RESEARCH

If You Ask Them, Will They Come? Predictors of Quarantine Compliance During a Hypothetical Avian Influenza Pandemic: Results From a Statewide Survey

Sarah Bauerle Bass, PhD, MPH; Sheryl Burt Ruzek, PhD, MPH; Lawrence Ward, MD, MPH; Thomas F. Gordon, PhD; Alexandra Hanlon, PhD; Alice J. Hausman, PhD, MPH; Michael Hagen, PhD

ABSTRACT

Background: An influenza pandemic, such as that of the H1N1 virus, raises questions about how to respond effectively to a lethal outbreak. Most plans have focused on minimizing impact by containing the virus through quarantine, but quarantine has not been used widely in the United States and little is known about what would be the public's response. The purpose of this study was to investigate factors that influence an individual's decision to comply with a hypothetical avian influenza quarantine order.

Methods: A total of 1204 adult Pennsylvania residents participated in a random digit dial telephone sample. The residents were interviewed regarding their attitudes about and knowledge of avian influenza and about compliance with quarantine orders, including staying at home or traveling to a government-designated facility.

Results: Analysis of variance showed differences among demographic groups in willingness to comply with quarantine orders, with women and individuals not presently employed more willing to stay at home or to travel to a government-designated facility if ordered. Those who did not regularly attend religious services were significantly less willing than those who did attend regularly to comply with any type of quarantine order. Regression analysis indicated that demographic variables, overall knowledge of avian influenza, attitudes about its severity, and the belief that the respondent and/or his or her significant other(s) may contract it were predictive.

Conclusions: The results of this study can provide health planners and policy makers with information for improving their efforts to conduct a quarantine successfully, including crafting messages and targeting information to certain groups of people to communicate risk about the epidemic.

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Key Words: disease outbreaks, communicable diseases, quarantine, communication

The emergence of new infectious diseases has forced public health planners to refocus on the need for improved preparedness strategies. The 2009 H1N1 influenza pandemic led many policy makers to consider how they would respond to a potentially devastating disease outbreak.[1-5] The Centers for Disease Control and Prevention (CDC) reported that between April and November 14, 2009, approximately 9820 deaths occurred, 213,000 people were hospitalized, and 47 million people were infected with H1N1.[6] Despite significant incidence, this new infection appears to have morbidity similar to seasonal influenza.[7] There remains the possibility, however, that a viral mutation could occur in which influenza became highly contagious and its potential lethality could result in a panic with devastating worldwide health and economic impact.[1,4,5,8,9] Researchers speculate that a variant of influenza, such as the H5N1 avian influenza virus, has the potential to become such a virus.[10,11] Because many believe it is only a matter of time until another deadly influenza pandemic occurs, most preparedness plans focus on methods of minimizing worldwide impact by containing the virus before widespread transmission can occur.[2,9,12]

US media reports about pandemic plans have prominently featured pharmacological responses to an influenza outbreak. These include the stockpiling of medications such as oseltamivir and efforts to develop a protective vaccine.[2,3,13] Responses to the 2009 H1N1 outbreak relied mostly on encouraging vaccination, especially for vulnerable populations, and promoting personal protective measures such as hand washing and using alcohol-based hand sanitizers. Less often reported are nonpharmacological countermeasures including social distancing, isolation, and quarantine.[9,14-16] Considered a central component of the successful effort to end the severe acute respiratory syndrome (SARS) outbreak in

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2003, many planners now regard these measures, especially isolation and quarantine, as essential tools to slow or prevent spread in the initial stages of an influenza pandemic.[17,18]

Quarantine has been used extensively in public health, but it has not been used in the United States for nearly 70 years.[19] Legally, most explicit quarantine powers are granted to states, originating at a local level during the colonial era.[20] Today, states may quarantine under a variety of laws addressing the health and safety of citizens.[21] The federal government also has more implicit quarantine authority under the Commerce Clause in the US Constitution (Article I, Section 8, Clause 3),[22] most notably in cases in which there is a risk of transmission of infectious disease across state lines[22] or if a state requests the intervention of the federal government.[23] Because many state quarantine laws are more than 100 years old and in response to the September 11, 2001 terror attacks and the SARS outbreak, public health experts developed the Model State Emergency Health Powers Act,[24] which provides guidance to states on revamping emergency response plans, including the use of quarantine orders.[22] Some argue it expands the federal government's authority under an Executive Order[25] to enact quarantine orders, including broad surveillance rights, mandatory vaccination and treatment, destruction and seizure of personal property, and isolation and quarantine.[26] Despite this expanded federal authority, a majority of states have enacted legislation based on these guidelines.[24]

