Fit Test Feasibility in Using an Elastomeric Half-Mask Respirator (EHMR) in Healthcare Workers in Response to a Simulated Public Health Emergency: A Randomized Controlled Trial

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INTRODUCTION

ABSTRACT

In instances of supply chain challenges or a public health emergency, shortages of disposable respirators can pose a challenge for healthcare workers. The limited quantities of respirators available to healthcare workers witnessed during the COVID-19 pandemic are illustrative of this phenomenon. The use of the elastomeric half mask respirator (EHMR), as recommended by the Centers for Disease Control and Prevention, can help relieve the strain on the supply of disposable respirators as well as potentially increase the level of protection for the wearer. This study sought to evaluate if respiratory protective devices that are commercially available and commonly used in industrial settings can be utilized in a healthcare setting. Additionally, this study sought to learn about preparing healthcare workers to wear these reusable respirators during a supply shortage of disposable respirators.

PROBLEM

Healthcare workers face a challenge in having access to sufficient respiratory protection when disposable respirators such as N95 respirators are in short supply[1,2]. In cases where healthcare systems experience a surge and healthcare workers recycle disposable respirators for multiple uses, there is a potential for increased risk for the healthcare worker[3]. Additionally, the effectiveness of an N95 respirator in protecting its wearer is highly dependent on a proper fit and seal; therefore, ensuring the proper training is key[4].

The study team sought to better understand how to train healthcare workers to use EHMRs. Further, the study sought to determine how quickly healthcare workers can be assessed for respirator fit as well as the proper use of the reusable respirators, particularly in a simulated public health emergency.

OBJECTIVES

- Determine the pass rate and time of positive pressure user seal check
- Determine the pass rate and time of negative pressure user seal check
- Evaluate the pass rate and time of OSHA qualitative fit testing method
- Evaluate difference between control and intervention groups

METHODS

Participants: 79 healthcare workers from the emergency department (ED), medical intensive care unit (MICU), surgical intensive care unit (SICU), and post anesthesia care unit (PACU) at Sinai-Grace Hospital in Detroit, Michigan were recruited

Randomization: 68 healthcare workers participated in the study and were randomly allocated into the intervention group to use the EHMR (80%, N=52) and control group to use N95 (20%, N=16).

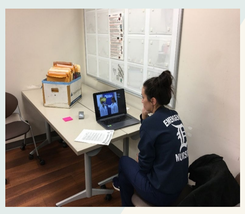
Respirators

- Intervention: Honeywell North RU8500 EHMR
- Control: 3M Healthcare 1860 N95 respirator




Training

- Participants were rapidly trained in one week to simulate the response to a public health disaster scenario
- Participants watched a NIOSH training video:
- EHMRs: https://youtu.be/aeN_OwuRSaE
- N95 FFRs: https://youtu.be/O3ijPhMBGTg
- An educational handout also given to participants to use when watching video
- Video and handout covered respirator inspection, donning, user seal checks, and doffing. Cleaning and disinfection were shown for the EHMR cohort
- Video also covered qualitative fit test procedures and steps
- All participants were given 5 to 15 minutes for practice before timed positive and negative pressure user seal checks and qualitative fit testing were conducted



Fit testing

- Used saccharin sodium, a sweet tasting aerosol, to determine whether air from outside of respirator was making it inside without being filtered
- Followed OSHA standard test protocol – 7 steps
- If participants tasted the sweet substance at any point the test was considered a FAIL
- Readjusted the seal, or participants changed to a smaller size of respirator
- Participants given up to three attempts to pass fit test with single size
- Fit test procedures for EHMR and FFR groups similar

Statistical analysis

- Descriptive statistics were calculated. T-test and Z-test were used.

RESULTS

Positive Pressure User Seal Check

- Intervention Group: 96.2% pass rate
  - Evaluation Time (seconds) Mean (M)±Standard Deviation (SD): 28±17
- Control Group: 100% pass rate
  - Evaluation Time (seconds) M±SD: 29±16
- No statistically significant difference between two groups (p=0.760)

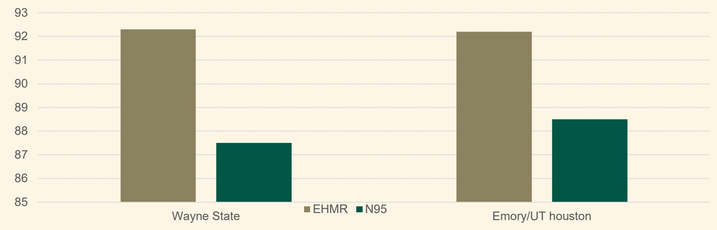
Negative Pressure User Seal Check

- Intervention Group: 100% pass rate
  - 17±17 seconds
- Control Group: 93.8% pass rate
  - 17±18 seconds
- No statistically significant difference between two groups (p=0.974)

WSU First Attempt Fit Test Pass Rate

- Intervention Group: 92.3% pass rate
- Control Group: 87.5% pass rate
- p<0.01
- Pass rate from WSU is similar to those from Emory and UT Houston sites

Figure 1. WSU Compared to Emory & UT Houston Sites



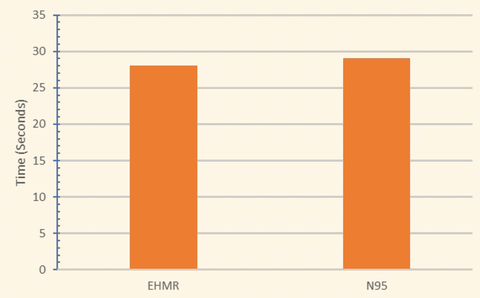
Evaluation for Total Fit Test Time (seconds, M±SD)

- Intervention Group: 381±179
- Control Group: 397±149

Average User Seal Check Pass Times

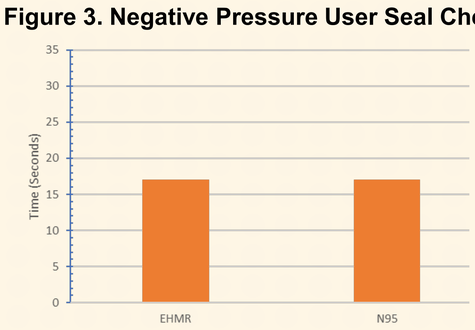
- indicate no statistically significant differences between the two groups for positive or negative pressure user seal check pass times.

Figure 2. Positive Pressure User Seal Check Time



EHMR: 28 seconds
N95: 29 seconds
p=0.760

Figure 3. Negative Pressure User Seal Check Time



EHMR: 17 seconds
N95: 17 seconds
p=0.974

CONCLUSIONS

Conclusion

- Rapid training and fit testing on healthcare workers to respond to a public health disaster is feasible with adequate planning on the testing schedule
- Most healthcare workers can pass pressure user seal checks and fit test in 1-2 attempts
- Training does not take significantly additional time to pass the fit test
- Use of reusable EHMR can be similarly trained as the N95 respirator and considered as alternative respirator by healthcare providers

Future Directions

- Assessing respirator disinfection strategies in a time-sensitive environment
- Maintenance of respirator fit testing and training
- Understanding lifespan of respirator and filter pieces in healthcare setting
- Incorporate the EHMR in hospital respiratory protection programs

Acknowledgements

- Thanks to CDC/NIOSH for funding and support: 75D30118C02647
- Thanks to the healthcare workers and administrative personnel of Sinai-Grace Hospital, Detroit Medical Center for participation
- Thanks to Wayne State University Institutional Review Board.
- This study was conducted in partnership with Emory University and University of Texas at Houston.

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