Information sources and adoption of vaccine during pandemics

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Abstract

Purpose – The purpose of this paper is to investigate the effects of different information sources on consumer health behavior during pandemics.

Design/methodology/approach – We collected survey data from 321 adults in a large western US city during November 2009 by mall and street intercepts. We analyzed their beliefs, attitudes and intentions with regard to adoption of the H1N1 (swine flu) vaccine. We developed and tested two alternative models on the role of mass media and personal information sources on the attitude towards the disease and the intention to get vaccinated.

Findings – Our study finds that mass media and personal sources of information simultaneously impact perceived threat from disease (attitude) and the intention to get vaccinated during a global pandemic. Personal information sources are more effective than mass media sources in impacting both attitude and intention. While the impact of mass media weakens from the attitude stage to the intention stage, the impact of personal information sources increases from the attitude stage to the intention stage.

Originality/value – The contribution of this paper to health policy makers and marketers is to draw implications on how mass media and personal information sources could be better utilized to counter future global pandemics.

Keywords Communication, Regression, Adoption and diffusion, Global pandemic, Healthcare marketing, Mass media information, Personal information, Vaccine, Health policy, Survey research

Paper type Research paper

Introduction

In June 2009, the World Health Organization (WHO) declared the H1N1 (swine flu) virus to be a global pandemic. The first pandemic of the twenty-first century was caused by a new combination of bird, pig and human viruses that spread quickly from person to person. Eighty per cent of the victims were under 65 years and 30 per cent had no underlying health risk factors (Dawood *et al.*, 2012). This was a big difference from the regular or seasonal flu, which affects mainly the elderly and those with weak health.

The outbreak was accompanied by near constant media attention in the USA. Some of the dramatic media stories focused on young, healthy people succumbing to the H1N1

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virus (CBS 60 Minutes, 2009). Others reviewed the history of influenza pandemics from the previous century. In 1918, the Spanish flu epidemic caused by an H1N1 strain resulted in 4 million deaths during a four-week period (Ahmed *et al.*, 2007). In 1976, following a swine flu infection in Fort Dix, New Jersey, the first mass influenza virus vaccination was developed. The mass vaccination program that followed exposed a serious side effect called Guillain-Barre syndrome, an acute disorder that can cause paralysis and death (Wang and Palese, 2009). All of these reports elevated public concerns about the serious threat of the 2009 H1N1 virus and the safety of the vaccine developed to prevent its spread.

The H1N1 vaccine was in short supply in the initial months and in the USA, the Center for Disease Control (2009) recommended that initial doses should be given to priority groups such as pregnant women, people who care for babies under six months of age, children six months to four years of age and health-care workers. Concerns of the US public were well-documented in several published national polls. A limited amount of vaccine was available between July-October 2009, so only about half the US public said they expected to receive the vaccine, while a higher percentage said they expected to get their children vaccinated. In making their decision, some people appeared to make a trade-off between the perceived risk of the virus and the perceived risk of the vaccine (ABC News/Washington Post Poll, 2009). The proportion of the US public that was concerned with getting sick from the H1N1 virus dropped from about 60 per cent in October 2009 to about 40 per cent in December 2009. By December 2009 the vaccine had become more widely available, yet only 14 per cent of US adults had been vaccinated (Steelfisher *et al.*, 2010), a low uptake of concern to health officials.

Deaths from H1N1 began to taper off in 2010 with the WHO declaring the end of the pandemic in August 2010. There were 18,500 laboratory-confirmed deaths worldwide. More comprehensive estimates by scientists put the number of worldwide fatalities due to the pandemic closer to 280,000 (Naik, 2012). In contrast, the seasonal flu causes about 36,000 deaths in the USA every year (New York Times Health Guide, 2013). Sixty per cent of the fatalities occurred in Southeast Asia and Africa, home to 38 per cent of the world's population (Naik, 2012). The highest mortality rates were in Africa due to poor infrastructure and lack of trained medical personnel.

This brief historical review of the 2009 H1N1 (swine flu) pandemic raises some interesting questions for health policy-makers and marketers. First, health policy-makers need to know what factors affect individuals' decisions to get a new minimally tested vaccine against a deadly contagious disease. As a follow-up, healthcare marketers can help design a communications approach to encourage adoption of the vaccine and minimize the number of deaths in future pandemics. Providing timely, accurate information about the seriousness of the threat and the availability of a safe, effective vaccine through appropriate information channels could motivate individuals to get vaccinated and stay healthy during future pandemics.

