Predicting the anticipated emotional and behavioral responses to an avian flu outbreak

Bruce W. Smith, PhD,[a] Virginia S. Kay, BA,[a] Timothy V. Hoyt, MS,[a] and Michael L. Bernard, PhD[b]
Albuquerque, New Mexico

Background: The purpose of this study was to develop a model to predict the emotional and behavioral responses to an avian flu outbreak.

Methods: The participants were 289 university students ranging in age, income, and ethnic backgrounds. They were presented with scenarios describing avian flu outbreaks affecting their community. They reported their anticipated emotional responses (positive emotion, negative emotion) and behavioral responses (helping, avoidance, sacrifice, illegal behavior) as if the scenarios were actually occurring. They also were assessed on individual differences expected to predict their responses.

Results: Participants were only modestly familiar with the avian flu and anticipated strong emotional and behavioral responses to an outbreak. Path analyses were conducted to test a model for predicting responses. The model showed that age, sex, income, spirituality, resilience, and neuroticism were related to responses. Spirituality, resilience, and income predicted better emotional responses, and neuroticism and female sex predicted worse emotional responses. Age, sex, income, and spirituality had direct effects on behavior. The emotional responses were directly related to each behavior and mediated the effects of individual differences.

Conclusion: Emotional responses may be important in predicting behavior after an outbreak of avian flu, and personal characteristics may predict both emotional and behavioral responses.

During the past century, 3 influenza pandemics occurred ("Spanish flu," "Asian flu," and "Hong Kong flu"). Almost inevitably, another pandemic will occur in the near future.[1] The most likely candidate appears to be a variant of the avian H5N1 strain, which has already met 2 of 3 conditions for a pandemic: it is a virus to which humans have little or no immunity and it can jump between species.[2] The only remaining condition is that it can mutate to a form that is easily transmissible between humans. The human cost of an H5N1 pandemic could be much higher than that of past pandemics, because of the increased likelihood of rapid transmission through air travel and high lethality. To date, 63% of persons with confirmed avian H5N1 infection have died, and the number of deaths from an H5N1 pandemic could be as high as 50 million.[3,4]

Preparation for pandemics has focused on the critical issues of surveillance, vaccine development and distribution, and health care coordination and response, with much less attention given to the response of ordinary citizens.[5,6] Although the response of public officials and health care professionals is certainly important, the response of citizens may have as great an affect on the overall impact of epidemics and other large-scale emergencies.[7,8] Citizen responses can range from acts of altruism and sacrifice that benefit the greater good to acts of self-protection and illegal behavior that benefit the individual at the expense of the larger community.[6,9] Understanding the response of ordinary citizens may be vital to developing a comprehensive and effective plan for controlling a pandemic.

There is a growing literature on the factors that may predict the emotional response to epidemics and large-scale traumatic events.[10] Demographic characteristics, such age, sex, income, and ethnic minority status, may be important. Personal characteristics, such as neuroticism, may put people at greater risk for anxiety, depression, and posttraumatic stress disorder. Neuroticism includes greater vulnerability to negative emotions, irrational ideas associated with distress, and difficulty controlling impulses and coping with stress.[11] Positive characteristics, such as optimism and resilience, may provide protection against emotional distress and may even foster positive outcomes.[12]

Spirituality and religion also may promote better psychological functioning in the context of stress.[13] Social relationships also may be important. Social support may be a protective factor, and social strain may be a risk factor for emotional distress.[8]

Although predictors of emotional responses have been identified, less is known about the factors that may predict behavior. This is unfortunate because, as was apparent after hurricane Katrina, the behavior of citizens may have a large, immediate, and direct impact on the greater public health.[9] Whereas little research has examined predictors of behavior directly, a logical place to start may be to examine the effects of predictors of emotional responses, because of the strong potential relationship between emotional and behavioral responses. Emotions have been characterized as "action tendencies," and there is both theory and empirical evidence to suggest that emotional distress may be linked to important behaviors in traumatic situations.[14-16]

The purpose of the present study was to explore the anticipated emotional and behavioral responses to an avian flu outbreak. Lau et al[5] studied the anticipated responses of Chinese adults in Hong Kong to an avian flu outbreak and found that most people anticipated emotional distress or changes in behavior. Our goal was to build on that work in several ways. First, we examined anticipated responses in a US sample farther removed from a potential outbreak and less primed by the severe acute respiratory syndrome (SARS) epidemic. Second, we expanded the psychological responses to include positive and negative emotions and the behavioral responses to include helping, sacrificial, avoidant, and illegal behaviors. Third, we assessed potential protective and risk factors to develop a model that may be useful in predicting responses to an actual pandemic.

Finally, we created 2 specific and progressively severe human-to-human transmission outbreak scenarios and asked participants to respond to them as if they were actually occurring. We thought this would create a sense of realism and immediacy and make it possible to examine responses at different levels of severity. We assessed participants' anticipated emotional and behavioral responses to each scenario. Our hypotheses were that (1) protective factors would predict more positive emotion, (2) risk factors would predict more negative emotion, (3) emotional responses would predict behavioral responses, and (4) the effects of risk and protective factors on behavioral responses would be mediated by emotion.

METHODS

Participants

The sample comprised 289 undergraduate students at the University of New Mexico in Albuquerque. The study was conducted in compliance with the University of New Mexico's Institutional Review Board to ensure ethical conduct of research. Informed consent was obtained from all participants by trained research assistants. The participants were recruited through a university website offering opportunities for participating in research. All of the participants received course credit for participating in the research.