Studies of past uses of quarantine, including during the 1918–1919 "Spanish flu" pandemic and the 2003 SARS outbreak, have identified several components of successful programs, as well as some shortcomings.[27-34] Current CDC guidelines for pandemic influenza mitigation[35] call for 3 primary strategies to combat the spread of influenza: vaccination, treatment of infected as well as exposed people, and implementation of infection control and social distancing measures, primarily quarantine in the home or a health care setting.[35] This plan was used during the most recent H1N1 outbreak but primarily focused on closing schools as a way to produce social distancing; since then, the CDC has discontinued encouraging school closures and has instead stressed the importance of vaccination, personal protective measures, and voluntary quarantine at home.[35] It is not clear how compliant the public has been with voluntary home quarantine. Even in situations in which people voluntarily comply with quarantine orders (eg, when the infectious agent is extremely lethal), the widespread use of quarantine would present many challenges, including the location, monitoring, care, and possible compensation of those placed under quarantine. Public support is vital for any program involving quarantine and isolation.[36-39] Addressing these challenges to enlist the support of the public is essential to optimize compliance in an environment of limited resources.

The purpose of this study was to investigate factors that may influence an individual's decision to comply with a quarantine order by using a hypothetical avian influenza pandemic as an example. This study examines not only the demographic characteristics of the individuals but also their attitudes about avian influenza, overall understanding of its transmission, and perceptions of its severity and the perceived risk of contracting the disease. Our results provide health planners with information that is useful for improving efforts to enact a quarantine order when the next pandemic occurs.

METHODS

A total of 1204 adult Pennsylvania residents participated in a random digit dial telephone sample in September 2006. The interviews were conducted by Abt SRBI Inc using a computer-assisted telephone interviewing system, under the direction of the Institute for Public Affairs, Temple University. Sample telephone numbers were called up to 8 times to complete an interview, and 1 attempt was made to convert each refusal. Within each household, a respondent was chosen according to a random-selection method. The response rate for the study was .28.

The interview data were weighted to accurately reflect population distributions across the state. These weights included a telephone weight to correct for unequal probabilities of selection due to a household having more than 1 telephone, a region weight to correct for population differences in the state, and a poststratification weight to represent the demographic characteristics of the population. These weighting strategies ensured that our sample's demographics matched the US Census estimates of the adult population. The overall margin of error attributable to sampling is ±2.8 percentage points. The sampling error for subgroups is slightly larger.

Survey

The survey instrument was developed based on existing surveys dealing with avian influenza[36,37] and a literature review of quarantine.[36-39] All of the avian influenza–specific questions used a 0 to 10 scale in which respondents were asked to rate how much they disagreed or agreed with statements or how likely they were or were not willing to carry out specific behaviors. The survey was structured to elicit overall perceptions of avian influenza and concern levels without explaining the differences between avian influenza that is transmitted from bird to human and avian influenza that may mutate and be transmitted from person to person, leading to a highly infectious pandemic.

A statement was then read to the respondents describing the difference between avian influenza as it exists today and how it may change if it mutated (Table 1). The interviewer also explained what quarantine is and how the government may carry it out (Table 1). This was done to ensure that all of the respondents were answering questions about vaccination and quarantine using the same definitions of avian influenza and quarantine. After reading these statements, respondents were asked

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about willingness to comply with quarantine at varying levels of coercion:

Level 1: respondent would voluntarily choose to stay at home for 2 weeks

Level 2: respondent would stay at home for 2 weeks if the US government requested

Level 3: respondent would travel to a quarantine facility if the US government requested

Level 4: respondent would travel to a facility if the US government ordered

Survey questions in the order in which they were asked are outlined in Table 1.

Analysis Strategy

Descriptive statistics were used to summarize the sample in terms of sociodemographic variables as well as responses to survey items. Means and standard deviations were reported for continuous measures of survey response items and frequencies were reported for categorical demographic measures. Two sample *t* tests and 1-way analysis of variance (ANOVA) models were used to compare continuous response items according to categorical independent variables including working status, sex, race, age, education, income, and religiosity. Linear regression models were then estimated to determine predictors of quarantine using sociodemographic and attitudinal variables. Post hoc tests were then used to compare pairwise differences in adjusted mean values when the independent variable had more than 2 levels.

RESULTS

Demographic Characteristics of the Sample

Table 2 presents the demographic characteristics of the survey sample. The sample comprised proportionately fewer men than women (45.8% vs 54.2%) and was primarily white (88.2%). It was also evenly split among the age-distribution groups, with roughly one third of the sample in each group. The majority of the sample (58.8%) was working, almost 45% had a household income between $30,000 and $74,000, and 56.5% had graduated from high school. Although the majority (62.2%) did not consider themselves born-again Christians, 41.6% indicated they attend religious services once per week or more often. In comparison with the 2000 Pennsylvania Census data, the survey sample is similar in demographics and differences were controlled for in the weighting scheme.