The purpose of this study is to examine the effects of different information sources on consumer health behavior during pandemics. To this end, we developed and tested two alternative models on the role of mass media and personal information sources on the attitude towards the disease and the intention to get vaccinated. In this study, we collected survey data from 321 adults in a large western US city during November 2009 by mall and street intercepts. We analyzed their beliefs, attitudes and intentions with regard to adoption of the H1N1 vaccine. Based on empirical testing of these models, the

contribution of this paper is to draw implications on how mass media and personal information sources could be better utilized to counter future pandemics.

Similar studies of the 2009 H1N1 pandemic have been conducted in Australia and Israel. A cross-sectional survey of 584 residents in Sydney, Australia, in May 2009 (Seale *et al.*, 2009) showed that about 40 per cent of the respondents felt that health authorities were exaggerating the risk of the pandemic, and about 58 per cent felt the government would deal with the pandemic effectively. Another survey of 387 students at higher education institutions in Israel in December 2009 (Teitler-Regev *et al.*, 2011) found that the factors positively affecting the intention to take the swine flu vaccine were past experience with the seasonal flu vaccine, higher levels of perceived susceptibility to the illness, perceived seriousness of illness and lower levels of barriers. However, in both these studies, there was no attempt to investigate the impact of information sources on risk perceptions or compliance.

This paper is organized as follows. In the next section, we review the existing literature to develop a baseline model and an alternative model of the effect of information sources on attitude towards a new vaccine, and the intention to get vaccinated. A description of the data collected and empirical testing of both models follows, which shows that the alternative model has a better fit with the data. Then, we discuss the public policy and marketing implications of the alternative model. The paper concludes with a discussion of the study limitations and ideas for future research.

Model development

Research in behavioral choice theory posits that an individual's intention to act is the single best predictor of behavior (Davies *et al.*, 2008). The intention to act is, in turn, influenced by attitudes towards performing that behavior, which is, in turn, influenced by beliefs (Fishbein and Ajzen, 1975). The health belief model (HBM), in this tradition, posits that the likelihood of an individual engaging in a preventive healthcare action, like getting vaccinated, is a function of the degree of threat from disease perceived by the person and a benefits-to-cost analysis of the preventive actions (Janz and Becker, 1984). Risker (1996) explicitly introduced information sources into the HBM. Individual differences (e.g. demographics), cues to action (e.g. mass media and personal sources of information) and past behavior affect the perceived threat from disease (attitude), which in turn affects the intention to get vaccinated. Such HBMs have received empirical support in the literature (Jayanti and Burns, 1998).

Healthcare research indicates that people exhibit different levels of trust in different health information sources (e.g. Ha and Lee, 2011). Analyzing a systematic random sample of 180 newspaper articles between 1994 and 1998, Moynihan *et al.* (2009) found that news media are an important source of information about new medical treatments, but there was concern that some of the coverage was inaccurate and overly enthusiastic. A Hong Kong study of the severe acute respiratory syndrome epidemic found that people were more likely to comply with health-related recommendations if they believed the government was providing clear and sufficient information and could be trusted to control the spread of infection (Tang and Wong, 2004). Thus, credibility of the mass media and government has been established as an important factor in attitudes towards new drugs and patients' intentions to adopt them. Existing research has established that medical professionals such as doctors have higher source credibility on health

information than mass media television, newspapers or Internet Web sites (Worsley, 1989; Freed *et al.*, 2011).

Independent of behavioral choice theory and healthcare research, media effects research and the theory of diffusion of innovations has looked at the communication mechanisms by which information sources affect peoples' attitudes, intentions and behavior. Media effects research recognizes differences in credibility between personal and mass media information sources and their corresponding impacts on attitudes, intentions and behavior (e.g. Lee *et al.*, 2007). In the diffusion of innovation literature, Rogers (1962) categorized segments of a population as innovators, early adopters, early majority, late majority and laggards based on their timing of adoption of innovations. Katz and Lazarsfeld (1955) proposed a two-step flow of communication, where mass media information sources first affect the attitudes of opinion leaders, who then use personal influence (word-of-mouth) to change the beliefs, attitudes, intentions and behavior of the rest of the population. Integrating these two research streams, Robertson (1967) suggested that mass media advertising was more effective in influencing the innovators and early adopters, while personal word-of-mouth information was more effective in influencing the early majority, late majority and laggards.

