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Predictors of Perceived Zoonotic Disease Risk Among the American Public

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D.V.M., Cornell University, 2012

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An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Epidemiology

2013

Abstract

Predictors of Perceived Zoonotic Disease Risk Among the American Public

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Background: During the past twenty years, several newly emerged, zoonotic diseases have resulted in outbreaks in the United States of America (U.S.). With these emergence events and the increased role of media in health communication, public risk perception has become an important factor influencing health behaviors of the general public.

Objective: As a step toward understanding factors that influence zoonotic disease risk perception, this analysis examined demographic characteristics, disease knowledge, attitudes, practices and media exposure as predictors of an elevated perception of zoonotic disease risk

Methods: Results of a nationally representative survey were used to construct a perceived zoonotic disease threat score (PTS). Student's t-test was used to examine the difference in mean PTS between individuals with and without each exposure or characteristic of interest. Exploratory factor analysis was conducted to allow further characterization of the relationship between individual characteristics and elevated PTS. Results of the exploratory factor analysis were used in the construction of a logistic regression model predicting the odds of elevated PTS.

Results: Exploratory factor analysis resulted in a three factor solution, with each factor named based on the concepts it represents (Prevention Behaviors, Knowledge Seeking Behaviors, H1N1 Concerns). A binary logistic regression model was constructed using the 3 Factor solution, sex, race, household income, education level, U.S. Census Division and having a child as predictors. When adjusting for other demographic and lifestyle characteristics, Knowledge Seeking Behaviors (Adjusted odds ratio 2.7; 95% Confidence Interval 1.8-4.1), H1N1 Concerns (0.1; 0.007-0.7), male sex (1.4; 0.98-2.1), Black race (2.3; 1.4-3.7), household income levels above $24,999 and education levels beyond a high school diploma each predicted an elevated PTS. Results from the logistic regression model were similar to the results of the initial correlation estimates.

Conclusion: The ability to use Knowledge Seeking Behaviors, H1N1 Concerns, sex, race, household income and education level in predicting populations with increased odds of having a high perception of risk, can be an important tool allowing health communicators target specific populations and create customized public health messaging and zoonotic disease risk communication.

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Introduction

During the past twenty years, several newly emerged, zoonotic diseases have resulted in outbreaks in the United States of America (US). With these emergence events and the increased role of media in health communication, public risk perception has become an important factor influencing health behaviors of the general public.

Risk perception, also referred to as 'hazard perception', has been studied in the US and abroad related to broad public health domains such as food safety and ecological risk (1-3). Subject specific studies on zoonosis risk perception, and outbreak specific studies have also been conducted, however most of these studies only sought to determine the level of risk perceived by the public (4-7); the question of what individual characteristics predict the level of perceived risk remains to be answered. With a greater understanding of individual risk perception, public health officials would have an opportunity to predict public responses to newly emerging diseases, direct educational efforts and, and develop more effective risk communication strategies(8).

Background

Over 60% of existing human pathogens are zoonotic and approximately 75% of emerging pathogens are of animal origin (9-12). Globally, human population growth, expansion of urban development, the ability to travel worldwide with relative ease, and the accompanying trafficking of animals has strengthened the inextricable link between humans, animals and the environment. Exposure to disease from companion animals, wildlife, and the surrounding environment is an inevitable possibility. Globalization has drastically increased the ease, and the likelihood of international infectious disease spread(5). Therefore, it is important the public understands how to minimize the risk of zoonotic disease transmission, an outcome that is only possible if public health agencies are able to effectively communicate prevention messages based on the public's perception of risk(13).

Emerging zoonotic diseases, and zoonotic diseases in general, have gained notoriety among Americans over the past decade. In 1999, West Nile Virus emerged for the first time in the Western Hemisphere via an outbreak in New York City. The outbreak was characterized by an epidemic of encephalitis and meningitis of unknown etiology in the human population, and increased mortality among New York City birds(14). Collaboration between human health and animal health agencies eventually revealed West Nile Virus as the culprit (14-16).

In November 2002, Severe Acute Respiratory Syndrome (SARS) emerged in Guangdong Province, China and subsequently infected over 8,000 people in 26 countries across 5 continents(17, 18). By the time the global outbreak was contained in July 2003, over 800 people died of the infection. (19). While there were only 29 cases, and no deaths in the United States (20), it became apparent that emerging infectious disease outbreaks can lead to substantial fear in the general public(5, 21).

