

BOARD # 241: First Responder and Emergency Manager Willingness to Wear Non-Medical Masks: An NSF- Engineering Education and Centers-Funded Research Experience for Undergraduates

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Abstract

COVID-19 emerged in early 2020 killing an estimated 7 million people by April 2025. Wearing masks and maintaining social distance can help limit the spread of infection. However, uncertainty, changing scientific insights, politics, cultural norms and values, knowledge, education, and more influence adherence to government masking mandates. First responders and emergency managers are at the forefront of response operations. Despite their critical role, little research has addressed the willingness of such personnel to wear non-medical masks during a pandemic. Accordingly, this 10-week qualitative student-led Research Experience for Undergraduates study aims to critically evaluate the perceptions of non-medical mask usage amongst first responders and emergency managers during the COVID-19 pandemic.

Introduction

Pandemics occur approximately three times per century [1]. Despite experience of Cholera, the Spanish, Asian, and Hong Kong Flu, HIV/AIDS, SARS, Swine Flu, and Ebola, the coronavirus pandemic (COVID-19) wreaked havoc around the globe, with the World Health Organization (WHO) reporting 7,094,447 deaths as of April 2025 [2]. At its most basic, pandemic response is quite simple: *mask up* and *socially distance*. However, the complexity of achieving this within an ever more globalized and socially interconnected world remains problematic. Due to the shortage of medical protective respirators, such as N95 respirators, the adoption of non-medical masks (i.e., paper or cloth masks worn as a general barrier during normal day-to-day activities) was suggested by health organizations due to their ability (albeit limited) to reduce transmission [3].

Several countries, including the United States, experienced strong push back on government mask mandates which sought to minimize the spread of the virus. Motivation to adopt non-medical masks vary from person to person and depend on factors such as culture, norms and values, and knowledge and education [4-7]. Promoting usage relies not only on rigorous design and engineering but also on preference, and the associated social and political connotations. Evaluating the human perception of non-medical masks usage is, therefore, critical to increasing adherence to mask mandates during future pandemics. This is particularly salient within the life-critical first responder and emergency manager roles as they are at the forefront of response operations and may have a higher risk of exposure [8]. Furthermore the effectiveness of masks in reducing transmission relies on high compliance [3]. Accordingly, this study aims to critically evaluate the perceptions of non-medical mask usage amongst first responders and emergency managers during the COVID-19 pandemic.

Methodology

During the summer of 2024, an undergraduate student researcher completed a 10-week research experience for undergraduates (REU) to address the research question, *what factors promote non-medical mask usage amongst first responders and emergency managers during a pandemic?* The REU student, termed lead researcher herein, completed a *hands-on* social sciences research program. This included training in qualitative research design, search engine and database usage, online survey methodology, analysis and referencing software usage, ethics and Institutional Review Board (IRB) familiarization, and soft skills development.

Methods for Collection

This study utilized interpretivism, an inductive system of logic, online survey methodology, and computer-assisted qualitative content analysis [9]. The lead researcher designed a qualitative survey which was disseminated to a purposive sample then snowballed for two weeks (due to the compressed 10-week schedule) using the Qualtrics Online Survey platform. The criteria for inclusion were 1) a first responder or emergency manager, 2) operational during COVID-19, and 3) based in the United States (US). The survey contained fifteen questions (10 closed and five open-ended). The questions included *what does the term non-medical mask mean to you; when, if at all, did you wear a non-medical mask during the pandemic; why did you wear or not wear a non-medical mask; what influenced your decision to wear or not wear a non-medical mask during the pandemic; and what would encourage or discourage you from wearing a non-medical mask in a future pandemic?* The research design and survey tool were submitted to the institutional IRB for review and clearance was secured (IRB-24-295).

Methods for Analysis

20 complete responses were secured from US-based first responders and emergency managers with between two and 15 years of experience, aged between 26 and 56, all of whom had at least one higher education degree. The responses were uploaded to the Atlas.ti qualitative analysis software and subjected to computer-assisted content analysis. This method is a systematic approach to identifying the hidden and deeper meanings within qualitative narratives. Three analytical sweeps were conducted: a familiarization sweep, and two independent analysis sweeps which were compared to ensure rigor and accuracy [10]. The lead researcher identified relevant quotations and constructed the initial codebook. The research team (lead researcher, graduate research assistant, and REU mentor) collectively reviewed and refined the codebook and (analytically) progressed from lower abstraction (quotations and codes) to higher abstraction (categories and themes) [11]. The resultant findings described below conceptualize the essence of the data and inform a posited tentative theory regarding factors that promote non-medical mask usage [9].