An alternative theory is the one-step flow of communication (Bennett and Manheim, 2006), which says that society, technology and individual communication habits have evolved over the past 50-60 years. Television and cable channels have proliferated, e-mail databases and data mining provide better targeting opportunities and individuals are more socially isolated than before. All of these conditions create opportunities for mass messages to be crafted and sent directly to selected individuals without any social meditation by opinion leaders to alter their beliefs, attitudes and behavior.

We wish to test whether mass media and personal information sources act according to the HBM model (they affect attitude alone, which in turn affects intention) or whether they operate simultaneously on both attitude (perceived threat from disease) and intention to get vaccinated as proposed by Bennett and Manheim (2006). The latter is an important theoretical extension of the HBM, which has significant implications for communication campaigns and marketing of vaccines to minimize the negative impact of future pandemics.

The baseline (HBM) model is a recursive, two-stage model:

$$\text{Perceived threat from disease} = f(\text{Credibility of mass media information sources, credibility information, of personal sources, past behavior, demographics}) \quad (1)$$

$$\text{Intention to get vaccinated} = f(\text{Residual of perceived threat from disease, cost} - \text{benefit of future behavior, demographics}) \quad (2)$$

The alternate model we want to test is also a recursive, two-stage model:

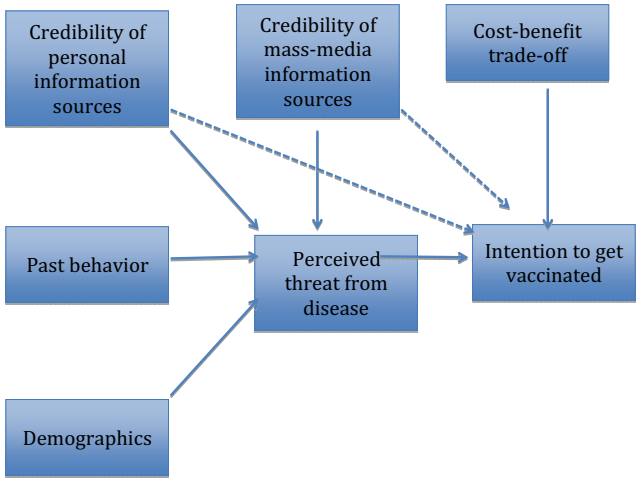
$$\text{Perceived threat from disease} = f(\text{Credibility of mass media information sources, credibility of personal information sources, past behavior, demographics}) \quad (3)$$

$$\text{Intention} = f(\text{Residual of perceived threat from disease, credibility of mass media information sources, credibility of personal information sources, cost} - \text{benefit of future behavior, demographics}) \quad (4)$$

Note that stage 1 is the same for both baseline and alternative models. The difference is in the second stage with intention as the dependent variable. Equation (3) explicitly adds credibility of mass media and personal information sources, which is absent from equation (2). The two models are depicted graphically in Figure 1.

Data analysis and results

Six MBA students and one of the authors collected the data as part of an elective semester-long course project. A simple, two-page survey questionnaire was designed and administered in person to adults in two shopping malls and three different neighborhoods of a large, West Coast US city (Appendix). Qualified respondents were adults who either lived or worked in the city. Over 10 days in November 2009, 330 responses were collected, of which 321 were usable. Although a convenience sample, demographics of the sample matched demographics of the city published by the US Census quite well in terms of gender and ethnicity (Table I). Because respondent time availability limits the amount of information that can be collected in an in-person survey, variables were mostly single-item Likert scales. Attitude (perceived threat from disease) was operationalized by, "On a scale of 1-10 how concerned are you about getting H1N1/Swine Flu?" (Appendix Q8). Past behavior was captured by, "Did you take the flu



Note: The seven constructs connected by solid arrows constitute the baseline (HBM). The HBM together with the two dotted arrows constitutes the alternative model

Figure 1.