In April 2009, novel influenza A subtype H1N1 virus emerged in the United States and Mexico(22, 23). The virus, responsible for the world's first influenza pandemic of the 21st century, was a quadruple reassortment virus with genes from human, swine and avian influenza A viruses(22). By the time the World health Organization (WHO) officially declared a pandemic in June 2009, there were nearly 30,000 confirmed cases in 74 countries (23, 24). Within a year, most countries in the world had reported confirmed infections with the novel virus(23). Alarmingly, young healthy individuals were disproportionately affected and the virus maintained sustained human to human transmission throughout the summer, which is unusual for influenza(23). Ultimately, the pandemic H1N1 2009 virus was responsible for over 16,000 confirmed deaths worldwide, with countless others undiagnosed or unreported(23). The initial moniker of "swine flu" was misleading, in that the human virus was not directly transmitted from swine to humans, however the modern pandemic was a dramatic reminder of the interconnection between human and animal health.

Risk Perception

The juxtaposition of zoonotic disease outbreaks with a growing American obsession with health and wellbeing in the media has resulted in new relationships developing between the general public, public health and the media (13, 25).

Several theories have been proposed to help better understand how the general public assesses risk. The psychometric paradigm appears to be one of the most common methodological approaches to studying an individual's perception of risk. It involves developing a list of risky events that span the range of potential hazards, developing psychometric scales describing the characteristics that influence human perception of risk, and asking individuals to evaluate the list of risky events based on the scale. The individual risk evaluations are interpreted using multivariate statistical methods such as factor analysis to identify the underlying factors that explain the variation in individual responses (3, 26). However a major shortcoming in theories such as the psychometric paradigm are that they do not fully capture the rational and irrational factors that contribute to an individual's risk perception(8, 26). Risk perception has been shown to be rooted in social and cultural factors, as well as personal characteristics such as familiarity with the hazard and personal ability to influence the risk (8, 27). Risk concerns may come about rationally, or they may just be a surrogate for other social or ideological concerns (8). This is the main difference in risk perception by the public and risk perception by experts: experts tend to determine risk based on facts and numbers, while the general public has a much more complex hazard analysis (1, 2, 4, 8). Because of this, it is essential that experts consider social and cultural factors when structuring risk communication; otherwise, risk management and risk communication efforts will be ineffective (8). True risk, along with the public's perception of that risk, should be considered for effective communication between public health officials and the general public (8, 13).

The Health Belief Model (HBM) is a theoretical approach explaining health-related behaviors and beliefs and their influence on health-related decision making. HBM proposes that when contemplating making changes in health behavior, individuals consider perceived susceptibility and severity of disease, perceived benefits and barriers to prevention, cues to action and their confidence in their ability to make their desired change (self-efficacy)(28). To effectively influence public health it is essential that policy makers and health promoters understand how the public perceives and responds to risk(8). Gaining this understanding would better inform communication between public health scientists and researchers, and the general public.

Risk communication through the US media can be a useful tool for public health officials; however media coverage can have varied impacts on an individual's understanding and perception of risk. According to Paul Slovic, the ability to evaluate a hazard is closely linked to the news media because the majority of citizens do not have first-hand experience with a potential hazard and therefore their only experience with the hazard is through threat documentation and reporting by the news media(8). Media attention to infectious diseases has generally been the result of the need to communicate timely safety information to the public, combined with the need to sell print media and maximize viewers. In a 2004 editorial in Science, Roger Glass suggested media attention, and therefore the attention of the general public, tends to lean disproportionately toward emerging infections of relatively little consequence, compared to more deadly national and international outbreaks such as seasonal flu, and diarrheal diseases(25). Glass proposes highly publicized emerging disease outbreaks have invoked fear in the general public, increasing the perceived risk of infection and disease(25). This is a potentially valid proposal given the 2004 Glass editorial was written following several years of both intentional and naturally occurring diseases such as West Nile Virus, anthrax, and severe acute respiratory syndrome (SARS).

