Face Mask Reuse Behaviours in Canadians During the COVID-19 Pandemic

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Abstract

Background: Mask-wearing in public spaces has become ubiquitous for most people in developed countries due to the ongoing pandemic. One key aspect of the protectiveness of masks is how many times it is used before disposing of (in the case of surgical or disposable masks) or washed (a cloth or reusable mask). Assessing mask reuse levels in key demographics can help us identify which groups are reusing masks more, and targeted educational campaigns can be accomplished which would hopefully lead to reduced mask reuse.

Methods: The online self-administered survey was created using Survey Monkey and distributed via Reddit, Youtube, the front desk of a local community center, and to associates of personal contacts. The survey consists of 13 questions which consisted of demographic, behavioural and open ended questions. Chi-square statistical tests were used to analyze the data.

Results: Overall, 99.5% of the 185 respondents wore face masks: 51.8% wore reusable, 34.2% wore disposable, and 16.2% equally wore disposable and reusable masks. Regarding frequency of use, a higher proportion (27%) wore their masks 3 - 4 times before disposing or washing. Frequency of reuse at 0 - 1, twice and 5+ times were equally distributed at 24.3%. The main reason for reuse was a lack of time (53%) followed by environmental reasons (28%). More than 50% of those surveyed believed that msks could be washed indefinitely without having the performance affected. This study found no statistically significant associations between several major demographic categories and level of mask reuse: (i) gender, $P = 0.253$, (ii) age, $P = 0.631$, (iii) education level, $P = 0.284$, and (iv) occupational field, $P = 0.395$.

Conclusion: Most of the Canadian population are wearing masks during the COVID19 pandemic and most people dispose of, or wash, their masks after 2-4 uses. Demographic variables of age, gender, occupation and education do not affect mask reuse levels. This information can aid in education efforts in the future by widening the scope of target audiences.

Keywords: mask, reuse, COVID19, pandemic, washing, safety, virus, SARS-COV-2

Introduction

Mask-wearing in public spaces has become ubiquitous for most people in developed countries due to the ongoing pandemic. The wearing of masks in public spaces is considered a vital component in alleviating the person to person spread to the novel coronavirus (COVID-19). The current climate surrounding face masks usually revolves around the idea of wearing a mask in order to protect others. However, the efficacy of the mask in protecting the wearer is usually less focused on, especially the efficiency of the mask in preventing the wearer from inhaling viral particles such as COVID-19. One key aspect of the protectiveness of masks is how many times it is used before disposing of (in the case of surgical or disposable masks) or washed (a cloth or reusable mask). Therefore, the objective of this literature review is to determine if there is justification for a survey study which focuses on the number of times an average mask is reused before being disposed of or washed, and the variables which contribute to reuse levels.

Literature Review

There is evidence of widespread mask reuse in current literature. A study in Brazil (Pereira-Ávila, 2020) also honed in on mask reuse. The study was relatively large, with 3, 981 participants in total. They found that over 50% of people use one-time use surgical masks more than once before disposing, and cloth masks over five times before washing.

The primary function of a face mask, in terms of wearer protection, is to prevent pathogens from entering the nose or mouth of the wearer. As the mask filters potential disease-causing microbes, these pathogens accumulate inside the mesh fibers of the mask (National, 2006) and this process worsens the protective abilities over time. In

a study done in Shanghai, China (Zhiqing, 2018), pathogen levels were five times higher in masks that were worn for 6 hours as compared to masks worn 2 hours. Not only that, the majority of these microbes were from the wearer themselves, most likely from touching the mask over time.

However, mask contact is even worse when reusing as compared to extended use. A recent rapid evidence review (Toomey, 2020) found that mask wearers often touch the front portion of the masks when removing or putting them on, creating chances for contact transmission between their hands and the mask. This could translate into increased microbe or viral load on the mask if the mask is not disposed of or washed frequently. Adding on to this issue is the longevity of COVID-19 on surfaces. Without disinfection, studies have shown that COVID-19 can survive on mask surfaces anywhere from 2 days (Dehbandi, 2020) to 9 days (Rubio-Romero, 2020). This means that unless the mask is isolated without wear for over 9 days, previous viral particles could threaten the mask wearer if the mask is reused and therefore reuse can lead to infection.

