

Research Article

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Knowledge, Attitudes and Practices Regarding 2009 H1N1 Vaccine Among Patients Hospitalized With Influenza A (H1N1) pdm09

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Abstract

Background: Although previous studies have assessed barriers to influenza vaccination in general populations, few studies have assessed barriers among ill persons to inform prevention programs.

Methods: We conducted a telephone survey of patients hospitalized with laboratory-confirmed 2009 H1N1 infection from December 2009 through April 2010 to evaluate pandemic vaccination coverage and identify attitudes and barriers to vaccination. Patients were asked to describe chronic medical conditions, healthcare-seeking behavior, 2009 H1N1 vaccination status, reason(s) and information that guided vaccine decision-making, and perceptions of risk of 2009 H1N1, vaccine safety and effectiveness.

Results: We interviewed 146 of 364 (40%) patients hospitalized with 2009 H1N1 in the state of Georgia. Fifteen (10%) patients received 2009 H1N1 vaccine before hospitalization. Although 109 (75%) respondents were in an Advisory Committee on Immunization Practices (ACIP) target group for 2009 H1N1 vaccination, only 54 (50%) were aware they should be vaccinated. Reasons for not receiving vaccination included concerns about vaccine safety or effectiveness (34%) and perception of risk of 2009 H1N1 (26%). Only 55 (38%) patients reported discussing 2009 H1N1 vaccination with their clinician; a significantly higher proportion of vaccinated than unvaccinated patients reported having a discussion with their clinician about vaccination ($p=0.002$).

Conclusions: To our knowledge, this study is the first to evaluate reasons for non-vaccination among persons hospitalized for influenza. Reasons for not being vaccinated included concerns about vaccine safety, unawareness of being in an ACIP target group, and unawareness of risk of severe outcomes from influenza. Our study characterized numerous missed opportunities for prevention, and identified a clear need for increased patient and clinician education regarding influenza vaccines.

Keywords: Influenza vaccine; 2009 Influenza A (H1N1); Perception; Information seeking behavior; Health education

Introduction

In response to the Influenza A (H1N1) pdm09 (2009 H1N1) pandemic, the Advisory Committee on Immunization Practices (ACIP) issued guidelines in August 2009 for prioritization of 2009 H1N1 vaccine in the United States in anticipation of vaccine availability in the fall. These guidelines, based in part on results from early epidemiologic investigations, identified initial target groups for vaccination: 1) persons at high risk for influenza complications (pregnant women, children and young adults aged 6 months to 24 years, and persons aged 25 to 64 years who have medical conditions that put them at higher risk for influenza-related complications, including severe outcomes such as hospitalization*), and 2) persons who pose a higher likelihood of influenza transmission to susceptible individuals (persons who live with or provide care for infants aged <6 months and health-care and emergency medical services personnel) [1].

Seasonal influenza vaccination rates, even among high-risk groups, have historically been below national Healthy People objectives [2-6], and several U.S. studies conducted in spring and summer 2009 evaluating public perception of the 2009 H1N1 pandemic predicted uptake of the monovalent vaccine in the range of 46 to 64% [7-10].

*Chronic medical conditions that confer a higher risk for influenza-related complications include chronic pulmonary (including asthma), cardiovascular (except hypertension), renal, hepatic, cognitive, neurologic/neuromuscular, hematologic, or metabolic disorders (including diabetes mellitus) or immunosuppression (including immunosuppression caused by medications or by human immunodeficiency virus) [1].

Concerns about vaccine safety and perceiving oneself to be at low risk of infection or severe illness were among the many issues associated with reluctance to likely be vaccinated in these studies.

