Media Use and Communication Inequalities in a Public Health Emergency: A Case Study of 2009–2010 Pandemic Influenza A Virus Subtype H1N1

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ABSTRACT

Objectives. Studies have shown that differences among individuals and social groups in accessing and using information on health and specific threats have an impact on their knowledge and behaviors. These differences, characterized as communication inequalities, may hamper the strength of a society's response to a public health emergency. Such inequalities not only make vulnerable populations subject to a disproportionate burden of adversity, but also compromise the public health system's efforts to prevent and respond to pandemic influenza outbreaks. We investigated the effect of socioeconomic status (SES) and health communication behaviors (including barriers) on people's knowledge and misconceptions about pandemic influenza A(H1N1) (pH1N1) and adoption of prevention behaviors.

Methods. The data for this study came from a survey of 1,569 respondents drawn from a nationally representative sample of American adults during pH1N1. We conducted logistic regression analyses when appropriate.

Results. We found that (*1*) SES has a significant association with barriers to information access and processing, levels of pH1N1-related knowledge, and misconceptions; (*2*) levels of pH1N1-related knowledge are associated positively with the adoption of recommended prevention measures and negatively with the adoption of incorrect protective behaviors; and (*3*) people with higher SES, higher news exposure, and higher levels of pH1N1-related knowledge, as well as those who actively seek information, are less likely than their counterparts to adopt incorrect prevention behaviors.

Conclusion. Strategic public health communication efforts in public health preparedness and during emergencies should take into account potential communication inequalities and develop campaigns that reach across different social groups.

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2009–2010 pandemic influenza A(H1N1) (pH1N1), a highly transmittable form of virus that initially appeared deadly, was seen to perfectly fit the disease profile of a lethal pandemic influenza anticipated to affect human health on a scale similar to the 1918 flu. As such, it attracted global attention and caused worldwide fear. During the early stages, when little was known about the disease severity or transmission mode, the novel pH1N1 virus received extensive coverage in the media and raised public concerns. One month after the first case, the World Health Organization (WHO) raised the influenza pandemic alert level to "Phase 5" on April 29, 2009, and only six weeks later to "Phase 6," the highest level. As of June 10, 2009, 27,737 confirmed cases of pH1N1 infection were reported in 74 countries.[1,2] Faced with a pandemic with possible high mortality, public officials identified mass media channels such as television, radio, and newspaper to promote public awareness, increase public knowledge, and cue the public to adopt protective behaviors. Studies have shown that routine exposure and strategic use of mass media can effectively provide public health information.[3–6] However, all individuals and social groups do not have the same access to this information.[7,8] Communication inequalities, defined as the differences in exposure to public health communication messages and capacity to access, process, and act upon the information received, are influenced by social determinants[3,9–14] and may result in disparities in health-related knowledge, behavior choices, and, ultimately, health outcomes.[10,12,15–23]

pH1N1 offered an opportunity to assess the influence of communication inequalities on people's knowledge about a public health threat and their subsequent compliance to recommended behaviors during a public health emergency. Level of knowledge was positively associated with socioeconomic status (SES) and was a strong predictor of adopting prevention practices.[6,14,16–24] Researchers also found that adopting prevention measures was strongly associated with sociodemographic factors and health communication behaviors, such as information seeking, news exposure, and perceived trust in the information sources.[6,15–23,25,26] During the course of pH1N1, public health communication campaigns about social distancing and hand hygiene were effective, prompting the public to curtail hand-shaking and hugging at social gatherings and adopt regular hand washing or use of hand sanitizers.[27–39] Yet, misconceptions also tend to arise in times of uncertainty, plausibly leading to adopting ineffective practices and jeopardizing efforts to contain the disease. pH1N1 was originally referred to by health officials and the WHO as "swine flu," causing worldwide confusion regarding the danger posed by pigs[39–42] and influencing incorrect prevention measures such as avoiding pork[43,44] despite repeated efforts to counter the inaccurate information.

Nevertheless, few studies have investigated the role communication inequalities play in people's knowledge and misconceptions about a perceived threat and in subsequent behavioral compliances. According to the structural influence model (SIM) of communication in public health,[8] health communication behaviors can be a pathway linking individual and social determinants (e.g., race/ethnicity and SES) with health outcomes (Figure). SIM posits that public communications can influence health by raising awareness, providing information, and reinforcing knowledge and behaviors; however, communication inequalities can affect people's attention to, processing of, and acting upon health information and the consequential behavioral outcomes, thereby exacerbating disparities among social groups.[4,7,11,24,45,46] We used SIM to guide the investigation on the role of communication inequalities in public health emergencies.

