

## Impact of medical and behavioural factors on influenza-like illness, healthcare-seeking, and antiviral treatment during the 2009 H1N1 pandemic: USA, 2009–2010

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*Received 3 October 2012; Final revision 22 January 2013; Accepted 27 February 2013;  
first published online 25 March 2013*

### SUMMARY

We analysed a cross-sectional telephone survey of U.S. adults to assess the impact of selected characteristics on healthcare-seeking behaviours and treatment practices of people with influenza-like illness (ILI) from September 2009 to March 2010. Of 216431 respondents, 8·1% reported ILI. After adjusting for selected characteristics, respondents aged 18–64 years with the following factors were more likely to report ILI: a diagnosis of asthma [adjusted odds ratio (aOR) 1·88, 95% CI 1·67–2·13] or heart disease (aOR 1·41, 95% CI 1·17–1·70), being disabled (aOR 1·75, 95% CI 1·57–1·96), and reporting financial barriers to healthcare access (aOR 1·63, 95% CI 1·45–1·82). Similar associations were seen in respondents aged  $\geq 65$  years. Forty percent of respondents with ILI sought healthcare, and 14% who sought healthcare reported receiving influenza antiviral treatment. Treatment was not more frequent in patients with high-risk conditions, except those aged 18–64 years with heart disease (aOR 1·90, 95% CI 1·03–3·51). Of patients at high risk for influenza complications, self-reported ILI was greater but receipt of antiviral treatment was not, despite guidelines recommending their use in this population.

**Key words:** Healthcare-seeking behaviour, influenza, influenza A(H1N1)pdm09, influenza antiviral treatment.

### INTRODUCTION

During the 2009 pandemic, the Centers for Disease Control and Prevention (CDC) recommended early empirical influenza antiviral treatment for groups at risk for severe outcomes from influenza A(H1N1)pdm09 virus infection, including persons aged  $\geq 65$

years and persons with underlying medical conditions such as asthma, diabetes, or heart disease [1]. Although evidence suggests that clinicians followed the Advisory Committee on Immunization Practices recommendations for use of antiviral agents in hospitalized patients [2], little is known about the propensity of high-risk persons in the community to seek healthcare for influenza or how frequently they received antiviral treatment.

We utilized the Behavioral Risk Factor Surveillance System (BRFSS) to describe the characteristics of

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Table 1. *Questions posed to respondents in the Behavioral Risk Factor Surveillance System (BRFSS) interview*

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- To determine the presence of ILI in respondents, two questions were asked: ‘During the past month, were you ill with a fever?’ If the respondent answered yes to fever in the past month they were asked ‘Did you also have a cough and/or sore throat?’ A ‘yes’ answer to both was classified as ILI.
  - To determine if medical care was sought by those with ILI, respondents were asked: ‘Did you visit a doctor, nurse, or other health professional for this illness?’
  - To determine the clinical diagnosis, respondents were asked ‘What did the doctor, nurse, or other health professional tell you? Did they say...’ and given the choice of three responses: (1) ‘You had regular influenza or the flu’, (2) ‘You had swine flu, also known as H1N1 or novel H1N1’, or (3) ‘You had some other illness, but not the flu’. A clinical diagnosis of influenza was defined as either the first or second response, and laboratory confirmation of influenza was not required.
  - To determine if an influenza test was administered, respondents were asked, ‘Did you have a flu test that was positive for this illness? Usually a swab from your nose or throat is tested. Would you say...’ and given the choice of three responses: (1) ‘Yes, had flu test and it was positive’, (2) ‘No, had flu test but it was negative’, or (3) ‘No, flu test was not done’. Having an influenza test administered was defined as either the first or second response.
  - To determine if antiviral treatment was given for the illness, respondents were asked ‘Did you receive Tamiflu<sup>®</sup> or oseltamivir or an inhaled medicine called Relenza<sup>®</sup> or zanamivir to treat this illness?’
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ILI, Influenza-like illness.

U.S. adults reporting symptoms consistent with influenza, healthcare-seeking behaviours, and influenza diagnosis and antiviral treatment during the 2009 pandemic.

## METHODS

The BRFSS is a state-based, random-digit-dialled telephone survey among the non-institutionalized U.S. population aged  $\geq 18$  years. It is the main source for state-based data on the prevalence of health-risk behaviours, chronic health conditions, and preventive health services related to chronic disease and injury; the survey methodology is described elsewhere [3].