As a step toward understanding factors that influence risk perception, this analysis will explore zoonotic disease-related risk perceptions and the association with various demographic characteristics, disease knowledge, attitudes and practices. This information can help guide public health messaging and interventions to better target specific populations based on their perception of risk at the interface between humans, animals and the environment. This study will also determine what individual characteristics could be used to predict an elevated level of perceived zoonotic disease risk. Individual demographics will be considered in addition to characteristics such as knowledge seeking behaviors and exposure to news media coverage to the influenza A H1N1 pandemic.

Methods

The Survey

The 2009 Porter Novelli ConsumerStyles Survey was administered in three parts between April and October, 2009 to a stratified random sample of a consumer survey mail panel (total 328,000 panelists). The survey included questions in varying formats covering knowledge, attitudes and practices of a wide range of health topics. The main sample was stratified on region, household income, population density, age & household size to create a nationally representative sample. A low income/minority supplement, and a households-with-children supplement were used to ensure adequate representation. This analysis was conducted on a subset of the 2009 ConsumerStyles dataset comprised of individuals who answered the entire three part survey (n= 2412).

The survey included questions regarding health and zoonoses-related knowledge, attitudes and exposures. Five Likert-type questions, with elements from HBM, were included to assess perceived threat of contracting a zoonotic disease [Table 1]. Response categories for each question were assigned values ranging 1-5 (1 strongly disagree; 5 strongly agree). Responses were summed to create what the author is calling a perceived zoonotic disease threat score (PTS; range 5-25); a higher PTS represented a higher perceived threat. All survey data were weighted so the sample distribution of gender, age, income, race, and household size matched that of the general population according to the U.S. Census 2008 Current Population Survey.

Descriptive Statistics

Student's t-test was used to compare mean PTS between those with and without each exposure or characteristic of interest.

Exploratory Factor Analysis

Factor analysis was selected as an analysis method in an effort to summarize the interrelationships between variables, and allow the inclusion of the maximum amount of information possible in the examination of predictors of elevated PTS.

A dichotomous variable was created from the PTS, with a score greater than or equal to 20 classified as "high perceived threat". A score of 20 or higher indicates the respondent selected a four ("agree") or greater for each of the five Likert-scale threat questions, or selected at least one five ("strongly agree"). The author acknowledges dichotomizing in this manner may result in a loss of sensitivity, particularly if an individual selected fives (strongly agree) on three likert-scale questions, but ultimately had a PTS of 19 because of low responses in the remaining questions.

Exploratory factor analysis was conducted using principal axis factoring and promax rotation on SAS 9.3 Software. Evaluation of Kaiser's Measure of Sampling Adequacy revealed an overall MSA of 0.77, and individual MSA values were greater than 0.5, confirming factorability. Initial factors were extracted using Common Factor Analysis, with variable prior communality estimated as the squared multiple correlation with all other variables. Factors were initially retained if they accounted for at least 10% total variation, had an Eigenvalue greater than 1 and cumulatively represented greater than 70% of variation. Items without a factor loading of ≥0.30 were dropped. Solutions with 3, 4 and 5 factors met the above criteria and were subjected to rotation to determine a parsimonious and reliable result. Twenty-three variables were retained in the analysis.

Oblique rotation was applied to facilitate factor interpretability and because it was suspected the factors would not be independent. The factors were expected to be conceptually different, however it was anticipated that there may be some correlation between two or more of the factors. Following oblique rotation of all the initial factor solutions, the 3 factor solution resulted in a parsimonious, simple solution factor pattern. There was a 33% correlation between Factor 2 and Factor 3 , so the oblique rotation was determined to be appropriate.

The resulting 3 factors were normally distributed. Factors were dichotomized into high and low categories using the median factor score as the cut point (Factor 1: 2.94, Factor 2: 15.06, Factor 3: 181.950). These Factors were included in a logistic regression model predicting PTS high (≥ 20) or not high (<20), adjusted for age, sex, income, education, US Census division of residence and whether or not the respondent had a child. Age was maintained as a continuous variable, and cutpoints for income and education level were determined based on existing health behavior literature (Household Income: <$25K, $25-49,999, $50-74,999, >$75K; Education: High school diploma or less, some college, college graduate, post graduate education).