METHODS

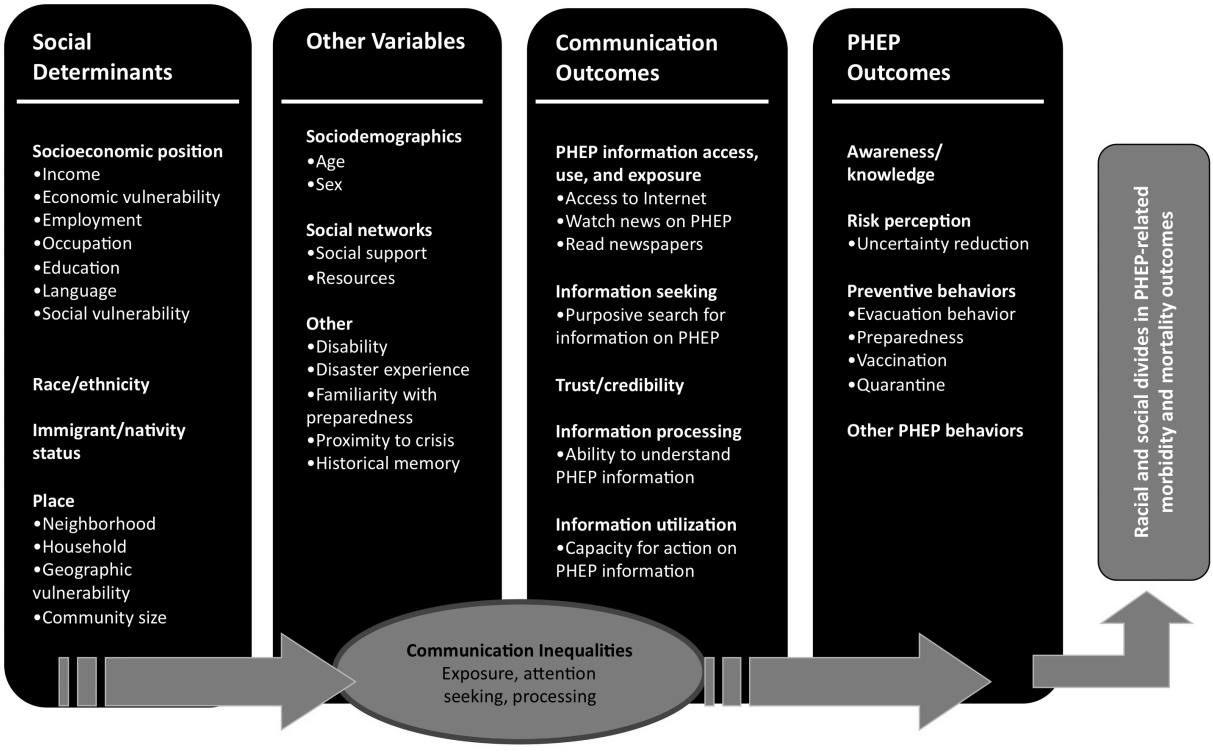
Survey instrument

We constructed a survey instrument from December 2009 through January 2010 to investigate the U.S. population's levels of pH1N1-related knowledge, communication, and preparedness behaviors. Prior to developing the survey, we conducted five focus groups with participants from diverse racial/ethnic and socioeconomic backgrounds in Massachusetts. We conducted cognitive testing with potential participants before finalizing the survey.

Sample

The data for this study came from a survey of 1,569 respondents drawn from a nationally representative sample of U.S. adults aged 18 years and older, collected from late February to early March 2010. Respondents participated in Knowledge Networks' KnowledgePanel® and were recruited using a dual sampling frame, a combination of random-digit-dial and address-based sampling, allowing for sampling of individuals with no telephone landlines. Households were provided with Internet access and necessary hardware if needed. We used post-stratification weights to adjust for noncoverage and nonresponder bias. Demographic and geographic distributions for the population aged 18 years and older from the most recent Current Population Survey[47] and the 2006 Pew Hispanic Center Survey of Latinos[48] were used as benchmarks in this adjustment. Post-stratification weighting included gender,

Figure. Structural influence model of communication inequalities[a]



[a]Jung M, Lin L, Viswanath K. Associations between health communication behaviors, neighborhood social capital, vaccine knowledge, and parents' H1N1 vaccination of their children. Vaccine 2013;31:4860-6.

PHEP = public health emergency preparedness

age, race/ethnicity, education, census region, urbanicity, Internet access, and dominant language.[49,50] For the purpose of this study, participants from minority racial/ethnic groups and those living below the federal poverty level were oversampled. The response rate was 66.3%.