From 1 September 2009 to 31 March 2010, BRFSS respondents in 49 states (excluding Vermont), the District of Columbia (D.C.), and Puerto Rico were interviewed using a module designed to evaluate the presence of symptoms of influenza-like illness (ILI) [4]. Respondents having fever with either cough or sore throat in the 30 days preceding interview date were defined as having had ILI. To determine if respondents with ILI sought medical care, they were asked if they had visited a healthcare professional for their illness. Respondents with ILI who sought medical care were asked about their clinical diagnosis and whether they were tested for influenza or received antiviral drugs intended for treating influenza (see Table 1 for details of questions in the BRFSS interview).

Self-reported characteristics included demographics, underlying medical conditions, behavioural characteristics, and healthcare access factors. Demographic characteristics evaluated were age; sex; race/ethnicity; educational attainment; and employment status. Underlying medical conditions evaluated were asthma; diabetes (excluding a diagnosis only during pregnancy); heart disease (ever having been diagnosed with myocardial infarction; angina; or coronary heart disease); the World Health Organization’s body mass index (BMI) classification (underweight, normal weight, overweight, obese) as calculated from self-reported weight and height. Disability (limited because of physical, mental, or emotional problems or any health problem that requires the use of special equipment) was also recorded. Behavioural factors evaluated were smoking [current smoker (having smoked at least 100 cigarettes and currently smoke every day or some days), former smoker (having smoked at least 100 cigarettes but currently does not smoke), and never smoked (have not smoked at least 100 cigarettes)]; binge drinking (males having  $\geq 5$  drinks on one occasion; females having  $\geq 4$  drinks on one occasion); and average daily alcohol consumption [non-drinker (no alcohol), moderate drinker ( $\leq 2$  drinks for men;  $\leq 1$  drink for women); and heavy drinker ( $> 2$  drinks for men;  $> 1$  drink for women)]. Indicators of healthcare access evaluated were insurance status at the time of interview for those aged 18–64 years; report of having a personal doctor(s); and report of financial barriers to care

(episodes in the past year when respondent needed to see a doctor but could not because of cost). Persons who reported current asthma, diabetes, or heart disease were defined as having had a high-risk medical condition.

We used SAS-callable SUDAAN<sup>®</sup> v. 10 statistical software (Research Triangle Institute, USA) to calculate population-weighted estimates and corresponding standard errors, 95% confidence intervals (CI), odds ratios (OR), and *P* values, taking into account the complex design of the BRFSS sampling plan. We used linear contrasts and  $\chi^2$  tests to evaluate differences in self-reported ILI, healthcare-seeking behaviour, influenza diagnosis and antiviral drug receipt by selected characteristics. *P* values <0.05 were considered statistically significant. To allow for comparison of the factors evaluated, prevalence estimates were sex- and age-adjusted using the standard year 2000 projected U.S. population when appropriate [5]. Response rates for BRFSS were calculated using Council of American Survey and Research Organization's (CASRO) guidelines.

We examined independent associations between respondent characteristics and the report of ILI and receipt of antiviral treatment using logistic regression models. These models were stratified by age group (respondents aged 18–64 and  $\geq 65$  years old) because the prevalence of underlying medical conditions, behavioural risk factors, and healthcare access differ by age [6]. We used the following candidate variables: age group; sex; race/ethnicity; education attainment; employment status; the presence of asthma, diabetes, heart disease, and disability; BMI classification; smoking, binge drinking, and daily alcohol consumption status; insurance status (excluding persons aged  $\geq 65$  years because Medicare serves as their primary source of reimbursement for medical care); report of a personal doctor and financial barriers to care; and report of a clinical influenza diagnosis or an influenza test (for the influenza treatment model only). To develop multivariable models, we included all candidate variables in a logistic model and removed non-significant variables using step-wise elimination, starting with the variable with the smallest magnitude of effect, until all remaining variables had Wald *F* *P* values <0.05 or removing an additional variable significantly increased the  $-2$  log likelihood of the model. We evaluated confounding by adding each excluded variable back into the final model individually and examining changes in the  $\beta$ -coefficients of the included variables; if addition of one of the

excluded variables caused a change in a  $\beta$ -coefficient of  $\geq 10\%$ , the variable was retained in the model.