Procedures

The study was conducted during a 2-hour visit in a private room in the laboratory of the first author. First, the participant completed a questionnaire containing the individual difference variables listed below. Second, the participant answered questions about familiarity with the avian flu, read a 3-page World Health Organization (WHO) fact sheet about avian flu,[17] and answered questions about their expectations of an outbreak. Third, the participant read avian flu outbreak scenario 1 and answered questions about anticipated emotional and behavioral responses if the scenario actually occurred. Finally, the participant read avian flu outbreak scenario 2 and answered the same questions about anticipated responses.

Avian flu outbreak scenarios

The 2 avian flu outbreak scenarios were created by the second author based on WHO information and accounts of previous epidemics and potential avian flu outbreaks. The scenarios were presented in the form of brief newspaper articles and are duplicated in the Appendix. The scenarios involved progressively severe instances of human-to-human avian flu transmission in New Mexico, where the study was conducted. Scenario 1 involved the death of 1 student, 11 other confirmed cases of avian flu, and 3 other possible cases of avian flu. Scenario 2 involved 101 confirmed cases and 80 fatalities in New Mexico, including the deaths of 27 fellow students.

Measures

Questions about familiarity and expectations of avian flu. Each participant was asked 4 questions about his or her knowledge of avian flu before reading the WHO fact sheet. The specific questions are listed in the Results section. After reading the fact sheet, the participant was asked about his or her expectations of the likelihood and severity of avian flu transmission. These questions, adapted from Lau et al,[5] are listed in Table 2.

Individual differences

Demographics. Age, sex, annual income, and ethnicity were assessed with single items.

Table 1. Participants' expectations about an avian flu outbreak

	Impossible	Very unlikely	Unlikely	Likely	Very likely	Will occur	Mean	SD
1. How likely do you think it is that *bird−to−bird* transmission of H5N1 will occur in the coming year:								
a. Outside of the US?	0.0	4.8	9.4	40.8	31.7	13.2	3.39	0.99
b. Within the US?	0.0	17.8	37.3	35.2	8.0	1.7	2.39	0.93
c. Within New Mexico?	2.1	31.0	30.7	28.2	5.9	2.1	2.11	1.05
2. How likely do you think it is that *bird−to−human* transmission of H5N1 will occur in the coming year:								
a. Outside of the US?	0.0	11.8	24.0	44.6	15.3	4.2	2.76	0.99
b. Within the US?	3.8	32.4	37.6	23.3	2.4	0.3	1.89	0.91
c. Within New Mexico?	5.6	42.2	35.3	15.0	1.7	0.3	1.66	0.89
3. How likely do you think it is that *human−to−human* transmission of H5N1 will occur in the coming year:								
a. Outside of the US?	4.9	24.4	25.4	35.2	7.7	2.4	2.24	1.12
b. Within the US?	8.4	41.5	32.1	15.7	1.7	0.7	1.63	0.95
c. Within New Mexico?	11.1	44.9	29.3	12.9	1.4	0.3	1.49	0.93
If a human-to-human H5N1 outbreak occurs in New Mexico, how likely do you think it is that:								
4. There would be a very high fatality rate?	1.0	5.9	20.6	43.2	24.0	5.2	2.99	0.99
5. Patients would be permanently physically damaged?	1.0	6.3	23.7	45.6	20.2	3.1	2.87	0.95
6. Vaccine supplies would be inadequate?	0.0	2.1	11.5	33.8	37.3	15.3	3.52	0.96
7. Medicine and/or treatment would be inadequate?	0.0	3.5	17.8	32.8	33.4	12.5	3.34	1.02
8. Infection control measures in hospitals would be inadequate?	0.3	4.9	20.9	34.1	26.5	13.2	3.21	1.09
9. Family members would contract the infection?	2.4	9.8	24.1	38.1	17.5	8.0	2.83	1.15

The response scale was as follows: 0 = impossible, 1 = very unlikely, 2 = unlikely, 3 = likely, 4 = very likely, 5 = very likely, 6 = will occur. The numbers for each response choice are the percentage who gave that response.

Neuroticism. The tendency to experience negative affects was assessed using the Big Five Inventory.[18] The 8 items (eg, "worries a lot") were scored on a 5-point scale, from 1 = strongly disagree to 5 = strongly agree. Cronbach's alpha was .845.

Optimism. The tendency to expect positive outcomes was assessed by the Life Orientation Test.[19] The 6 items (eg, "I'm always optimistic about my future") were scored on a 5-point scale, from 1 = strongly disagree to 5 = strongly agree. Cronbach's alpha was .781.

Resilience. The ability to bounce back from stressful events was assessed with the Brief Resilience Scale.[20] The 6 items (eg, "I tend to bounce back quickly after hard times") were scored on a 5-point scale, from 1 = strongly disagree to 5 = strongly agree. Cronbach's alpha was .858.

Social strain. The frequency of negative social interactions was assessed using 4 items.[21] The items (eg, "How often in the past month has someone been critical of your behavior") were scored on a 5-point scale, from 1 = none of the time to 5 = all of the time. Cronbach's alpha was .811.

Social support. The perception that social support is available was assessed using the Interpersonal Support Evaluation List.[22] The list includes 12 items (eg, "when I need suggestions on how to deal with personal problems, I know someone I can turn to") that were scored on a 4-point scale, from 1 = definitely false to 4 = definitely true. Cronbach's alpha was .842.