Dependent variables

We created the following dependent variables as measurements of communication inequalities:

1. Assessments of knowledge: To determine respondents' levels of knowledge and misconceptions about pH1N1 transmission, we asked them, "To the best of your knowledge, how can someone get H1N1?" Possible answers included, "From being in close contact with someone who has pH1N1 (within arms-length of someone)," "From touching objects (e.g., glass) recently touched by someone with flu," "From eating pork," "From coming in contact with pigs," and "None of the above." Adapting from the knowledge scores developed by Savoia et al. in 2010,[26,51] we constructed two knowledge assessment scores:
   a. Knowledge score: Respondents obtained a score of 0, 1, or 2: one point for checking each of the following correct options: "close contact" and "touching objects," and one point if none of the following were checked: "eating pork," "coming in contact with pigs," or "none of the above."
   b. Misconceptions score: Respondents obtained one point for checking each of the following: "eating pork" or "coming in contact with pigs."
2. Behavioral compliances were determined based on participants' self-report on whether or not they had changed their health behaviors and adopted precautionary measures in response to news reports of pH1N1. We assessed precautionary measures recommended by the U.S. Centers for Disease Control and Prevention (CDC) as outcome variables in the final models.
   a. Recommended prevention behaviors:
      1. Those who "reduced human contact with people outside of [their] immediate

family, such as signs of affection (hug/kiss), shaking hands, or sign of peace during worship";

2. Those who "washed [their] hands or used hand sanitizer more frequently";
3. Wrong prevention behavior: those who "avoided eating pork products."

The aforementioned variables were dichotomously coded as "1" for items that were checked and "0" for items that were not checked.

Independent variables

We included two sets of independent variables on the basis of substantive and theoretical relevance in accordance with the SIM:[7]

1. SES, measured by education and annual household income (Table 1); and
2. pH1N1-related health communication behaviors, measured by the following variables adapted from the National Cancer Institute Health Information National Trends Survey:[52–54]
   a. Information-seeking behaviors, capturing individuals' purposive rather than incidental interaction with pH1N1-related information, were measured with the question, "Have you actively searched for information about H1N1?" ("yes" = seekers, "no" = non-seekers).
   b. Source of pH1N1 information was reported, where participants "had received the most information about the pH1N1 outbreak."
   c. We measured trust in information source by a factual statement that participants answered with "yes" or "no:" "You trust information from the source [you have received the most pH1N1 information from]."
   d. Communication barriers experienced during the pH1N1 pandemic were measured by (*1*) amount of information provided: participants were asked about "the [perceived] amount of information the media have provided on H1N1," with possible answers including "too much information," "not enough information," "just the right amount of information," and "don't know"; (*2*) difficulty in understanding the information delivered: participants responded to the question about "difficulty [experienced] in understanding the pH1N1 information that the media delivered" on a 10-point scale (0 = very hard to understand, 10 = very easy to understand); and (*3*) accessibility: "You can get the information you want from the source [you have received the most pH1N1 information from] immediately" ("yes" or "no").
   e. General news exposure: Respondents were asked how many out of the past seven days they had read newspapers, watched national and local news on television, and read news on the Internet. We calculated an average exposure of news during the past seven days based on the responses.
   f. To determine knowledge's impact on behaviors, we calculated knowledge assessment

Table 1. Socioeconomic status and demographic characteristics of a nationally regpresentative sample of 1,569 U.S. adults aged 18 years and older during 2009–2010 pH1N1[a]

Socioeconomic status	*Percent*
Education	
≥Bachelor's degree	28
Some college	29
High school	30
<High school	14
Annual household income	
≥$60,000	42
$35,000–$59,999	23
$15,000–$34,999	21
≤$14,999	14
Employment status	
Employed	55
Unemployed	21
Retired/disabled	24
Demographic factors	
Age (in years)	
18–24	11
25–34	19
35–44	19
45–54	17
≥55	34
Gender	
Male	49
Female	51
Race/ethnicity	
Non-Hispanic white	68
Non-Hispanic black	11
Hispanic	14
Non-Hispanic other	7
Language spoken at home	
Non-English	10
English	90

[a]Data source: Harvard School of Public Health Preparedness and Emergency Response Learning Center LAMPS project, 2009 H1N1 and General Emergency Preparedness Communications Survey.

pH1N1 = pandemic influenza A(H1N1)

scores as predictors in the models assessing the behaviors.

Potential confounders

According to SIM, the sociodemographic factors potentially influential in determining communication inequalities—age, sex, race/ethnicity, employment status, and language spoken at home—were controlled.