The 2009 H1N1 vaccine first became available to ACIP target groups in Georgia in early October 2009, and by early December 2009 the vaccine was made available to all Georgia residents [11]. Despite widespread availability of the monovalent vaccine by the end of 2009, however, 2009 H1N1-associated hospitalizations increased in Georgia in January 2010 while the majority of the country was observing a decline in activity. Following an investigation into this winter wave of 2009 H1N1 illness in Georgia, we surveyed patients hospitalized with

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laboratory-confirmed 2009 H1N1 in order to determine if they had been vaccinated, and if not, why they had not been vaccinated. Specifically, we sought to 1) assess their knowledge, attitudes, and practices toward the 2009 H1N1 vaccine, 2) identify barriers to receiving 2009 H1N1 vaccine prior to hospitalization, as well as what role access to care played in vaccine uptake, and 3) evaluate the relationships between patients' self-perceived health status and the ACIP recommendations for 2009 H1N1 vaccination. By interviewing severely ill patients, as opposed to surveys of the general public, we hoped to identify reasons and barriers that had actually prevented those persons from being vaccinated for influenza, in order to inform vaccination and prevention programs.

Methods

We identified patients hospitalized in Georgia with laboratory-confirmed 2009 H1N1 influenza from December 1, 2009 through April 30, 2010 through established surveillance for influenza-associated hospitalizations. Hospitalized patients in the Atlanta metropolitan area were identified using surveillance data from the Emerging Infections Program (EIP), and hospitalized patients outside of metropolitan Atlanta were identified using aggregate surveillance data collected by the Georgia Department of Community Health. Between June 3rd and June 25th, 2010, we administered a standardized telephone survey to patients identified as hospitalized during the time period above. We attempted to contact non-respondents at least 10 times by telephone. For patients under 18 years of age, we requested to interview a parent or guardian as a proxy. Patients who died prior to survey implementation were excluded from the survey sample. This investigation was part of the emergency public health practice response to the pandemic, and was reviewed by appropriate Centers for Disease Control and Prevention (CDC) authorities and deemed not to be research in accordance with the federal human subjects protection regulations at 45 Code of Federal Regulations 46.101c and 46.102d and CDC's Guidelines for Defining Public Health Research and Public Health Non-Research.

Data collected in the survey included respondents' or their child's 2009 H1N1 vaccination status and reason(s) for not getting vaccinated. Children between the ages of 6 months and 8 years were considered vaccinated if they received one dose of 2009 H1N1 vaccine. Respondents were also asked about healthcare-seeking behavior and underlying medical conditions, or if they were care givers for persons at high risk for influenza complications. We assessed respondents' perceptions of his/her risk of influenza and severe outcomes as well as the safety and effectiveness of the 2009 H1N1 vaccine. Finally, we inquired about the source of information used to guide decision-making about vaccination, as well as advice they may have received from their healthcare provider regarding 2009 H1N1 vaccination.

Questions pertaining to perceived health status, risk of influenza, risk of severe outcomes from influenza, and perceived vaccine safety and effectiveness were presented to respondents on a Likert Scale.[†]

Data analysis was performed using SAS v 9.2 (SAS Institute, Cary, NC). Univariate and bivariate analyses were carried out using a 2-tail

^{*}Respondents were asked about their or their child's health status in the year prior to their hospitalization with the answer choices of 1=excellent, 2=good, 3=fair, and 4=poor. Questions regarding perceived risk of infection and severe outcomes could be answered as 1=no risk, 2=low risk, 3=moderate risk, 4=high risk, or 5=certain/guaranteed risk. Questions about perceived vaccine safety and effectiveness had answer choices of 1=very safe/effective, 2=safe/effective, 3=neither safe/effective nor dangerous/ineffective, 4=dangerous/ineffective, or 5=very dangerous/very ineffective. Answers provided to open-ended questions (reasons against 2009 H1N1 vaccination, source of information) were categorized into common themes for analysis. Respondents answering "don't know," "no opinion," or "refused" to the Likert Scale questions were excluded from analysis.

uncorrected Chi-Square or Fisher exact test. Data collected from questions using a Likert scale were evaluated using the Wilcoxon rank sum method [12]. A p-value of less than 0.05 was considered statistically significant.