## RESULTS

### Report of ILI

From September 2009 to March 2010, self-reported ILI data were available from 216431 respondents. Median survey response rate was 55% (state range 24–74%), calculated as the percentage of persons who completed interviews among all eligible persons, including those who were not contacted. Median cooperation rate was 75% (state range 55–95%), calculated as the percentage of persons who completed interviews among all eligible persons who were contacted.

Of respondents, 8.1% reported ILI in the month before interview [4]. Compared to respondents not reporting ILI, those with ILI were younger and significantly more likely to be women, as well as less educated, unable to work, or disabled (Table 2). Respondents with ILI were also significantly more likely to have a high-risk condition, be current smokers or binge drinkers, lack health insurance, and report financial barriers to care compared to those who did not report ILI. Regardless of the age group examined, respondents with a high-risk condition reported ILI more often than respondents without a high-risk condition ( $P < 0.01$  for all three age groups examined; Fig. 1).

Multivariable logistic regression models controlling for potential confounders identified several factors independently associated with greater ILI in respondents aged 18–64 and  $\geq 65$  years, including a current or former diagnosis of asthma or heart disease, having a disability, being a current smoker, or reporting financial barriers to healthcare (Tables 3 and 4). Respondents aged 18–64 years who were obese also had increased odds of reporting ILI (Table 3). After adjusting for other factors, the association between ILI and diabetes was increased but not significant in either age group.

### Report of healthcare seeking

Of 14601 respondents with ILI, 40% sought healthcare for their illness. Compared to respondents who did not seek healthcare, those who did were more likely to be older, female, and unable to work (Table 2). Several high-risk medical conditions and

Table 2. Age- and sex-adjusted characteristics of respondents aged  $\geq 18$  years who did and did not report influenza-like illness (ILI) and healthcare seeking (Behavioral Risk Factor Surveillance System, 1 September 2009 to 31 March 2010)