Spirituality. Spirituality was assessed using a single item: "To what extent do you consider yourself a spiritual person?"[23] It was scored on a 5-point scale, from 1 = not at all to 5 = a great deal.

Emotional responses to an avian flu outbreak

Positive and negative emotions. These were measured using the Positive and Negative Affect Schedule.[24] This schedule includes 10 items to assess positive emotional states (eg, "enthusiastic," "proud") and 10 items to assess negative emotional states (eg, "upset," "afraid"). Before reading the scenarios, the participant was asked how much he or she normally experienced these emotions. After reading each scenario, the participant was asked to indicate how much he or she would feel each emotion if the scenario were actually occurring. The scores were computed for normal levels and each scenario. Cronbach's alphas for positive emotion were 0.861 normally, 0.823 for scenario 1, and 0.823 for scenario 2. Cronbach's alphas for negative emotion were 0.818 normally, 0.905 for scenario 1, and 0.888 for scenario 2.

Behavioral responses to an avian flu outbreak

After the participant reported anticipated emotional responses, he or she was asked to assess the likelihood of engaging in 11 different behaviors related to the 2 scenarios. These behaviors, listed in Table 2, were designed to assess major categories of behavior, including avoiding places to reduce the risk of catching the flu, helping infected friends and family members, making sacrifices to obtain vaccines and medications, and illegal behavior to obtain vaccines and medications. The

Table 2. Principal components analyses of the avian flu–related behavior items

	Scenario 1				Scenario 2			
	1	2	3	4	1	2	3	4
Avoidance								
Avoid crowds	.918	−.017	.065	−.024	.924	−.002	.094	.049
Avoid visiting hospitals	.846	.054	.045	−.003	.848	.027	.046	−.012
Avoid leaving your residence	.841	−.119	−.040	.032	.843	−.042	−.079	.041
Keep your children/yourself from school	.840	.073	−.085	.005	.865	.003	−.101	−.060
Helping								
Help infected family members or friends directly (eg, administering medication)	.009	.918	−.045	.055	−.083	.828	−.009	.060
Help infected family members or friends indirectly (eg, running errands)	−.013	.867	.050	−.069	.073	.883	−.001	−.038
Illegal								
Steal from a hospital to acquire vaccines and/or medication for yourself, family, or friends	.016	.011	−.957	.069	.032	.025	−.950	−.074
Steal from a neighbor to acquire vaccines and/or medication for yourself, family, or friends	−.042	−.017	−.951	.069	−.006	.000	−.942	−.089
Purchase vaccines and/or medication on the black market (on the stress) for yourself, family, or friends.	.072	.012	−.650	−.269	.030	−.028	−.649	.344
Sacrifice								
Wait in long lines for vaccines and/or medication for yourself, family, or friends	−.026	−.011	−.020	−.956	−.044	.010	−.008	.947
Pay high prices for vaccines and/or medication for yourself, family, or friends	.023	.038	.019	−.936	.085	.043	.029	.908
Percent of variance	33.72	20.59	16.35	9.42	35.51	10.12	15.56	18.26

The four components are listed under "Scenario 1" and "Scenario 2," and the component loadings shown are from the pattern matrices.

avoidance items were adopted from Lau et al,[5] and the other items were created for this study based on a review of behavioral responses to previous epidemics.

Statistical analyses

Principal components analyses were used to create behavioral response subscales. The scenario 1 and scenario 2 emotional and behavioral responses scores were compared using independent-sample *t*-tests. The emotional and behavioral response scores of men and women were compared using paired-sample *t*-tests. Correlation analyses were used to examine the zero-order relationship between variables and to test the hypotheses about them. Path analyses were used to test an overall model and our hypothesis about emotion mediating the effects of individual differences on behavior. An alpha of 0.05 was used as the test for all analyses.

RESULTS

The study group was 67% female, with a mean age of 20.56 years (standard deviation ± 4.71; range, 18 to 55 years). The ethnic breakdown was 51% white, 32% Hispanic, 3% American Indian or Alaska native, 3% Asian or Pacific Islander, 2% black, and 9% mixed or other. The college year breakdown was 51% freshmen, 21% sophomores, 18% juniors, and 10% seniors. The

mean annual income was $12,403 ± $1,195 (range, $0 to $130,000).

Before reading the WHO fact sheet, each participant answered the questions about familiarity with the avian flu. The distribution of responses to the "how familiar are you with the avian influenza?" were 16% for "never heard of it," 55% for "heard of it but cannot recall details," 28% for "generally familiar and can recall some details," and 1% for "knowledgeable and can recall many details." The correct responses to the 3 true/false questions were 71% for "avian flu refers to a large group of different influenza viruses that primarily affect birds," 71% for "H5N1 is a particularly virulent form of avian influenza for which there is no vaccine," and 28% for "the H5N1 virus jumps easily to humans and spreads readily and sustainably among humans."

After reading the WHO fact sheet, the participant was asked questions regarding expectations related to an avian flu outbreak. Although these questions were partially addressed in the WHO fact sheet, no definitive answers were given, leaving room for individual participants to respond differently. Our goal was to provide the most current information relevant to these questions and then see how the participants interpreted it.

Table 1 displays the results. First, the participants were asked how likely they thought that bird-to-bird, bird-to-human, or human-to-human transmission of H5N1 was outside the United States, within the United

States, and within New Mexico. For each type of transmission, there was a significant decrease in perceived likelihood when comparing transmission outside the United States to within the United States and transmission within the United States to within New Mexico. For each location, there was a significant decrease in perceived likelihood when comparing bird-to-bird with bird-to-human transmission and bird-to-human with human-to-human transmission. Figure 1 shows these changes.