Likelihood of Compliance With Quarantine

Respondents were asked how willing they would be to comply with various levels of quarantine on a scale of 0 to 10, with zero meaning very unlikely and 10 meaning very likely. Using ANOVA, we examined compliance with each type of quarantine (dependent variables) using sociodemographic characteristics.

As shown in Table 3, ANOVA analysis revealed statistically significant differences in means by demographic group for all types of quarantine. Sex is significantly related to compliance with all 4 types of quarantine. Women consistently reported being more willing than men to adhere to each level of quarantine, including choosing to stay at home ($F = 36.4$, $P < .0001$), staying home if requested by the government ($F = 43.45$, $P < .0001$), traveling to a facility if requested by the US government ($F = 6.77$, $P = .0094$), and traveling to a facility if ordered

TABLE 1

Survey Questions on Attitudes About Avian Influenza and Likelihood of Compliance with Quarantine

Overall Attitudes About Avian (Bird) Influenza	Response Options
1. How closely have you been following the news in recent months about the avian flu, often called the bird flu?	1 = very closely, 2 = somewhat closely, 3 = not too closely, 4 = not closely at all
2. How likely do you think it is that bird flu will infect people in the United States?	0 – 10 scale: 0 = very unlikely–10 = very likely
3. How likely do you think it is that you or someone else in your household will get bird flu?	0 – 10 scale: 0 = very unlikely–10 = very likely
4. In general, if a person came into contact with other people who have been infected, how likely do you think it is that the person will get bird flu?	0 – 10 scale: 0 = very unlikely–10 = very likely
5. If a person eats chicken or other poultry that has been infected, how likely do you think it is that the person will get bird flu?	0 – 10 scale: 0 = very unlikely–10 = very likely
6. If a person is infected with bird flu, how likely do you think it is that a person will die from bird flu?	0 – 10 scale: 0 = very unlikely–10 = very likely
7. If a vaccine—a medicine to protect you from bird flu—were available, how likely would you be to get vaccinated?	0 – 10 scale: 0 = very unlikely–10 = very likely
Quarantine Compliance	
1. In an epidemic, how likely would you be to choose to stay in your home for 2 weeks, even if you were not sick yourself?	0 – 10 scale: 0 = very unlikely–10 = very likely
2. How likely would you be to stay in your home for 2 weeks if the US government asked you to do so, even if you were not sick?	0 – 10 scale: 0 = very unlikely–10 = very likely
3. How likely would you be to go to an emergency facility for 2 weeks if the U S government asked you to do so, even if you were not sick?	0 – 10 scale: 0 = very unlikely–10 = very likely
4. How likely would you be to go to an emergency facility for 2 weeks if the U S government ordered you to do so, even if you were not sick?	0 – 10 scale: 0 = very unlikely–10 = very likely

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TABLE 2

Demographic Characteristics of the Sample

Demographic Characteristic	n (%)
Age, y (N=1193)	
18–44	422 (35.4)
45–59	393 (32.9)
≥60	378 (31.7)
Sex (N=1204)	
Male	551 (45.8)
Female	653 (54.2)
Race (N=1192)	
White	1051 (88.2)
Nonwhite	141 (11.8)
Employment (N=1203)	
Working	707 (58.8)
Nonworking	496 (41.2)
Income (N=1029)	
<$30,000	280 (27.2)
$30,000–$74,000	460 (44.7)
≥$75,000	289 (28.1)
Education Level (N=1200)	
Less than high school	82 (6.8)
High school graduate	678 (56.5)
More than high school	440 (36.7)
"Born again Christian" (N=892)	
Yes	337 (37.8)
No	555 (62.2)
Religious services attendance (N=1185)	
Never	173 (14.6)
A few times/year	519 (43.8)
≥Once/week	493 (41.6)

by the US government ($F = 7.37$, $P = .0067$). A smaller difference was observed by race; nonwhites were more likely than whites to indicate that they would be willing to travel to a facility if asked by the US government ($F = 4.71$, $P = .0302$).

There were also significant relations by age, education level, income, and religiosity:

- Respondents older than 65 years were more willing than younger respondents to choose to stay at home ($F = 5.56$, $P = .004$) or to stay at home if requested by the US government ($F = 3.36$, $P = .0332$).