Results

We identified 364 patients hospitalized with laboratory-confirmed 2009 H1N1 influenza in Georgia from December 1, 2009 through April 30, 2010. Sixteen patients died prior to survey implementation and were excluded, leaving 348 patients who met our case definition; 146 patients (42%) agreed to participate in the study and were interviewed

Category	H1N1 vaccinated	H1N1 unvaccinated	Total*
	n = 15 n (%)	n = 128 n (%)	N = 146 N (%)
Demographic characteristic			
Female	9 (60)	68 (53)	78 (53)
Age			
< 6 months	0 (0)	1 (0.8)	2 (1)
6 months-24 years	5 (33)	23 (18)	29 (20)
25-64 years	9 (60)	89 (70)	99 (68)
65+ years	1 (7)	9 (7)	10 (7)
Race			
White	10 (67)	78 (61)	88 (60)
Black	4 (27)	39 (30)	46 (32)
Other	1 (7)	11 (9)	12 (8)
Hispanic	1 (7)	8 (6)	9 (6)
ACIP target groups for H1N1 vaccination(1)†			
(1) Higher risk for influenza or influenza-related complications	13 (100)	91 (97)	106 (97)
(i) Persons aged 6 months – 24 years	5 (38)	23 (24)	29 (27)
(ii) Pregnant women	0 (0)	13 (14)	13 (12)
(iii) Persons aged 25-64 years with chronic medical conditions	8 (62)	59 (63)	68 (62)
Asthma or other chronic lung disease	5 (38)	28 (30)	33 (30)
Diabetes or other metabolic/endocrine disorder	4 (31)	28 (30)	33 (30)
Immunosuppressive disorder	1 (8)	13 (14)	14 (13)
Chronic cardiovascular disorder	1 (8)	11 (12)	13 (12)
Neurological/neurodevelopmental	4 (31)	8 (9)	12 (11)
Hematologic disorder	2 (15)	11 (12)	13 (12)
Renal disorder	0 (0)	9 (10)	9 (8)
Hepatic disorder	0 (0)	1 (1)	1 (1)
(2) Transmission risk to susceptible persons	1 (8)	18 (19)	19 (17)
(i) Living with/caring for child <6 months	0 (0)	12 (13)	12 (11)
(ii) Healthcare personnel	1 (8)	9 (10)	10 (9)
Not in an ACIP target group	2 (13)	34 (27)	37 (25)

*Column totals may not equal vaccinated plus unvaccinated. Respondents who answered "Don't know" or refused to answer an individual question are included only in the "Total" column

†Rows may total >100% because respondents could answer "Yes" to more than one ACIP condition

NOTE: None of the differences between vaccinated and unvaccinated groups were statistically significant at the p≤0.05

Table 1: Demographics and Advisory Committee on Immunization Practices (ACIP) target group status of survey respondents hospitalized with 2009 H1N1 influenza in Georgia, December 2009-April 2010.

by telephone. The remaining 202 patients refused (59) or could not be reached (133).

The majority of survey respondents (75%) were over 24 years of age (mean age: 41 years); 78 (53%) were female, and 60% were white and 32% were black (Table 1). Demographic data from hospitalization records for 133 of the 202 patients who did not participate in the survey indicated that non - respondents were a mean age of 39 years, 49% were female; 36% were white and 50% were black. Survey respondents were significantly more likely than non-respondents to be white ($p<0.01$), but were not different in terms of age or gender. Most respondents (75%) were in an ACIP target group for 2009 H1N1 vaccination. Of the 109 respondents in an ACIP target group, 29 (27%) were aged 6 months to 24 years, 13 (12%) were pregnant at the time of hospitalization, 68 (62%) were 25 to 64 years of age with a chronic medical condition that placed them at high risk for severe outcomes from influenza, and 19 (17%) indicated that they had direct contact with individuals at high risk for influenza complications. Asthma (or other chronic lung disease) and diabetes (or other metabolic or endocrine disorder) were the most commonly reported high-risk conditions (30% each) among respondents in an ACIP target group.

Fifteen of 146 respondents (10%) reported receiving 2009 H1N1 vaccination before hospitalization, 128 (88%) had not received 2009 H1N1 vaccination, and three (2%) were unsure. Respondent vaccination status did not differ significantly by gender, race, or ethnicity.

