ORIGINAL RESEARCH

Anticipated Behaviors of Emergency Prehospital Medical Care Providers during an Influenza Pandemic

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Abstract

Introduction: Emergency prehospital medical care providers are frontline health workers during emergencies. However, little is known about their attitudes, perceptions, and likely behaviors during emergency conditions. Understanding these attitudes and behaviors is crucial to mitigating the psychological and operational effects of biohazard events such as pandemic influenza, and will support the business continuity of essential prehospital services.

Problem: This study was designed to investigate the association between knowledge and attitudes regarding avian influenza on likely behavioral responses of Australian emergency prehospital medical care providers in pandemic conditions.

Methods: Using a reply-paid postal questionnaire, the knowledge and attitudes of a national, stratified, random sample of the Australian emergency prehospital medical care workforce in relation to pandemic influenza were investigated. In addition to knowledge and attitudes, there were five measures of anticipated behavior during pandemic conditions: (1) preparedness to wear personal protective equipment (PPE); (2) preparedness to change role; (3) willingness to work; and likely refusal to work with colleagues who were exposed to (4) known and (5) suspected influenza. Multiple logistic regression models were constructed to determine the independent predictors of each of the anticipated behaviors, while controlling for other relevant variables.

Results: Almost half (43%) of the 725 emergency prehospital medical care personnel who responded to the survey indicated that they would be unwilling to work during pandemic conditions; one-quarter indicated that they would not be prepared to work in PPE; and one-third would refuse to work with a colleague exposed to a known case of pandemic human influenza.

Willingness to work during a pandemic (OR = 1.41; 95% CI = 1.0–1.9), and willingness to change roles (OR = 1.44; 95% CI = 1.04–2.0) significantly increased with adequate knowledge about infectious agents generally. Generally, refusal to work with exposed (OR = 0.48; 95% CI = 0.3–0.7) or potentially exposed (OR = 0.43; 95% CI = 0.3–0.6) colleagues significantly decreased with adequate knowledge about infectious agents. Confidence in the employer's capacity to respond appropriately to a pandemic significantly increased employee willingness to work (OR = 2.83; 95% CI = 1.9–4.1); willingness to change roles during a pandemic (OR = 1.52; 95% CI = 1.1–2.1); preparedness to wear PPE (OR = 1.68; 95% CI = 1.1–2.5); and significantly decreased the likelihood of refusing to work with colleagues exposed to (suspected) influenza (OR = 0.59; 95% CI = 0.4–0.9).

Conclusions: These findings indicate that education and training alone will not adequately prepare the emergency prehospital medical workforce for a pandemic. It is crucial to address the concerns of ambulance personnel and the perceived concerns of their relationship with partners in order to maintain an effective prehospital emergency medical care service during pandemic conditions.

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Introduction

Emergency prehospital medical care providers are frontline health workers, but most studies on the behaviors of professional personnel in relation to disasters and/or emergencies have not included the prehospital workforce.[1–6]

In general, perception of risks, as opposed to actual risks, alter behavior.[7–9] Consistent with this is the evidence that healthcare workers' willingness to report for duty during disasters is dependent on the disaster type.[10] To date, the literature suggests that among healthcare personnel, non-conventional disasters (such as those involving infectious agents) may be associated with lower willingness to work.[11–13] Only one study known to the authors has examined attitudes related to pandemic influenza,[6] and this investigation did not include personnel from the emergency prehospital medical care sector. Understanding the perceptions, attitudes, and consequent potential behavior of this section of the health workforce is fundamental to mitigating the psychological and operational effects of such an event. It seems likely that managing health messages and operational support to emergency prehospital medical care providers and their families will be important in maintaining essential prehospital services if a pandemic does occur.

This study builds on previous work by the authors in which pre-event knowledge and attitudes of a national sample of emergency prehospital medical care providers in relation to a potential human influenza pandemic were examined.[14] Understanding how to manage and support the responses of frontline health workers to an infectious disease outbreak is critical to the emergency system response.

Objectives

This work investigated the association between knowledge and attitudes of Australian emergency prehospital medical care providers regarding avian influenza and their anticipated behavioral responses during pandemic conditions.

