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Development of a qualitative respirator fit testing program for BSN students

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ABSTRACT

The COVID-19 pandemic has impacted the nursing student clinical experience. At the time of this project, hospitals hosting students for clinical experiences had a high population of COVID-19 positive patients. University and hospital policies at the time prohibited students from caring for COVID-19 patients due to the inability to safely ensure that students could access the proper protective equipment (PPE) necessary when caring for patients in airborne precautions. Infection control guidelines for patients in airborne precautions require a N95 respirator to be always worn by healthcare providers. These respirators require yearly fit test following OSHA (Occupational Safety and Health Administration) standards. Hospitals do have the resources to complete N95 fit tests for nursing students. The solution was to provide qualitative N95 mask fit testing, performed by university faculty, staff, and students using OSHA guidelines and standards. Within 3 months, over 50% of the student population had been fit tested, which increased the clinical opportunities for the students.

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Introduction

During the COVID-19 pandemic, nursing students had limited sometimes no clinical experiences. This was due to hesitation from clinical partners trying to prevent increased spread of the virus and efforts to prioritize personal protective equipment (PPE) for individuals deemed essential workers. As the pandemic has continued, nursing schools have realized that students need to be prepared to care for COVID-19 patients post-graduation, and that students can be a helpful resource to units caring for patients in airborne isolation.

Currently, patients who test positive for COVID-19 are placed in airborne isolation and healthcare providers are required to use a N95 filtering facepiece respirator (FFR) or powered air purifying respirator (PAPR) while providing care. The United States Department of Labor Occupational Safety and Health Administration (OSHA) requires a thorough mask fit test prior to use. N95 respirators are named for their “ability to filter 95% or more of tiny 0.3-μm particles” and are the “mainstay of protection against airborne pathogens” (Dugdale & Walensky, 2020). Sickbert-Bennett et al. (2020) provide reassuring evidence of the performance of National Institute for Occupational Safety and Health (NIOSH)-approved N95 respirators outperforming alternatives in terms of filtration efficiency. Their research and testing prove that N95 masks reprocessed using ethylene oxide sterilization, as well as masks that are up to 11 years past expiration, maintain remarkably high filtration efficiency under laboratory conditions. N95 masks with suboptimal fit still had comparable filtration efficiency of more than 90%.

To keep students and patients safe and to abide by OSHA guidelines an evidenced based, financially fiscal N95 fit testing program was developed by nursing faculty and staff at a liberal arts university in Louisville, Kentucky. This program was developed to ensure that students had access to the recommended PPE and could safely care for patients in airborne precautions.

Problem

The first challenge was the nursing department’s initial policy prohibiting nursing students caring for COVID-19 patients or providing COVID-19 screenings due to the risk of exposure and the inability of students to be fit tested for an N95 respirator. The second challenge was related to the logistics of fit testing all nursing students. Clinical partners were unable to provide this for students, but willing to change their affiliation agreements and policies to allow the university to perform the fit testing of students.

Solution

As the pandemic continued, the department recognized the need to modify the policy to give students the opportunity to care for COVID-19 patients, as they would be doing post-graduation and to broaden the number of units which students could do

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clinical rotations. Faculty voted to change the policy to allow students to care for COVID-19 patients if proper PPE was provided and used, these changes were reflected in the BSN handbook and course syllabi.

Once the policy was changed, faculty and staff began looking for methods to have students fit tested. Initially, the only option was to provide fit testing through local hospital employee health departments, which limited accessibility for nursing programs in the area. Health departments were unable to provide the testing for students due to limited time and resources.

In the Louisville Metro area, there are 12 nursing programs in need of clinical partnerships, and currently there are only 26 local healthcare facilities that are shared between the schools. The fit testing procedure requires a significant amount of time and supplies, and the feasibility of hospitals providing these resources to all nursing students is unrealistic. Further investigation of the policy and recommendations for fit testing showed OSHA Standard 1910.134 - Respiratory Protection does not designate specific qualifications for the test providers but focuses on procedures that are outlined in OSHA Appendix A—Fit Testing Procedures (Mandatory). There were no certification or licensure requirements to perform N95 respirator testing (OSHA, 2021). Once the individual had reviewed the OSHA PowerPoint presentation on Qualitative Fit Test Training and was deemed proficient to perform the testing by a licensed healthcare provider, they could begin testing others, which led to faculty, staff, and even nursing students providing fit testing once trained and educated.

Methods

There are two commonly used methods to fit test individuals to a N95 respirator, a qualitative or quantitative fit test. A qualitative fit test determines whether the respirator user can detect a taste using either isoamyl acetate (banana oil), saccharin (sweet), denatonium benzoate (Bitrex) (bitter), and irritant smoke. Irritant smoke is the least used option as it is more dangerous and less reliable than the others. Denatonium benzoate (Bitrex) aerosol is the most widely used in the United States and Canada because it is easily detected and does not carry health concerns like the others. Denatonium benzoate (Bitrex) is commonly used as a taste aversion agent in household, garden, and automotive liquids to deter children or animals from ingesting the harmful agents and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers (OSHA, 2004). With qualitative fit testing, testing the individual is completed by performing a series of exercises including talking and bending at the waist, constantly assessing for the taste of the agent. If during the exercises the user can taste the agent, the respirator is not sealed and therefore, the fit of that respirator cannot be confirmed. With quantitative testing the ratio of aerosols is measured both outside and inside the respirator while the wearer performs similar exercises. For the wearer to have a successful respirator seal the ratio must exceed a set threshold (Hon et al., 2017).