Second, the participants were asked questions about how severe he or she thought that a human-to-human outbreak in New Mexico would be, and whether the public health response would be adequate. Most of the participants indicated that it was at least "likely" that there would be a high fatality rate (72%), patients would suffer permanent physical damage (69%), and family members would contract the infection (64%). The majority also thought it would be at least "likely" that there would be inadequate vaccine supplies (86%), medicine and treatment (79%), and infection control measures in hospitals (74%).

Next, we conducted principal components analyses (PCAs) with an oblimin rotation for the behavioral items. We used an oblimin rotation because it is preferred when the components are correlated.[25] We expected the components to be correlated, and found that most of the resulting behavior scores were correlated in our path analysis model. Table 2 displays the results of these analyses. For each scenario, there were 4 components, with the same items composing each component. These components were termed "avoidance," "helping," "illegal," and "sacrifice." We computed avoidance, helping, illegal, and sacrifice scores for scenario 1, scenario 2, and both scenarios combined using the items identified in the PCAs. We used the items rather than component scores so that our results could be compared with other studies using the same items. Cronbach's alphas for avoidance, helping, illegal, and sacrifice were 0.884, 0.725, 0.837, and 0.906 in scenario 1 and 0.897, 0.641, 0.836, and 0.882 in scenario 2. We used the scores for scenarios 1 and 2 for cross-scenario and cross-sex comparisons and used the average of both scores for the correlation and path analyses.

Table 3 shows the cross-scenario and cross-sex means and standard deviations for the emotional and behavioral responses. We used a Bonferroni correction to adjust for the 18 t-tests represented in Table 3, changing the alpha value to 0.0028 (P < .05/18).[26] Females scored lower on positive emotion than males in both scenarios 1 and 2, and females scored higher on negative emotion than males in scenario 2. For the sample as a whole, all of the emotional and behavioral responses demonstrated significant increases from scenario 1 to scenario 2.
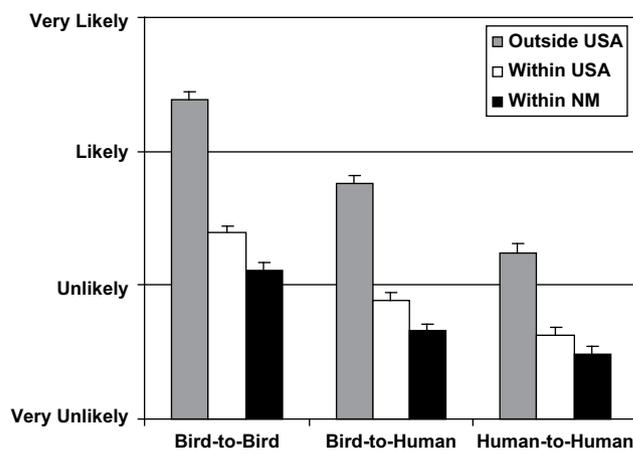
Fig 1. Expectations regarding the likelihood of avian flu transmissions occurring in the following year.

We also compared behavioral responses within each scenario using paired-sample t-tests. Once again, we used a Bonferroni correlation to adjust for the 12 t-tests, changing the alpha value to 0.0042 (P < .05/12). All differences were significant; the most likely behavior for each scenario was sacrifice, followed by helping, avoidance, and illegal behavior.

For the whole sample, the mean normal levels of positive and negative emotion were 3.46 ± 0.65 and 1.72 ± 0.55, respectively. We compared these normal levels of positive and negative emotion with the emotions during scenarios 1 and 2 using Bonferroni correction for multiple comparisons, with α = 0.0125 (P < .05/4). Positive emotion for scenarios 1 and 2 was significantly below the normal level (t = 19.621, P < .001, d = 1.210 and t = 20.764, P < .001, d = 1.350, respectively). Negative emotion for scenarios 1 and 2 was significantly above the normal level (t = -13.030, P < .001, d = .901 and t = -20.047, P < .001, d = 1.420, respectively). These differences are displayed in Fig 2.

Table 4 presents the descriptive statistics and correlations for the individual differences and the emotional and behavioral responses averaged across both scenarios. The first hypothesis was that the protective factors (income, optimism, resilience, spirituality, and social support) would predict greater positive emotion. This hypothesis generally was supported, in that 3 of 5 possible correlations were significant in the expected direction. The second hypothesis was that the risk factors (neuroticism and social strain) would predict greater negative emotion. This was supported, in that both correlations were significant in the expected direction. The third hypothesis was that emotion would predict behavioral responses. This generally was supported, in that 4 out of 8 possible correlations were significant.

Table 3. Descriptive statistics for anticipated emotional and behaviors responses

	Scenario 1		Scenario 2		All participants		Scenario change*
	Male	Female	Male	Female	Scenario 1	Scenario 2	
Emotional responses							
Positive emotion	2.91 (0.68)[a]	2.49 (0.70)[a]	2.76 (0.75)[b]	2.40 (0.71)[b]	2.63 (0.72)[c]	2.52 (0.74)[c]	−.151
Negative emotion	2.20 (0.89)	2.43 (0.81)	2.50 (0.88)[b]	2.83 (0.79)[b]	2.36 (0.84)[c]	2.72 (0.83)[c]	.431
Behavioral responses							
Avoidance	5.42 (2.34)	5.31 (2.10)	6.23 (2.16)	6.06 (2.15)	5.34 (2.17)[c]	6.11 (2.15)[c]	.356
Sacrifice	7.26 (2.05)	7.75 (1.44)	7.57 (1.92)	8.09 (1.20)	7.59 (1.67)[c]	7.93 (1.49)[c]	.214
Helping	6.77 (1.83)	6.78 (1.71)	7.06 (1.73)	7.17 (1.63)	6.77 (1.75)[c]	7.13 (1.66)[c]	.211
Illegal	4.04 (2.26)	3.84 (2.20)	4.52 (2.60)	4.20 (2.28)	3.90 (2.22)[c]	4.30 (2.39)[c]	.173