Analysis

We performed descriptive analyses, expressed as weighted frequencies and percentages, to account for the complex sampling design and to allow estimates to be nationally representative. We applied binary ordered logistic regression (knowledge models) and logistic regression (misconceptions models) to test for significant bivariate associations between each predictor and the outcome variables. Based on the results and SIM, we first conducted hierarchical multivariate logistic regression analyses and tested knowledge/misconception as major outcomes of interest and SES variables as major independent variables (tier-1). We then added mediating health communication variables such as general news exposure, information seeking, or barriers to access or use information (tier-2). Finally, knowledge was added as a third-tier variable (tier-3) to the behavioral compliances models, where adoption of recommended prevention behaviors (e.g., social distance [Models 5–7] and hand hygiene [Models 8–10]) and incorrect prevention behaviors (pork avoidance) were used as outcome variables. Using cross-tabulations, chi-square, and t-test, we examined the associations between identified significant social determinants and information sources. We conducted all analyses using Stata® version 11.0.[55] We used the survey weight-related svy command or svy option when appropriate.

RESULTS

Sample demographics

Demographic data are shown in Table 1. About half (49%) of the weighted sample population was ≤44 years of age, 44% had ≤high school education, and 14% had an annual income of <$15,000. Sixty-eight percent were non-Hispanic white, 11% were non-Hispanic black, 14% were Hispanic, and 7% were of another race/ethnicity.

Sources of pH1N1 information

Most people received information through local television news (35%), national network news (23%), the Internet (11%), or a doctor, nurse, or other medical professional (11%). Sources such as cable network television news stations, non-English-speaking television stations, national newspapers, social media, and non-English newspapers were used by ≤5% of the sample population. People with ≤high school education relied more on local television news and national network news and less on local newspapers and the Internet. Surprisingly, for information exchange related to pH1N1, social media usage was very low. Of the 45% of participants who self-reported owning at least one social media account, only 4% used these sites to receive or share information about pH1N1 (data not shown).

Information seeking and barriers to access and process information

Only 15% of the population actively searched for information about pH1N1, of which two-thirds had at least some college education. Almost 60% of the participants reported trusting the source from which they received the most pH1N1 information, while about 40% of the respondents remained skeptical about the information they received. Only 23% reported that they were able to access information they wanted immediately. When asked to assess the amount of information provided by the media on pH1N1, 47% of the respondents, usually those with a higher income, thought the media had provided just the right amount of information (Table 2).

Knowledge and misconceptions

Table 2 shows the results of two-tiered multivariate logistic models for knowledge (Models 1–2) and misconceptions (Models 3–4) about pH1N1 virus transmission. The majority of the participants (88%) knew at least one of the two correct mechanisms of pH1N1 virus transmission; however, at least 12% of the participants had misconceptions about transmission and thought pH1N1 could be transmitted via pork consumption and/or contact with pigs. Models 1 and 2 showed those with <high school education had significantly less knowledge about pH1N1, but this finding became insignificant once health communication behaviors were considered. Three types of communication barriers were identified to be significantly associated with lower levels of knowledge: (*1*) inability to immediately find what was needed from the information source, (*2*) a perceived shortage of sufficient pH1N1-related information in the media, and (*3*) difficulty in understanding the pH1N1 information that the media delivered. Difficulty in understanding the pH1N1 information and lower general news exposure were also important predictors of misconceptions (Model 4).

Table 2. Logistic regression examining the association among SES, knowledge and misconception about pH1N1 virus transmission, and health communication behaviors in a nationally representative sample of adults aged 18 years and older during 2009–2010 pH1N1[a]