Visualizing the Data

The findings are presented within a comprehensive network diagram (Figure One). This visual method illustrates the complex relationships between the lower and higher levels of abstraction [10]. The diagram visualizes the inherent connectedness and relationships between the codes, categories, and themes which can be difficult to explain in written form. The overlapping relationships between the network nodes (codes, categories, and themes) are, therefore, described using connectors to illustrate the connectedness between the lower and higher levels

of abstraction [10]. In accordance with qualitative research norms, the themes (which constitute the posited tentative theory) and indicative example quotations rather than the full findings are described below in narrative form to provide context and maintain readability [9, 10].

Qualitative Validity

Maxwell's [12] three-factored model for qualitative validity is applied herein. First, the detailed and replicable methodology affords *descriptive* validity by clearly articulating the foundations and conduct of the study. Second, the charting of the subjective analytical inferences made are overtly charted within the posited comprehensive network diagram which affords *interpretative* validity. Third, the findings form the basis for the posited tentative theory which affords *theoretical* validity.

Findings and Discussion

The lead researcher identified 151 (thematically relevant to the research question) quotations which informed 20 codes (left column), six categories (center column), and three constituent themes (left column): *external pressures*, *mask usage challenges*, and *personal reasons* and *perceptions*. The lead researcher then created the comprehensive network diagram below to chart the findings, and ensure *interpretative* and *theoretical* validity [12].

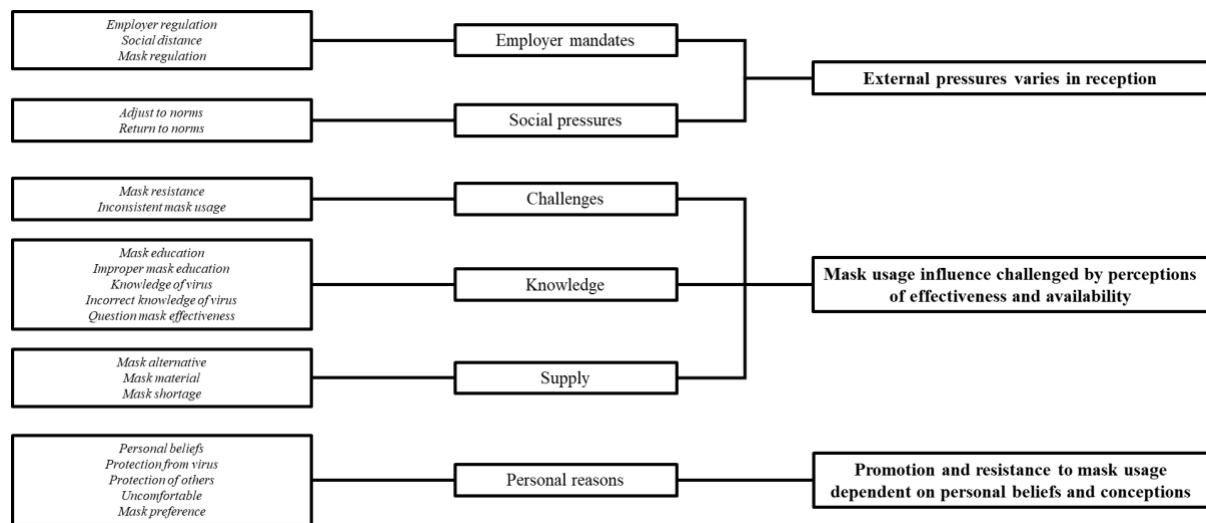


Figure 1 - Comprehensive Network Diagram

Themes and Indicative Quotations

Theme one: external pressure: refers to a general resistance to non-medical mask usage stemming from distrust in the underpinning research and an outright rejection of government mandates. The example quotations below inform this theme:

- *Because it was mandated by my work agency to wear medical grade masks during work hours.*
- *Knowing the spread of disease to me or from me was lower by being around people I knew who practiced safe social distancing and masking.*
- *Governors' executive orders required wearing.*

- *My own health, my family's health, and hoping to end the pandemic.*

Theme two: mask usage challenges: refers to supply issues, and perceptions of masking alternatives, which offer lower protection than non-medical masks [3]. The example quotations below inform this theme:

- *The only thing that would encourage me would be data that showed that they worked as opposed to the amount of data that shows that they provide little to no protection and are often worse for individuals. I would be even more resistant in the future.*
- *The federal government changed their opinion several times. Lack of facts to justify.*
- *I would not wear one because of the dishonesty to make people wear them*