Qualitative fit testing was determined to be the most efficient option due to the lower cost of fit testing supplies, and it prevented the waste of an N95 mask during fit testing. Therefore, the school of nursing developed a qualitative respiratory fit program to be implemented by faculty, staff and students with training and education focused on when to wear the N95 respirator, limiting exposure while in precautions, seal checks, and proper donning and doffing.

There were numerous stakeholders involved in this project, including students, faculty, staff, and clinical partners. Once the development of a respiratory fit testing program was deemed feasible, the nursing department communicated with the hospital partners to determine whether they would change their policies allowing for schools to fit test their own students using the OSHA policies and guidelines. Three major hospital systems agreed, contingent on further proof of education provided during the fit testing procedures such as: full mask fit testing, not only seal check, education on donning and doffing of PPE, education on right mask, right task, emphasis on cluster care and minimalization of in/out of rooms; and maintenance of appropriate student supervision by instructor/preceptor according to the Clinical Affiliation Agreement. Once it was determined that all requirements were fully met through fit test training, we were able to begin fit testing students.

The costs associated with the N95 respirator fit testing program was related to the numerous different N95 respirators being used at each clinical facility and the cost of the N95 respirator qualitative fit testing kits, extra control, and testing solutions. Many of the hospitals donated boxes of their approved, in-stock N95 respirators. The School of Nursing paid for the costs associated with the program as outlined in the table below (Table 1). Total costs for the project were approximately $4,500.

Implementation

To implement the N95 fit testing procedure, students were prioritized to be fit tested based on their clinical placements. Students who were most likely to be on units with COVID-19 patients were prioritized. First some units required N95 masks to be always worn, such as the local Labor and Delivery units. Accelerated, 1-year nursing students were also given precedence due to their limited time in each clinical rotation. Fit testing events were held by faculty, staff, and trained students performed the fit testing.

All materials were purchased from an online retailer, including the hoods, nebulizers, and solutions. Fit testing instructions were printed and provided for anyone performing the fit test (see Appendix A). These materials were available through the OSHA website. An example of a fit testing session included two fit test administrators and one person responsible for reviewing the student questionnaire and documentation of results. Everyone performing the fit testing could potentially fit four individuals at one time. Each fit testing session takes approximately twenty minutes, 10 minutes for filling a health questionnaire and 7-10 minutes for the actual fit testing.

This project began in January 2022 and by May 2022, 153 (53%) students had been successfully fit tested. The urgency for fit testing waned as COVID-19 numbers declined in the hospital; however, during anticipated spikes in positivity rates, with continued fit testing students will be prepared to care for this population. A continuation plan has been developed; fit testing has become a routine part of student orientation to nursing clinicals at the start of the semester. Nursing students in their community and public health clinical will learn the OSHA required testing process, and once competency is determined they will be involved with testing, using these hours as part of their clinical requirement.

A database has been created and housed on OneDrive with sharing access to clinical instructors and the N95 respirator fit testing

| Table 1 |
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| Costs Associated With Respirator Fit Testing Program |
| Item | Cost per Unit | Number of Units | Total Cost |
| N95 respirator fit test kit | $300 | 8 | $2,548.40 |
| Masks | $1.20 average cost per mask | 1,535 | $1,842.60 |
| Extra control and testing solution | FT-32 - $26.23/each | 24 | $633.48 |
| FT-31 - $26.94/each | | | |
| Total | 1,567 | | $4,541.14 |
coordinators. Clinical instructors will be able to access this database to determine whether students have been tested and which masks properly fit. Confidential healthcare information that is gathered in the required forms prior to fit testing is kept under lock and key while the student remains at the university.

Challenges

Many of the hospital systems in our area only approved certain N95 masks, based on contracts between the hospital organization and particular mask manufacturers. Hospitals only approving certain masks available within their organization will require students to be fit tested multiple times depending on clinical rotations. This also created additional costs, as the department must supply multiple types of masks to fit test students.

Initially, there was some miscommunication between the department and clinical instructors. Some clinical instructors were unaware of the policy change and that fit testing had taken place. Now, clinical instructors are updated regarding the policy and aware of the fit testing, and database of student results during their orientation to the course, lab, or clinical.

Conclusion

The COVID-19 pandemic has brought about many challenges and opportunities for nursing schools. During the height of COVID-19 hospital admissions, nursing students were often on units but limited with assignments due to policies prohibiting care of patients in airborne isolation, lack of mask fit testing, or available PPE. The opportunity to update current policies, review OSHA guidelines, train on how to perform fit testing, and communication with clinical partners was necessary to provide students with N95 fit testing. This process was not only important to the school of nursing but also hospitals and nursing staff. Students are valuable members of the healthcare team, and this change in practice allowed students with unique experiences as they prepare to enter nursing practice.

Declaration of Competing Interest

We have no conflict of interest to disclose.

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