Characteristics	Reported ILI			Sought healthcare for ILI		
	Yes (n = 14 611)	No (n = 201 820)	P value	Yes (n = 6463)	No (n = 8138)	P value
Age group						
$\geq 65$ years*	6.7 (0.27)	17.9 (0.14)	<0.01	9.5 (0.52)	4.9 (0.29)	<0.01
Sex						
Male*	42.6 (0.94)	49.0 (0.26)	<0.01	35.6 (1.44)	47.3 (1.24)	<0.01
Race/ethnicity						
White, non-Hispanic (NH)	69.1 (0.93)	68.4 (0.28)	0.45	69.1 (1.59)	69.3 (1.19)	0.93
Black, NH	8.9 (0.61)	10.6 (0.19)	0.01	10.0 (1.33)	8.5 (0.69)	0.32
Hispanic	13.3 (0.75)	14.5 (0.25)	0.15	13.3 (1.22)	13.1 (0.95)	0.93
American Indian/Alaska Native	2.3 (0.39)	1.03 (0.05)	<0.01	1.9 (0.31)	2.5 (0.57)	0.36
Level of education						
Less than high school	13.6 (0.65)	12.0 (0.21)	0.02	13.5 (0.98)	13.5 (0.88)	0.99
High school graduate	33.4 (0.88)	34.0 (0.27)	0.54	32.7 (1.48)	33.6 (1.13)	0.63
Some college/college graduate or more	53.0 (0.90)	54.0 (0.28)	0.26	53.8 (1.51)	52.9 (1.16)	0.64
Employment status						
Employed	51.8 (0.85)	56.2 (0.27)	<0.01	50.0 (1.49)	52.8 (1.16)	0.12
Unemployed	10.9 (0.61)	9.9 (0.20)	0.12	9.8 (1.05)	11.6 (0.77)	0.17
Unable to work	11.4 (0.55)	5.7 (0.11)	<0.01	14.3 (1.19)	9.4 (0.57)	<0.01
Homemaker	6.7 (0.36)	7.9 (0.13)	<0.01	6.1 (0.48)	7.2 (0.55)	0.14
Student	5.6 (0.53)	4.9 (0.17)	0.26	5.7 (0.78)	5.4 (0.69)	0.82
Retired	13.7 (0.35)	15.4 (0.08)	<0.01	14.1 (0.53)	13.5 (0.47)	0.39
Underlying condition						
No chronic†	66.4 (0.84)	79.6 (0.20)	<0.01	62.5 (1.46)	69.5 (1.07)	<0.01
Current asthma	18.3 (0.71)	8.0 (0.15)	<0.01	22.3 (1.28)	15.0 (0.87)	<0.01
Diabetes	12.4 (0.56)	8.8 (0.12)	<0.01	14.6 (1.18)	10.9 (0.64)	<0.01
Heart disease	11.0 (0.54)	6.1 (0.09)	<0.01	12.5 (1.14)	9.82 (0.63)	0.04
Any chronic‡	33.6 (0.84)	20.4 (0.20)	<0.01	37.5 (1.46)	30.5 (1.07)	<0.01
Disability	36.8 (0.81)	21.2 (0.20)	<0.01	41.9 (1.46)	33.4 (1.01)	<0.01
Weight status						
Underweight	1.87 (0.24)	1.78 (0.08)	0.72	1.84 (0.33)	1.77 (0.28)	0.87
Normal weight	31.6 (0.89)	33.6 (0.27)	0.03	29.9 (1.50)	32.9 (1.16)	0.12
Overweight	31.7 (0.83)	36.0 (0.27)	<0.01	32.7 (1.45)	31.4 (1.05)	0.46
Obese	34.8 (0.84)	28.6 (0.26)	<0.01	35.6 (1.34)	34.0 (1.09)	0.36
Pregnancy						
Pregnant*	3.8 (0.81)	4.0 (0.23)	0.83	4.5 (1.12)	3.2 (1.15)	0.41
Smoking status						
Current smoker	29.4 (0.85)	19.4 (0.23)	<0.01	26.2 (1.41)	30.7 (1.07)	0.01
Former smoker	23.9 (0.65)	24.6 (0.20)	0.32	25.7 (1.12)	23.0 (0.83)	0.06
Never smoked	46.6 (0.88)	56.0 (0.27)	<0.01	48.1 (1.49)	46.3 (1.14)	0.33
Alcohol use						
Binge drinker	17.4 (0.74)	15.4 (0.22)	0.01	13.9 (1.09)	19.6 (0.98)	<0.01
Non-drinker	50.7 (0.87)	50.4 (0.28)	0.70	56.1 (1.5)	47.0 (1.10)	<0.01
Moderate drinker	43.8 (0.89)	44.5 (0.28)	0.43	40.2 (1.49)	46.5 (1.14)	<0.01
Heavy drinker	5.5 (0.44)	5.1 (0.13)	0.41	3.8 (0.55)	6.5 (0.60)	<0.01
Healthcare access						
No insurance (aged 18–64 yr)*	22.7 (0.91)	19.7 (0.28)	<0.01	13.6 (1.30)	28.5 (1.23)	<0.01
No personal doctor	19.6 (0.78)	20.4 (0.25)	0.37	9.0 (0.86)	25.9 (1.05)	<0.01
Financial barrier to care	26.5 (0.80)	15.7 (0.23)	<0.01	19.0 (1.01)	31.2 (1.08)	<0.01
Diagnostic testing						
Tested for influenza*	n.a.¶	n.a.¶	n.a.¶	31.8 (1.62)	n.a.¶	n.a.¶
Tested + for influenza§	n.a.¶	n.a.¶	n.a.¶	41.5 (2.82)	n.a.¶	n.a.¶

n.a., Not available.

Values given are% (s.e.).

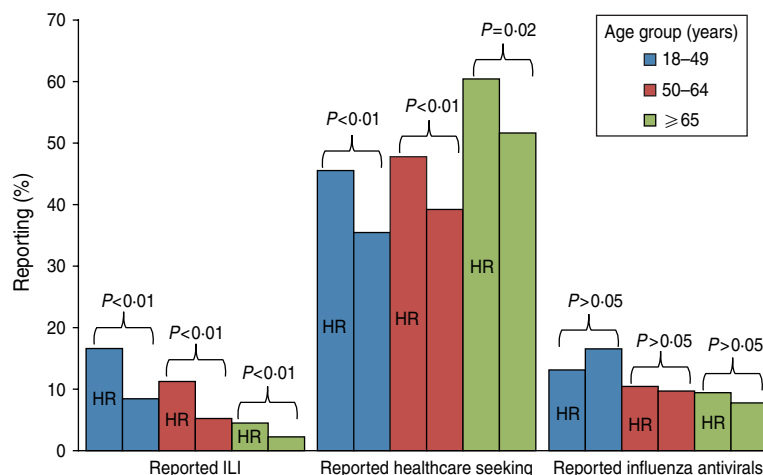
\* Estimate not age- and sex-adjusted since variable includes an age or sex component.