The effectiveness of cloth masks seems to decline with successive washes. A Nepalian study (Neupane, 2019) found that the porosity of cloth masks increased each time they were washed, levelling out at about a 20% porosity increase after the fourth wash and drying cycle. Therefore, this study can also determine if people are keeping their cloth masks for too long before disposing.

Purpose of the Study

Currently, there are several gaps in the current knowledge regarding face mask reuse practices. While it is safe to assume that some degree of mask reuse is occurring, as shown in the Brazilian study, it's difficult to say with any degree of certainty how

often or how many times people do so in developed countries like Canada. It is also unknown how widespread mask reuse is. Is it 10% of the population? 30% Or is it 70%? There is simply no study that addresses these issues. It's also unknown as to why people reuse masks. Variables such as education, gender, age, occupation, socio-economic bracket could each uniquely affect mask wearing etiquette. Perhaps workplace mask policies affect mask reuse. Or their preference between cloth or disposable masks lead to differences in reuse. These variables will be illuminating in telling us who and why people reuse masks.

Methods and Materials

Materials

A Windows computer with Microsoft Excel and NCSS 12 software was used to analyze data from an online survey hosted by SurveyMonkey. Also, a printer was used to print a physical copy of the QR code of the survey and was used at a local community centre.

Standard Methods

An online SurveyMonkey survey was distributed publicly on Reddit between the weeks of January 10th to February 16th, 2021. Subreddits such as r/TakeMySurvey are followed by those who are more inclined to respond to surveys (Jones, 2020). The survey was forwarded to contacts of the primary researcher's professor, Helen Heacock. They were told to forward the information to their own contacts as well. It was also forwarded to a personal friend who is a high school teacher. Though he did not complete the survey himself, he asked his students to fill it out if they chose to. The survey was also posted as a QR code at a local community centre for visitors to scan and complete. Lastly, the survey link was posted to several Canadian COVID19-related YouTube videos in the comments section. Since the study revolves around

mask reuse, people who consume COVID19 content may be more likely to complete the survey (Nemoyten, 2018).

The survey consisted of three main parts: demographics, general knowledge and information about mask reuse, and one open-ended question. To keep the survey comfortable to use, a "Prefer not the answer" option was listed for each closed-ended question.

Inclusions and Exclusion Criteria

Since this study is focused on Canadians, non-Canadians were excluded from the study. Friends, family and classmates of the primary researcher were excluded as well.

Ethical Considerations

The study methods received approval from the BCIT Research Ethics Board. The link to the survey contained a cover letter, consent form and the survey itself.

Results

Descriptive Statistics

Of the 185 respondents, 41.3% were male, 57.07% were female, 1.09% were other and 0.54% preferred not to answer. The age distribution was fairly broad, with 25.95% being 24 and under, 25.95% 25-34, 30.27% 35-54 and 17.84% 55+. In terms of education level, 15.68% were high school level or earlier, 25.41% had some level of college/technical school/university experience, 31.35% had a university undergraduate degree, and 27.57% had some type of university graduate degree. Occupational fields varied between healthcare and medicine (17.3%), business (16.22%), services (11.89%), law enforcement (3.24%), arts and entertainment (10.27%), industry and manufacturing (8.11%), not current working (17.84%), skip this question (1.62%) and other (13.51%).

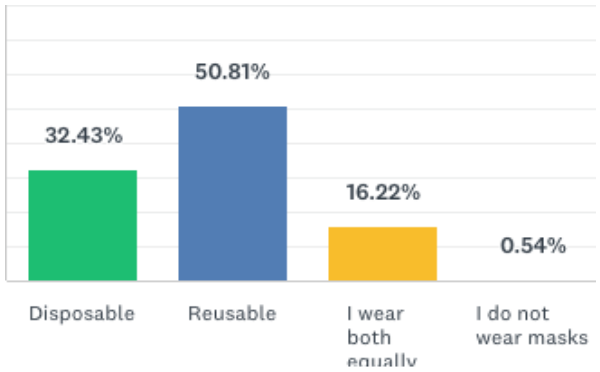

Figure 1: Type of mask worn

Most respondents (50.8%) wore reusable masks while some wore disposable masks (32.4%) and 16.22% wore both types equally.