- Respondents who had graduated from high school were more likely than those who did not to say they would choose to stay at home ($F = 3.61$, $P = .0273$), while both high school and college graduates were more likely than those who were not to stay at home if asked by the US government ($F = 5.48$, $P = .0273$). Those without a high school diploma, however, indicated that they would be more likely to travel to a facility if ordered by the US government ($F = 3.16$, $P = .0426$) compared with those with more education.

- Respondents making less than $30,000 or between $30,000 and $74,000 ($F = 3.34$, $P = .0357$) were more likely to say they would stay at home if the US government asked or travel to a government facility if the US government requested ($F = 4.72$, $P = .0091$) compared with those who made more than $75,000.

- Respondents who were not employed were more likely to say they would choose to stay at home ($F = 23.98$, $P < .0001$), stay at home if asked by the US government ($F = 12.04$, $P = .0005$), and travel to a facility if the US government asked ($F = 4.77$, $P = .0291$) compared with those respondents who were employed.

Significant differences were seen using the variable of frequency of religious service attendance. Respondents who indicated that they never attended religious services were much less willing to comply with quarantine orders than those who attended services. This group was significantly different from the other 2 groups in willingness to stay at home if asked ($F = 5.02$, $P = .0067$), travel to a facility if asked ($F = 7.84$, $P = .0004$), and travel to a facility if ordered ($F = 16.33$, $P < .0001$).

Multivariate Models Predicting Likelihood of Compliance With Levels of Quarantine

Regression analyses determined which survey items significantly predicted the likelihood of compliance with the 4 levels of quarantine. Regression analyses included all of the demographic variables used in ANOVA analyses as well as attitudinal and overall knowledge questions concerning avian influenza, as shown in Table 1.

As indicated in Table 4, a number of variables contributed significantly to predicting compliance with all of the quarantine variables. Specific predictors for choosing to stay at home included how closely respondents were following the news; in this case, not following the news was a significant predictor of respondents stating that they would choose to stay at home. In addition, how likely someone thought he or she or someone close to him or her may contract avian influenza predicted reported willingness to stay at home as did being female and not presently working. The overall model for this quarantine variable had an R^2 value of .13 ($F = 4.55$, $P < .0001$).

For the quarantine variable *stay at home if the US government asked*, significant predictor variables included how closely someone was following the news (again, those who had not been following the news were more likely to say they would stay at home), how likely he or she believed he or she or someone close would contract the virus (after being told the difference between avian influenza as it exists today and what could occur if it becomes infectious), sex (being female), and age (being between the ages of 18 and 44). The overall model for this quarantine variable had an R^2 value of .12 ($F = 4.13$, $P < .0001$).

There were a number of predictors of respondents' willingness to travel to a facility, either by US government request or order. If the US government requested, only 1 predictor variable was significant, whereas there were 7 significant predictors of

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complying with the more coercive level of quarantine. The 1 significant predictor for requesting that individuals travel to a facility was the belief that "my doctor would be able to get enough vaccine" ($R^2 = .11$, $F = 3.53$, $P < .0001$). Significant predictors for the US government order level of quarantine included the belief that the respondent or someone close to him or her would contract avian influenza, the belief that someone could die from avian influenza, the belief that the respondent's doctor would be able to obtain enough vaccine if it were available, increased attendance at religious services, having less than a high school education, and not presently working. The overall regression model for this quarantine variable had an R^2 value of .10 ($F = 3.24$, $P < .0001$).

DISCUSSION

A significant finding is that sociodemographic characteristics only partially predict respondents' self-reported likelihood of complying with quarantine orders. Including both sociodemographic characteristics and attitudinal variables better predicts self-reported likelihood of compliance with each of the levels of quarantine in a hypothetical avian influenza outbreak.

Although differences can be seen across sociodemographic groups in response to quarantine questions, the ANOVA revealed significant differences between or among groups in willingness to comply, with the likelihood of willingness to comply decreasing as the level of quarantine increased. For example, although most respondents said they would choose to stay at home for 2 weeks, far fewer were willing to travel to a quarantine facility if requested or ordered to by the government. Significant differences in willingness were evident by sex, working status, education level, age, and income. Women overall were much more likely than men to indicate they would be willing to comply with quarantine orders. Although some women may indicate more willingness to stay at home because they are not working, employment status does not seem to explain why women are more willing to travel to a government facility. Perhaps because women exhibit more positive health protective behavior, they perceive quarantine in whatever form as a way to avoid contagion. Employment status shows a similar pattern. Again, it may be that those who are not working are more likely to stay at home because they do not see themselves as having to worry about losing their job if they stay at home or shelter in a government-provided facility for 2 weeks.

