ATTITUDES, KNOWLEDGE, AND PREPAREDNESS ON USE OF RESPIRATORY PROTECTION AMONG PHYSICIANS IN TRAINING

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ABSTRACT

Background: A study was performed to determine whether physician trainees followed guidelines for appropriate respirator usage.
Methods: A cross-sectional survey instrument was administered to 656 physicians in training to investigate respirator usage.
Results: Survey response rate was 51%. Respondents reported the following rates of respirator training and usage in the previous year; training (21%), fitting (18%), use (37%), and possession of respirator (6%). Types of respirators selected included; surgical masks (37%), N-95 masks (36%), unknown type (12%), and none (17%). Reported usage of respirators by respondents when posed with a clinical scenario involving a patient posing risk was 77% either "unlikely," or "very unlikely." Perceived barriers to respirator usage included the following; interference with routine doctor-patient relationship (53%), communication difficulties (44%), discomfort (37%), and interference with clinical skills (17%). Ninety-five percent reported that patient's would feel either "worried" or "isolated" if greeted by a physician wearing a respirator.
Conclusions: Physician trainees report limited respirator knowledge and preparedness.

BACKGROUND

Health care workers are at increased risk of acquiring infectious diseases from transmission of respiratory pathogens including *Mycobacterium tuberculosis*, influenza virus, and other respiratory bacterial and viral pathogens (CDC, 1994; Yassi, 2005). Additionally, the emergence of organisms such as SARS-Coronavirus, Avian Influenza A, and other infectious organisms along with the development of concerns for the intentional release of agents of bioterrorism such as anthrax, and smallpox has created increased interest in control of spread of the diseases caused by these agents (Gamage, 2005). The risk of these threats poses both general public health as well as occupational health hazards and requires the development of ongoing strategies for control.

Postulated mechanisms of transmission of these diseases include inhalation of airborne droplets, fomite contact from skin to mucous membranes, and incidental ingestion of infected material

(Seto, 2003). Infected patients can produce these contaminants by coughing, sneezing, deposition of infected secretions onto contact surfaces, and by iatrogenic means such as intubation, manipulation of oxygen masks, bronchoscopy, and nebulization of aerosolized medicines (Loeb, 2004; Scales, 2003).

Protection of health care workers from these diseases has been the focus of many efforts. Recent efforts have attempted to apply the *hierarchy of control technologies* utilized in the industrial or occupational setting to develop methods for reduction of exposure, and prevention of disease (Thorne, 2004). The hierarchy of control technologies as classically described in the industrial hygiene literature consists of 1) engineering controls, followed by 2) administrative and work practice controls and lastly, 3) personal protective equipment (PPE) (DiNardi, 2003). Engineering controls used in health care settings include use of isolation rooms with negative pressure ventilation, HEPA filtration of patient ventilators, instrumentation and equipment, and experimental usage of ultraviolet radiation within ventilation ducting. Administrative controls include isolation of patients suspected to be contagious, instructional signage in patient waiting areas, and the provision of necessary equipment and supplies to ensure availability of adequate hygiene and personal protective equipment. However, despite these attempts at control, the dynamic nature of health care settings provides unique challenges in the design of necessary engineering and administrative controls to adequately protect health care workers. Accordingly, it is presently accepted that control of highly infectious agents demands utilization of PPE in health care settings (CDC, 1998; CDC, 2003).

Although use of respirators has been shown to reduce transmission of respiratory infection among health care workers, and despite the increased concerns about bioterrorism, compliance with recommended use of respirators in the clinical setting has been reportedly uncommon (McDiarmid, 1996). This study was undertaken to determine current knowledge, attitudes, and preparedness among physicians in training in the use of respirators to prevent transmission of infectious respiratory diseases.

STUDY DESIGN AND METHODS

We administered a cross-sectional survey (see Figure 1) to an entire cohort of 656 physicians-in-training (556 resident physicians and 100 fourth year medical students) at one institution to collect baseline information and to compare differences in knowledge, attitude, and preparedness in the prevention of transmission of infectious respiratory diseases during routine clinical responsibilities. The survey was mailed one time to the entire cohort of resident physicians and fourth year medical students at one institution. Administration of the questionnaire began in April 2004 and concluded in June 2004. For purposes of analysis, housestaff were stratified into the following categories: Primary Care, Medical and Pediatric Specialties, and General Surgery and Surgical Specialties. Analyses were performed using SAS® 9.1 (SAS Institute Inc., Cary, NC, USA). We utilized Fishers' Exact Test to examine statistical differences among the groups of physician trainees. We provided an incentive of complimentary movie passes to participants who returned a completed survey to encourage participation.