Values are means with standard deviations in parentheses. T−tests were conducted to compare differences in means between males and females within each scenario and for all participants' scores between Scenarios 1 and 2 Means sharing the same superscript (a, b, c) in the same row are significantly different at $p < .05$ with a Bonferroni correction for 18 multiple comparisons ($P < .0028 = .05/18$). *Cohen's d effect size for the change from Scenario 1 to Scenario 2 for all participants.

Specifically, negative emotion was related to female sex, lower resilience, higher neuroticism, and greater social strain. Positive emotion was related to older age, higher income, male sex, higher optimism and resilience, and lower neuroticism. Helping was related to older age, higher optimism, resilience, spirituality, social support, and greater positive emotion. Sacrifice was related to female sex and greater negative emotion. Illegal behavior was related to lower resilience, higher neuroticism and social strain, and less positive emotion and greater negative emotion. Avoidance was related to older age and less positive emotion and greater negative emotion.

Finally, we used path analysis to test an overall model and the fourth hypothesis, that the emotional responses would mediate the effects of the individual differences on behavioral responses. We retained all of the emotional and behavioral responses but only the individual differences that were significant predictors of responses when the other variables were controlled. The individual differences retained were age, income, sex, spirituality, resilience, and neuroticism. We allowed the predictors and the errors of the criterion variables to correlate. Figure 3 displays the final model, which provided a good fit to the data ($\chi^2[44] = 70.31$; $P = .007$; comparative fit index = 0.997; Tucker-Lewis index = 0.994; root mean square error of approximation = 0.046).

The model partially supports our mediation hypothesis, in that 5 of the 9 effects of individual differences on behavior are indirect through positive or negative emotion. Direct effects of older age and higher spirituality on more helping, male sex on more illegal behavior, and income on more sacrifice were seen. In addition, direct effects of female sex, income, and higher resilience and spirituality on more positive emotion and of neuroticism on more negative emotion were seen. Finally, there were direct effects of positive emotion on more helping and less illegal behavior and
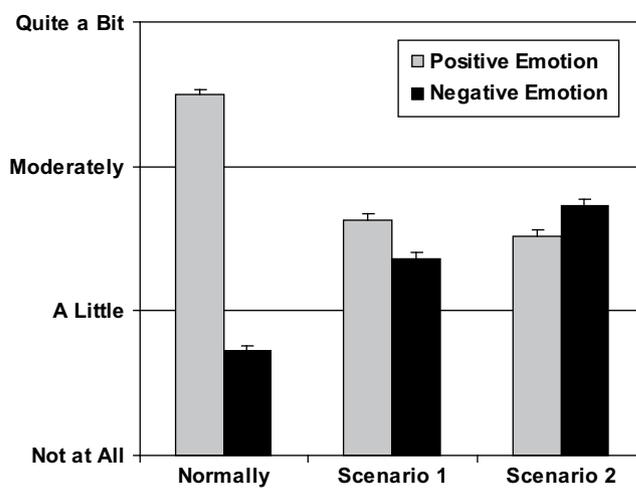
Fig 2. Normal levels of positive and negative emotions and anticipated emotional responses after avian flu scenarios 1 and 2.

of negative emotion on more avoidance, sacrifice, and illegal behavior.

DISCUSSION

The purpose of this study was to examine the anticipated emotional and behavioral responses to an avian flu outbreak and the effects of risk and protective factors on these responses. This study also provided new information about the familiarity and expectations of a US sample regarding a potential avian flu outbreak. The results generally support the hypotheses that protective factors would predict positive emotions, risk factors would predict negative emotions, and emotions would predict behaviors. They partially support the hypothesis that the effects of risk and protective factors on behaviors would be mediated by emotion. There were also direct effects of protective factors on behavior.

Table 4. Correlations analyses between potential individual differences and anticipated emotional and behavioral responses*

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age	20.56	4.71	–															
2. Income†	12,403	1,195	.558‖	–														
3. Sex‡	0.67	0.47	−.019	.001	–													
4. Ethnicity§	0.51	0.50	−.062	−.047	−.047	–												
5. Optimism	3.58	0.69	.173‖	.132¶	.050	.115	–											
6. Resilience	3.61	0.72	.161‖	.167‖	−.139¶	.069	.378‖	–										
7. Neuroticism	2.69	0.71	−.105	−.116¶	.271‖	−.107	−.301‖	−.591‖	–									
8. Spirituality	2.30	1.29	.138¶	.090	.191‖	.125¶	.182‖	−.052	−.027	–								
9. Social support	3.46	0.48	.034	.176‖	.104	.006	.407‖	.226‖	−.219‖	.056	–							
10. Social strain	2.27	0.89	−.158‖	−.143¶	.070	−.040	−.354‖	−.316‖	.407‖	−.057	−.344‖	–						
11. Positive emotions	2.57	0.70	.159‖	.167‖	−.261‖	−.001	.215‖	.302‖	−.201‖	.085	.115	−.080	–					
12. Negative emotions	2.54	0.79	−.041	−.091	.164‖	−.083	.027	−.201‖	.367‖	.013	−.020	.159‖	−.139¶	–				
13. Avoidance	5.73	2.04	.127¶	.050	−.032	.044	.009	−.114	.090	.049	.062	−.028	−.121‖	.467‖	–			
14. Helping	6.95	1.59	.178‖	.092	.018	−.036	.211‖	.132¶	−.038	.158‖	.128¶	.013	.168‖	.029	−.056	–		
15. Illegal	4.10	2.20	−.088	−.064	−.055	−.058	−.049	−.154‖	.185‖	−.027	.002	.143‖	−.163‖	.365‖	.326‖	.026	–	
16. Sacrifice	7.76	1.47	.080	.086	.161‖	.046	.090	−.010	.105	.058	.007	.052	−.066	.311‖	.230‖	.305‖	.274‖	–