Theme three: personal reasons and perceptions: indicates that non-medical mask usage often stemmed from a perceived need to protect loved ones. The example quotations below inform this theme:

- *Wearing a mask to keep myself and others safe is something that we should all do; a person could be a carrier and not know it. Better safe than sorry!*
- *It was hot, dirty quickly, re-breathing my water vapor.*
- *Wearing a non-medical mask in the future will depend on the risks at that time.*

The posited findings align with other studies [4, 6] in that they indicate that adherence to government mask mandates is mixed, and usage of non-medical masks is impacted by distrust, supply issues, and personal feelings regarding the need to protect loved ones. This suggests that personalizing the need for non-medical mask usage and providing accessible scientific evidence, in addition to rigorous design and engineering, may promote adherence to government mask mandates. These preliminary findings form the basis of a research poster that was presented by the lead researcher at the American Society for Engineering Education 2025 Conference in Montreal, Quebec, Canada. Furthermore, a manuscript that draws out and more fully develops the posited tentative theory is currently under development for publication.

Conclusion

Additional REU projects, which will build on these preliminary findings, are scheduled for summer 2025 and 2026 respectively. As part of this REU, the lead researcher successfully completed the following objectives: create a qualitative social science research design, efficiently utilize research software (Qualtrics, EndNote, and Atlas.ti), understand how to navigate the IRB process and its historical importance within research, conduct qualitative content analysis and report findings in diagrammatic, poster, and written formats. The success of this REU was grounded in clearly defined weekly objectives, ongoing monitoring, open two-way communication, and tailored hands-on guidance provided as needed by both the graduate research assistant, and the REU mentor.

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References

- [1] S. Sampath *et al.*, "Pandemics Throughout the History," (in eng), *Cureus*, vol. 13, no. 9, p. e18136, Sep 2021, doi: 10.7759/cureus.18136.
- [2] World Health Organization. "WHO COVID-19 Dashboard." <https://data.who.int/dashboards/covid19/deaths> (accessed April 28, 2025).
- [3] J. Howard *et al.*, "An Evidence Review of Face Masks Against COVID-19," *Proceedings of the National Academy of Sciences*, vol. 118, no. 4, p. e2014564118, 2021, doi: 10.1073/pnas.2014564118.
- [4] V. S. Shelus *et al.*, "Motivations and Barriers for the Use of Face Coverings During the COVID-19 Pandemic: Messaging Insights from Focus Groups," *International Journal of Environmental Research and Public Health*, vol. 17, no. 24, p. 9298, 2020, doi: 10.3390/ijerph17249298.
- [5] L. He *et al.*, "Why do People Oppose Mask Wearing? A Comprehensive Analysis of U.S. Tweets During the COVID-19 Pandemic," *Journal of the American Medical Informatics Association*, vol. 28, no. 7, pp. 1564-1573, 2021, doi: 10.1093/jamia/ocab047.
- [6] L. Martinelli *et al.*, "Face masks during the COVID-19 pandemic: a simple protection tool with many meanings," *Frontiers in public health*, vol. 8, p. 606635, 2021.
- [7] M. O. Rieger, "To Wear or Not to Wear? Factors Influencing Wearing Face Masks in Germany During the COVID-19 Pandemic," *Asian Journal of Social Health and Behavior*, vol. 3, no. 2, pp. 50-54, 2020, doi: 10.4103/shb.Shb_23_20.
- [8] A. M. Wilson *et al.*, "Respirators, Face Masks, and their risk Reductions via Multiple Transmission Routes for first Responders within an Ambulance," *Journal of occupational and environmental hygiene*, vol. 18, no. 7, pp. 345-360, 2021, doi: 10.1080/15459624.2021.1926468.
- [9] E. Bell, A. Bryman, and B. Harley, *Business Research Methods*, 5th ed. Oxford, UK: Oxford University Press, 2019.
- [10] T. McAleavy, C. Dement, and H. Murphy, "Inductive Qualitative Content Analysis: From Research Design to Presenting Your Findings," in *Content Analysis: Methods and Practices*, C. D.P. Ed. Hauppauge, NY, USA: Nova Science, 2024, ch. 1, pp. 1-30.
- [11] C. Erlingsson and P. Brysiewicz, "A Hands-on Guide to Doing Content Analysis," *African Journal of Medicine*, vol. 7, no. 3, pp. 93-99, 2017, doi: 10.1016/j.afjem.2017.08.001.
- [12] J. A. Maxwell, *Understanding Validity in Qualitative Research* (The Qualitative Research Companion). London, UK: Sage Publications, 2002.