Sensitivity analysis was conducted by creating a similar logistic regression model using a PTS score dichotomized with different cut points. For the sensitivity analysis, PTS was dichotomized based on whether or not the individual indicated strong agreement, and therefore high perceived threat, for at least two of the likert-scale threat questions; the summed threat score was not used as a criteria when dichonomizing. The predictor variables remained the same as in the primary model, with the same cutpoints.

Results

Descriptive Statistics and Statistical Trends

During initial analysis, 71 observations were excluded because they did not complete all five Likert-scale perceived threat questions, resulting in a study sample size of 2,341 survey participants. Responses were analyzed based on the individual's demographics, report of the presence or absence of various exposures and level of agreement with knowledge and attitude statements [Table 2, Table 3]. PTS were normally distributed (mean 13.3; SD 4.1).

Black study participants had a significantly higher PTS than whites, but no significant difference was observed between the PTS of Hispanic respondents compared to white respondents. Participants with an annual household income over $50,000 had a significantly lower mean PTS compared to participants with a household income lower than $25,000. Individuals with a college or post graduate education had a significantly lower mean PTS compared to participants without post-secondary education. Participants living in New England had the highest PTS (mean 14.2; SD 3.7) while participants living in the Mountain division had the lowest PTS (mean12.4; SD 4.3).

Individuals who indicated agreement with the statement "rabies is a serious problem around the world", individuals who indicated disagreement with the statement "raw milk is safe to drink", and individuals who reported knowing "more about health and nutrition than most people" all had a higher mean PTS. Individuals who had ever found a tick on themselves had a significantly lower mean PTS compared to those who had not, while having a previous diagnosis of Lyme Disease did not make a significant difference in mean perceived threat.

Participants who reported hiking as a regularly enjoyed leisure activity had a lower mean PTS compared to individuals who did not hike (hikers mean 12.8 SD 4.3; non-hikers mean 13.4 SD 4.1), however there was no significant difference between participants who did and did not report hunting as a regular activity (Hunters mean13.4 SD 4.0; non-hunters mean 13.3 SD 4.2). People who did and did not report leisure gardening had no significant difference in their mean PTS (gardener mean 13.2 SD 4.0; non-gardener mean 13.4 SD 4.2).

Individuals who closely followed the news about Influenza A(H1N1), individuals who planned to get an H1N1 vaccine, and individuals who were worried about contracting the H1N1 virus had a higher mean PTS compared to individuals who did not report these concerns. Individuals who felt the news media was exaggerating the dangers of H1N1 had a significantly lower mean PTS compared to individuals who felt the news media was not taking H1N1 seriously enough. Participants who reported their workplace developed a plan to respond to a possible outbreak of Influenza A (H1N1) did not have a significantly different threat score compared to individuals who did not report having a workplace response plan.

Factor Analysis

Because of missing values for factor items, 173 observations were omitted. The 3 factor solution account for 83% of the total variation, and each factor had a minimum of 4 variables with loadings greater than 0.4 [Table 4]. The 3 factors were labeled according to their item content Factor 1, "prevention behaviors" (38.6% of variance), Factor 2, "knowledge seeking behaviors" (29.4% of variance), and Factor 3, "H1N1 concerns" (15.1 % of variance).

Of the 2,168 observations retained for factor analysis, 182 (7.7%) had a high PTS (score ≥20). The initial model included the three factor solution, age, sex, income, education, income, US Census division of residence, whether or not the individual had a child and interaction terms between the factors and the demographic variables. The variable for age of the respondent, and associated interaction terms, were removed due to collinearity conflicts with Factor 2 and Midwest region. Interaction terms were assessed using backward elimination. The final model identified nine predictors of high PTS [Table 5], with significant interaction between Factor 3 and income.

The sensitivity analysis model showed small variations in the estimated OR in the model used for sensitivity analysis compared to the primary model, however the variations were not large enough to change interpretation of the results. Because the variation was not meaningful, the primary model with PTS dichotomized based on summed score is determined to be robust.

Discussion:

Participant's perceived health risks at the interface between humans, animals and the environment differed from what was anticipated. Overall, the infectious disease threat questions reflected a low level of perceived threat from animals, insects, and their environment. Additionally, examining correlations between PTS and lifestyle traits such as pet ownership, hunting and gardening, it appears individuals with exposure to certain known risk factors for zoonotic disease had an unexpectedly lower PTS.