Methods

Study Design

In Australia, a network of nine ambulance services provides emergency prehospital medical care. As described in detail elsewhere,[14] reply-paid postal questionnaires were distributed to a random sample of approximately 20% of ambulance personnel (n = ~3,000) in May 2006, stratified according to ambulance service; gender, and location (metropolitan versus non-metropolitan). The sample comprised a cross-section of employees in the emergency prehospital medical care sector in Australia, including staff involved in administration, education, and management, as well as those engaged in providing emergency prehospital medical care.[14] Various strategies were used to maximize the response fraction.

The Behavioral and Social Sciences Ethical Review Committee of the University of Queensland approved the protocol for this project, which complies with the provisions contained in the National Statement on Ethical Conduct on Research Involving Humans.[15]

Survey Items and Variables

The questionnaire contained 115 items divided into four sections: (1) demographic information; (2) knowledge of influenza; (3) attitudes and perceptions; and (4) anticipated behaviors. All variables (except age, which was treated as a continuous variable) were dichotomized for analyses. The variables have been described in detail elsewhere,[14] but are summarized briefly.

Demographic Variables—Key demographic variables included: gender; age; location (metropolitan/non-metropolitan); length of service in the ambulance system (≤5 years/>5 years); current position (operational/non-operational); volunteer status (volunteer/non-volunteer); relationship status (living in permanent relationship/not); and children (yes/no).

Knowledge of Influenza—The questionnaire covered five domains of knowledge: general knowledge of avian influenza; general knowledge of pandemic human influenza; and methods of influenza infection transmission, protection, and decontamination. For each of these domains, participants responded to a number of items for which appropriate responses had been identified by an expert panel (comprising: epidemiologists, infectious disease experts, and psychologists). The number of correct responses was summed, and a total score exceeding a predefined limit was categorized as "adequate knowledge" within that domain. Other scores were categorized as "inadequate knowledge".

Participants also responded (yes/no) to six statements about their perceptions of the adequacy of their education and training on aspects of pandemic human influenza (e.g., symptom recognition; correct reporting procedures; effectiveness of antiviral medications). Positive scores were summed, and a score >5 was categorized as "perceived adequate education/training". An additional item (yes/no) addressed perceived adequacy of education and training about infectious agents generally.

Attitudes and Perceptions—Attitudes and perceptions related to living and working in pandemic conditions were examined using three domains based on questions using a five-point Likert response scale. The three domains were: anxiety (eight items); perceived risk (10 items); and overall concern (one item). Responses to items on anxiety and perceived risk were summarized as mean scores, and then divided into two groups of approximately equal size (high and low perceived risk; high and low anxiety) to facilitate binary logistic regression. Two additional items measured perceived level of concern among survey respondents' relationship partners with regard to pandemic influenza in general, and home quarantine during pandemic conditions.

Outcome Variables—Anticipated behaviors during pandemic conditions were examined using five variables. Participants' responses on five-point Likert scales were dichotomized to indicate low or high propensity in relation to: (1) willingness to work; (2) preparedness to wear personal protective equipment (PPE); (3) willingness to change work role; (4) refusal to work with a colleague exposed to a *known* case of influenza; and (5) refusal to work with a colleague exposed to a *suspected* case of influenza.

Variable	n	(%)	95% CI (%)
High willingness to work during PHI	408	56.3	52.6–59.9
High preparedness to wear PPE	549	75.7	72.4–78.8
High willingness to change role	344	47.4	43.7–51.1
Low refusal to work with colleagues exposed to known PHI	479	66.1	62.5–69.5
Low refusal to work with colleagues exposed to suspected PHI	557	76.8	73.6–79.8

Table 1—Anticipated behaviors of emergency prehospital medical care personnel during pandemic human influenza (n = 725; PHI = Pandemic Human Influenza; PPE = personal protective equipment)