Of the 109 respondents in an ACIP target group, 94 (86%) reported that they had not been vaccinated, thirteen (12%) reported vaccination, and 2 (2%) were unsure of their vaccination status or refused to answer the question. Ninety-one of 106 respondents (86%) who were in an ACIP target group because they had conditions that placed them at high risk for severe outcomes from 2009 H1N1 had not been vaccinated, and 18 of 19 respondents (95%) who were in an ACIP target group because they had direct contact with individuals at high risk for influenza complications had not received the vaccine. Among persons with conditions that placed them at high risk for severe outcomes from 2009 H1N1, 5/29 (17%) respondents aged 6 months to 24 years reported vaccination, 0/13 pregnant women reported vaccination, and 8/68 (12%) respondents aged 25 to 64 years with a chronic medical condition reported vaccination. Five (15%) of 33 patients with asthma or other chronic lung disease and 4 (12%) of 33 patients with diabetes or other metabolic or endocrine disorder reported receiving 2009 H1N1 vaccination. Vaccinated patients were not significantly more likely to be in an ACIP target group than unvaccinated patients ($p=0.43$).

Concerns about vaccine safety and effectiveness were common among those who provided a reason for not being vaccinated for 2009 H1N1 (34%) (Table 2). Specific reasons for not getting vaccinated included having existing health conditions, perception of being at low risk for influenza and influenza complications, or lack of vaccine availability. While availability of the vaccine was cited as a reason by 14% of patients, other issues related to access (vaccine cost, insufficient time to get the vaccine, other unspecified reasons) accounted for less than 10% of the reasons cited by patients for why they did not receive the vaccine.

Healthcare providers were the most common source of information patients used to decide whether to receive the 2009 H1N1 vaccine; 43 of 146 (29%) respondents indicated receiving information about the 2009 H1N1 vaccine from a clinician, pharmacist, or public healthsource (Table 3). A significantly lower proportion of unvaccinated patients (25%) reported getting their information from a healthcare professional than did vaccinated patients (73%) ($p<0.01$). Other sources of

Respondent reason	H1N1 unvaccinated N=125 N (%)*
Vaccine safety or effectiveness concerns	42 (34)
Felt medical condition was a contraindication to vaccination	15 (12)
Thought vaccine would cause influenza illness	11 (9)
Concerns about vaccine side effects	5 (4)
Did not believe vaccine would be effective	4 (3)
Concerns about vaccine safety (unspecified)	7 (6)
Perception of 2009 H1N1 illness risk	33 (26)
Thought vaccine was not needed	19 (15)
Thought risk of influenza was low	8 (6)
Thought influenza would not cause severe illness	6 (5)
Vaccine access barriers	29 (23)
Vaccine was not available, long lines for vaccine	17 (14)
Vaccine was too expensive	5 (4)
Insufficient time to get vaccine	5 (4)
Access barriers (unspecified)	2 (2)
Other	27 (22)
Advised against vaccination by clinician	11 (9)
Confusion about 2009 H1N1 versus seasonal influenza vaccine ¹	7 (6)
Religious beliefs/philosophical objection	4 (3)
Had already contracted 2009 H1N1	3 (2)
Allergic to a vaccine component	2 (2)
Non-specific reasons	15 (12)
Vaccination was not considered a priority ²	7 (6)
Did not want the vaccine	8 (6)

*Columns may total>100% because respondents could give>1 reason

¹Common response included "Got flu shot two times, thought I would be immune," "Didn't know there were two vaccines, didn't know the difference between the two," "Figured that seasonal flu vaccine would be sufficient, one flu is the flu." "Never had a flu shot in my life, was told if I've never needed one before, I will not need one now." ²Common responses included "Didn't get around to it," "Didn't occur to me to get it," "Just didn't go to the doctor"

Table 2: Reasons for not receiving the 2009 H1N1 monovalent vaccine among survey respondents hospitalized for 2009 H1N1 influenza in Georgia, December 2009-April 2010.