		Knowledge about pH1N1 virus transmission		*Misconception about pH1N1 virus transmission*	
Independent variables	*Percent*	*Model 1: SES[b] OR (95% CI)*	*Model 2: SES and health communication behaviors[b] OR (95% CI)*	*Model 3: SES[b] OR (95% CI)*	*Model 4: SES and health communication behaviors[b] OR (95% CI)*
SES					
Education					
≥Bachelor's degree	28	Ref.	Ref.	Ref.	Ref.
Some college	29	0.98 (0.59, 1.61)	1.09 (0.65, 1.81)	0.98 (0.43, 2.23)	0.90 (0.38, 2.11)
High school	30	0.53[c] (0.33, 0.86)	0.61 (0.37, 1.02)	1.94 (0.92, 4.11)	1.73 (0.80, 3.77)
<High school	14	0.55[c] (0.30, 1.00)	0.64 (0.33, 1.22)	1.71 (0.68, 4.27)	1.38 (0.50, 3.80)
Annual household income					
≥$60,000	42	Ref.	Ref.	Ref.	Ref.
$35,000–$59,999	23	0.82 (0.50, 1.37)	0.79 (0.47, 1.35)	1.56 (0.70, 3.47)	1.45 (0.64, 3.32)
$15,000–$34,999	21	0.96 (0.60, 1.53)	0.83 (0.52, 1.35)	0.93 (0.43, 1.99)	0.94 (0.43, 2.07)
≤$14,999	14	0.81 (0.50, 1.29)	0.79 (0.49, 1.26)	1.64 (0.79, 3.39)	1.48 (0.69, 3.17)
Health communication behaviors					
Information-seeking behavior					
Information non-seeker	85		Ref.		Ref.
Information seeker	15		1.25 (0.78, 2.00)		0.61 (0.32, 1.16)
News exposure					
High	60		Ref.		Ref.
Low	40		0.87 (0.59, 1.29)		1.84[c] (1.07, 3.16)
Trust in information source					
No	41		Ref.		Ref.
Yes	59		1.36 (0.93, 1.99)		1.05 (0.61, 1.82)
Barriers to information accessing and processing					
Ability to immediately find what was needed					
No	77		Ref.		Ref.
Yes	23		1.61[c] (1.06, 2.46)		0.75 (0.41, 1.38)
Assessment of the amount of H1N1-related information in the media					
Just the right amount	47		Ref.		Ref.
Not enough	13		0.43[c] (0.26, 0.71)		1.51 (0.75, 3.05)
Too much	25		0.88 (0.56, 1.40)		0.88 (0.43, 1.82)
Don't know	15		0.74 (0.44, 1.25)		1.34 (0.66, 2.72)
Difficulty in understanding the H1N1 information that the media delivered					
Very easy	29		Ref.		Ref.
Somewhat easy	45		0.77 (0.52, 1.15)		1.11 (0.57, 2.15)
Somewhat hard	22		0.68 (0.41, 1.13)		1.74 (0.81, 3.74)
Very hard	3		0.25[c] (0.07, 0.90)		3.58[c] (1.03, 12.45)

[a]Data source: Harvard School of Public Health Preparedness and Emergency Response Learning Center LAMPS project, 2009 H1N1 and General Emergency Preparedness Communications Survey.

[b]All models are adjusted for age, sex, race/ethnicity, employment status, and language spoken at home.

[c]Statistically significant at $p<0.05$

SES = socioeconomic status

pH1N1 = pandemic influenza A(H1N1)

OR = odds ratio

CI = confidence interval

Ref. = reference group

Determinants of behavioral compliance

By expanding the aforementioned models, we examined an integrated model with behavior compliances as the outcome variables of interest (Tables 3–5). We found that health communication behaviors played a more significant role in the adoption of recommended behaviors than SES (Tables 3 and 4). In the social distancing models (Table 3, Model 7), participants with a knowledge score of 1 or 2 were 3.47 and 4.55 times, respectively, more likely than their counterparts to adopt recommended prevention measures, and their likelihood of adopting wrong prevention measures was greatly reduced (by 62% and 77%, respectively) (Table 5, Model 13). Those who experienced fewer communication barriers and had higher levels of knowledge were more likely to exercise hand hygiene and social distancing (Tables 3 and 4, Models 7 and 10). At the time of the survey, 5% of respondents still followed incorrect prevention measures and avoided pork products. Levels of knowledge functioned as a key and moderating determinant in increasing the adoption of recommended prevention measures and reducing the adoption of incorrect measures (Tables 3–5, Models 7, 10, and 13). The pork avoidance models (Table 5) showed that information seekers, people with higher SES, and those with high media exposure were less likely to adopt incorrect prevention behaviors than information non-seekers, those with lower SES, and those with low media exposure. Individuals who were able to find the information they wanted immediately were more likely to adopt behavior changes, correct or incorrect, than those who could not immediately find the information they wanted.

DISCUSSION

We used SIM as a guide to investigate a range of structural and communication-based factors that may impact knowledge and behaviors during a public health emergency. Misconceptions arise when public health messages are unclear or when critical information is delayed in reaching the intended recipients due to limited media exposure or information seeking. Our data showed that these communication inequalities disproportionately affected individuals with lower SES who retained incorrect information even after public officials' repeated efforts to correct misperceptions. Because those with exposure to information compared with non-exposed people were more likely to perform related behaviors, health information must be closely customized to the target audience to prevent potentially detrimental behaviors. Furthermore, respondents who reported that they received just the right amount of information about the virus responded to the threat more often than individuals who felt they received too much or too little information. Given that 25% of the sample reported hearing too much information, it could indicate possible burnout or desensitization from over-sensationalized accounts in the media. A communications campaign designed to motivate information seeking, increase news exposure, and reduce barriers to accessing and processing information can improve the public's ability to prepare for and respond to a health threat. In fact, strategies that aim to promote efficacy in prevention behaviors could help motivate people to seek out more information. These strategies should take into consideration the sociodemographic characteristics of the target audience in determining format and channel of delivery, providing important information about the threat and actionable prevention tactics via designated websites and telephone hotlines, as swiftly as possible.

