

Voluntary Infectious Disease Precautions and Non-Pharmaceutical Interventions among Students at a University in Texas during the Spring 2009 Novel H1N1 Outbreak

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Abstract

This study examines the influence of perceptions of general threat of the novel H1N1 virus and individual risk of contracting the virus on the voluntary adoption of infectious disease controls and non-pharmaceutical interventions among students attending a university in Texas during the spring 2009 outbreak. The data are from online surveys conducted one week after the CDC announcement of the outbreak. The results suggest that perception of the general health threat contributes to the adoption of infectious disease controls and non-pharmaceutical interventions.

Key Word

Influenza, Pandemic Influenza, Non-pharmaceutical interventions, college students, threat perception.

Introduction

Among the threats facing the United States, an infectious respiratory illness such as pandemic influenza has the potential to directly infect large numbers of people, disrupt social and economic activities, and result in significant morbidity and mortality.¹ Efforts to reduce exposure, limit mortality, and minimize workplace and infrastructure disruption depend upon the public taking actions in the form of infectious disease preventions and non-pharmaceutical interventions early in the outbreak. The preventative actions necessary to mitigate a pandemic require the public to be informed and willing participants. Historical research suggests that early and layered non-pharmaceutical interventions, such as social distancing through the prohibition of public gatherings, mitigated the effects of a severe influenza pandemic.² The public appears to be theoretically willing to engage in social distancing and other non-pharmaceutical interventions.³ However, little is known about the array of preventative measures people will take when faced with an actual influenza outbreak of pandemic potential in contemporary times. The 2009 novel H1N1 influenza outbreak provides an opportunity to examine the utilization of preventative actions to reduce transmission early in the identification of an outbreak. In this study, we examine

the influence of general threat perception and individual risk assessment on the implementation of basic infectious disease prevention measures and non-pharmaceutical interventions among students at a Texas university.

Preventative Actions: Basic Infectious Disease Control and Non-Pharmaceutical Interventions

Basic infectious disease control efforts and non-pharmaceutical interventions have been identified as important early actions to reduce the spread of infectious respiratory disease outbreaks.^{4,5} These efforts include infectious disease prevention through hand hygiene and respiratory etiquette⁶ and non-pharmaceutical interventions such as social distancing.⁷⁻⁹ These actions can be implemented by the public without training or specialized equipment.

Hand hygiene is important to infectious disease prevention since it reduces microorganism burden on the hands, thereby reducing the chance of disease transmission.¹⁰ It is especially important in preventing the spread of flu viruses.¹¹ This form of hygiene includes washing hands with soap and water and the use of alcohol-based hand sanitizers. After the 2003 SARS outbreak, hand washing compliance increased in the first phase of the outbreak and remained at a high level for 22 months after the outbreak.¹²

Respiratory etiquette includes covering the mouth with a tissue and disposing of the tissue immediately or using the sleeve or crook of the elbow rather than a hand when coughing or sneezing.¹³ This procedure reduces the spread of respiratory diseases because microbes do not live as long on fabric and are less likely to spread.¹⁴ In clinical settings, a lack of ongoing respiratory etiquette has been linked to outbreaks of pertussis.^{15,16} While respiratory etiquette programs are part of the CDC guidelines for pandemic response, it is not clear how willing the public is to engage in such practices.¹⁷

Non-pharmaceutical interventions include case isolation, household quarantine practices, travel restrictions, and social distancing such as school and workplace closures and public gathering restrictions.⁹ Mathematical modeling suggests that non-pharmaceutical interventions could flatten the overall epidemic peak if implemented early and sustained throughout the outbreak.¹⁸ The result would be a reduced surge burden on the healthcare system and additional time for vaccine development; but the models do not provide evidence of an overall reduction in the size of the epidemic.

There is evidence of the effectiveness of social distancing during the 1918-1919 Spanish Influenza pandemic³ and the 2002-2003 SARS outbreak.^{19,20} For non-pharmaceutical interventions to be effective there needs to be a coordinated effort between public health officials and the general population. The public has suggested that they are theoretically willing to participate in non-pharmaceutical interventions, but specific segments of the population may be less likely to comply due to the expected financial burden of compliance.² Despite agreement on the importance of early adoption of basic infec-

tious disease controls and non-pharmaceutical interventions, little research has examined factors that may influence the public willingness to adopt the array of practices. Two factors that may contribute to a willingness to adopt these practices include perceptions of the seriousness of the outbreak and individual risk of infection.