Information source	H1N1 vaccinated	H1N1 un-vaccinated	Total*	p-value†
	n=15 n (%)	n=128 n (%)	N=146 N (%)	
Healthcare professional (clinician, pharmacist, public health)	11 (73)	32 (25)	43 (29)	<0.01
Media (internet, television, newspaper, radio)	3 (20)	37 (29)	40 (27)	0.7
Friend, peer, or co-worker	1 (7)	9 (7)	10 (7)	>0.99
Personal knowledge or experience	1 (7)	9 (7)	10 (7)	>0.99
Other‡	2 (13)	4 (3)	-6 (4)	0.24
None	1 (7)	42 (33)	43 (29)	0.06

*Categories are not mutually exclusive and therefore may total >100%

† P-values calculated by comparing the proportion of vaccinated versus unvaccinated persons using each information source, using a 2-tail Fisher exact p-value

‡Employer (2 vaccinated, 1 unvaccinated); church (2 unvaccinated); information from child's school (1 unvaccinated)

Table 3: Source(s) of information used to decide whether to get the 2009 H1N1 vaccine by survey respondents hospitalized for 2009 H1N1 influenza in Georgia, December 2009-April 2010.

information included the media (internet, television, print media, or the radio) (27%).

Perceived health status was poorer among vaccinated respondents compared to unvaccinated respondents, but this

	H1N1 vaccinated(n=15) Median response	H1N1 unvaccinated(n=128) Median response	p-value *
Perceived health status	3.0	2.0	0.4
Perceived risk of influenza	3.0	2.0	0.03
Perceived risk of severe outcome	4.0	2.0	<0.01
Perceived H1N1 vaccine safety	2.0	2.0	0.04
Perceived H1N1 vaccine effectiveness	1.5	2.0	0.03

*P-values calculated by comparing the mean rank sum of responses among vaccinated versus unvaccinated persons answering each question, using a Wilcoxon rank sum exact test. Persons who answered "Don't know," "No opinion," or refused to answer an individual question were excluded from the p-value calculation.

NOTE: Likert scale answer options: health status (1=excellent, 2=good, 3=fair, and 4=poor); perceived risk of influenza or severe outcome (1=no risk, 2=low risk, 3=moderate risk, 4=high risk, or 5=certain/guaranteed risk); perceived vaccine safety (1=very safe, 2=safe, 3=neither safe nor dangerous, 4=dangerous, or 5=very dangerous); perceived vaccine effectiveness (1=very effective, 2=effective, 3=neither effective nor ineffective, 4=ineffective, or 5=very ineffective)

Table 4: Self-perceived health status, vaccine safety, and risk of influenza among survey respondents hospitalized for 2009 H1N1 influenza in Georgia, December 2009-April 2010.

	H1N1 vaccinated n=15 (%)	H1N1 unvaccinated n=128 (%)	Total* N=146 (%)	p-value
Seen by clinician in year prior to hospitalization				
5 or more times	10 (67)	65 (51)	78 (53)	0.19
3 to 4 times	4 (27)	37 (29)	41 (28)	
0-2 times	1 (7)	26 (20)	27 (18)	
Spoke to clinician about H1N1 vaccine	11 (73)	43 (34)	55 (38)	<0.01
In ACIP vaccine target group	13 (87)	94 (73)	109 (75)	0.43
Patient knew (s)he was in ACIP target group	9 (69†)	44 (47†)	54 (50†)	0.12

*Columns and rows may not total 100% because respondents who answered "Don't know" or refused to answer an individual question are included only in the "Total" column

† Percentage calculated using number of patients in ACIP vaccine target group as denominator

Table 5: Healthcare-seeking behavior and knowledge of ACIP high-risk status among survey respondents hospitalized for 2009 H1N1 influenza in Georgia, December 2009-April 2010.

difference was not statistically significant ($p=0.4$) (Table 4). Vaccinated respondents reported a significantly higher perceived risk of both influenza disease and severe outcomes from influenza compared with unvaccinated respondents. Vaccinated respondents also perceived the vaccine to be significantly safer and more effective than unvaccinated respondents.

