Routine Elastomeric Use and Evaluations in Healthcare (REUSE): Use Barriers in a Three-Month Follow-Up Study at Sinai-Grace Hospital, Detroit Medical Center

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ABSTRACT

Reusable elastomeric half-mask respirators (EHMRs) may provide an alternative to assist with supply shortages of N95® filtering facepiece respirators) during pandemics and have been recommended by the U.S. CDC. This 3-month observational study was conducted to examine the feasibility of EHMR wearing in healthcare workers (HCWs) and to assess their use experience and barriers. The hypothesis was that HCWs are able to use EHMRs in their daily healthcare tasks after appropriate training. After training and fit testing, HCWs used the EHMR for 3 months on a daily basis during their patient care tasks. Biweekly, they filled out an online questionnaire to assess barriers. A composite score was calculated by summing up the scores of all seven items of use barrier (scores ranged from 7 to 28), with a higher score indicating a higher level of experienced barrier. The analysis of variance (ANOVA) was used to test the differences in the mean score of barriers among groups. The daily total use hours were also assessed with Chi-square test. The generalized linear model analysis was performed to examine the predictors of average barrier score change over time. A total of 115 participants were consented to participate in this study initially, 68 participated in the 3-month observational follow-up study and 59 participants completed all biweekly surveys. For EHMR wear time, 29.9% used it for 1-3 hours, 24.1% for 4-6 hours, 19.5% for 7-10 hours, and 20.7% ≥ 11 hours. The mean total score for all barrier items was 12.55 (±3.61). There was no significant difference (p>0.05) in total mean score among all six biweekly surveys. Physicians had less barriers of using EHMR (9.00 in physicians vs 12.58 in nurses, p = 0.016). Younger participants (aged 18-25 years) reported higher scores than older ones (15.67 vs 10.33, p<0.001). Participants with high school of education reported a higher level of barrier score compared to those with a higher education (16.50 vs 12.39, p < 0.01). African Americans reported higher scores than Caucasians and other ethnic groups (13.06 vs 12.01, nonparametric test p < 0.03). After controlling for other covariates, variables at baseline including education, race, and EHMR wear hours were statistically significantly associated with average changes in the barrier scores. Implementing an EHMR use program in a mid-sized hospital is feasible although overall wear time of the EHMR during the work shift was variable. The conversion to the use of EHMRs needs to consider the demographic characteristics of HCWs. Prior training needs to be provided. Further studies at more locations and more EHMR models are needed for improved assessment, and methods to increase the use time needs to be trialed. The study provides evidence that implementing an EHMR use program in a mid-sized hospital is feasible. The EHMR use data may help healthcare organizations to develop strategies to increase EHMR wear time. Adequate training on use is a requirement for use. EHMRs provide alternative respirators during pandemics as well as routine healthcare activities, and healthcare organizations should consider implementing an EHMR program to help mitigate potential N95 respirator shortages and as a reusable respirator alternative to reduce cost.

INTRODUCTION

- Comforts/discomforts and use barriers are important factors that affect workers' sustainable and effective use of respirators for respiratory protection against infectious agents and hazards.
- Little research has been conducted in healthcare settings to assess user barriers of elastomeric half-mask respirators (EHMRs) in healthcare workers (HCWs) during their routine patient care tasks.
- Most healthcare organizations use N95 filtering facepiece respirators (FFRs) and few HCWs are familiar with the use of EHMRs.
- In a pandemic situation, the use of EHMRs may provide alternative respirators and help solve supply shortage problems.
- Meanwhile it also saves hospital money, but how the use is experienced by HCWs is unknown.
- This study as the second project of the CDC's three-site contract study on "Assessment of Elastomeric Respirators in Healthcare Delivery Settings" followed up HCWs for three months at Sinai-Grace Hospital in Detroit Medical Center in Michigan.

OBJECTIVES

- To examine the feasibility of HCWs' use of the EHMR while caring for patients and assess their use experience during the 3-month observation period, and at the closure of the three-month observation period including use time and frequency, comforts/discomforts and user barriers.
- Based on that some recommendations can be made to improve the use experience of HCWs.

