ORIGINAL RESEARCH

Evaluation of a Pandemic Preparedness Training Intervention for Emergency Medical Services Personnel

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Abbreviations:
EMS = emergency medical services
EMT = emergency medical technician
FDNY = Fire Department of New York
PPE = personal protective equipment
SARS = severe acute respiratory syndrome

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Abstract

Introduction: Emergency medical services (EMS) personnel play an integral role during the national response to a pandemic event. To help ensure their health and safety, especially during the early stages of an outbreak, knowledge and adherence with personal protective equipment (PPE) and infection control strategies will be essential.

Objectives: The objective of this study was to assess the effectiveness of a multi-method, pandemic preparedness training intervention using a pre-/post-test design.

Methods: A convenience sample of 129 EMS personnel participated in a training program on pandemic preparedness. Training consisted of an educational intervention with a focus on the routes of transmission of the influenza virus, proper use of respiratory PPE, agency policies regarding infection control practices, and seasonal influenza vaccination. This was followed by a skill-based drill on respirator fit-checking and proper respirator donning and doffing procedures.

Results: Pre-/post-test results indicate a significant increase in knowledge and behavioral intentions with respect to respirator use, vaccination with seasonal influenza vaccine, and willingness to report to duty during a pandemic.

Conclusions: This method was effective in increasing knowledge and compliance intentions in EMS healthcare personnel. Further research should focus on whether training results in behavior modification.

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Introduction

The emergence of potentially devastating respiratory-borne diseases, such as severe acute respiratory syndrome (SARS) and avian influenza, has heightened concern regarding preparedness in the healthcare sector, including the emergency medical services (EMS) sector. During the early phases of an outbreak, before there are adequate supplies of prophylaxis medications or vaccines available, worker protection will depend on non-pharmaceutical prevention efforts such as personal protective equipment (PPE).[1] To that end, many EMS departments are updating their policies and procedures with respect to respiratory PPE and other infection control strategies. Unfortunately, compliance with these types of devices is known to be suboptimal across the healthcare industry.[2–4] Although this issue is not well-documented for EMS workers, available data suggest that compliance with respiratory PPE is similarly subpar in this workforce.[5] The impact of this is exemplified during the SARS outbreak in 2003, when >850 paramedics were exposed to patients with SARS. Of these, 436 were placed in 10-day home quarantine with four developing probable SARS and were hospitalized.[6]

Several studies on healthcare workers have examined the risk factors for poor compliance with PPE use in general. Three sets of factors appear to be most influ-

ential in this regard; including: (1) individual factors (e.g., demographics, lack of knowledge, and misperception of risk); (2) organizational factors (e.g., safety culture (including training), policies and procedures, staffing and scheduling, and PPE availability and accessibility); and (3) equipment factors (e.g., comfort and fit).[7–10] With respiratory PPE compliance, all of these factors are important, especially equipment factors, as these devices have the potential to be uncomfortable to wear, particularly for extended periods of time.[11]

Although data are sparse, studies have documented the lack of pandemic training in the EMS sector.[12] Combined lack of training and poor compliance with respiratory PPE not only may lead to increased risk of exposure and infection of EMS personnel, but also may lead to a lack of willingness to report to duty during an infectious disease outbreak such as a pandemic, or even to job abandonment.[13] Data from several recent non-EMS studies indicate that as much as 50% of the healthcare workforce is unwilling to report to duty during a pandemic event.[14–16] In a recent, small study on pandemic preparedness in EMS personnel, only 55% of participants surveyed were willing to report to duty, even though, historically, EMS personnel are among the most responsive workgroup with respect to mass-causality incidents.[17] Fear of contagion and lack of trust in protective equipment has been suggested as an important risk factor with respect to responsiveness to infectious disease outbreaks.[16–19] Therefore, it seems reasonable to assume that training and skill-building drills that target respiratory PPE use would be effective in increasing knowledge and employees' intentions to comply with respiratory protection policies and procedures. It also may serve to increase workers' willingness to report to duty during a pandemic.

To address these issues, a large, urban, EMS department recently developed, implemented, and evaluated a multimethod training intervention designed to increase knowledge levels on pandemic influenza, encourage compliance with non-pharmaceutical prevention strategies, including the appropriate use of N95 respirators, and improve the level of willingness to report to duty during a pandemic event.

Methods

Research Design

The research study was conducted using a quasi-experimental pre-/post-test intervention design. The study protocols were approved by the Institutional Review Board at Columbia University, the Fire Department of New York (FDNY), and Local 2507 (Uniformed Emergency Medical Technicians (EMTs), Paramedics and Fire Inspectors Union, affiliated with District Council 37).