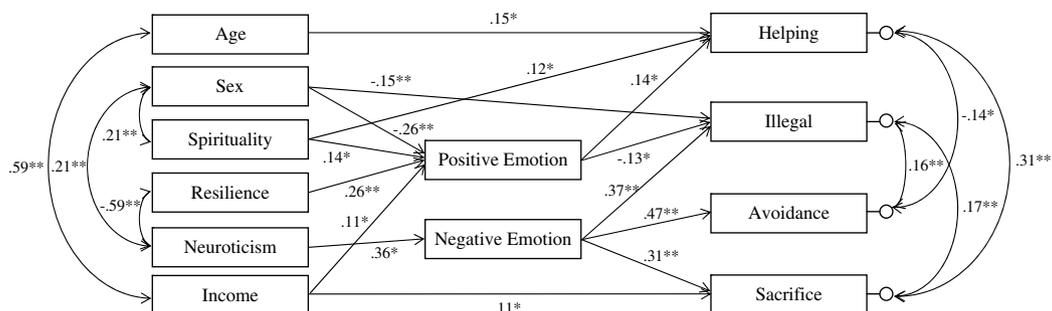*The means for the emotional and behavioral responses across both scenarios were used for these analyses.
†Income amount is in dollars.
‡Sex was coded as follows: male = 0; female = 1.
§Ethnicity was coded as follows: white = 0; nonwhite = 1.
¶$P < .05$.
‖$P < .01$.

Fig 3. Path model with standardized beta weights predicting anticipated emotional and behavioral responses to an avian flu outbreak. The means for the emotional and behavioral responses across both scenarios were used for these analyses. Sex was coded as male = 0, female = 1. *$P < .05$; **$P < .01$.

This US sample demonstrated only a modest familiarity with the avian flu; 72% thought that the H5N1 virus already capable of human-to-human transmission. Moreover, the expectation that transmission would be much less likely in the United States may reflect a lack of appreciation of the potential for long-distance transmission through birds or air travel. In addition, our participants expected that public health preparedness would be relatively poor were human-to-human transmission to occur in New Mexico. The proportions expecting inadequate vaccines (86%), medicines/treatments (79%), and infection control measures (74%) were greater than those reported in a recent study of Chinese citizens in Hong Kong (63%, 55%, and 43%, respectively).[5]

The results regarding anticipated levels of various emotional and behavioral responses are important in several respects. First, the findings lend support to the notion that anticipated responses may be comparable to actual responses. The increased levels of emotional distress and the higher levels of helping behavior versus illegal behavior closely parallel findings for past events, including the SARS outbreak.[8,9] Second, the increase in distress and behavioral responses from scenario 1 to scenario 2 suggests a dose-response relationship between pandemic severity and responses. Third, women anticipated greater emotional distress than men, paralleling findings for other stressors and suggesting women may be at greater risk for mental problem problems.

Although wanting to obtain descriptive data on familiarity, expectations, and anticipated responses, we were most interested in gaining insight into the relationships among emotion, behavior, and potential risk and protective factors. We found that emotion was an important predictor of behavior and that positive and negative emotion had both overlapping and unique effects. Negative emotion had the strongest effects and was related to increased avoidance, sacrifice, and illegal behaviors. Positive emotion had weaker effects and was related to increased helping behavior and decreased illegal behavior. These results support the concept of emotions as "action tendencies" and theories about emotions affecting decision making and behavior.[15,16]

Although optimism and social support were related to responses in the correlation analyses, resilience, spirituality, and income were the only protective factors that predicted responses in the path analyses when other variables were controlled. Resilience was a strong predictor of positive emotion, paralleling the findings of other studies, and was indirectly related to increased helping behavior and decreased illegal behavior.[12] Spirituality was related directly to increased positive emotion and helping behavior and related indirectly to increased helping behavior and decreased illegal behavior. The effects of spirituality on helping behavior may be related to the emphasis on altruistic behavior in many religious and spiritual traditions. Finally, income had similar effects to spirituality, in that it also was related to increased positive emotion but to increased sacrifice behavior rather than helping behavior.

Although social strain was related to responses in the correlation analyses, neuroticism was the only risk factor related to responses in the final path model. Neuroticism was directly related to negative emotion but not to any behaviors. The effect of neuroticism on negative emotion was strong, however, and the similarly strong effects of negative emotion on 3 of 4 behaviors suggests that neuroticism and negative emotion may play a key role in influencing behavior during a pandemic.