		Willingness to work		Willingness to use PPE		Willingness to change role*		Refusal to work with colleagues—Known exposure§		Refusal to work with colleagues—Suspected exposure	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Demographic Characteristics	Location of work (metro)	0.64	0.5–0.9	0.65	0.4–0.9						
	Length of service (>5 years)			0.53	0.3–0.8						
	Gender (female)					0.67	0.5–0.9				
Knowledge	Infection transmission (adequate)			0.65	0.4–0.9						
	Perceived education/ training in infectious disease generally (adequate)	1.41	1.0–1.9†			1.44	1.0–2.0	0.48	0.3–0.7	0.43	0.3–0.6
Attitudes/ Perceptions	Confidence in employer (high)	2.83	1.9–4.1	1.68	1.1–2.5	1.52	1.1–2.1			0.59	0.4–0.9
	Overall concern (high)	0.36	0.2–0.5			0.28	0.2–0.4	2.64	1.8–3.8	2.33	1.6–3.5
	Perceived partner concern (high)	0.60	0.4–0.9					1.98	1.2–3.2		
	Perceived partner concern re: home quarantine (high)									1.99	1.1–3.5

Table 2—Predictors of (anticipated) behaviors in emergency prehospital medical care providers during a pandemic human influenza (PPE = personal protective equipment)
*Adjusted for perceived overall partner concern
†p = 0.05 (include as CI is 1.0)
§Adjusted for confidence in employer

Statistical Processing

Five separate logistic regression models were constructed to examine the relationships between the predictor variables (demographic characteristics, knowledge and attitudes) and the five anticipated behaviors of emergency prehospital medical care personnel during a pandemic. Initially, the results were summarized as crude odds ratios with 95% confidence intervals (CI). Predictor variables that were significantly associated with the outcome variable (i.e., 95% CI not including 1.0, p <0.05) in crude analyses then were entered into a multivariate logistic regression model. This was done for each of the five outcome variables. Any pre-

dictor variables that were no longer significantly related to the outcome variables were removed from the model, one at a time, and the impact on the remaining variables assessed. If no changes to the odds ratios of the other variables beyond 10% were observed, the variable was not included in the final model for that anticipated behavior. Analyses were performed using SPSS 11.5 (SPSS Inc., Cary, NC).

Results

Response to the survey was low (725/2,929 = 24.7%), but the participants were representative of the Australian emergency prehospital medical care workforce in relation to the three stratification factors used in obtaining the sample (ambulance service, age, gender).[14] Of the survey participants, 56.3% indicated that they would be willing to work during pandemic conditions, and three-quarters of respondents would be prepared to work in PPE (Table 1). Approximately half (53%) of ambulance personnel surveyed indicated that they would be unwilling to change roles during a pandemic, and one-third would refuse to work with a colleague exposed to a known case of pandemic human influenza. One-quarter of respondents indicated that they would refuse to work with a colleague exposed to *suspected* influenza.

Variables Associated with Anticipated Behavior

The independent predictors of anticipated behaviors of emergency prehospital medical care personnel during pandemic conditions are summarized in Table 2.

Willingness to Work—Emergency prehospital medical care providers based within metropolitan regions were significantly less willing than were those employed outside of the metropolitan regions to work during a pandemic (OR = 0.64; 95% CI = 0.5–0.9). Respondents with high overall concern (OR = 0.36; 95% CI = 0.2–0.5) and those who perceived that their relationship partners were concerned (OR = 0.60; 95% CI = 0.4–0.9) also were less willing to work during pandemic conditions. Increased willingness to work during a pandemic was associated with high confidence in their employer (OR = 2.83, 95% CI = 1.9–4.1) and perceived adequate education/training on infectious disease generally (OR = 1.41; 95% CI = 1.0–1.9; $p = 0.05$).

PPE—Among the emergency prehospital medical care personnel surveyed, reduced preparedness to wear PPE was independently associated with working within a metropolitan region (OR = 0.65; 95% CI = 0.4–0.9), working in an ambulance service for >5 years (OR = 0.53; 95% CI = 0.3–0.8); and having adequate knowledge of infection transmission (OR = 0.65; 95% CI = 0.4–0.9). Increased preparedness to wear PPE during pandemic conditions was significantly associated with confidence in the employer (OR = 0.68; 95% CI = 1.1–2.5).

