who have contracted COVID-19*. https://www.statcan.gc.ca/o1/en/plus/2370-health-outcomes-canadians-who-have-contracted-covid-19

The Associated Press. (2023, May 5). *WHO downgrades COVID pandemic, says it's no longer a global emergency | CBC News*. CBC. https://www.cbc.ca/news/health/who-pandemic-not-emergency-1.6833321

Tucker, R. C., Marx, K., & Engels, F. (Eds.). (1978). *The Marx-Engels reader* (2d ed). Norton.

Zitron, E. (2023, November 7). *The fight over return-to-office is getting dirty*. Business Insider. https://www.businessinsider.com/return-to-office-mandates-employees-managers-fight-messy-remote-work-2023-11

Appendix

A heavy-duty N95 respirator, representing a more durable option.

An KN95 respirator, representing a lightweight, cost-effective option.