Lyme disease is caused by infection with *Borrelia burgdorferi,* a tickborne bacteria(29). Tick bites are a known risk factor for contracting Lyme disease, however individuals who reported finding a tick on themselves had a statistically lower mean PTS compared to those who had not found a tick. Conversely, individuals with a history of Lyme disease had a higher mean PTS (not statistically significant). The present study does not provide explanation for this occurrence, however based on the HBM, a Lyme disease diagnosis may increase an individual's perceived susceptibility and perceived severity, thus influencing their attitudes and beliefs regarding risk of zoonotic disease. Similarly, individuals with a history of a tick bite, but who were not subsequently diagnosed with Lyme disease may have a lower perceived susceptibility because their exposure did not result in disease. This finding suggests personal experience influences perceived risk, a conclusion supporting Slovic's analysis(8).

Many of the statistically significant relationships between the various exposures and PTS found in the preliminary analysis were duplicated in the logistic regression model produced. Controlling for age, sex, region of residence, income, education and the other Factors, the odds of a person who scored high in Factor 2, (knowledge seeking behaviors), having a high PTS was 2.7 times that of a person with a low Factor 2 score. In the preliminary analysis, individuals who were aware that rabies is a worldwide problem, knew raw milk is not safe to drink and felt they knew more about health than most other people all had higher PTS (significant at α=0.05).

The increase in perceived threat resulting from media exposure described by Glass(25) was also demonstrated in this analysis. In preliminary analysis, individuals who closely followed media coverage of H1N1 reported a higher mean PTS, additionally individuals who believed the media was not taking the threat of H1N1 seriously had a higher mean PTS. In the logistic regression model, individuals with a high Factor 3 score (H1N1 concerns) had slightly greater odds of a high PTS compared to those with a low Factor 3 score. Similarly, income, race and education all had statistically significant associations with PTS in preliminary analysis and each of these exposures proved a statistically significant predictor of a high PTS, with black males living in the northeast US having the highest OR compared to white females living in the western US (OR 6.29; CI 2.59,15.27).

Strengths and Weaknesses

Historically, health messaging tended to focus on conveying information and did not consider the individual characteristics and behavioral patterns that affect an individual's access, ability and willingness to use such information. According to HBM, in order for behavioral change to successfully occur, people must accept their susceptibility to a condition, understand the true severity of the consequences, and feel empowered to take necessary action. In general, the ability to use knowledge seeking behaviors, sex, race, income, education and residency as predictors of perceived threat of zoonotic disease can be a useful tool in predicting what populations have the greatest odds of having a high or low perception of risk, and therefore allow health communicators to target specific populations and create customized messaging. However, this study only analyzes predictors for an individual's perceived categorical high or low risk, but does not indicate if an individual's perception of risk is higher than warranted, or so low that they may not employ proper precautions. The extra step of quantifying perceived risk would have allowed me to make this determination and would prove more useful in targeting groups and prioritizing risk communication.

In future analysis, I would not include pet ownership variables in the Factor determination because pet ownership characteristics would be more useful when used as a predictor of PTS rather than a factor variable. This would allow a more direct analysis of the impact of pet ownership on PTS, and the ability to estimate an OR for high PTS based on pet ownership. While pet ownership is taken into account when calculating factor scores, the ability to produce estimates based on pet ownership could be extremely useful in the justification of targeting pet owners for interventions or education initiatives.

Based on the sensitivity analysis, dichotomizing PTS by the summed score is acceptable. However the model with PTS dichotomized based on and individual indicating strong agreement with at least two of the Likert-scale threat questions did not show evidence of collinearity problems. As a result, age of the respondent remained an independent predictor in the model, which may make it a more desirable model if age is deemed an important factor for intervention planning and implementation.

While this study presents a number of interesting associations between perceived threat and personal characteristics, and suggests predictors of a high perception of threat, it does not indicate directionality in how perceived threat and behavior interact. Does high perceived threat motivate protective behaviors or does performing protective behaviors reduce perceptions of threat? Similarly, does higher education, and exposure to risk factors reduce perceived threat because these individuals feel more informed of the true threat level and prevention methods? How does increasing income and education level impact perceived threat? According to HBM, perceived susceptibility and knowledge play a role in health behavior in a general sense, but additional studies examining this relationship as it pertains to zoonotic disease would be interesting.