† Respondent never told they had myocardial infarction, angina, coronary heart disease, current asthma, or diabetes.

‡ Respondent ever told they had myocardial infarction, angina, coronary heart disease, current asthma, or diabetes.

§ For respondents who reported an influenza test.

¶ Estimate unavailable because influenza testing and the result only ascertained for respondents with ILI who sought medical care.



**Fig. 1** [colour online]. Comparison between adults aged  $\geq 18$  years with and without high-risk conditions of influenza-like illness (ILI), healthcare seeking for ILI, and influenza antiviral receipt in those who sought care, by age group (Behavioral Risk Factor Surveillance System, 1 September 2009 to 31 March 2010). HR, High-risk respondent (i.e. respondent ever told they had myocardial infarction, angina, coronary heart disease, current asthma, or diabetes).

reported disability were also more common in respondents who sought healthcare. In every age group, respondents with high-risk conditions sought healthcare more often than respondents without high-risk conditions ( $P<0.01$  for respondents aged 18–49 and 50–64 years, and  $P=0.02$  for respondents aged  $\geq 65$  years; Fig. 1). Of respondents who sought healthcare, 32% reported having been tested for influenza and 42% of those tested recalled a positive influenza test result.

Compared to respondents who sought healthcare, those who did not were more likely to be current smokers; be binge, moderate, or heavy drinkers; not have health insurance or a personal doctor; or report financial barriers to healthcare (Table 2).

### Report of a clinical influenza diagnosis

Of 6148 respondents with ILI who sought healthcare, 26% received a clinical diagnosis of influenza. None of the underlying medical conditions, behavioural, or healthcare access factors we analysed varied significantly between those who were and were not diagnosed with influenza (data not shown). However, when compared to respondents not receiving an influenza diagnosis, respondents receiving an influenza diagnosis were more likely to be younger (persons aged 18–64 years: 93.7% of respondents with an influenza diagnosis vs. 89.5% of respondents without an influenza diagnosis,  $P<0.01$ ) and Hispanic (Hispanic: 18.2% of respondents with an

influenza diagnosis, 11.8% of respondents without an influenza diagnosis,  $P=0.02$ ).

### Report of influenza antiviral treatment

Receipt of influenza antiviral treatment was ascertained for 5265 respondents with ILI who sought healthcare. Overall, 14% of respondents and 36% of respondents who received a clinical diagnosis of influenza received influenza antiviral treatment; those receiving antiviral treatment were more likely to have been tested for influenza and received a positive influenza test result (Table 5). Respondents receiving antiviral treatment were also more likely to be younger and employed than respondents who did not receive antiviral treatment. No other underlying conditions, behavioural factors, or healthcare access factors were significantly associated with receipt of antiviral treatment. Notably, having a high-risk condition was not significantly associated with receiving influenza antiviral treatment, regardless of age group ( $P>0.05$  for all three age groups examined, Fig. 1).

Multivariable logistic regression models controlling for potential confounders found an almost 13-fold increased odds of influenza antiviral treatment with an influenza diagnosis in respondents aged 18–64 years (OR 12.7, 95% CI 8.1–20.0) while the effect of an influenza diagnosis was less than half this value for respondents aged  $\geq 65$  years (OR 5.50, 95% CI 2.5–12.0) (see Supplementary Tables S1, S2). Additionally, receiving an influenza test was associated with greater odds of influenza antiviral treatment

Table 3. *Characteristics associated with influenza-like illness (ILI) in respondents aged 18–64 years in multivariable analysis (Behavioral Risk Factor Surveillance System, 1 September 2009 to 31 March 2010)*