Low seeking rates also mean that it is important to effectively and promptly use the media outlets people are routinely exposed to most often to provide knowledge and preventive behaviors at proper health literacy levels after a pandemic begins, particularly as this outlet seems to be the way many low SES non-seekers received the threat-related information. Such information could come from CDC or another trusted source and be disseminated through a variety of channels (e.g., media as well as community centers). Future studies are warranted to explore the additional challenges to designing prevention campaigns so that they may be intercepted and acted upon equally by all SES groups. These social inequalities manifested in people's behavioral response in a time of crisis may be particularly salient in regard to social distancing behaviors, as factors such as flexible work hours and occupation type may determine the ability to comply with this action. Therefore, public officials need to coordinate with workplaces, labor departments, and community groups so that at a structural level, people will be given more flexible hours to stay home when needed.

Limitations

Our cross-sectional study design limited us from drawing a causal relationship among social determinants, health communication behaviors, and preparedness outcomes. We were also limited by self-reported data; however, our survey items were adopted from widely tested national surveys[52–54] and validated by cognitive testing. Longitudinal studies, systems science methodologies, or experiments are required to provide stronger evidence for such relationships. Also, this study was conducted a few months after the beginning

Table 3. Logistic regression examining the association among social distancing behaviors against pH1N1 virus, SES, and health communication behaviors as well as pH1N1-related knowledge in a nationally representative sample of adults aged 18 years and older during 2009–2010 pH1N1[a]

		Social distancing		
Independent variables	*Percent*	*Model 5: SES[b] OR (95% CI)*	*Model 6: SES and health communication behaviors[b] OR (95% CI)*	*Model 7: SES, health communication behaviors, and pH1N1-related knowledge[b] OR (95% CI)*
SES				
Education				
≥Bachelor's degree	28	Ref.	Ref.	Ref.
Some college	29	1.04 (0.56, 1.92)	1.19 (0.61, 2.29)	1.15 (0.60, 2.19)
High school	30	0.85 (0.46, 1.58)	1.28 (0.65, 2.52)	1.40 (0.72, 2.70)
<High school	14	1.43 (0.66, 3.11)	1.87 (0.85, 4.14)	2.10[c] (1.00, 4.41)
Household income				
≥$60,000	42	Ref.	Ref.	Ref.
$35,000$–$59,999	23	0.65 (0.34, 1.23)	0.62 (0.32, 1.20)	0.61 (0.32, 1.18)
$15,000–$34,999	21	1.41 (0.75, 2.63)	1.05 (0.55, 1.98)	1.06 (0.57, 1.97)
≤$14,999	14	1.02 (0.53, 1.99)	0.99 (0.51, 1.89)	1.03 (0.54, 1.95)
Health communication behaviors				
Information-seeking behavior				
Information non-seeker	85		Ref.	Ref.
Information seeker	15		0.62 (0.36, 1.05)	0.65 (0.38, 1.12)
News exposure				
High	60		Ref.	Ref.
Low	40		0.82 (0.49, 1.37)	0.88 (0.53, 1.45)
Trust in information source				
No	41		Ref.	Ref.
Yes	59		3.08[c] (1.84, 5.16)	3.02[c] (1.82, 5.01)
Barriers to information accessing and processing				
Ability to immediately find what was needed				
No	77		Ref.	Ref.
Yes	23		2.68[c] (1.59, 4.51)	2.59[c] (1.54, 4.36)
Assessment of the amount of H1N1-related information in the media				
Just the right amount	47		Ref.	Ref.
Not enough	13		1.87 (0.96, 3.65)	2.18[c] (1.10, 4.32)
Too much	25		0.75 (0.42, 1.33)	0.72 (0.41, 1.28)
Don't know	15		0.77 (0.41, 1.45)	0.77 (0.41, 1.46)
Difficulty in understanding the H1N1 information that the media delivered				
Very easy	29		Ref.	Ref.
Somewhat easy	45		1.09 (0.65, 1.83)	1.12 (0.67, 1.86)
Somewhat hard	22		0.49 (0.23, 1.02)	0.51 (0.25, 1.07)
Very hard	3		0.92 (0.21, 4.03)	1.18 (0.31, 4.57)
Level of H1N1-related knowledge				
Knowledge about H1N1 virus transmission				
No correct answer (score of 0)	10			Ref.
One correct answer (score of 1)	45			3.47[c] (1.61, 7.47)
Two correct answers (score of 2)	44			4.55[c] (2.10, 9.88)

[a]Data source: Harvard School of Public Health Preparedness and Emergency Response Learning Center LAMPS project, 2009 H1N1 and General Emergency Preparedness Communications Survey.