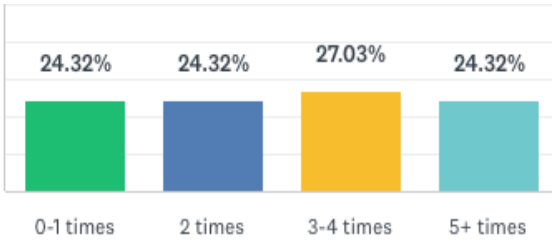

Figure 2: How many times masks are used before washing/disposal

The spread here was quite even. It should be noted that 75.68% of respondents reused masks at least 2 times before disposing/washing.

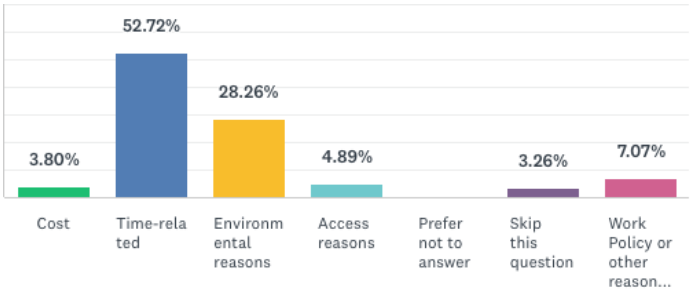

Figure 3: Reasons for Mask Reuse

Time was the main reason for mask reuse, followed by environmental reasons.

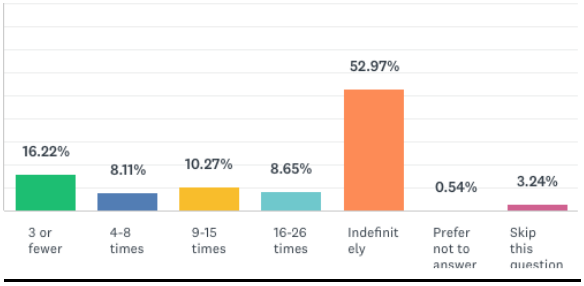

Figure 4: How many times do people believe a reusable mask can be washed before losing effectiveness

Over half (52.97%) of respondents believe that reusable masks can be washed indefinitely without any performance decrease.

Inferential Statistics

To analyze the data between the independent variables of age, gender, education and occupation with the dependent variable of mask reuse, chi-square tests were performed using NCSS 12 software. This study has found no statistically significant associations between several major demographic categories and level of mask reuse.

Table 1: The Null and Alternative Hypotheses

Ho and Ha	Test Used	Result	Conclusion
Ho: There is no association between age and mask reuse levels Ha: There is an association between age and mask reuse levels	Chi-Square	P = 0.631	Do not reject Ho and conclude there is no association between age and mask reuse levels.
Ho: There is no association between education level and mask reuse levels Ha: There is an association between education and mask reuse levels	Chi-Square	P = 0.2839	Do not reject Ho and conclude there is no association between education level and mask reuse levels.
Ho: There is no association between gender and mask reuse levels Ha: There is an association between gender and mask reuse levels	Chi-Square	P = 0.2532	Do not reject Ho and conclude there is no association between gender and mask reuse levels.
Ho: There is no association between occupation field and mask reuse levels Ha: There is an association between occupation field and mask reuse levels	Chi-Square	P = 0.3947	Do not reject Ho and conclude there is no association between occupation field and mask reuse levels.

Discussion

There are some important patterns to be found in the descriptive statistics.

Mask Reuse

Most people are using their masks at least twice before washing or disposing, and therefore this supports Pereira-Ávila (2020), which states that over half of people use disposable masks more than once before disposal. In this study, times of mask wearing were not directly recorded, and therefore this may have affected the results. However, in the open-ended section, many people stated that though they reuse disposable masks several times if used for short periods, they would dispose of one after a single use if used for a prolonged stretch of time. This suggests people who use masks briefly are the ones who are at higher risk of mask contamination due to reuse. However, those who wear masks for prolonged periods of time are also at risk. Zhiqing (2018) states that pathogen levels are five times greater in masks that have been donned for 6 hours as compared to 2 hours. Also, some health sites such as the World Health Organization (When and how to use masks, 2020) state that masks should be disposed of when soiled or wet. The longer masks are worn for, especially when used for talking, the greater the moisture content or dampness, allowing pathogens to grow. Standardization of recommendations would be beneficial for proper mask usage, especially when considering that repeated donning and doffing of masks creates opportunities for touching of the mask front, according to Toomey (2020). A lack of time was the most common reason for mask reuse, followed by environmental concerns. Combined, these two factors comprise over 80% of the decision to reuse masks. This suggests that convenience is the greatest factor for mask reuse. In 2020, there were several months when access may have been