This survey was conducted during the 2009 influenza A (H1N1) pandemic, therefore study participants may have had a heightened sense of threat related to zoonoses. Perceptions of threat can be a motivating force for people to seek information and perform protective behaviors. However, it is impossible to tell if heightened perceived threat of H1N1 infection lead individuals to follow H1N1 news coverage more closely, for example, or if closely following the news resulted in increased perceived threat.

Future Directions

Since the WNV, SARS and H1N1 outbreaks in the US, other emerging diseases of animal origin have continued to impact public health. Many activities can put an individual at risk for contracting a zoonotic disease. Some types of exposures are obvious, such as animal contact at agricultural fairs and petting zoos (30, 31), while other forms of contact may be less obvious, such as contact with pet food (32). In recent years, backyard poultry flocks have grown in popularity, resulting in a noticeable spike in cases of human Salmonellosis from live poultry; CDC has recorded over 700 cases of human Salmonellosis linked to backyard poultry flocks in the last two years alone(33, 34). In addition to traditional foodborne outbreaks, Americans have also been infected with *Salmonella* transmitted directly or indirectly from pet amphibians, reptiles, domestic cats and even dog food (32, 35-39).

In addition to the domestic examples of new infections and new vectors, there have been highly publicized instances of emerging zoonoses overseas. In 2013, notable investigations of emerging zoonotic diseases have included Influenza A H7N9 in China, Middle East Respiratory Syndrome Coronavirus (MERS CoV) in the Arabian Peninsula, and the third consecutive year of domestic swine-origin influenza A outbreaks in the US (40-49).

Continued evaluation of factors affecting the public's perception of risk will improve the effectiveness of health communication surrounding these emerging threats. Studies evaluating the link between an individual's perceived risk and their actual risk of contracting a zoonotic disease are essential. The primary question for a future study would be: If an individual's perceived risk is lower than their actual risk, are they more likely to contract a zoonotic disease compared to individuals with reasonable or elevated perceived risk?

The analysis included in this study gives a general sense of predictors of elevated risk, but more studies are needed to determine how risk perception influences disease outcome. Risk communication and public health education are ultimately aimed at reducing morbidity and mortality. The potential identification of zoonotic disease risk perception as a risk factor for developing a disease could revolutionize the way public health officials seek to reduce disease, and support an even greater emphasis on effective risk communication to the general public.

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Tables

Table 1. Infectious disease threat questions (n= 2341).[a]

	Weighted %
Infectious diseases caused by my interaction with animals and the environment are a threat to my health	
Strongly/somewhat disagree	34.76
Neither agree nor disagree	32.62
Strongly/somewhat agree	32.62
New infectious diseases are coming from interactions people are having with animals and their surroundings	
Strongly/somewhat disagree	38.66
Neither agree nor disagree	38.51
Strongly/somewhat agree	22.82
I am at risk for getting an infectious disease that comes from bugs around my home or on my pets	
Strongly/somewhat disagree	40.57
Neither agree nor disagree	33.75
Strongly/somewhat agree	25.68
I am concerned about getting an infectious disease from my outdoor activities	
Strongly/somewhat disagree	57.41
Neither agree nor disagree	26.56
Strongly/somewhat agree	16.02
The possibility of getting an infectious disease from a pet, wild animal, or outdoor bugs scares me	
Strongly/somewhat disagree	53.65
Neither agree nor disagree	27.79
Strongly/somewhat agree	18.56

[a]Only respondents who completed all five zoonotic disease threat questions were eligible.