It is striking that age and female sex were important in the final model and that social support and social strain were not important. Even though most of the participants in our sample were young, there were sufficient participants in an age range to allow detection of a positive relationship with helping behavior. In addition, whereas past studies shown that women are more vulnerable to emotional distress, our path model showed that women actually were more vulnerable to reduction in positive emotions. Finally, the lack of effects for the social relationship measures in the final

model suggests that the personal characteristics assessed may be more important.

This study has several implications for infection control and pandemic preparedness. First, the US public may need more education about the dangers of an avian pandemic and better health care preparedness to boost public confidence. Second, the dose-response relationship found between severity and emotional and behavioral responses should be considered when planning for the progression of a pandemic. Third, mental health planning should consider women and persons with higher neuroticism scores as being at greater risk for emotional problems. Fourth, plans for reducing emotional distress and increasing positive emotions may have important implications for behavior that may impact others as well as the mental health of individuals. Finally, citizen preparedness may benefit from a focus on fostering resilience (eg, teaching coping skills) and encouraging people to draw on spiritual resources that address concerns regarding a pandemic.

This study has several limitations. We examined anticipated, not actual, responses to an avian outbreak. Nonetheless, as noted earlier, our findings paralleled those of actual events and were in accordance with previous studies on risk and protective factors and theories of the impact of emotion on behavior. Although psychological research has shown that humans are limited in their ability to predict future emotions and behavior,[27,28] there is also evidence that predictions regarding the direction of emotions (eg, more negative emotion, less positive emotion) and predictions regarding behavior are significantly related to actual behavior.[29,30] Factors that reduce the accuracy of predictions include affective forecasting errors, temporally induced optimistic biases, self-serving projections, failure to imagine situational forces and constraints, and personality differences.[27,31] Our goals are to compare responses to hypothetical scenarios with responses to actual events, to better characterize the differences between them, and to develop algorithms to adjust for these differences.[32]

Another limitation was the young mean age of our study sample and the fact that all participants were college students. Nonetheless, the sample included a relatively broad range of age, a full range of incomes, and a large proportion of ethnic minority participants. In addition, we did not use an established measure to assess behavior; most of the items used were created for this study. We were not aware of any existing measures that would have been more relevant or appropriate, and we used PCA in an effort to create reliable behavior subscales.

CONCLUSION

This study has demonstrated that anticipated emotional responses and behavioral responses to an avian flu outbreak may be related and identified several factors that predict these responses. The findings suggest that an avian flu pandemic may have a significant impact on mental health and that emotional responses may be related to actual behavior. Positive emotion may be important, as may negative emotion. Pandemic preparedness should consider the potential impact of emotional responses on behavior, plan for the special needs of people with risk factors (eg, neuroticism), and find ways to foster protective factors, such as resilience and spirituality. Finally, additional effort may be needed to educate the US public about the dangers and status of an avian flu pandemic threat and to help build confidence in the health care response.