Ethnicity	No. (323)	Sample (%)	No. (805,235)	City census data[a] (%)
African American	23	7.1	48,870	6.1
Asian	96	29.7	267,715	33.2
Caucasian	131	40.6	268,643	33.4
Hispanic	36	11.1	121,744	15.1
Other	37	11.5	98,263	12.2
Gender				
Female	163	50.5	395,370	49.1
Male	160	49.5	409,865	50.9

Note: [a]2010 Census Data from United States Census State and County QuickFacts Page

Table I.
Sample versus city demographics

shot last year? (Yes/No)" (Appendix Q4). We used three demographic variables: age (18-29, 30-44, 45-54, 55-64 and 65+), gender (male/female) and number of children at home (Appendix Q2). The cost-benefit trade-off was captured by, "On a scale of 1-10, how confident are you in the safety of the H1N1 vaccine?" (Appendix Q9). Intention to get vaccinated was operationalized by, "Are you planning to take the H1N1 vaccine? (Yes/Maybe/No)" (Appendix Q6). Respondents were provided a list of information sources and asked, "What is your current source of information about the H1N1 virus and the vaccine?" (they could select multiple sources – Appendix Q10). For any selected source, they were asked to rate the level of trust they had in that source on a five-point Likert scale (1 = low trust, 5 = high trust) (Appendix Q10). Information sources were categorized into mass media (government, news media and non-news Internet) and personal sources (doctor, school, work and friends/family). For each of these two categories, a credibility index was created for each respondent by adding the weighted level of trust across the selected information sources. These indices reflected respondents' credibility in mass media and personal information sources. We use the mean-centered values of the indices in the model estimation.

A correlation matrix of the variables used in our models is presented in Table II.

The first equation in both our models is the same. Since attitude (perceived threat from disease) is measured as a ten-point Likert scale we estimate this using ordinary least squares (OLS) regression to estimate the first equation. The second equation in both our models has *Intention to get vaccinated* as the dependent variable. To tease out the indirect effects of information sources on the intention variable, the residual value of perceived threat from disease from the OLS regression is used as an independent variable in the second equation. Because the intention variable has three ordered response categories (Yes/Maybe/No), we estimate it using the ordered logit model (Kennedy, 2003). Results of our HBM are presented in Table III (Columns 1 and 2) and results of the alternate model are presented in the same table as Columns 1 and 3.

Columns 1 and 2 show support for the HBM. As expected, credibility of personal and mass media information sources affects perceived threat from disease (Column 1) and residual of perceived threat from disease affects intention to get vaccinated (Column 2). In the alternate model (Columns 1 and 3), we allow credibility of mass media and personal information sources to affect both perceived threat and intention simultaneously. Credibility of mass media sources has a strong positive impact on

Table II. Correlation matrix

Independent variables	Intention to get vaccinated	Perceived threat from disease	Confidence in vaccine safety	Past behavior	Credibility of personal information sources	Credibility of mass media information sources	Age	Gender	No. children at home
Intention to get vaccinated	1.0	0.53**	0.22**	0.32**	0.26**	0.16**	0.10*	0.07	0.10*
Perceived threat from disease		1.0	0.20**	0.21**	0.19**	0.16**	0.10*	−0.09	0.08
Confidence in vaccine safety			1.0	0.10*	0.15**	0.24**	0.03	−0.09	0.08
Past Behavior				1.0	0.19**	0.01	0.23**	0.09	0.20**
Credibility of personal information sources					1.0	0.26**	−0.02	0.10*	0.09
Credibility of mass media information sources						1.0	0.04	0.04	−0.01
Age							1.0	−0.12**	0.15**
Gender								1.0	0.08
Number of children at home									1.0

Note: **significant at $p < 0.05$; *significant at $p < 0.10$

Independent variables	Column 1 DV for OLS: perceived threat from disease (standardized estimates)	Column 2 DV for ordered logit: intention to get vaccinated	Column 3 DV for ordered logit: intention to get vaccinated
Residual of Perceived threat from disease		0.415**	0.443**
Confidence in vaccine safety		0.169**	0.125**
Past behavior	0.128**		
Credibility of personal information sources	0.129**		0.538**
Credibility of mass media sources	0.118**		0.316*
Gender	0.097*	0.365	0.272
Age	0.063	0.259**	0.247**
Number of children at home	0.123**	0.240	0.211
R-square/pseudo *R*-square	0.112	0.125	0.160

Table III.
Model estimation

Notes: **significant at $p < 0.05$; *significant at $p < 0.10$

perceived threat from disease (Column 1) but a weak positive impact on intention (Column 3). However, credibility of personal information sources has a strong positive impact on both perceived threat of disease (Column 1) and intention (Column 3). In fact, the credibility of personal information sources has a stronger positive impact on intention to get vaccinated (Column 3) than on perceived threat (Column 1). The pseudo *R*-square for the intention equation in Column 3 (0.160) is higher than in Column 2 (0.125). We also conducted a likelihood ratio test between the two ordered logit models in Columns 2 and 3. The chi-square statistic is 22.135, which is greater than the critical value 5.99 with two degrees of freedom. Hence, the results suggest that the alternative model (Columns 1 and 3) has a better fit with the data than the HBM model (Columns 1 and 2).