Questionnaire

Specialty of training (e.g. surgery, pediatrics, cardiology, etc…) _____

Level of training
MS III _____ MS IV _____ PGY-1 _____ PGY-2 _____ PGY-3 _____
PGY-4 _____ PGY-5 or higher _____

For a patient with symptoms of fever, cough, and rhinorrhea, how likely would you be to use a respirator at the first visit?
Very Likely _____Likely _____Neither Likely or Unlikely _____ Unlikely _____Very Unlikely _____

Please rank the following procedures or scenarios in terms of your risk for acquiring an infection like the SARS virus from a patient (1= highest, 5= lowest):

Bronchoscopy _____
Nebulizer treatment _____
Intubation _____
Evaluation of suspected patient in ED _____
Evaluation of suspected patient on hospital floor _____

How do you think most patients would feel if their physician greeted them wearing a respirator (mark one)?
Reassured _____ Isolated _____ Worried _____

Have you been trained in the use of a respirator in the past year?
Yes _____ No _____

Have you been fit with a respirator for your own personal use in the past year?
Yes _____ No _____

Have you used a respirator in a clinical setting in the past year?
Yes _____ No _____

What type of respirator have you used when concerned with contracting a disease from a patient (mark all that apply)?
Surgical Mask _____ N-95 (TB type) Respirator _____ Don't know _____ None_____ Other_____

Do you have a respirator that only you use?
Yes _____ No _____

If yes, how much time would it take for you to get your respirator and put it on?
0-5 minutes _____ 6-15 minutes _____ 16-30 minutes _____
31-60 minutes _____ >60 minutes _____

How often do you get a new respirator?
More than once per day _____ Daily _____ Weekly _____ Monthly _____ > Monthly _____

Which of the following are barriers to your use of a respirator (mark all that apply?)
Communication difficulties _____ Interference with routine doctor patient relation _____
Interference with clinical skills _____ Discomfort _____ other (specify) _____

Figure 1. Questionnaire

RESULTS

Responses to this cross-sectional survey of physicians-in-training were categorized by the following: knowledge in training, fitting, and use of respirators; likelihood in use of a respirator; risk of infection (transmission of SARS virus) under a variety of clinical scenarios; barriers towards use of respirators; and patient attitudes towards physicians' use of respirators. The response rate was 51% (54% housestaff, and 42% medical students- see Table 1).

Table 1. Demographics

Discipline of Training	Response to Survey *n*, (%)
Medical Student	42 (14%)
Primary Care	85 (29%)
Medical and Pediatric Specialty	70(24%)
Surgical and Surgical Specialty	63 (21%)
Other	38 (13%)
Total	298 (100%)

Year of Training*	Response *n*, (%)
Medical Student	42(14%)
PGY-1	44 (15%)
PGY-2	53 (18%)
PGY-3	58 (19%)
PGY-4	45 (15%)
PGY-5 or greater	56 (18%)
Total	298 (100%)

* PGY refers to year of training after medical school.

Training, fitting, use and possession of a respirator in the previous year were limited in this cohort of physician trainees (see Table 2) with 21% having been trained in the use of respirators, and 18% having been fitted with a respirator. Use of a respirator in the past year was reported by 37%. Six percent of respondents reported possession of a respirator for their own personal use. Of the 6% that reported having their own personal respirators, 79% of those reported that they could access and don his/her respirator within five minutes.

Type of respirator selected for personal protection varied with 57% reporting use of a surgical mask, 36% reporting use of an N-95 masks (TB type), 17% reporting no use, and 12% reporting unknown (sum >100% due to multiple responses).

With respect to likelihood of the respondent using a respirator when in a clinical setting with a patient at risk of transmission of infectious airborne pathogens, respondents reported only 23% were likely to use a respirator.

Physician responses to evaluating risk of various clinical scenarios were evaluated by sum ranking. Physicians ranked perception of risk from transmission of agents from highest to lowest: 1) bronchoscopy, 2) intubation, 3) evaluation of a patient suspected to be infected in the Emergency Department, 4) airway nebulization, and lastly, 5) evaluation of a patient suspected to be infected in the hospital ward.

Physician trainees reported the following concerns as barriers to their usage of respirators; 53% reported interference with routine doctor-patient relationship, 44% reported communication difficulties, 37% reported discomfort (37%), and 17% reported interference with clinical skills (sum >100% due to multiple responses).

Respondents were queried on their perceptions of patient attitudes towards physicians wearing respirators. The respondents reported that 95% of patients would feel either "worried," (78%) or "isolated" (17%) if greeted by a physician wearing a respirator.

Table 2. Respirator Training, Fitting, and Use by Discipline of Training

Physician Discipline	Training in Respirators (%)	Fitting of Respirators (%)	Use in Respirators (%)	Use of N-95 Respirator (%) (when respirators were used)
All Respondents	21	18	37	36
Primary Care (PC)	32	29	61	50
Medical and Pediatric Specialties (MPS)	26	26	39 [c]	50
Surgical and Surgical Specialties (SSS)	11 [a]	6 [b]	19 [d]	17 [e]

[a] PC versus SSS p=0.003; MPS versus SSS p=0.04
[b] PC versus SSS p=0.0006; MPS versus SSS p=0.0042
[c] PC versus MPS p=0.098
[d] PC versus SSS p=0.000003; MPS versus SSS p=0.021
[e] PC versus SSS p=0.00006; MPS versus SSS p=0.001

We observed statistically significant differences in training in use of respirators, fitting of respirators, and use of respirators between the groups. Training in use of respirators was reported more frequently in Primary Care (32%) versus Surgical and Surgical Specialties (11%), $p<0.005$, and Medical and Pediatric Specialties (26%) versus Surgical and Surgical Specialties (11%), $p=0.04$.