Table 2. Demographic characteristics & mean perceived threat level of HealthStyles Respondents 2009 (n= 2,341).[a]

	Total n (weighted %)	Mean (SD)	P-value*
Gender			
Male	1136 (47.3)	13.5 (4.0)	
Female	1205 (52.7)	13.2(4.2)	P=0.23
Age (years)			
18-34 (ref)	253 (24.2)	13.0(5.5)	
35-54	1155 (38.1)	13.4(3.8)	P=0.14
55+	933 (37.7)	13.5(4.1)	P=0.11
Race/Ethnicity[b]			
White (ref)	1570 (74.4)	13.0(4.2)	
Black	298 (9.3)	15.3(4.1)	P<0.05
Hispanic	306 (11.4)	13.5(3.9)	P=0.12
Household Income			
<$25K (ref)	609 (24.3)	14.0(4.5)	
$25-49,999	492 (23.7)	13.7(4.5)	P=0.24
$50-74,999	397 (19.3)	13.0(3.9)	P<0.05
>$75K	843 (32.7)	12.8(3.6)	P<0.05
Education[c]			
High school graduate or less (ref)	727 (29.9)	13.8(4.2)	
Some College	858 (37.9)	13.4(4.2)	P=0.08
College Graduate	442 (19.8)	12.8(4.1)	P<0.05
Post Graduate	296 (12.4)	12.9(3.8)	P<0.05

[a]Only respondents who completed all five zoonotic disease threat questions were eligible.
[b]167 Missing values
[c]18 Missing values
*2-Sample T-test

Table 3. Mean perceived threat level by participant exposures, knowledge, attitudes and practices; HealthStyles Respondents 2009 (n= 2,341).[a]

	Mean (SD)	P-value*
Knowledge & Exposures		
Rabies is a serious problem around the world		
Strongly/Moderately Disagree	11.1(3.7)	
Strongly/Moderately Agree	13.5(3.7)	P<0.0001
I know more about health and nutrition than most other people		
Strongly/Moderately Disagree	12.8(4.2)	
Strongly/Moderately Agree	13.3(4.3)	P<0.05
Raw milk is safe to drink		
Strongly/Moderately Disagree	13.8(4.0)	
Strongly/Moderately Agree	12.7(4.5)	P<0.05
Currently own any pets[b]		
No	14.0(4.1)	
Yes	13.0(4.1)	P<0.05
Ever found a tick on themselves		
No	13.5(4.2)	
Yes	12.9(4.1)	P<0.05
Ever diagnosed with Lyme Disease		
No	13.3(4.1)	
Yes	14.3(4.2)	0.2678
Healthcare related job with patient contact[c]		
Yes	13.1(4.7)	
No	15.0(4.6)	P=0.39
Workplace developed a plan to respond to a possible outbreak of Inflenza A (H1N1)		
No	13.2(4.2)	
Yes	13.1(3.9)	0.6936
Practices		
Plan to get the vaccination for influenza A (H1N1) this year- September 2009 to April 2010		
No	13.0(4.2)	
Yes	13.8(4.1)	P<0.05
Use purell		
Monthly, less often or never	12.8(4.2)	
Daily or Weekly	13.8(4.1)	P<0.05
Wash animal bite wounds with soap and water to prevent rabies[d]	14.0(4.2)	P<0.05
Check children for bites after returning from outdoor settings to prevent rabies[d]	14.5(4.0)	P<0.05
Attitudes		
Level of concern about the spread of Influenza A(H1N1) in the US		
Very/somewhat concerned	11.9(4.3)	
Not at all/not very concerned	13.8(4.0)	P<0.05
How closely followed news stories about Influenza A(H1N1) in the past month		
Very/fairly closely	13.9(4.0)	
Not at all/not too closely	13.5(12.2)	P<0.05
Opinion on how the news media is reporting the dangers of inflenza A (H1N1)		
News media are not taking the dangers seriously	14.7(4.0)	
News media are exaggerating the dangers	12.2(4.2)	P<0.05
Worried themselves or immediate family may contract influenza A (H1N1) during next 12 months[e]		
No	12.3(4.2)	
Yes	14.1(4.0)	P<0.05

[a]Only respondents who completed all five zoonotic disease threat questions were eligible.
[d]54 Missing values
[e]43 Missing values
[d]Compared to participants who reported not doing any activity to prevent themselve & their family from getting rabies (mean 13.3; SD 4.7)
[e]for participants who indicated they were worried about contracting H1N1