Perceptions of General Threat and Individual Risk

People have a limited understanding of biological threats, including infectious respiratory diseases.²¹ Recent outbreaks of SARS and Avian Flu (H5N1) have provided opportunities to examine the relationship of perceptions of threat and susceptibility to the implementation of infectious disease prevention and non-pharmaceutical interventions. In the case of SARS, perceived susceptibility, severity of infection, and perceived efficacy of hand-washing influenced self-reported hand-washing compliance.¹²

While previous research suggests that people are willing and able to change behaviors in response to infectious respiratory disease outbreaks, research has not examined the spectrum of infectious disease control measures and non-pharmaceutical interventions that would be considered as part of a comprehensive response to a pandemic event. Much of the research on the variety of actions required of a population during a pandemic have been hypothetical exercises measuring anticipated compliance.²²

Social Vulnerability

Social vulnerability is a measure of societal resistance or resilience; which stems from the fact that some groups are more vulnerable to disaster losses.²³ Yet vulnerability is more than simply a set of demographic characteristics.^{24,25} Social vulnerability varies across time, location, and type of event. A pandemic outbreak may expose vulnerabilities in ways that differ from other disaster events. As has been demonstrated in disaster research, characteristics such as age, race, children in the household, and occupation can both increase vulnerability and decrease the ability to recover.²⁶ For example, while the findings on age are inconsistent, many studies have documented that the elderly are more likely to have negative health consequences and are slower to recover after a disaster.²⁷⁻²⁸

There is an increasing awareness among disaster researchers and practitioners on the differential effects of disasters on minorities and minority communities^{29,30} and the need for diverse groups to be integrated into pandemic planning.³¹ Minority populations are at greater risk during every stage of a disaster. In a hypothetical pandemic, confidence in government and expectations of adequate resource allocations differs across racial and ethnic groups with African-Americans and Hispanics having greater distrust of government and fearing discriminatory treatment during response.²² Additionally, American Indians and Hispanics tend to be more fatalistic and have less faith in the efficacy of preventative actions.²¹ Finally, racial and ethnic minorities and lower income individuals may find it difficult to comply with community mitigation measures.²

The presence of children complicates every stage of disasters.³⁰ In the case of the H1N1 influenza outbreak, schools became a focus of transmission and many were temporarily closed due to suspected outbreaks. While children with respiratory illnesses tend to infect other children, it is also common that children will infect caregivers given the close proximity of the adult to the child, and that children have more difficulty adhering to infectious disease control measures such as hand washing and respiratory etiquette.

Health care workers are more likely to be exposed during a pandemic and to have information on how to minimize the risk of contracting the illness. The spread of infectious respiratory diseases in clinical settings is documented, and the implementation of hand hygiene and respiratory etiquette has been shown to reduce outbreaks.^{15, 16} Despite the risk of contracting a pandemic influenza strain, many health care workers anticipate continuing to work during a pandemic.³² Additionally, students in health care fields are likely sources of volunteers during a pandemic outbreak.³³

Theoretical Framework

The public wants and needs information that provides actionable steps to prevent illness, reduce anxiety, and facilitate effective response efforts.³⁴ Much of the theory, research, and application of emerging infectious disease communication focuses on the one-way transmission of facts from experts to the public,³⁵ and leaving untested assumptions of the public's reaction such information. From the literature on natural disasters and evacuations, there are three significant factors in the decision-making process during a disaster – defining the threat as real, the level of perceived risk, and the presence of an adaptive plan – that promotes or inhibits response decisions.³⁶ During a pandemic, how the public adapts their behaviors to minimize the risk of contracting and/or spreading the illness is an important component to pandemic response.

Context and Data

Data were collected from a university in Texas during the first three weeks of the public response to the H1N1 outbreak in the United States. The university was particularly well-suited to a study of preventative actions due to the fact that the university has multiple satellite campuses around the state, including sites in major urban areas with confirmed H1N1 cases. Additionally, the university has a diverse student body, many students who are parents of children under 18 years old, and a significant proportion majoring in health and allied health fields.