The majority (82%) of respondents were seen by a physician at least 3 times in the year prior to their influenza hospitalization (Table 5). Although the exact timing of these visits in relation to 2009 H1N1 vaccine availability was not ascertained, this demonstrated that most patients had access to healthcare providers. While healthcare-seeking behavior did not differ significantly between vaccinated and unvaccinated groups, a significantly higher proportion of vaccinated respondents reported having spoken to a clinician about the 2009 H1N1 vaccine prior to their hospitalization ($p<0.01$). Overall, 55 respondents (38%) spoke to a clinician about the 2009 H1N1 vaccine; of these 55 respondents, 34 (62%) reported that they were advised to receive vaccine (including 23 who were not vaccinated), 11 (20%) reported that they were advised

not to receive the vaccine (none whom were vaccinated), and 7 (13%) were not advised either way (none of whom were vaccinated). Of the 11 patients who reported that they were advised against 2009 H1N1 vaccination, 10 (91%) were in an ACIP target group. Reasons reported by patients for why their clinician advised against the vaccine included pregnancy, history of organ transplant, and other immunosuppressive conditions. Of note, none of the reasons given for why patients were advised not to receive the vaccine is a contraindication according to the ACIP.

Only half of the patients that were in groups recommended for 2009 H1N1 vaccination by ACIP reported knowing they were in a vaccination target group. Speaking to a clinician about the 2009 H1N1 vaccine, however, was significantly associated with correct self-assessment of ACIP target group status; among 109 respondents in an ACIP target group, 31 of the 48 respondents who reported speaking to a clinician about the 2009 H1N1 vaccine prior to hospitalization knew their target group status, compared to 16 of the 48 respondents who did not know their target group status ($p=0.003$).

Discussion

We conducted a survey of patients hospitalized in Georgia with laboratory-confirmed 2009 H1N1 influenza to assess their knowledge, attitudes, and practices toward vaccination. Patients were hospitalized from December 2009 to April 2010, several months after the 2009 H1N1 vaccine was made available to ACIP target groups, and in many cases, weeks to months after the vaccine was made widely available to the general public. Vaccination coverage among these patients was low (10%), even though the majority fell into an ACIP target group for vaccination, and were considered a priority to receive vaccine. To our knowledge, this is the first study to look at barriers to vaccination among patients with severe 2009 H1N1 illness. Previous studies have assessed reasons for non-vaccination among the general public and even high risk groups, however ours is the first to examine such reasoning among persons who were actually ill. By surveying only hospitalized patients, we hoped to identify barriers to vaccination among persons at the highest risk for severe outcomes of influenza infection. As such, while we acknowledge the likelihood that fewer of our survey respondents were vaccinated than the general population, we were not seeking to achieve a random sample as is done, for example, in vaccine effectiveness studies. We think that the information from this study can be a powerful adjunct to future vaccination education campaigns when presented as "real life" examples of the reasons for, and consequences of, failure to be vaccinated.

Pandemic influenza vaccination coverage in Georgia was lower than the national average. As of the end of February 2010, approximately 24% of all U.S. residents aged 6 months or older compared with 17% of Georgia residents aged 6 months or older had been vaccinated [13]. Among individuals in the initial ACIP target groups, 33% of U.S. residents and 23% of Georgia residents had received a 2009 H1N1 vaccination [13].

Concerns about vaccine safety and a perceived low risk of 2009 H1N1 illness were primary reasons why many patients failed to be vaccinated before hospitalization. Vaccine safety concerns and perceived low risk of illness have been identified as barriers to both seasonal and 2009 H1N1 influenza vaccination among high-risk groups and the general public in previous studies [7,9,10,14,15]. While many respondents cited lack of availability as a reason for not receiving the 2009 H1N1 vaccine, other factors related to access (vaccine cost, transportation to a vaccination site) played little or no part in the low rate of vaccine uptake observed in this survey population.

While the medical community served as the largest source of information for patients' decisions regarding 2009 H1N1 vaccination, the media was also a major source. This was particularly true among unvaccinated patients, many of whom indicated that they obtained information from the internet. These findings are consistent with a national survey by Maurer et al. where vaccination was highest amongst respondents who cited their employers, healthcare providers, or public health as the most influential source of information, and was lowest amongst those citing the media or no source of information [15].