Participants

The EMS workers, including EMTs and paramedics who were participating in a mandatory, department-sponsored, pandemic preparedness education program were asked to voluntarily complete anonymous pre-/post-test questionnaires.

Training Program

The training was conducted over a one-month period in FDNY EMS stations. The training included a didactic component that focused on basic pandemic knowledge (e.g., routes of transmission and signs and symptoms of influenza infection), and department-specific infection control policies and procedures, with an emphasis on the proper use of N95 respirators. The training was conducted in a small group setting by trained EMS station officers using a standard set of training materials, slide set, and training manual. Immediately following this portion, the station officer demonstrated the correct way to check the fit of the N95 respirators, as well as proper donning and doffing methods. The FDNY provides annual N95 fit-testing to all EMS workers during their annual occupational health examination, but this drill provided each EMS worker with additional hands-on training and practice in how to properly fit-check, don, and doff these devices on their own supportive work setting. The EMS personnel practiced these procedures using their own N95 respirators. Immediate feedback on their techniques was given. The entire program took <30 minutes to complete.

Pre-/Post-Test Questionnaire

Anonymous pre-/post-test self-administered questionnaires were developed to assess pandemic knowledge, departmental infection control policies and procedures related to "flu-type" calls, behavioral intentions with respect to seasonal influenza vaccine (available at no cost by the department) and respiratory compliance, and willingness to report to duty during a pandemic event. A knowledge scale consisting of seven items was constructed by a panel of experts to assess knowledge on pandemic influenza. Participants willing to complete the pre-/post-tests were given a packet containing a disclosure and consent form, pre-coded questionnaires, a nine-item training evaluation form, and a return envelope. The pre-test was completed just before the training program and the post-test immediately after the training. The completed questionnaires were placed into a sealed envelope by the participant and returned to the FDNY-EMS Office of Medical Affairs, which then forwarded all received questionnaires to the research study office for data entry and processing.

Data Processing

Questionnaires missing substantial amounts of data were not included in the analysis, resulting in a sample of 129 participants. All data were entered into a database and then reviewed by a data manager to ensure accuracy of data entry. Data editing was followed by a basic descriptive analysis of the data, including the calculation of means, medians, percentages, proportions, and standard deviations. Level of significance was set at an alpha level of 0.05, two-tailed. A dependent *t*-test was performed to examine the knowledge scale mean difference between pre-/post-tests, and chi-square statistics were used to measure significant differences on single items. All analyses were conducted using SPSS 16.0.1 (SPSS, Inc., Chicago, IL).[20]

Results

Demographics

Demographic information is provided in Table 1. The majority of responding EMS participants were male (71%)

Characteristics	n (% reporting)*
Gender	
Male	91 (71.1)
Female	37 (28.9)
Age	38.15 ±11.35 years
Highest Educational Degree	
High School Diploma	30 (23.3)
Associate's Degree or Some College	77 (59.7)
Bachelor's Degree	19 (14.7)
Masters Degree or Higher	3 (2.3)
Professional Certification	
EMT-B	98 (76.0)
EMT-P	31 (24.0)
Marital Status	
Married/Partner	69 (54.8)
Unmarried/No Partner	57 (45.2)
Years Worked as an EMT/Paramedic	
0 to 5	36 (28.3)
6 to 10	25 (19.7)
11 to 15	16 (12.6)
16 to 20	27 (21.3)
20+	23 (18.1)
Years Worked as an EMT/Paramedic for Current Employer	
0 to 5	47 (37.6)
6 to 10	26 (20.8)
11 to 15	20 (16.0)
16 to 20	20 (16.0)
20+	12 (9.6)

Table 1—Demographic characteristics of the sample (n = 129)
*Column numbers may not add to 129 due to missing values.

with an average age of 38 years. Three-fourths of the sample were EMT-Basic and the remaining participants were paramedics. More than half (52%) had worked for the department for >10 years. Demographic information of the sample was compared to department-wide demographic information and was similar (data not shown).

Pre-/Post-Test Analysis

Although baseline scores on the seven-item knowledge scale were high (M = 6.3, max = 7.0), results indicate that there is a statistically significant difference between the pre-test and post-test knowledge scale, $t(128) = 3.6$, $p < 0.001$, $d = 0.3$ (95% CI = 0.2–0.5). After the training, participants scored significantly higher on the post-test (M = 6.6 ±0.8 (±1 standard deviation)) than on the pre-test (M = 6.3 ±1.1). Thus, training was effective at increasing knowledge.