In Column 1, past behavior has a strong positive relationship with perceived threat from disease, which means those who took the seasonal flu shot in the previous year take the threat of H1N1 more seriously. Confidence in vaccine safety is strongly and positively related to intention to get vaccinated in Columns 2 and 3, as we would expect.

We included gender, age and number of children at home as control variables in Table II. In Column 1, number of children at home has a strong positive relationship with perceived seriousness of threat, which makes sense because people with more children at home are more concerned about the virus affecting their family. In Column 1, gender has a weak relationship with perceived seriousness of threat, indicating that women have a slightly higher threat perception than men. In Columns 2 and 3, age has a strong positive relationship with *Intention to get vaccinated*, indicating that older people are more motivated to get the vaccine than younger people, who may consider they are invulnerable.

Research and managerial implications

In their article, Stremersch and Van Dyck (2009) provide a framework and research agenda for marketing of the life sciences. They highlight the challenges of marketers in this area as therapy creation, therapy launch and therapy promotion. Specific challenges within therapy promotion are communication management and patient compliance, and they call for more research in this area. Our study's focus on how to use mass media and personal information sources to motivate individuals to take the vaccine when there is a global pandemic makes specific contributions in this area.

In terms of research contribution, our alternative model allows for both types of information sources (mass media and personal) to simultaneously affect attitude and intention, and has a better fit with the data than the baseline extant HBM in the extant literature. Our study provides empirical support for the idea of simultaneous impact of mass media and personal sources of information, consistent with Bennett and Manheim (2006), and an improvement over the earlier two-stage sequential flow of communication mediated by opinion leaders (Katz and Lazarsfeld, 1955). It makes sense that in the modern world of high-technology global communication, attitude and intention can be shaped simultaneously by both mass media and personal word-of-mouth influence.

Healthcare marketing takes the view that influencing attitudes, intentions and behavior can do more to increase the health of a population than can treatment of illness (Rothschild, 1999). Education through timely and accurate communications influences knowledge, attitudes and beliefs in favor of healthy behavioral choices (Rasmuson *et al.*, 1988). During pandemics, risk communication strategy is especially vital (Haider *et al.*, 2008). Our results show that mass media and personal information sources are not equally effective in spreading information about the perceived seriousness of the threat and influencing intention to get vaccinated. We show that personal information sources are more effective than mass media sources in impacting both attitude and intention. While the impact of mass media weakens from the attitude stage to the intention stage, the impact of personal information sources increases from the attitude stage to the intention stage.

Univariate analysis of our data show that the most used information sources by our respondents during the pandemic were the news media and government, yet these were not the most trusted sources. Doctors were the most trusted information source but not used as much. This is consistent with existing literature (Worsley, 1989; Freed *et al.*, 2011). A possible reason for this asymmetry is that access to personal information sources such as doctors, co-workers and school administrators is difficult. They are busy, scarce resources. Therefore, mass media sources (government, news media and non-news Web sites) should be used more up front in the campaign to shape attitudes towards the perceived threat of the pandemic. Later in the campaign, personal information sources like doctors, co-workers and school administrators could be used to motivate individuals' intention to get vaccinated. Mass media campaigns, especially on television, could include interviews with credible personal information sources, such as doctors, coworkers and school administrators, to enhance their effectiveness.

About three-quarters of our sample respondents had no plans to take the H1N1 vaccine (Appendix Q6). In a follow-up question (Appendix Q7), we asked those who

had no plans to explain why, by selecting one or more reasons from a list. The most frequently selected reason was "There are mixed reports regarding the need for vaccination", followed by "In most cases, contracting the H1N1 virus is not life threatening", and then "The vaccine has not been tested adequately and is too risky". In an open-ended question (Appendix Q3), we asked our sample respondents what thoughts came to mind when they heard the words "H1N1" or "swine flu". Only 35 respondents chose to answer this question. A content analysis on these responses indicated the most common response had to do with "media hype", followed by "not enough information from reliable sources" and "low credibility of conflicting information". Both these pieces of data highlight the need for the messages in the communications campaign to be clear and consistent and address these concerns of the target population. Messages should be backed by scientific evidence and the public should be educated to give more weight to messages based on such evidence.