[b]All models are adjusted for age, sex, race/ethnicity, employment status, and language spoken at home.

[c]Statistically significant at $p<0.05$

pH1N1 = pandemic influenza A(H1N1)

SES = socioeconomic status

OR = odds ratio

CI = confidence interval

Ref. = reference group

Table 4. Logistic regression examining the association among hand hygiene practices against pH1N1 virus, SES, and health communication behaviors as well as pH1N1-related knowledge in a nationally representative sample of adults aged 18 years and older during 2009–2010 pH1N1[a]

		Hand hygiene practices		
Independent variables	*Percent*	*Model 8: SES[b] OR (95% CI)*	*Model 9: SES and health communication behaviors[b] OR (95% CI)*	*Model 10: SES, health communication behaviors, and pH1N1-related knowledge[b] OR (95% CI)*
SES				
Education				
≥Bachelor's degree	28	Ref.	Ref.	Ref.
Some college	29	0.81 (0.47, 1.37)	0.99 (0.56, 1.75)	0.99 (0.56, 1.77)
High school	30	0.59 (0.34, 1.01)	0.85 (0.48, 1.49)	0.92 (0.52, 1.63)
<High school	14	0.56 (0.30, 1.05)	0.68 (0.34, 1.36)	0.73 (0.35, 1.52)
Household income				
≥$60,000	42	Ref.	Ref.	Ref.
$35,000–$59,999	23	0.77 (0.45, 1.32)	0.67 (0.38, 1.18)	0.68 (0.38, 1.21)
$15,000–$34,999	21	1.00 (0.57, 1.76)	0.79 (0.45, 1.38)	0.80 (0.45, 1.40)
≤$14,999	14	0.84 (0.50, 1.40)	0.75 (0.45, 1.26)	0.77 (0.45, 1.30)
Health communication behaviors				
Information-seeking behavior				
Information non-seeker	85		Ref.	Ref.
Information seeker	15		0.63 (0.32, 1.21)	0.65 (0.34, 1.27)
News exposure				
High	60		Ref.	Ref.
Low	40		0.70 (0.47, 1.05)	0.72 (0.47, 1.08)
Trust in information source				
No	41		Ref.	Ref.
Yes	59		1.42 (0.94, 2.15)	1.41 (0.93, 2.13)
Barriers to information accessing and processing				
Ability to immediately find what was needed				
No	77		Ref.	Ref.
Yes	23		2.47[c] (1.46, 4.17)	2.30[c] (1.36, 3.88)
Assessment of the amount of H1N1-related information in the media				
Just the right amount	47		Ref.	Ref.
Not enough	13		1.42 (0.69, 2.89)	1.58 (0.76, 3.31)
Too much	25		0.95 (0.57, 1.56)	0.95 (0.58, 1.57)
Don't know	15		0.72 (0.40, 1.32)	0.75 (0.41, 1.37)
Difficulty in understanding the H1N1 information that the media delivered				
Very easy	29		Ref.	Ref.
Somewhat easy	45		1.85[c] (1.16, 2.95)	1.92[c] (1.20, 3.09)
Somewhat hard	22		0.97 (0.55, 1.72)	1.02 (0.58, 1.81)
Very hard	3		1.74 (0.56, 5.45)	2.11 (0.69, 6.46)
Level of H1N1-related knowledge				
Knowledge about H1N1 virus transmission				
No correct answer (score of 0)	10			Ref.
One correct answer (score of 1)	45			1.62 (0.86, 3.05)
Two correct answers (score of 2)	44			2.34[c] (1.18, 4.65)

[a]Data source: Harvard School of Public Health Preparedness and Emergency Response Learning Center LAMPS project, 2009 H1N1 and General Emergency Preparedness Communications Survey.

[b]All models are adjusted for age, sex, race/ethnicity, employment status, and language spoken at home.