Discussing the 2009 H1N1 vaccine with a healthcare provider was significantly associated with both patients' knowledge of their ACIP target group status and 2009 H1N1 vaccine uptake, which is similar to the results of the aforementioned survey by Maurer et al. [16]. In addition, several other published studies have cited the importance of provider recommendation on patients' decisions to receive seasonal influenza vaccine [17,18]. The impact of provider input on influenza vaccination rates is therefore significant. Several unvaccinated patients reported receiving direction from their healthcare provider that was inconsistent with ACIP recommendations. These patients reported being advised by their physician not to receive the vaccine, even though they were in an ACIP-recommended target group. Many of the reasons why patients were being advised against vaccination were not contraindications, but in fact were the very reasons that placed them in an ACIP target group for 2009 H1N1 vaccination.

We identified several barriers to vaccination in this study, many of which have been described in similar studies. Fears over perceived vaccine safety, incorrect physician advisement about the vaccine, and the sentiment that 2009 H1N1 was not a serious illness may have all contributed to the low vaccination rates that we observed. Improving influenza vaccination rates will require a multi-pronged approach that addresses each of these issues. The majority of unvaccinated respondents reported using non-healthcare resources to make vaccine decisions, underscoring the need to consider how to most effectively disseminate vaccine recommendations to those groups at highest risk. The medical community, as a critical influence of patient health behaviors, should be educated about recommendations for influenza vaccination (including a correct understanding of vaccine contraindications) and encouraged to actively reach out to their patients at higher risk of influenza-related complications to communicate the benefits of influenza vaccine. In addition, patients need to be educated about their risk of influenza at routine healthcare encounters, as this was an opportunity frequently missed among our survey respondents.

Our study had several limitations. The possibility of participation bias may have affected our results, as a higher percentage of survey participants were white as compared to non-respondents. Respondents and non-respondents may differ in their attitudes and behaviors toward influenza vaccine according to racial groups. Vaccination status and medical encounters were self-reported and therefore dependent upon patient recall. In addition, medical conditions were self-reported which may have resulted in misclassification of patients into ACIP target groups. Furthermore, patients were surveyed up to six months after their hospitalization, and were asked to recall their opinion of the 2009 H1N1 vaccine, and reasons for declining the vaccine, before their influenza illness. Two influenza vaccines were available during the 2009-2010 influenza season, and confusion about the types of influenza vaccine may have also occurred. In order to minimize recall bias and vaccine confusion, we used survey questions from two national 2009 H1N1 influenza surveys to retain standardization of responses [19,20]. In addition, we trained survey administrators and distinguished between the seasonal and pandemic vaccines. Another potential limitation of

this study was generalizability of results to other patient populations: the survey was conducted among patients hospitalized for 2009 H1N1 in Georgia and may not reflect the knowledge, attitudes, and practices of other patient populations. Furthermore, barriers to 2009 H1N1 vaccination may not be generalizable to seasonal influenza vaccination.

In conclusion, we conducted a survey to learn why people with severe outcomes of 2009 H1N1 had not been vaccinated, even though the vaccine was readily available. To the best of our knowledge, our study is the first to evaluate reasons for non-vaccination among persons who were hospitalized for influenza. This study characterizes numerous missed opportunities for vaccination among these high risk individuals. Our results show that only half of survey respondents in ACIP target groups for 2009 H1N1 vaccination actually knew that they were in one of these groups. We demonstrated that most high risk patients had access to care, and many talked to a healthcare provider about the 2009 H1N1 vaccine, yet were not vaccinated for influenza. Many persons who knew they were in a high risk group still declined vaccination because of concerns about safety and effectiveness. These issues likely represent gaps in communication between public health, the medical community, and the at-risk public. Results from our survey can be used to craft effective prevention messages aimed at these populations at highest risk for influenza. Dissemination of accurate information, in a mechanism that is trusted and accepted by the general public, is critical to improving vaccination rates, both during regular influenza seasons as well as in future pandemics.

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