HYPOTHESES TESTED

- After essential training on EHMR use, HCWs will be able to use the EHMR in their routine healthcare work.
- Each HCW may have different use experience depending on the setting and tasks performed.
- They will be able to provide helpful feedback on feasibility of incorporating EHMR into their healthcare work practice.

METHODS

Study Design
A prospective cohort one-group three-month intervention study using training intervention without randomization, a control group and effectiveness assessment.

Recruitment Process
- Hospital leaders and nurse managers asked to assist in announcing the study.
- Recruitment flyers posted on select work units.
- Unit leaders asked to announce the study to workers.
- Management not actively recruited workers.
- Study flyers and contact information left in lunchrooms and nurse stations.
- Study team members joined morning and evening huddle meetings to explain the study and conduct the consenting process.
- Workers interested in participating asked to sign a consent form and be evaluated for eligibility.

Data Collection Methods
- Be trained by watching an online video and using a handout.
- Be qualitatively fit tested.
- Use the EHMR for three months and fill out an online questionnaire every two weeks
- and through REDCap

Data Analysis
- A composite score calculated summing up scores of all seven items of use barrier (scores ranged from 7 to 28), with a higher score indicating a higher level of experienced barrier to wearing an EHMR.
- Total hours of using EHMR over the work shift were assesses by using a 4-category (i.e., 1-3 hours, 4-6 hours, 7-10 hours, ≥ 11 hours) variable.
- Chi-square test used to examine differences of time of wearing in each category over six surveys.
- Analysis of variance (ANOVA) used to test the differences on the mean score of barriers in groups.
- Generalized linear model (GLM) analysis performed to examine the predictors of average barrier score change over time.
- Age, education, occupation and EHMR wear hours (categorical carriable) included as covariates.
- All statistical analyses were conducted using IBM SPSS Statistics for Windows version 28.0.

EHMR Tested

Front view and back view of Honeywell North RU8500 EHMR

- Different models have varying face coverage areas and pressure
- Tight-fitting, negative pressure types (FFR, EHMR) must be fit-tested
- Must be certified by NIOSH prior to sale in the U.S.

RESULTS

Study Sample Size
- A total of 115 participants consented to participate in this study initially.
- 68 participated in the 3-month observational follow-up study.
- 59 participants completed all biweekly surveys.

EHMR Use Frequency
- 29.9% used it for 1-3 hours.
- 24.1% for 4-6 hours.
- 19.5% for 7-10 hours.
- 20.7% ≥ 11 hours.

RESULTS

Barrier Scores
- Mean total score for all barrier items was 12.55 (±3.61).
- There was no significant difference (p>0.05) in total mean score among all six biweekly surveys.
- Physicians had less barriers of using EHMR (9.00 in physicians vs 12.58 in nurses, p = 0.016).
- Younger participants (aged 18-25 years) reported higher scores than older ones (15.67 vs 10.33, p<0.001).
- Participants with high school of education reported a higher level of barrier score compared to those with a higher education (16.50 vs 12.39, p < 0.01).
- African Americans reported higher scores than Caucasians and other ethnic groups (13.06 vs 12.01, nonparametric test p < 0.03)

Factors Affecting Barriers
After controlling for other covariates, variables at baseline statistically significantly associated with average changes in the barrier scores include:

- Education.
- Race.
- EHMR wear hours.

CONCLUSIONS

- Implementing the use of EHMRs in a mid-sized hospital is feasible, but the overall wear time during work shifts varies.
- The conversion to the use of EHMRs needs to consider the demographic characteristics of healthcare workers.
- Prior training needs to be provided.
- Further studies at more locations and with more EHMR models are needed for improved assessment, and methods to increase the use time need to be trialed.

PUBLIC HEALTH IMPLICATIONS

- The study provides evidence that implementing an EHMR use program in a mid-sized hospital is feasible.
- The EHMR use data may help healthcare organizations to develop strategies to increase EHMR wear time.
- Adequate training on use is a requirement for use.
- EHMRs provide alternative respirators during pandemics as well as routine healthcare activities, and healthcare organizations should consider implementing an EHMR program to help mitigate potential N95 respirator shortages and as a reusable respirator alternative to reduce cost.

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