Characteristics	aOR (95% CI)
Age group (years)	
18–24	<b>2.47 (2.04–2.99)</b>
25–34	<b>2.04 (1.78–2.34)</b>
35–44	<b>1.66 (1.46–1.88)</b>
45–54	<b>1.33 (1.19–1.48)</b>
55–64	Ref.
Sex	
Female	<b>1.29 (1.17–1.41)</b>
Male	Ref.
Race/ethnicity	
Black, non-Hispanic (NH)	<b>0.75 (0.63–0.90)</b>
Hispanic	0.92 (0.78–1.08)
American Indian/Alaska Native	<b>1.73 (1.17–2.57)</b>
Other, NH	1.11 (0.91–1.36)
White, NH	Ref.
Level of education	
Less than high school	0.90 (0.76–1.05)
High school graduate	0.92 (0.83–1.02)
Some college/college graduate or more	Ref.
Employment status	
Unable to work	1.09 (0.94–1.27)
Unemployed	0.95 (0.81–1.11)
Homemaker	0.92 (0.78–1.07)
Student	0.97 (0.75–1.24)
Retired	<b>0.76 (0.63–0.91)</b>
Employed	Ref.
Asthma	
Current asthma	<b>1.88 (1.67–2.13)</b>
Former asthma	<b>1.43 (1.17–1.75)</b>
Never asthma	Ref.
Diabetes	
Yes	1.15 (0.99–1.34)
No	Ref.
Disability	
Yes	<b>1.76 (1.57–1.96)</b>
No	Ref.
Heart disease	
Yes	<b>1.41 (1.17–1.70)</b>
No	Ref.
Weight status	
Underweight	0.82 (0.60–1.14)
Overweight	0.96 (0.86–1.08)
Obese	<b>1.15 (1.03–1.29)</b>
Normal weight	Ref.
Smoking status	
Current	<b>1.41 (1.27–1.57)</b>
Former	1.00 (0.90–1.11)
Never	Ref.
Binge drinker	
Yes	1.05 (0.91–1.21)
No	Ref.



Table 3 (*cont.*)

Characteristics	aOR (95% CI)
Heavy drinker	
Moderate	1·09 (0·98–1·20)
Heavy	1·11 (0·89–1·39)
Non-drinker	Ref.
Health insurance	
No	0·94 (0·81–1·08)
Yes	Ref.
Personal doctor	
None	0·89 (0·78–1·01)
One or more	Ref.
Financial barrier to care	
Yes	<b>1·63 (1·45–1·82)</b>
No	Ref.

aOR, Adjusted odds ratio.

for respondents aged 18–64 years (OR 2·7, 95% CI 1·8–4·1) and  $\geq 65$  years old (OR 2·4, 95% CI 1·1–5·4). Respondents aged 25–34 years (OR 2·1; 95% CI 1·0–4·2) or who reported heart disease (OR 1·90; 95% CI 1·0–3·5) had increased odds of receiving influenza antiviral treatment, and persons reporting unemployment had decreased odds of receiving influenza antiviral treatment (OR 0·4, 95% CI 0·2–0·88). Respondents aged  $\geq 65$  years who reported other employment (unemployed, homemaker, student, or retired) (OR 0·30, 95% CI 0·11–0·85) or having no personal doctor (OR 0·02, 95% CI 0·00–0·48) had decreased odds of receiving influenza antiviral treatment.

## COMMENT

This large study of community-dwelling persons during the 2009 pandemic found that prevalence of ILI and healthcare seeking for ILI varied by underlying medical condition, behavioural factors, and healthcare access factors of respondents. In contrast, treatment of influenza with antiviral agents was similar in patients with and without many of the high-risk conditions evaluated and was decreased in the unemployed and patients aged  $\geq 65$  years.

Younger adults, current smokers, and those reporting asthma, heart disease, or disability were more likely to report ILI, suggesting an increased susceptibility to ILI in these groups. Increased illness from H1N1pdm09 virus infection in younger persons is well documented [7, 8], but to our

knowledge, no study has systematically assessed influenza susceptibility or the likelihood of developing ILI in those with high-risk conditions, and behavioural risk factors (e.g. smoking or heavy alcohol consumption) [9]. Limited evidence can be found in vaccine trials, community studies, or outbreak investigations, which suggest that smoking [10–15], asthma [16–20], obesity [19], and heart disease [21] are associated with either increased ILI, increased influenza, or an increased likelihood of developing ILI, although findings are not specific to H1N1pdm09 or the age groups evaluated in this study. Moreover, other studies fail to confirm these relationships [22–24].