a larger concern, but supplies have now since stabilized, and the increased supply of masks have consequently reduced their pricing.

Mask Washing

In terms of mask washes, reusable masks are being washed too many times. According to Neupane (2019), cloth masks become 20% more porous after the fourth wash cycle. Though reusable masks are designed to be washed, pure cotton masks do increase in porosity with successive washes. However, over half of the people from this study believe that reusable masks can be washed indefinitely. This suggests that the term "reusable" mask may possibly give the public the idea that it is infinitely reusable, and therefore infinitely washable. Since people do not see the porosity difference with their eyes, it may be difficult for them to detect that the masks have become more air-permeable, especially when the effect has slowly matured over several wash cycles. Additionally, there is no current widespread education regarding mask porosity increases. The public may understand the importance of washing their reusable masks but seem to be largely unaware of the issues regarding excessive washing.

External Validity

The findings could be extrapolated to all residents of Canada (excluding Territories). Ages recorded were relatively broad and inclusive, large percentages of both genders responded, and a vast array of occupations and education levels were included.

Limitations

Limitations include a lack of other methods of survey delivery, limited response rate, lack of a prize to incentive participants,

limited time to gather responses, and a lack of money for promotion.

The survey itself also had limitations. The generalizability of the results may have been improved if the survey was offered across more social media platforms. Extra questions could have also been added to find rationale behind behaviours.

Knowledge Translation

We now know that gender, age, education level, and occupational status does not greatly affect the levels of mask reuse in Canadians. Therefore, any future efforts to reduce mask reuse will not have to create special programs for target groups. A broad educational campaign, not targeting any specific demographic group would probably be sufficient.

On a local level, stakeholders such as business owners, schools and smaller organizations could put forth health promotion campaigns that aim to reduce mask reuse, as well as to remind people of the dangers regarding successive washing of reusable masks. These campaigns would mainly target individuals who use cotton reusable masks, as well as those who use disposable masks for brief periods, and therefore more likely to reuse. On a provincial level, knowing why people reuse masks may be useful. Since the study reveals that most people reuse masks largely due to convenience, the Ministry of Environment may opt to make masks accessible in public spaces, similar to complimentary waste bags at dog parks as this practice has shown to reduce unclaimed dog waste and also improve park cleanliness (Kilcona, 2015). By increasing accessibility to complimentary single-use masks, increased mask changing behaviour may be seen in the public. Also, environmental concerns are another issue that cause people to reuse masks. Therefore, different waste or

sterilization strategies may be used so that masks may be either disposed of with less effect to the environment or may be reused instead of disposed of altogether.

Future Research

Future student projects may include:

- Seeing if people would be willing to reuse second-hand masks that have been sterilized, and what factors contribute to their decisions.
- Conducting the same study, but with the two questions that are listed in the limitations section above. The survey would include questions regarding reusable mask material and average time of mask usage.
- Conducting a study post-pandemic to assess levels of mask use and reasons for wearing a mask without the presence of a viral threat.

Conclusion

Though the COVID19 pandemic may not last forever, this unprecedented event has changed our view on the importance of face masks, and indirectly, the issue of mask reuse. This research study showed that the demographics of age, gender, occupation and education level have little to no association with levels of mask reuse. However, the study revealed that people are reusing masks more than we may expect, and the primary reason is for convenience with the secondary reasons being environmental concerns. A second issue of note is that most people seem to believe that reusable masks are able to withstand unlimited wash cycles without losing performance. These findings give us reason to believe that increased educational efforts are needed to remind people of the dangers regarding successive mask washing. More importantly, varying levels of government looking to decrease mask reuse

levels may find success in increasing the accessibility of masks in public spaces, as well as encourage new mask recycling technologies. By employing educational efforts and minimizing public concerns regarding mask reuse, public health and safety may be improved and mask use behaviours could change, therefore better preparing us for any future events similar to COVID19.