Age, education level, and income groups were also significantly different. Respondents who were older than 60 years were more likely than those who were 60 or younger to say they would stay at home by choice or if asked. Because many of those older than 60 may also not be working, it follows that they would be more willing to stay at home. Younger people, however, were less willing to stay at home, perhaps for fear of losing employment. An alternative explanation is that older people are, on average, more concerned about health issues and are also more familiar with the ravages of epidemics such as poliomyelitis and

TABLE 3

Quarantine Variables by Independent Demographic Variables, ANOVA Analysis

Working Status	Level of Quarantine	n	Mean (SD)
Working	1	695	7.54 (0.14)
	2	697	7.79 (0.13)
	3	698	5.30 (0.15)
	4	695	6.61 (0.16)
Not working	1	485	8.36 (0.13)
	2	489	8.37 (0.14)
	3	478	5.75 (0.19)
	4	476	7.01 (0.18)
		F	*P*
	1	23.98	<.0001*
	2	12.04	.0005*
	3	4.177	.0291*
	4	3.21	.0737
Sex	**Level of Quarantine**	**n**	**Mean (SD)**
Female	1	639	8.34 (0.11)
	2	642	8.53 (0.11)
	3	636	5.73 (0.16)
	4	630	7.02 (0.15)
Male	1	541	7.14 (0.16)
	2	544	7.46 (0.16)
	3	540	5.20 (0.18)
	4	541	6.46 (0.18)
		F	*P*
	1	36.4	<.0001*
	2	43.45	<.0001*
	3	6.77	.0094
	4	7.37	.0067*
Race	**Level of Quarantine**	**n**	**Mean (SD)**
White	1	1031	7.93 (0.10)
	2	1038	8.09 (0.10)
	3	1031	5.40 (0.13)
	4	1022	6.77 (0.13)
Nonwhite	1	137	7.55 (0.34)
	2	134	7.70 (0.32)
	3	133	6.07 (0.37)
	4	138	6.83 (0.37)
		F	*P*
	1	2.29	.1308
	2	2.50	.1143
	3	4.71	.0302*
	4	.05	.8254
Age	**Level of Quarantine**	**n**	**Mean (SD)**
18 – 44 (1)	1	415	7.67 (0.16)
	2	416	8.01 (0.15)
	3	414	5.59 (0.19)
	4	417	6.86 (0.19)
44 – 59 (2)	1	387	7.73 (0.17)
	2	389	7.69 (0.20)
	3	389	5.11 (0.19)
	4	386	6.48 (0.21)
≥60 (3)	1	368	8.32 (0.15)
	2	371	8.30 (0.16)
	3	362	5.63 (0.21)
	4	359	6.85 (0.21)
		F	*P*
	1	5.56	.0040*
	2	3.36	.0351*
	3	2.11	.1214
	4	1.20	.3012

(continued)

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TABLE 3

Quarantine Variables by Independent Demographic Variables, ANOVA Analysis (continued)

Education Level	Level of Quarantine	n	Mean (SD)
<High school	1	81	7.62 (0.41)
	2	80	7.20 (0.42)
	3	77	5.87 (0.47)
	4	78	7.16 (0.43)
High school graduate	1	668	8.00 (0.12)
	2	671	8.12 (0.12)
	3	662	5.39 (0.15)
	4	657	6.57 (0.15)
≥High school	1	427	7.48 (0.15)
	2	432	8.08 (0.14)
	3	433	5.55 (0.16)
	4	433	7.12 (0.17)
		F	***P***
	1	3.61	.0271*
	2	5.48	.0043*
	3	1.02	.3616
	4	3.16	.0426*
Income	**Level of Quarantine**	**n**	**Mean (SD)**
<$30,000	1	274	8.02 (0.20)
	2	276	8.19 (0.19)
	3	272	5.82 (0.23)
	4	273	6.93 (0.23)
$30,000– $74,000	1	454	7.99 (0.15)
	2	457	8.26 (0.14)
	3	455	5.63 (0.20)
	4	450	6.87 (0.21)
≥$75,000	1	284	7.52 (0.21)
	2	287	7.73 (0.21)
	3	284	4.96 (0.24)
	4	286	6.55 (0.23)
		F	***P***
	1	2.82	.0603
	2	3.34	.0357*
	3	4.72	.0091*
	4	0.94	.3902
Religious Service Attendance	**Level of Quarantine**	**n**	**Mean (SD)**
Never attend	1	169	7.72 (0.31)
	2	169	7.53 (0.13)
	3	166	4.60 (0.32)
	4	166	5.49 (0.34)
Attend a few times/yr	1	513	7.91 (0.14)
	2	516	8.08 (0.13)
	3	514	5.65 (0.17)
	4	513	6.97 (0.17)
≥Attend 1/wk	1	484	7.95 (0.14)
	2	486	8.29 (0.13)
	3	482	5.71 (0.18)
	4	476	7.13 (0.17)
		F	***P***
	1	0.46	.6315
	2	5.02	.0067*
	3	7.84	.0004*
	4	16.33	<.0001*

Level 1: Choose to stay at home for 2 weeks; level 2: stay at home if asked to by government; level 3: travel to facility if asked to by government; level 4: travel to facility if ordered to by government.