References

1. Goldrick BA, Goetz AM. Pandemic influenza: What infection control professionals should know. Am J Infect Control 2007;35:7-13.
2. World Health Organization. WHO consultation on priority public health interventions before and during an influenza pandemic. Geneva: World Health Organization; 2004. p. 1-59.
3. Thorson A, Ekdahl K. Avian influenza: is the word on the verge of pandemic?...and can it be stopped? J Conting Crisis Manage 2005;13:21-8.
4. World Health Organization. Cumulative number of confirmed human cases of avian influenza A/(H5N1) reported to WHO, June 19, 2008. Available from: http://www.who.int/ csr/disease/avian_influenza/country/cases_table_2008_06_19/en/index.html. Accessed July 3, 2008.
5. Lau JT, Kim JH, Tsui H, Griffiths S. Perceptions related to human avian influenza and their associations with anticipated psychological and behavioral responses at the onset of outbreak in the Hong Kong Chinese general population. Am J Infect Control 2007;35:38-49.
6. Reissman DB, Watson PJ, Klomp RW, Tanielian TL, Prior SD. Pandemic influenza preparedness: adaptive responses to an evolving change. J Homeland Secur Emerg Manage 2006;3:2 article 13.
7. Helsloot I, Ruitenberg A. Citizen response to disasters: a survey of literature and some practical implications. J Conting Crisis Manage 2004;12:98-111.
8. Stein BD, Tanielian TL, Eisenman DP, Keyser DJ, Burnam MA, Pincus HA. Emotional and behavioral consequences of bioterrorism: planning a public health response. Milbank Q 2004;82:413-55.
9. Rodriguez H, Trainor J, Quarantelli EL. Rising to the challenges of catastrophe: the emergent and prosocial behavior following hurricane Katrina. Ann Am Acad Political Soc Sci 2006;604:82-101.
10. Norris FH, Friedman MJ, Watson PJ. 60,000 disaster victims speak, part II: summary and implications of the disaster mental research. Psychiatry 2002;65:240-60.
11. Costa PT, McCrae RR. NEO PI-R: the revised NEO Personality Inventory. Odessa, FL: Psychological Assessments Resources; 1992.
12. Fredrickson BL, Tugade MM, Waugh CE, Larkin GR. What good are positive emotions in crises? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. J Pers Soc Psychol 2003;84:365-76.
13. Pargament KI, Smith BW, Koenig HG, Perez L. Patterns of positive and negative religious coping with major life stressors. J Sci Study Relig 1998;37:710-24.
14. Amato PR. Emotional arousal and helping behavior in a real-life emergency. J Appl Soc Psychol 1986;16:633-41.
15. Frijda NH. The emotions. Cambridge, UK: Cambridge University Press; 1986.
16. Lowenstein GF, Weber EU, Hsee CK, Welch N. Risk as feelings. Psychol Bull 2001;127:267-86.
17. World Health Organization. Ten things you need to know about pandemic influenza. Available from: http://www.who.int/csr/disease/influenza/pandemic10things/en/. Accessed May 25, 2007.
18. Benet-Martinez V, John OP. Los Cinco Grandes across cultures and ethnic groups: multitrait multimethod analyses of the Big Five in Spanish and English. J Pers Soc Psychol 1998;75:729-50.
19. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. J Pers Soc Psychol 1994;67:1063-78.
20. Smith BW, Dalen J, Wiggins K, Tooley E, Christopher P, Bernard J. The Brief Resilience Scale: sssessing the ability to bounce back. Int J Behav Med 2008;15:194-200.
21. Finch JF, Okun MA, Barrera M, Zautra AJ, Reich JW. Positive and negative social ties among older adults: measurement models and the prediction of psychological stress and well being. Am J Community Psychol 1989;17:585-605.
22. Cohen S, Mermelstein R, Kamarck T, Hoberman H. Measuring the functional components of social support. In: Sarason IG, Sarason BR, editors. Social support: theory, research, and application. The Hague: Martinus Nijhoff; 1985. p. 73-94.
23. Fetzer Institute. Multidimensional measurement of religiousness/spirituality for use in health research: a report of the Fetzer Institute/National Institute on Aging. Kalamazoo, MI: Fetzer Institute; 1999. p. 87.
24. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect. J Pers Soc Psychol 1988;54:1063-70.
25. Fabrigar LR, Wegener DT, MacCallum RC, Strahan EJ. Evaluating the use of exploratory factor analysis in psychological research. Psychol Methods 1999;4:272-99.
26. Maxwell SE, Delaney HD. Designing experiments and analyzing data: a model comparison perspective. 2nd ed. New York: Erlbaum; 2003.
27. Diekmann K, Tenbrunsel AE, Galinskey AD. From self-prediction to self-defeat: behavioral forecasting, self-fulfilling prophecies, and the effect of competitive expectations. J Pers Soc Psychol 2003;85:672-83.
28. Epley N, Dunning D. The mixed blessing of self-knowledge in behavioral prediction: enhanced discrimination but exacerbated bias. Pers Soc Psychol Bull 2006;5:641-55.
29. Armitage CJ, Conner M. Efficacy of the theory of planned behaviour: a meta-analytic review. Br J Soc Psychol 2001;40:471-99.
30. Wilson TD, Gilbert DT. Affective forecasting: knowing what to want. Curr Dir Psychol Sci 2005;14:131-4.
31. Dunn EW, Brackett MA, Ashston-James C, Schneiderman E, Salovey P. On emotionality intelligent time travel: individual differences in affective forecasting ability. Pers Soc Psychol Bull 2007;22:85-93.
32. Ayton P, Pott A, Elawkili N. Affective forecasting: why can't people predict their emotions? Thinking Reasoning 2007;12:62-80.

APPENDIX: MOCK NEWSPAPER ARTICLES USED TO PRESENT THE AVIAN FLU OUTBREAK SCENARIOS

Scenario 1

First Death in New Mexico Linked to Poultry Flu. ALBUQUERQUE, Aug. 29, 2008 (AP) – A 24-year-old male who died today in Albuquerque is the first victim of the poultry-borne flu in the United States. Investigations by the US Centers for Disease Control

and Prevention and the World Health Organization into the source of his infection indicate exposure to sick and dead poultry while on a recent visit to family residing in Riau Province, Indonesia. As international news services have reported, Indonesia is in the midst of a bird-to-bird avian flu epidemic. Indonesian farmers have slaughtered 1.2 million chickens as a preventive measure, but several dozen cases of bird-to-human transmission have been confirmed.

The infected male returned to Albuquerque on August 20 to attend classes at the University of New Mexico. He exhibited a fever and respiratory ailments for several days before seeking treatment and was identified as being infected with the H5N1 virus only last week. To date, 11 others have been confirmed to have the virus, and in another 3 persons, there are strong suspicions. The H5N1 appears to have mutated into a strain that spreads through persons with no immunity, realizing the fears of health experts that the virus had infected a person who also had the flu virus.

Fear of the illness has people filling doctors' waiting rooms and health authorities taking tough measures to curb its spread. Officials are working on identifying passengers on the victim's international and domestic return flights who were exposed to the virus, as well as university students and staff who were either directly or indirectly in contact with him.

Scenario 2

80 Fatalities Linked to New Mexico Poultry Flu Outbreak. ALBUQUERQUE, Sept. 17, 2008 (AP)– Within the past 2 weeks, 89 additional cases of H5N1 have been reported despite rigorous efforts of health authorities to contain the virus. Of the 101 H5N1 cases confirmed to date in New Mexico, 80 have been fatal. The youngest victim was a 3-year-old female from Las Cruces. Among the victims are 27 students and staff from the University of New Mexico in Albuquerque and Rio Rancho.

Cases of H5N1 were initially limited to the Albuquerque area but are now cropping up across the state and elsewhere in the southwest. Officials from the Centers for Disease Control and Prevention and the World Health Organization warn that the infection rate is only likely to accelerate unless radical containment efforts are implemented.

State health officials urge individuals exhibiting symptoms of H5N1 to seek immediate medical attention. Initial symptoms of H5N1 include fever, sore throat and cough, muscle aches, headache, lethargy, eye infections, breathing problems, and chest pains.