Acknowledgements

The lead author would like to thank Helen Heacock for her optimism and ongoing encouragement throughout the process of this entire study, as well as all the survey participants.

Competing Interest

The author declares that they have no competing interests.

References

Dehbandi, R., & Zazouli, M. A. (2020). Stability of SARS-CoV-2 in different environmental conditions. *The Lancet Microbe*, *1*(4), e145. https://doi.org/10.1016/s2666-5247(20)30093-8

Jones, N. (2020, February 6). *A 7-step guide for effective survey recruitment on Reddit*. Medium. https://towardsdatascience.com/a-7-step-guide-for-effective-survey-recruitment-on-reddit-77837380cbe

Kilcona Park Waste Bag Dispenser Pilot Project Evaluation | Kilcona Park Dog Club. (2015). Kilconaparkdogclub. http://kilconaparkdogclub.ca/

kilcona-park-waste-bag-dispenser-pilot-project-evaluation/#.YGHTwEhKj9A

National Academies of Sciences Engineering and Medicine. (2006). *Reuse of Disposable Medical Masks During Flu Pandemic Not Recommended; Reusing Respirators Is Complicated*. Nationalacademies.Org. https://www.nationalacademies.org/news/2006/04/reuse-of-disposable-medical-masks-during-flu-pandemic-not-recommended-reusing-respirators-is-complicated

Nemoyten, A. (2018, March 27). *Three Lessons for DIY Market Research with Surveys and… Reddit?* Medium. https://medium.com/@aaronnemoyten/three-lessons-for-diy-market-research-with-surveys-and-reddit-1f902d3c4a94

Neupane, B. B., Mainali, S., Sharma, A., & Giri, B. (2019). Optical microscopic study of surface morphology and filtering efficiency of face masks. *PeerJ*, *7*, e7142. https://doi.org/10.7717/peerj.7142

Pereira-Ávila, F. M. V., Lam, S. C., Góes, F. G. B., Gir, E., Pereira-Caldeira, N. M. V., Teles, S. A., Caetano, K. A. A., Goulart, M. C. L., Bazilio, T. R., & Silva, A. C. O. (2020). Factors associated with the use and reuse of face masks among Brazilian individuals during the

COVID-19 pandemic. *Revista Latino-Americana de Enfermagem*, *28*, 1–9. https://doi.org/10.1590/1518-8345.4604.3360

Rubio-Romero, J. C., Pardo-Ferreira, M. C., Torrecilla-García, J. A., & Calero-Castro, S. (2020). Disposable masks: Disinfection and sterilization for reuse, and non-certified manufacturing, in the face of shortages during the COVID-19 pandemic. *Safety Science*, *129*, 104830. https://doi.org/10.1016/j.ssci.2020.104830

Toomey, E., Conway, Y., Burton, C., Smith, S., Smalle, M., Chan, X. H. S., Adisesh, A., Tanveer, S., Ross, L., Thomson, I., Devane, D., & Greenhalgh, T. (2020). Extended use or re-use of single-use surgical masks and filtering facepiece respirators during COVID-19: A rapid systematic review. *Infection Control & Hospital Epidemiology*, 1–25. https://doi.org/10.1017/ice.2020.1243

Zhiqing, L., Yongyun, C., Wenxiang, C., Mengning, Y., Yuanqing, M., Zhenan, Z., Haishan, W., Jie, Z., Kerong, D., Huiwu, L., Fengxiang, L., & Zanjing, Z. (2018). Surgical masks as source of bacterial contamination during operative procedures. *Journal of Orthopaedic Translation*, *14*, 57–62. https://doi.org/10.1016/j.jot.2018.06.00

Zhang, J. (n.d.). Submission History. Bcit.Ca. Retrieved 2021, from https://learn.bcit.ca/d2l/lms/dropbox/user/folders_history.d2l?db=286677&grpid=0&isprv=0&bp=0&ou=704834