Our results also suggest that adherence by health-care providers to antiviral treatment recommendations during the pandemic was poor in the outpatient setting. Receipt of antiviral treatment was uncommon in adults with ILI who sought care for their illness and was not significantly affected by the presence of most high-risk conditions. In this survey, asthma, diabetes, heart disease, and age  $\geq 65$  years were associated with greater healthcare seeking for ILI. However, no high-risk condition, except heart disease in respondents aged 18–64 years, was significantly associated with greater receipt of influenza antiviral treatment compared to persons without these high-risk conditions. Additionally, although not significant, the effect of a clinical diagnosis of influenza on receipt of antiviral treatment in respondents aged  $\geq 65$  years was half that of respondents aged 18–64 years, and overall proportions of influenza antiviral treatment in this age group were low. For adults,

Table 4. *Characteristics associated with influenza-like illness in respondents aged  $\geq 65$  years (Behavioral Risk Factor Surveillance System, 1 September 2009 to 31 March 2010)*

Characteristics	aOR (95% CI)
Age group (years)	
65–74	<b>1.78 (1.48–2.16)</b>
$\geq 75$	Ref.
Sex	
Female	<b>1.36 (1.13–1.64)</b>
Male	Ref.
Race/ethnicity	
Black, non-Hispanic (NH)	0.74 (0.51–1.09)
Hispanic	0.94 (0.64–1.40)
American Indian/Alaska Native	<b>2.69 (1.17–6.15)</b>
Other, NH	1.18 (0.70–1.98)
White, NH	Ref.
Level of education	
Less than high school	1.08 (0.83–1.39)
High school graduate	0.87 (0.72–1.04)
Some college/college graduate or more	Ref.
Employment status	
Unable to work	1.39 (0.93–2.07)
Unemployed, homemaker student, or retired	0.89 (0.71–1.12)
Employed	Ref.
Asthma	
Current asthma	<b>2.74 (2.24–3.36)</b>
Former asthma	<b>1.52 (1.02–2.25)</b>
Never asthma	Ref.
Diabetes	
Yes	1.18 (0.97–1.42)
No	Ref.
Disability	
Yes	<b>1.73 (1.45–2.05)</b>
No	Ref.
Heart disease	
Yes	<b>1.54 (1.27–1.85)</b>
No	Ref.
Smoking status	
Current	<b>1.74 (1.32–2.30)</b>
Former	<b>1.21 (1.01–1.45)</b>
Never	Ref.
Binge drinker	
Yes	0.66 (0.39–1.11)
No	Ref.
Heavy drinker	
Moderate	0.96 (0.79–1.16)
Heavy	<b>0.48 (0.27–0.86)</b>
Non-drinker	Ref.
Personal doctor	
None	0.71 (0.51–1.00)
One or more	Ref.
Financial barrier to care	
Yes	<b>1.71 (1.32–2.23)</b>
No	Ref.

aOR, Adjusted odds ratio.



Table 5. Age- and sex-adjusted prevalence of characteristics of adults with influenza-like illness who sought healthcare and did/did not report receipt of influenza antiviral drugs (Behavioral Risk Factor Surveillance System, 1 September 2009 to 31 March 2010)