The data are from a panel study conducted every two days over a 14 day period starting on May 1, 2009 and concluding on May 15, 2009. The data for this study are from the first two rounds, which were collected on May 1-2 and May 3-4, 2009. Approximately 10 percent of the student body (1169) were selected randomly as potential participants and were sent an email with a hyperlink to the web-based survey. In each round, the hyperlink was active for 48 hours. This allowed for the rapid collection of data from a population that can be

accessed by email. The Institutional Review Board approved the protocol and the Office of Institutional Research provided the list of email addresses.

Response rates were low and, as would be expected with panel data, decreased over time. It is not unusual for email and web-based surveys to have significantly lower response rates compared to telephone and mail survey.³⁷⁻³⁹ Additionally, a valid response rate is difficult to calculate since it cannot be determined how many respondents actually received and opened the email inviting participation⁴⁰ due to the fact that some students do not use their university email account on a regular basis and do not have email forwarded to a regularly used account. Additionally, the H1N1 flu outbreak occurred during the last two weeks of the semester, a time in which student participants expressed some concern about participation given particularly hectic end-of-semester schedules. A total of 118 students participated in rounds 1 and 2.

The problems of sampling bias and sampling size preclude generalizability of the results. These problems can be somewhat common in disaster research, especially in research conducted during events. Despite the problems associated with the sampling, the sample does reflect the general characteristics of the university population in terms of key demographic variables such as gender, race/ethnicity, and major.

Preventative Actions

Basic infectious disease prevention includes frequent, thorough handwashing and covering mouth when coughing. Additionally, people were encouraged to refrain from touching their hands to their eyes, mouth, and nose.¹⁷ The CDC identifies non-pharmaceutical interventions to include case isolation of the ill, voluntary home quarantine of non-ill people suspected of contracting the pandemic influenza, closures of schools and child care programs, and social distancing to reduce contact among adults.⁹ The questions asked of the respondents focused on voluntary infectious disease control measures and social distancing activities. Specifically, respondents were asked, "As of right now, have you done any of the following things to avoid getting the H1N1 (swine) flu? (Select all that apply)". The possible actions included frequent handwashing, frequent use of hand sanitizer, not touching eyes, mouth, and nose, avoiding contact with ill people, avoiding people gathering, avoiding required daily activities such as work or school, and avoiding optional activities such as eating at restaurants and going to the mall. An additive scale was created with a range of zero (engaged in no listed preventative actions) to 7 (engaged in all listed preventative actions).

Independent Variables

The respondents' perception of the general threat of the influenza outbreak was measured with the question, "On a scale of 0 to 10, 0 being not at all serious and 10 being extremely serious, how serious of a public health threat is the current flu outbreak?" Respondents were asked to identify their perceived risk of contracting the H1N1 flu with the following question, "On a scale of 0 to 10, 0 being no chance of getting this flu and

10 being absolutely certain you will get this flu, what you do think are your chances of getting this flu?"

The respondents were asked their age and the data collected in years. Racial and ethnic identity was identified with the question, "What is your race/ethnicity?" The response categories were "African-American", "Asian/Pacific Islander", "Hispanic", "Native American/American Indian", "White", and "Other". Non-whites were collapsed into a single category coded 0 and whites coded 1. Respondents were asked to identify their major, and those with majors in health-related fields (e.g. nursing, physical therapy, health studies, etc.) were coded 1 and non-health-related majors (e.g. elementary education, library science, history, etc.) were coded 0. Finally, respondents were asked if there was a child or children under the age of 18 years living in the household. The responses were coded 1 for yes and 0 for no.

Analysis

Table 1 provides the distribution of all variables used in the present study. About one-fourth of the respondents are below 24 years of age with a median age of 29 years. The majority of the respondents are White (65.0 percent), 29.1 percent have a child or children less than 18 years of age living at home, and 42.4 percent of the respondents are majoring in health-related fields. The perceived individual risk of contracting the flu is generally low among these students as indicated with a median score of 4.0, and the average value for public health threat is 6.0. When asked about taking preventative actions, the average score is 3.0.

Table 2 shows the regression outcomes for three models. Model 1 includes background variables. Perceived individual risk and public health threat variables are included in Model 2. Model 3 contains all the variables. The only variable statistically significant across all three models is the perceived seriousness of the overall public health threat of the H1N1 outbreak. The background variables and perceived individual risk are not significant in predicting the number of preventative actions taken by the respondents. The final model has an adjusted R² of 0.224.