Change in Work Role—Female respondents were significantly less willing than were their male peers to change work role during a pandemic (OR = 0.67; 95% CI = 0.5–0.9), as were personnel who demonstrated high overall concern about working during a pandemic (OR = 0.28; 95% CI = 0.2–0.4). Perceived adequacy of education/training on infectious agents generally was a significant predictor of preparedness to change role during a pandemic (OR = 1.44; 95% CI = 1.04–2.0). Respondents who were confident in their employer were significantly more willing to change roles during a pandemic (OR = 1.52; 95% CI = 1.1-2.1).

Refusal to Work with Colleagues Exposed to Known or Suspected Influenza—Perceived adequate education/training on infectious agents generally was associated with significantly lower refusal to work with colleagues exposed to known (OR = 0.48; 95% CI = 0.3–0.7) or suspected (OR = 0.43; 95% CI = 0.3–0.6) pandemic human influenza. High confidence in employer was significantly associated with lower refusal to work with colleagues exposed to suspected influenza (OR = 0.59; 95% CI = 0.4–0.9), but not with colleagues exposed to known influenza (OR = 0.71; 95% CI = 0.5–1.1). Increased likelihood of refusal to work with colleagues exposed to either known or suspected influenza was associated with two factors: (1) high overall concern (known: OR = 2.64; 95% CI = 1.8–3.8; suspected: OR = 2.33; 95% CI = 1.6–3.5), and (2) the individual's perception that their relationship partner was concerned about home quarantine (known: 1.98; 95% CI = 1.2–3.2; suspected: OR = 1.99; 95% CI = 1.1–3.5).

Discussion

Almost half of the emergency prehospital medical care personnel who participated in this survey indicated that they would be unwilling to work during pandemic conditions, and one-third would be unwilling to work with colleagues who had been exposed to cases of suspected influenza. These findings have significant operational and organizational implications for the prehospital sector, business continuity of essential services, and pandemic preparedness.

It has been reported that, at least in 2006, this sample had poor knowledge about both influenza and avian influenza, and perceived inadequate education/training in relation to avian influenza.[14] Moreover, knowledge and perceived adequacy of education/training were associated with attitudes related to working during pandemic conditions. The present analysis indicates that the likely behavior of emergency prehospital medical care personnel during a pandemic is associated only with perceived adequate education/training on infectious agents generally, and not with more specific knowledge about infection protection, decontamination procedures, avian influenza; and/or pandemic human influenza.

This has not been observed in the literature. Adequate understanding of infection control methods was correlated with the willingness of nurses in Taiwan to treat patients with SARS,[16] although this analysis did not adjust for other relevant variables. DiMaggio and colleagues[12] reported that emergency medical technicians who had received training and education were more willing to respond to terrorist incidents, even when other variables such as pay and concern about disease were taken into account. On the other hand, in a survey completed by healthcare workers in Japan post-SARS, knowledge of the illness was not associated with acceptance of risk once other relevant variables

were taken into account,[17] but was associated with increased avoidance of potentially infected patients. The present study suggest that while knowledge of contagious diseases and their prevention is closely linked to attitudes and perceptions of the risk associated with a pandemic, the attitudes and perceptions are more proximate influences in terms of the likely responses of emergency prehospital medical care personnel during such an event.

However, these data also indicate that preparedness to wear PPE among emergency prehospital medical care providers is associated with the perception of adequate education/training about infection transmission methods. Others have reported similar findings,[16,18–21] but those studies were qualitative[21] or descriptive[16,18] in nature, or only reported crude associations.[19] As demonstrated in the present study, Gershon and colleagues found that previous training remained a significant predictor of compliance with Universal Safety Precautions (USP) by healthcare workers in the US, even after adjusting for potential confounding variables using multivariate logistic regression analyses.[22] Nevertheless, the association between knowledge and willingness to wear PPE reported in the present study is limited to perceived education/training specifically about methods of infection transmission, and not with knowledge regarding infection protection, decontamination, avian influenza, or pandemic human influenza. This specificity warrants further investigation.