Fitting of respirators was reported more frequently in Primary Care (29%) versus Surgical and Surgical Specialties (6%), $p<0.001$, and Medical and Pediatric Specialties (26%) versus Surgical and Surgical Specialties (6%), $p<0.005$.

Use of respirators was reported more frequently in Primary Care (61%) versus Surgical and Surgical Specialties (19%), $p<0.001$, and Medical and Pediatric Specialties (39%) versus Surgical and Surgical Specialties (19%), $p=0.021$. Use of respirators was also reported more frequently in Primary Care (61%) versus Medical and Pediatric Specialties (39%), $p<0.01$.

Use of N-95 masks was reported more frequently among Primary Care (50%) versus Surgical and Surgical Specialties (17%), $p<0.001$, and Medical and Pediatric Specialties (50%) versus Surgical and Surgical Specialties (17%), $p<0.001$.

DISCUSSION AND CONCLUSIONS

This study suggests that physicians in training indicate that they have limited knowledge in the application and recommended practices for the usage of respirators in health care settings. Primary Care and Medical and Pediatric Specialties report higher levels of training, fitting, and use of respirators than their Surgical and Surgical Specialty counterparts. However, at all levels of training, and across these disciplines the level of training in use of respirators does not appear to reflect current guidelines recommended by Centers for Disease Control and Prevention (CDC).

These physician trainees also did not report high likelihood for using respirators when working in settings that place them at increased risk for contracting an infectious respiratory disease. In our study, we did not attempt to determine whether this tendency reflects a level of informed and reasonable decision making, or whether it reflects limitations of knowledge or inherent risk taking behavior. Further study into decision-making logic by physicians regarding the use of respirators may help to guide educational efforts and occupational practice recommendations.

The true risk of contracting a respiratory disease during clinical procedures and clinical settings is unclear. However, it has been demonstrated that performing certain procedures does carry a higher risk of developing infectious diseases. For example, intubation, bronchoscopy, and delivery of aerosolized medications were shown to increase risk of transmission of SARS during the outbreak of 2003 (Loeb, 2004; Scales, 2003). In our study, the sum ranking of perceived risk of clinical procedures and exposures by respondents was in line with the rankings of the observed risks found in these studies. Further characterization of the risk for transmission of infectious organisms from these and other clinical procedures would also help clarify recommendations for use of PPE, as well as further development of appropriate administrative and engineering controls.

Barriers for use of respirators reported by physicians in training included interference with routine doctor-patient relationship and communication difficulties. In the often hectic and noisy setting of modern health care facilities, especially in the setting of the Emergency Department, this perception likely has some merit. Respirators do reduce transmission of speech, and by covering a portion of the face they can reduce non-verbal communication cues. How this might impact the delivery and quality of health care has not yet been assessed. Interestingly, only 17% of respondents reported interference with clinical skills. It may be that use of a respirator does have a minimal impact on the clinical skill set demanded by physicians. However, it should also

be noted that only 37% of respondents reported use of respirator, and the clinical skills performed while using the respirators remains unknown.

Adherence to infection control guidelines has been described as being dependent on a multi-focused effort relying upon individual, organizational, and environmental factors (Moore, 2005). While this study did not address organizational or environmental factors regarding use of respirators, we did demonstrate that knowledge and attitudes do appear to be associated with individual decisions for use of respirators. We were not able to address what organizational or environmental factors were in place for this cohort to compare respondents' reports with institutional provisions regarding respirators.

On querying physicians in training on their perception of patient acceptance of usage of respirators by clinicians, we observed that the physician trainees did express the opinion that the majority of patients would feel worried or isolated. This is likely important in that this concern might influence the decision to use a respirator by a physician. Patient perception to clinician use respirators has not been reported. Further study is necessary to determine if this perception is valid.

This study does address issues regarding use of respirators in a population of health care workers not previously reported. The population of physician trainees does represent a broad spectrum of medical specialties on a cohort that had received education from a wide array of both US and international medical schools. Limitations of this study include the use of cross-sectional design, the use of a single institution for selection of study participants, recall bias by respondents, and the limited response rate of 51% of administered surveys. These factors do limit our ability to generalize these findings to all physicians in training. However, even if all non-respondents were using respirators, the training and use of respirators reported from this survey would remain suboptimal.

Finally, use of respirators has been shown to protect health care workers from transmission of infectious diseases. While the absolute risk of infection from airborne pathogens remains unclear, current recommendations from the CDC support use of respirators in specific clinical settings. Our study suggests that physicians in training would benefit from additional education, training, and support for use of respirators in these clinical settings.

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