Conclusion

Since the data were collected for this article, the WHO has moved the classification of the novel H1N1 from a level 5 to a level 6 pandemic. Therefore, this article provides an important contribution in the examination of early response to a pre-pandemic influenza threat. The novel H1N1, thus far, has been highly contagious but with limited mortality. All of this could change in the coming months as the virus continues to spread. The data from this early time point suggest that the students responding to the survey were aware of the H1N1 influenza outbreak but did not characterize their individual risk for contracting the infection as high. Additionally, fewer than half of the preventative measures were adopted by most respondents. The single factor that predicted adoption of preventative actions was the perceived seriousness of the threat. This suggests that these respondents were reacting to an overall threat

perception and not one of individual perceived risk. Contrary to the theoretical framework of Perry, Lindell and Greene³⁶, this may indicate that the definition of the threat as real but not an individual assessment of personal risk influences the adoption of preventative measures to reduce the risk of contracting the flu virus during a pre-pandemic.

An “all disaster event” response understanding can be useful but the dynamics of specific disaster mechanisms require variations in preparedness and response. The theoretical framework used in this analysis comes from the literature on evacuation response. Pandemics will not require evacuations – quite the opposite – they are more likely to require quarantine. Despite the difference, the principle of a preventative action response is required on the part of the general public in the event of a hurricane or a pandemic. While the “all event” model has limitations, a more complete understanding of threat response is possible and application across events can be facilitated by testing theories across disaster mechanisms. Indeed, since disasters are low probability high risk events, waiting for the exact event to occur without looking across the spectrum of disasters could result in greater delayed and inappropriate response and unnecessary injury and loss of life.

This study is an empirical contribution to understanding of risk perception on preventative behaviors during a pre-pandemic influenza outbreak among college students. While the study is limited to a single university, the university has multiple campuses in a state where the first novel H1N1 death in the United States occurred. Understanding how students respond to such information and their willingness to adopt preventative actions will be critical in addressing and reacting to a pandemic early in the outbreak. Schools environments provide opportunity to transmission of infectious respiratory diseases, and as noted in the CDC guidelines, will possibly require closure during a pandemic. While the focus of school-based infectious respiratory disease transmission has been on primary and secondary schools, colleges and universities share many of the same characteristics that make transmission more likely. Additionally, many colleges and universities have a residential component that is absent from the majority of primary and secondary schools. More research is needed to examine the risks of the school environment and the risk perceptions of students, especially college students.

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Table 1. Background characteristics of the respondents.

Variables	Percent	Number
Age		
19-23	24.6	29
24-33	39.8	47
34+	35.6	42
Race/Ethnicity		
Whites	65.0	76
Non-Whites	35.0	41
Has children living at home		
Yes	29.1	34
Educational Major		
Non-Health Major	57.6	68
Health Major	42.4	50
Perceived risk of flu		
Very low risk	11.9	10
2	19.0	16
3	17.9	15
4	14.3	12
5	9.5	8
6	20.2	17
7	4.8	4
Very high risk	2.4	2
Public Health Threat		
Not at all serious	2.4	2
2	8.5	7
3	9.8	8
4	13.4	11
5	12.2	10
6	19.5	16
7	7.3	6
8	14.6	12
9	8.5	7
Extremely serious	3.6	3
Preventative action		
No action	22.6	19
1	11.9	10
2	13.1	11
3	25.0	21
4	17.9	15
5	2.4	2
6	3.6	3
All actions	3.6	3

Table 2. Effects of Demographic Characteristics, Perceived Risk, and Perception of Public Health Threat on Adoption of Preventative Actions.

Variables	Model 1		Model 2		Model 3	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Constant	2.746	0.833	0.279	0.523	0.312	0.939
Age	-0.003	0.018			0.006	0.017
Race/Ethnicity	0.473	0.474			0.420	0.435
Children living at home	-0.567	0.473			-0.558	0.442
Major	-0.028	0.435			-0.102	0.399
Perceived risk			0.100	0.112	0.139	0.117
Public health threat			0.310*	0.091	0.290*	0.094
R-square	0.025		0.201		0.224	

* $p < 0.05$