Few studies have investigated the impact of confidence in the employers on behavior of healthcare workers. Tzeng and colleagues observed that healthcare workers who perceived that their employer was poorly equipped to deal with infectious disease (i.e., SARS) led to resignations.[16] Healthcare workers (including prehospital personnel) who perceived a positive safety climate in their organization were more likely to comply with Universal Safety Precautions during terrorist incidents.[12] However, the majority of these studies[21] were not analytical in nature, thereby limiting the conclusions that can be drawn. In the present study, confidence in their employer was associated with each of the five likely behavioral responses measured (i.e., willingness to work, preparedness to wear PPE, willingness to change role, and refusal to work with colleagues exposed or potentially exposed to influenza), even after adjusting for confounding factors. This is an issue that must be considered in pandemic planning in the emergency prehospital medical care sector, and in the wider healthcare sector, if risk behaviors are to be managed effectively.

This study suggests that the perceived level of concern in one's relationship partner is associated with the likely behavioral responses of emergency prehospital medical care personnel during pandemic conditions, even after adjusting for other relevant variables. Previous research suggests that concern for safety of family members impacts on the willingness of healthcare personnel to work during disasters/hazardous events.[12,23–25] A recent study that included prehospital personnel[11] demonstrated that making prophylaxis/treatment available to families of healthcare personnel significantly increased the latter's willingness to work, regardless of whether the intervention was known to be effective or experimental. These results indicate that pandemic preparedness requires the development of strategies to identify and allay concerns of family members if disruptions to emergency prehospital medical care are to be minimized during pandemic conditions.

Factors such as sense of duty,[1,3] child or eldercare obligations,[10] gender,[10] peer behavior,[26,27] and perceived risk of infection[25,28] previously have been hypothesized to affect attitudes and/or behavior of healthcare and emergency prehospital medical care personnel toward working during pandemic (or similar) conditions. The current study indicates that it may be crucially important to address the concerns of the staff and the perceived concerns of their relationship partners. While there is some indication that knowledge about relevant aspects of infectious disease is an upstream determinant of such concerns, a more sophisticated strategy for preparing ambulance services to face a pandemic would go beyond attempting to impart factual information to staff. Instead, strategies should deal directly with issues such as willingness to work during a pandemic, willingness to change roles under such conditions, and willingness to work with exposed (or potentially exposed) colleagues. In pandemic conditions, where it is anticipated that part of the workforce will be unavailable due to illness and quarantine,[29] absenteeism motivated by anxiety or concern over working could have significant implications for maintaining an adequate service.

Strengths and Limitations

While participation in this study was low (24.7%), the findings have important implications. Issues related to the low response rate have been described.[14] Even if all of the members of the sample who did not respond failed to do so because of lack of concern about working during an outbreak of avian influenza, these data suggest that at least one in eight emergency prehospital medical care personnel (and up to half) may be unwilling to work during pandemic conditions. Given the increased demand that would be placed on emergency prehospital medical care providers during pandemic conditions, as well as the reduced availability of staff due to illness or quarantine, absenteeism because of unwillingness to work would impact significantly on the response capacity. Furthermore, it is likely that these calculations are conservative, because those who did not participate in the survey were representative of the Australian prehospital workforce in terms of the stratifying factors of jurisdiction, location, and gender.

Conclusions

Notwithstanding the limitations of the data due to the response rate, this study demonstrates that it is unlikely that education and training alone will adequately prepare the emergency prehospital medical care workforce for a pandemic. Further, the data indicate that addressing the concerns of personnel and their relationship partners, as well as the level of confidence in their organization to respond appropriately, is required in order to maintain adequate emergency prehospital medical care during a pandemic influenza or similar event.

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Editorial Comments—Anticipated Behaviors of Emergency Prehospital Medical Care Providers during an Influenza Pandemic

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Tippett and co-authors are to be congratulated for an insightful and well written paper that addresses an important issue in prehospital care. Governments and emergency operations personnel often plan for future pandemics with a focus on distribution of "stuff" such as gloves, masks, beds, and ventilators. Inadequate attention is directed to healthcare provider staffing, including staffing of prehospital care units. A basis for the focus on "stuff" is an assumption that healthcare workers have a "duty-to-care" and will respond willingly with generous disregard of personal safety and personal obligations to provide staffing during increased demand for care of a pandemic affected population.