*Significant $P < .05$.

tuberculosis, which are unfamiliar to younger respondents. Interestingly, this is in opposition to those willing to be vaccinated for influenza. Many studies have reported a disparity in the number of those older than 65 years, as well as ethnic disparities, in obtaining seasonal influenza vaccination.[40,41]

Respondents who have earned a high school diploma were more likely to be willing to choose to stay at home than those with a college degree, but college graduates were more willing to stay at home if the government asked than those without a high school diploma. Finally, respondents without a high school diploma were more likely to say they would travel to a government facility if ordered to, compared to both those with a high school diploma or college degree. Because people with lower levels of education also tend to have lower incomes and less social capital, they may fear reprisal from the government by not complying more than people who have higher incomes and more social capital.

Similar significant differences were seen in income levels. Those with moderate levels of income were more willing to stay at home if asked to, whereas those making <$30,000 were more willing to travel to a facility if asked to by the government. It may be that those with lower incomes are either not working at all or do not believe they have a choice if the government tells them they must comply. Conversely, those with the highest incomes are the least likely to comply with any of the quarantine orders. Again, this may be a function of social capital or empowerment, wherein these respondents believe that they have the capacity to make a decision about what to do in an avian influenza epidemic and do not need the input of the government. They may also fear reprisal less.

Finally, large differences were seen in willingness to comply between those who never attended religious services compared to those who did. Respondents who never attended services were significantly less likely to stay at home if the government asked compared to those who attended services once per week or more. They were also less likely than either those who regularly attended religious services or periodically attended services to travel to a facility if asked or ordered. In fact, the more often they attended religious services, the more likely respondents were to indicate their likelihood of complying with each level of quarantine. It may be that respondents who regularly attend religious services are more trusting of institutions and thus more likely to accept government recommendations or orders. They may also have a greater concern for the well-being of communities than those who are less integrated into community institutions. Respondents who do not attend religious services may be less likely to comply with authority, including government recommendations and orders, and believe they prefer to make their own decisions about what to do in an avian influenza outbreak.

A number of knowledge/attitude variables also positively predicted the likelihood of complying with levels of quarantine. Closely following the news about avian influenza was negatively