Scores on the departmental policy regarding the management of "flu-like" calls also increased significantly, $\chi^2(1, n = 126) = 36.2$, $p < 0.001$. After training, the proportion of participants who correctly identified the criteria for a "flu-type" emergency call increased from 42% to 52% of the sample. Furthermore, scores on departmental policies regarding infection control procedures for "flu-type" calls increased after training ($p < 0.01$, Fisher's exact test). Prior to training, 72% of respondents correctly identified when to don PPE when responding to a "flu-type" call; after training, this proportion increased to 91%. Behavioral intentions with respect to wearing N95 respirators during a pandemic when dispatched to "flu-like" calls similarly increased, from 76% to 84%, $\chi^2(1, n = 128) = 19.4$, $p < 0.001$. Prior to the training, 45% of the participants were planning to receive the seasonal influenza vaccine and after the training, this increased to 52%, $\chi^2(1, n = 123) = 84.9$, $p < 0.001$. In addition, prior to training, 69% of participants reported that they would receive a safe and effective avian influenza vaccine if it became available during a pandemic. After training, this percentage increased to 77%, $\chi^2(1, n = 127) = 34.7$, $p < 0.001$. The proportion of participants who thought that respiratory PPE would afford them a high degree of protection increased from 69% to 84%, $\chi^2(1, n = 129) = 48.4$, $p < 0.001$. Prior to the training, 72% of participants agreed or strongly agreed with the statement: "I feel confident that I have enough knowledge to protect myself from infection with avian influenza;" after the training, this increased to 93% ($p < 0.01$, Fisher's exact test). Finally, willingness to report to duty during a pandemic increased from 63% at the pre-test to 66% during the post-test, $\chi^2(1, n = 128) = 53.2$, $p < 0.001$.

Training Program Evaluation

In general, the training program was well received. A total of 128 evaluations were returned, and almost all of the participants found the program valuable (98%). Participants reported that the program reinforced their understanding of PPE effectiveness (95%) and >92% of participants felt that the training effectively improved their knowledge of respiratory illnesses. A total of 97% of participants felt that the training program addressed the risks they faced as a first responder. The length of time of the training program was considered acceptable to 95% of the participants.

Discussion

The training program was effective in increasing participants' basic pandemic knowledge (at least in the short-term), and knowledge on their own department's infection control policies and procedures. Importantly, behavioral intentions regarding compliance with departmental policies with respect to the use of respiratory PPE also increased, as did their intentions to accept the seasonal flu vaccine. Similarly, EMS workers' intentions regarding reporting to work during a pandemic increased. This may have been related to improvements in participants' understanding of how they could work safely during a pandemic and/or knowing how to properly use N95 respirators.

By providing these types of training programs, other employers may support employees' willingness to work during potentially hazardous conditions, such as a pandemic event. In high-risk employment settings, employers have an obligation to effectively train employees on procedures that will reduce their risk of occupational exposure. Training on the use of PPE is just one aspect of an overall safety program. Unfortunately, in health care, competing interests

and limited training time, trainers, and even in some cases, training facilities, can undermine safety programs. Simply having safety equipment available will not ensure compliance and appropriate use. With respiratory PPE use in particular, with compliance known to be suboptimal, a simple, short training program and skill-building drill may be an important component to an overall safety program.[7] This approach might be helpful to other EMS departments and healthcare work groups.

The PPE training was well received by the participants, and almost all found it to be a useful exercise. The addition of the skill-building drill was important, as these devices are not worn commonly, and are known to be difficult to wear effectively.[21] While all FDNY EMS employees are fit-tested for N95 respirators annually, the chance to receive hands-on training to review the procedures to properly fit-check, don, and doff these devices in a supportive work setting was seen as useful. The program was cost-effective, did not require any technology, and utilized available time between calls. The station officers routinely meet, which made training them (i.e., train-the-trainer) feasible. Since all of the trainers used the same course material, standardized information was disseminated. This is particularly important when communicating departmental policies.

Limitations

The sample was a convenience sample of EMS workers who were scheduled on the days that training occurred, thus representing a small sample of the department's EMS workforce (n = 2,992). Future research should include more sophisticated study designs and larger samples. Another limitation of this study is that the post-test was conducted immediately following the training, and therefore, it measures only short-term retention of information. Follow-up studies are needed to determine how well this information is retained for much longer time periods. However, it makes sense to provide this type of training on a routine basis. Also, since this study was conducted in a large, urban department, it would be helpful to repeat this type of study in other community settings. The extent that this training program might be effective in an all volunteer force, or a combination career/volunteer force is unknown. However, since most volunteer forces conduct regular drills and training, this might readily be incorporated into standard programs. Finally, additional research is required to determine if the training translates into actual behavior change. While this is arguably more difficult to assess, it is the true measure of the effectiveness of this type of program.

Conclusions

The results from this study indicate that this didactic and skill-building training approach was effective in increasing knowledge, at least in the short-term, and in changing behavioral intention. More work is needed to ascertain if this type of training results in behavior modification.

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