Table 4. Rotated Factor Pattern (n=2168)*

	Factor1	Factor2	Factor3
Factor 1: Prevention behaviors			
Which do you do in order to prevent you and your family from getting rabies?- I/we get pets vaccinated annually	**75**	-3	0
Which do you do in order to prevent you and your family from getting rabies?- I/we keep pets under close supervision so they don't catch rabies from a wild animal	**71**	3	2
Which do you do in order to prevent you and your family from getting rabies?- I/we have pets spayed or neutered so they will be more likely to stay home	**70**	1	4
Currently own a pet	**68**	-16	-9
Currently own a dog	**61**	-13	-5
Which do you do in order to prevent you and your family from getting rabies?- I/we call local animal control officer if I see a wild animal acting strangely	**46**	21	14
Which do you do in order to prevent you and your family from getting rabies?- I/we wash the wound with soap and water for at least five minutes if bitten by an animal.	**45**	20	10
Which do you do in order to prevent you and your family from getting rabies?- I/we go see a doctor immediately if I/anyone gets bitten by an animal	**41**	18	13
Currently own a cat	**37**	-12	-9
Which do you do in order to prevent you and your family from getting rabies?- I/we check my children for bites when coming from trips to parks, camps, or outdoor settings	**33**	17	9
Which do you do in order to prevent you and your family from getting rabies?- I/we don't handle wild animals	**32**	9	11
Factor 2: Knowledge seeking behaviors			
Agreement with statement: I try to understand my personal health risks	1	**66**	13
Agreement with statement: It is important to me to be informed about health issues	-1	**60**	18
Agreement with statement: I know more about health and nutrition than most other people	2	**55**	3
Agreement with statement: I actively try to prevent disease and illness	1	**54**	13
Agreement with statement: When I read or hear something that's relevant to my health care, I bring it up with my doctor	1	**53**	20
Agreement with statement: I like to get health information from a variety of sources	3	**41**	12
Does your work involve direct contact in the care of patients?	11	**38**	-22
Do you work in a health care related job?	8	**37**	-22
Factor 3: H1N1 Concerns			
Worried you or someone in your immediate family may get sick from H1N1 in next 12 months?	9	4	**72**
Worried you or someone in your immediate family may get sick from seasonal influenza in next 12 months?	10	1	**67**
How concerned are you about the spread of H1N1 in the US?	4	20	**59**
How closely have you been following H1N1 news stories?	4	30	**48**

*Values are multiplied by 100 and rounded to the nearest integer †173 observations omitted due to missing values

Table 5. Predictors of a High (>20) Perceived Threat Score (n=2168)

Predictor	Crude OR (95% CI)	Adjusted OR (95% CI)
Factors[a] (ref=low)		
Prevention Behaviors	0.8 (0.6-1.2)	0.8 (0.6, 1.2)
Knowledge Seeking Behaviors	3.5 (2.3, 5.2)*†	2.7 (1.8, 4.1)*†
H1N1 Concerns	4.1 (2.7, 6.4)*†	0.1 (0.007, 0.7)*†
Sex		
Male	1.1 (0.8, 1.6)	1.4 (0.98, 2.1)†
Race/Ethnicity (ref=white)		
Black	3.5 (2.2, 5.5)*†	2.3 (1.4, 3.7)*†
Hispanic	1.5 (0.9, 2.6)	1.2 (0.7, 2.1)
Household Income (ref <25K)		
$25-49,999	0.6 (0.4, 0.96) *†	0.5 (0.3,0.9)*†
$50-74,999	0.4 (0.2, 0.6) *†	0.3 (0.2, 0.7)*†
>$75K	0.3 (0.2, 0.5) *†	0.3 (0.2, 0.5)*†
Education (ref= HS Graduate or less)		
Some College	0.7 (0.4, 0.99) *†	0.7 (0.5, 1.1)†
College Graduate	0.4 (0.2, 0.7) *†	0.5 (0.3,0.97)*†
Post Graduate	0.5 (0.2, 0.9) *†	0.6 (0.3, 1.1)†
United States Census Division (ref=West)		
Northeast	1.6 (0.8, 2.9)	1.9 (1.0, 3.7)*†
Midwest	1.1 (0.6, 2.0)	1.1 (0.6, 2.0)
South	1.3 (0.8, 2.2)	1.0 (0.6, 1.7)
Have a child		
Yes	0.8 (0.5, 1.3)	1.1 (0.7, 1.7)

* significant at a=0.05 ; †significant at a=0.15

<u>Appendix I:</u> Census Regions and Divisions of the United States, from Census.gov