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TABLE 4

Regression Analyses Predicting Reported Compliance With 4 Levels of Quarantine

Level 1: Choose to Stay at Home for 2 wk (N = 609)			
Whole Model	R^2	*F*	*P*
	.14	4.39	<.00*
Variables	**β**	**95% CI**	***P***
How closely you follow news about avian flu	–.59	–0.89 to 0.29	.00*
Likelihood avian flu will come to US	.02	–0.09 to 0.13	.72
Likely you/someone close will get flu	.01	–0.09 to 0.12	.83
How likely infect if come in contact with someone	–.02	–0.11 to 0.07	.63
Get it from infected chicken/poultry	–.04	–0.12 to 0.05	.35
How likely they will die	.08	–0.03 to 0.18	.15
If virus changed, likely you/someone close will get it	.15	0.03 to 0.26	.01*
Likely some would not get vaccine needed	–.02	–0.11 to 0.07	.64
Doctor would have vaccine supply	.09	–0.02 to 0.19	.12
Disabled	.12	–0.49 to 0.74	.69
"Born again Christian"	.21	–0.27 to 0.68	.39
Religious services attendance	.02	–0.44 to 0.49	.93
Income	–.26	–1.01 to 0.49	.54
Sex	.68	0.20 to 1.16	.01
Education	.42	–0.69 to 1.50	.18
Age	–.08	–0.68 to 0.53	.42
Race	–.34	–1.30 to 0.65	.50
Work status	.56	0.02 to 1.12	.05*
Level 2: Stay at Home if Government Asked (N = 611)			
Whole Model	R^2	*F*	*P*
	.12	3.89	<.00*
Variables	**β**	**95% CI**	***P***
How closely you follow news about avian flu	–.44	–0.73 to 0.14	.00*
Likelihood avian flu will come to US	–.02	–0.14 to 0.09	.64
Likely you/someone close will get	.01	–0.09 to 0.10	.92
How likely infect if come in contact with someone	.01	–0.07 to 0.09	.81
Get it from infected chicken/poultry	–.01	–0.09 to 0.07	.83
How likely they will die	.04	–0.06 to 0.14	.42
If virus changed, likely you/someone close will get	.15	0.05 to 0.26	.01*
Likely some would not get vaccine needed	.05	–0.02 to 0.13	.16
Doctor would have vaccine supply	.12	0.01 to 0.22	.03*
Disabled	–.13	–0.73 to 0.48	.68
"Born again Christian"	.13	–0.32 to 0.59	.56
Religious services attendance	.39	–0.04 to 0.83	.08
Income	–.17	–0.86 to 0.53	.88
Sex	.57	0.11 to 1.04	.02*
Education	–.60	–1.80 to 0.59	.48
Age	.37	–0.27 to 1.04	.05*
Race	–.24	–1.07 to 0.60	.58
Work status	.46	–0.13 to 1.05	.12
Level 3: Travel to Facility if Government Asked (N = 610)			
Whole Model	R^2	*F*	*P*
	.11	3.30	<.00*
Variables	**β**	**95% CI**	***P***
How closely you follow news about avian flu	–.09	–0.45 to 0.26	.60
Likelihood avian flu will come to US	–.05	–0.20 to 0.10	.50
Likely you/someone close will get	.02	–0.11 to 0.16	.73
How likely infect if come in contact with someone	.02	–0.11 to 0.15	.74
Get it from infected chicken/poultry	.05	–0.07 to 0.17	.38
How likely they will die	.12	–0.02 to 0.25	.09
If virus changed, likely you/someone close will get	.11	–0.02 to 0.23	1.0
Likely some would not get vaccine needed	–.03	–0.14 to 0.09	.64
Doctor would have vaccine supply	.27	0.15 to 0.39	<.00*
Disabled	–.22	–1.12 to 0.69	.64
"Born again Christian"	–.14	–0.77 to 0.49	.67
Religious services attendance	.27	–0.32 to 0.86	.37
Income	.60	–0.47 to 1.66	.47
Sex	.03	–0.55 to 0.62	.91
Education	–.25	–1.50 to 1.02	.61
Age	.82	–0.13 to 1.77	.19
Race	–.38	–1.36 to 0.60	.45
Work status	.38	–0.49 to 1.25	.39

(continued)

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TABLE 4

Regression Analyses Predicting Reported Compliance With 4 Levels of Quarantine (continued)

Level 4: Travel to Facility if Government Ordered (N = 606)			
Whole Model	R^2	*F*	*P*
	.10	3.02	<.00*
Variables	β	**95% CI**	*P*
How closely you follow news about avian flu	.27	–0.11 to 0.66	.16
Likelihood avian flu will come to US	.02	–0.13 to 0.17	.75
Likely you/someone close will get	–.18	–0.31 to –0.04	.01*
How likely infect if come in contact with someone	.06	–0.06 to 0.18	.35
Get it from infected chicken/poultry	–.02	–0.14 to 0.09	.67
How likely they will die	.17	0.03 to 0.30	.01*
If virus changed, likely you/someone close will get	.15	0.02 to 0.28	.03*
Likely some would not get vaccine needed	–.01	–0.12 to 0.11	.91
Doctor would have vaccine supply	.20	0.07 to 0.33	.00*
Disabled	–.35	–1.28 to 0.58	.46
"Born again Christian"	–.15	–0.79 to 0.48	.63
Religious services attendance	.54	–0.05 to 1.13	.05*
Income	–.17	–1.13 to 0.80	.94
Sex	–.39	–0.99 to 0.20	.19
Education	.18	–1.02 to 1.44	.06*
Age	.73	–0.14 to 1.60	.24
Race	–.48	–1.46 to 0.51	.34
Work status	.83	0.04 to 1.63	.04*

*Significant $P \leq .05$.

associated with likelihood of complying (ie, respondents who had been following the news about avian influenza were less likely to say they would comply with quarantine orders than those who had not followed the news closely). In contrast, respondents who believed that they were susceptible to the virus were more likely to indicate a likelihood of complying with recommendations or orders. This seems incongruent; however, respondents who had not followed the news may have obtained misinformation about avian influenza and believed themselves more susceptible than those who were informed about the virus and its effects. Thus, people who were the least informed may also have believed they were more likely to contract the virus and die of it than do those who followed the news and were less fearful about contagion. Finally, those who believed that their doctor would be able to obtain enough vaccine to distribute to them if an epidemic occurred were also more likely to say they would comply with quarantine orders. Perhaps those who had confidence that they would obtain access to vaccines have a generally positive attitude about health care and public health efforts, and perceived quarantine as an acceptable strategy to protect their health.