In their paper, Tippett and co-authors examine the willingness of prehospital providers to respond to different health emergencies. The paper appropriately studies the association of pandemic response willingness to perceived safety for the healthcare provider and their family as well as support from their employers. As the authors note, there is little in the way of literature that has looked at response of prehospital providers in the setting of a pandemic. While the response to the structured survey used by the authors was 24.7%, they were able to show that the response group reflected the demographics of the study population and the results of this study probably reflect that of the prehospital providers in Australia. This study should be valid for other developed nations with advanced life support-level prehospital emergency medical services.

The conclusions of this study were dramatic. It was shown that there is a strong concern for adequate prehospital provider response during a pandemic due to an unwillingness to expose oneself to the infection, a consideration for the concerns of the prehospital providers' relationship partners, and ambiguity in the employer-employee relationship. These findings parallel those found and published in three papers describing other subgroups of healthcare providers.[1–3]

While the current H1N1 pandemic may be controlled with the development and distribution of an effective vaccine, the recent severe acute respiratory syndrome (SARS) pandemic shows the vulnerability of healthcare systems and governments when faced with a rapidly expanding pandemic for which all who are exposed are at risk. The World Health Organization estimates that approximately 30% of reported SARS cases were among healthcare workers. Further World Health Organization estimates were that SARS had an overall 10% mortality rate. Despite these estimates and concern expressed by healthcare workers, there has been little done by governmental, professional, and health organizations other than priority vaccination programs, when vaccine is available, to address the risks that healthcare workers take in responding to a pandemic.

A recent United Kingdom study suggests that in the face of a pandemic for which healthcare responders are at risk for infection, absenteeism may be as high as 85%. As also described by Tippett and co-authors, this UK study found that many would choose to be absent from work due to an unacceptable risk to self and family.[1] A interesting association with lack of motivation to provide care during a pandemic that is reported in both papers is a distrust of government and employers to provide for protection and support for healthcare providers during times of health emergencies.

While there is scant research in the medical literature directed at anticipated healthcare provider response during a pandemic, there is a generous amount of opinion that has been published in the medical management and ethics literature. Among ethicists and health planners, there is an assumed "duty-to-care" for healthcare workers.[4–10] The modern ethical concept of the healthcare duty-to-care during an infectious disease outbreak seems to have developed in the context of the HIV pandemic.[5,10] Clinically, this is an inadequate model on which to base current medical ethics when considering pandemic infections because the risk of healthcare worker cross-infection with HIV is extremely low, whereas the risk of infection from SARS or an influenza strain for which a vaccine has not been developed is high. Institutional and public cooperation in logistics, remuneration, psychological, and legal support are acknowledged as areas that may help remove barriers to healthcare worker response during a pandemic. But, there is little published that addresses the dilemma of job obligation versus the personal and family safety that a healthcare worker must face during a pandemic. For many healthcare workers, the obvious ethical decision may be to put safety of self and family above all else. This decision is particularly appropriate for a healthcare provider who is obligated to provide for and care for children and family.

The duty-to-care dilemma is particularly difficult to resolve with the urbanization of society and development of governmental control of medical care. Currently, the healthcare worker duty-to-care is not defined and therefore, it is difficult for an individual to accept as an obligation. In the past, and within rural environments healthcare workers are more likely to accept a duty-to-care obligation because of their close relationship with the community and the community's sole reliance on them for health services. Current urban society and government tend to believe that duty-to-care cannot be left to personal choice or an appeal to morality based on an ethic derived from individual obligations.[3]

Planning that focuses on "stuff" will fall short of the major resource challenge in a future pandemic for which there is high risk of infection. That major resource challenge will be available healthcare workers needed to deal with increased rates of pandemic related illness. Tippett and coauthors have provided a structured study on this perplexing problem. They are to be congratulated for presenting evidence that helps develop possible solutions to the predictable crisis of healthcare provider response in the face of a pandemic for which there is no protection from cross-infection.

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