[c]Statistically significant at $p<0.05$

pH1N1 = pandemic influenza A(H1N1)

SES = socioeconomic status

OR = odds ratio

CI = confidence interval

Ref. = reference group

Table 5. Logistic regression examining the association among pork avoidance behaviors against pH1N1 virus, SES, and health communication behaviors as well as pH1N1-related knowledge in a nationally representative sample of adults aged 18 years and older during 2009–2010 pH1N1[a]

		Pork avoidance behaviors		
		Model 11: SES[b]	*Model 12: SES and health communication behaviors[b]*	*Model 13: SES, health communication behaviors, and pH1N1-related knowledge[b]*
Independent variables	*Percent*	*OR (95% CI)*	*OR (95% CI)*	*OR (95% CI)*
SES				
Education				
≥Bachelor's degree	28	Ref.	Ref.	Ref.
Some college	29	4.34 (0.65, 29.06)	10.72[c] (1.43, 80.13)	11.12[c] (1.48, 83.37)
High school	30	2.17 (0.45, 10.45)	5.94 (0.76, 46.15)	5.87 (0.74, 46.24)
<High school	14	4.32 (0.91, 20.43)	11.27[c] (1.46, 87.26)	10.08[c] (1.33, 76.34)
Household income				
≥$60,000	42	Ref.	Ref.	Ref.
$35,000–$59,999	23	3.65 (0.96 13.98)	4.11 (0.88, 19.08)	3.36 (0.76, 14.82)
$15,000–$34,999	21	7.27[c] (1.32, 40.02)	6.51[c] (1.17, 36.16)	5.88[c] (1.16, 29.76)
≤$14,999	14	10.70[c] (2.65, 43.15)	9.38[c] (2.00, 44.10)	7.95[c] (1.68, 37.56)
Health communication behaviors				
Information-seeking behavior				
Information non-seeker	85		Ref.	Ref.
Information seeker	15		0.34[c] (0.16, 0.73)	0.30[c] (0.14, 0.66)
News exposure				
High	60		Ref.	Ref.
Low	40		2.34[c] (1.12, 4.91)	2.32[c] (1.12, 4.78)
Trust in information source				
No	41		Ref.	Ref.
Yes	59		1.15 (0.55, 2.44)	1.29 (0.61, 2.70)
Barriers to information accessing and processing				
Ability to immediately find what was needed				
No	77		Ref.	Ref.
Yes	23		3.11[c] (1.54, 6.31)	3.06[c] (1.50, 6.23)
Assessment of the amount of H1N1-related information in the media				
Just the right amount	47		Ref.	Ref.
Not enough	13		2.16 (0.88, 5.27)	2.01 (0.82, 4.94)
Too much	25		0.80 (0.38, 1.71)	0.71 (0.32, 1.58)
Don't know	15		0.71 (0.23, 2.16)	0.72 (0.23, 2.23)
Difficulty in understanding the H1N1 information that the media delivered				
Very easy	29		Ref.	Ref.
Somewhat easy	45		1.37 (0.65, 2.91)	1.35 (0.62, 2.95)
Somewhat hard	22		1.81 (0.64, 5.11)	1.67 (0.60, 4.61)
Very hard	3		2.13 (0.25, 18.39)	1.06 (0.09, 13.14)
Level of H1N1-related knowledge				
Knowledge about H1N1 virus transmission				
No correct answer (score of 0)	10			Ref.
One correct answer (score of 1)	45			0.38[c] (0.16, 0.89)
Two correct answers (score of 2)	44			0.23[c] (0.09, 0.58)

[a]Data source: Harvard School of Public Health Preparedness and Emergency Response Learning Center LAMPS project, 2009 H1N1 and General Emergency Preparedness Communications Survey.

[b]All models are adjusted for age, sex, race/ethnicity, employment status, and language spoken at home.

[c]Statistically significant at $p<0.05$

pH1N1 = pandemic influenza A(H1N1)

SES = socioeconomic status

OR = odds ratio

CI = confidence interval

Ref. = reference group

of pH1N1. Because individuals may have been more affected by their social conditions early on during an emergency when information was unavailable or unclear, this time difference between the beginning of the pandemic and when the survey was conducted may have greatly decreased the effect of the social disparities detected. Therefore, a tool to rapidly develop surveys as an emergency unfolds is needed to capture timely information and assess information needs in future public health emergencies.

CONCLUSIONS

Communication inequalities could compromise public health systems' ability to effectively prevent and respond to pandemic influenza outbreaks. Low SES, communication barriers, and low levels of pH1N1-related knowledge are significantly associated with misconceptions and uptake of incorrect precautionary behaviors, which are difficult to reverse. Traditional forms of mass media and communications through pre-established social networks remain the primary information sources and channels for public health messages. Providing information about recommended prevention measures in a way that is immediately accessible and understandable to the public can increase the public's level of knowledge about the pandemic, promote the uptake of effective precautionary behaviors, and reduce ineffective prevention behaviors.

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