Because perception that doctors can acquire vaccine was significant in predicting the likelihood of complying with 3 of the 4 levels of quarantine, ensuring access to vaccines may be a particularly important element in successfully implementing quarantine. This may be part of the public's frustration with the distribution of the H1N1 vaccine, which was mostly provided by public health clinics or "vaccination events" rather than by private doctors.[42] Future efforts may be more successful if vaccinations were provided by a broader number of providers.

The regression analyses elucidate which variables best predict who would or would not comply with quarantine orders. Each of the levels of quarantine scenarios have slightly different significant predictors, suggesting that messages may have to differ depending on the level of quarantine action that public health officials believe needs to be taken. Although the overall fit of the model and the R^2 statistics are relatively low (ranging from .10 to .14), the models do identify specific variables that may help public health planners to develop media or risk communication messages to maximize public quarantine compliance.

Limitations

A major limitation of this study is that respondents had low levels of familiarity with avian influenza and thus may have had difficulty accurately envisioning their likelihood of complying with quarantine recommendations or orders. In addition, because R^2 statistics were low, other variables not captured in this survey may be important in determining how people may react in the event of an avian influenza outbreak in the United States. Although a 28% response rate is not untypical for a random digital dial telephone survey, the methodology may have inherent biases, including who answers the telephone and/or is willing to participate in a telephone survey. This may have affected the validity and reliability of the survey and its results. It should also be noted that the language used in the statement about quarantine and read to respondents did not clarify which level of government would be issuing a quarantine order (state or federal), although questions about willingness to comply with quarantine orders or recommendations used the words "United States government" (Table 1). This omission may have changed the answers of some respondents who dis-

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trust the federal government more than their state government and could have affected results. However, overall willingness to comply with quarantine orders was generally high and this effect may not have significantly affected results. Finally, as with any study of intentions, behavior may be different in an actual, rather than hypothetical, situation.

CONCLUSIONS

These results provide information that is potentially useful for preparing for an outbreak that may be contained with isolation and quarantine. Unlike the present H1N1 outbreak, a mutated H5N1 outbreak, which could have higher morbidity and mortality, would require further community mitigation besides vaccination efforts and personal behaviors including isolation and quarantine. In this study, respondents viewed varying levels of quarantine differently, suggesting that public health communications need to be crafted to take into account the likelihood of decreasing levels of cooperation with increasing levels of coerciveness. In general, the public would initially be cooperative with a generalized request to voluntarily quarantine themselves or quarantine themselves if asked to do so in the event of an avian influenza outbreak; and this could, if reinforced, be sustained through the initial stages of an outbreak. Cooperation levels would likely decrease, however, the longer the outbreak lasted. Thus, it would be important for public health planners to develop a clear plan that is communicated to the public and sets realistic guidelines for how the public is to comply with the request. Similar to the www.flu.gov Web site and the subsequent public information campaign on the H1N1 outbreak that encouraged vaccination and frequent hand washing, communication about what isolation and quarantine are and what is expected of the public must be clear, with an articulated expected result. This is certainly true when public health officials are competing with an around-the-clock news cycle that produces many contrary messages. The safety of the H1N1 vaccine was 1 message public officials have had to discuss and defend, resulting in public confusion about who should and should not be vaccinated.[42] In the case of mandatory quarantine, messages would be even more difficult to keep clear.

In this study, for example, if asked or ordered to seek shelter in a facility, respondents were much less willing to cooperate, although means were in the mid-range of the 0 to 10 scale. We can conclude from these results that, although not pleased with the idea of going to a facility, most respondents would not respond overly negatively toward the possibility, especially if the morbidity and mortality of the outbreak was high. This attitude may be enhanced further by targeted messages to those groups who indicated they were the least willing to comply. It should be noted that these means actually increase when the order is more coercive. This is encouraging and again suggests that levels of cooperation by the public during a pandemic would, at least initially, be more positive than expected. It may also indicate that the more specific public health planning is before an outbreak occurs, the better the response from the public.

Finally, public health preparedness planners may consider the possibility of increasing the public awareness of quarantine and the willingness of significant proportions of the population to comply with orders. Such awareness campaigns may foster a spirit of cooperation and expectation of being prepared to take positive action to contain an outbreak successfully.

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About the Authors

Author Affiliations: Drs Bass, Ruzek, Gordon, and Hausman are with the Department of Public Health, Dr Ward is with the Department of Medicine, and Dr Hagen is with the Institute for Public Affairs, Temple University. Dr Hanlon is with the School of Nursing, University of Pennsylvania.

Correspondence: Address correspondence and reprint requests to Dr Sarah Bauerle Bass, Associate Professor of Public Health, Temple University, 1301 Cecil B. Moore Ave, Room 927, Philadelphia, PA 19122 (e-mail: sbass@temple.edu).

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