Limitations and future research

The data collection methodology used in the study has all the limitations of cross-sectional surveys. We have found associations among the variables in our models but causality cannot be inferred. Our variable measures are limited to single items and hence reliability cannot be established. Our sample of respondents is a convenience sample. Despite these limitations, we believe we have found some interesting results that can help researchers and health policy-makers use communication campaigns as a more effective tool in future pandemics. Future research should improve on the study's limitations and establish more generalizable results.

One of the characteristics of the early stages of a pandemic is that the vaccine is in short supply because it needs to be developed and manufactured for a new strain of virus. This was the case during the H1N1 swine flu pandemic of Fall 2009. Our measure of cost-benefit trade-off in Figure 1 only took into account the safety of the vaccine, which is quite narrow. Cost-benefit should also include access to and availability of the vaccine and the costs or barriers in that regard. Including a broader conceptualization and operationalization of the cost-benefit trade-off in the HBM would be highly desirable in future research. Another limitation is that different segments may respond to information sources differently. For example, mass media sources may be more effective among mature consumers (Moschis and Friend, 2008). Therefore, future research may investigate segment specific media habits.

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Appendix

H1N1/Swine Flu Survey

1. **Do you live or work in City X?**
   A. Live
   B. Work

2. **Demographics:**
   Age: 18-29, 30-44, 45-54, 55-64, 65+
   Gender: Male, Female
   Ethnicity: Caucasian, Asian, African American, Hispanic, Decline, Other_____
   Occupation: Employed in Private Sector, Employed in Public Sector, Student, Unemployed, Retired
   Pregnant: Yes, No
   Number of children at home:
   Number of adults at home:

3. **What thoughts come to mind when you hear the term H1N1 or Swine Flu?**
   _____
   _____

4. **Did you take the flu shot last year?**
   A. Yes
   B. No

5. **Have you taken the flu shot or H1N1 vaccine this year?**
   A. Flu shot only
   B. H1N1 vaccine only
   C. Both Flu Shot & H1N1 vaccine
   D. None

6. **Are you planning to take the H1N1 vaccine?**
   A. Yes
   B. No
   C. Undecided

7. **If you do not plan to get the vaccine for H1N1 or are still undecided, then please explain why? (Please select all that apply)**
   A. I do not know where to get the vaccination
   B. I cannot afford the vaccination
   C. In most cases, contracting the H1N1 virus is not life threatening
   D. I am not in the risk group
   E. There are mixed reports regarding the need for vaccination
   F. The vaccine has not been tested adequately and is too risky
   G. The regular flu shot will protect me
   H. Other_____

8. **On a scale of 1-10 how concerned are you about getting H1N1/Swine Flu?**
   (Low) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (High)

9. **On a scale of 1-10, how confident are you in the safety of the H1N1 vaccine?**
   (Low) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (High)

(*continued*)

Figure A1.

10. What is your current source of information regarding the H1N1 virus and vaccine? (Please select all that apply)

Please rate the level of trust that you have in each current source to provide accurate information regarding the H1N1 virus and vaccine.
(Low Trust) 1, 2, 3, 4, 5 (High Trust)

	Current Sources (Y/N)	Level of Trust (1-5)
Doctor		
Government		
School		
Work		
News Media		
Non-news Internet		
Friends/Family		
Other:		

11. What do you think about the information you have regarding the H1N1 virus and vaccine?

A. Adequate information
B. Too much information
C. Not enough information provided
D. Conflicting information
E. Other_____

12. The World Health organization has issued a Phase 6 pandemic alert, implying H1N1 flu virus can easily spread from one person to another. Additionally, the U.S. Center for Disease Control has reported that the H1N1 virus is widespread within 46 states of the U.S.

Now, on a scale of 1-10, how concerned are you about getting H1N1/Swine Flu?
(Low) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (High)

13. The U.S. Center for Disease Control expects the 2009 H1N1 influenza vaccine to have a similar safety profile as seasonal flu vaccines, which have a very good safety track record.

Now, on a scale of 1-10, how confident are you in the safety of the H1N1 vaccine?
(Low) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (High)

Figure A1.

About the authors

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