Characteristics	Receipt of influenza antiviral drugs, % (S.E.)		P value, yes vs. no
	Yes (n = 620)	No (n = 4645)	
Age group (years)			
≥ 65 years*	5.29 (0.94)	9.26 (0.58)	<0.01
Sex			
Male*	33.0 (3.57)	34.8 (1.65)	0.65
Race/ethnicity			
White, non-Hispanic (NH)	66.5 (3.55)	71.8 (1.78)	0.18
Black, NH	7.9 (1.51)	9.6 (1.37)	0.40
Hispanic	16.9 (3.09)	11.7 (1.29)	0.12
American Indian/Alaska Native	Not available†	Not available†	—
Level of education			
Less than high school	15.3 (2.80)	12.4 (1.07)	0.32
High school graduate	32.5 (3.26)	31.7 (1.56)	0.83
Some college/college grad or more	52.1 (3.54)	55.9 (1.69)	0.34
Employment status			
Employed	51.3 (3.34)	51.7 (1.64)	0.91
Unemployed	5.8 (1.34)	10.5 (1.36)	0.01
Unable to work	12.1 (1.77)	13.1 (0.89)	0.61
Homemaker	8.9 (1.77)	5.46 (0.48)	0.06
Student	8.3 (2.51)	4.9 (0.84)	0.20
Retired	13.6 (1.59)	14.3 (0.55)	0.68
Underlying condition			
No chronic‡	65.5 (3.01)	62.9 (1.36)	0.42
Current asthma	20.5 (2.76)	21.2 (1.09)	0.83
Diabetes	14.4 (2.05)	13.3 (0.87)	0.64
Heart disease	13.0 (1.88)	11.6 (0.73)	0.48
Any chronic§	34.5 (3.01)	37.1 (1.36)	0.42
Disability	40.5 (3.36)	39.1 (1.45)	0.72
Weight status			
Underweight	1.93 (0.74)	1.52 (0.25)	0.59
Normal weight	27.9 (3.25)	30.0 (1.67)	0.57
Overweight	35.6 (3.48)	31.6 (1.63)	0.30
Obese	34.6 (3.43)	36.9 (1.62)	0.54
Pregnancy			
Pregnant*	Not available†	Not available†	—
Smoking status			
Current smoker	26.8 (3.36)	23.9 (1.29)	0.42
Former smoker	22.1 (2.40)	26.6 (1.32)	0.10
Never smoked	51.0 (3.47)	49.6 (1.64)	0.70
Alcohol use			
Binge drinker	16.5 (2.84)	13.3 (1.20)	0.29
Non-drinker	56.4 (3.36)	55.4 (1.70)	0.78
Moderate drinker	41.0 (3.37)	40.4 (1.72)	0.87
Heavy drinker	2.6 (0.90)	4.2 (0.76)	0.16
Healthcare access			
No insurance (age 18–64 yr)*	12.2 (2.75)	13.5 (1.35)	0.68
No personal doctor	6.9 (1.52)	10.0 (1.13)	0.10
Financial barrier to care	19.9 (2.92)	19.5 (1.21)	0.90
Clinical diagnosis			
Received influenza dx	75.3 (3.05)	22.9 (1.55)	<0.01
Diagnostic testing			
Tested for influenza	54.1 (3.60)	27.0 (1.60)	<0.01
Tested + for influenza¶	77.8 (3.29)	28.4 (3.05)	<0.01

\* Estimate not age- and sex-adjusted since variable includes an age or sex component.

† Estimate unavailable because the unweighted sample size for the denominator is <50 or the confidence interval half width is >10.

‡ Respondent never told they had myocardial infarction, angina, coronary heart disease, current asthma, or diabetes.

§ Respondent ever told they had myocardial infarction, angina, coronary heart disease, current asthma, or diabetes.

¶ Respondents who reported an influenza test.

these underlying medical conditions, as well as age  $\geq 65$  years, are known to increase the risk for complications from influenza [9]. During the 2009 pandemic, early antiviral treatment was recommended for persons with high-risk conditions, regardless of influenza severity [1]. Prompt treatment with antiviral medications has been shown to reduce the risk of complications from seasonal influenza [25, 26], and treatment for persons with high-risk conditions should not be delayed while awaiting results of diagnostic testing. In this study, however, the likelihood of receiving antiviral treatment was much greater in those who received an influenza test than in those who did not, although we were unable to distinguish patients who received antiviral treatment concurrently with an influenza test being ordered from those who received treatment after an influenza test result was known. The widespread reports that persons aged  $\geq 65$  years may have some pre-existing immunity to H1N1pdm09 may have contributed to the reduction in influenza antiviral treatment, as well as the small decrease in influenza diagnosis compared to those aged  $< 65$  years. However, an explanation for the lack of increased antiviral receipt in those with high-risk conditions remains unclear.

Less than half of respondents overall sought healthcare for ILI, and healthcare access factors reduced healthcare-seeking behaviour. Lack of insurance (for respondents aged 18–64 years), a personal doctor, or the ability to afford healthcare reduced healthcare seeking significantly in the nearly 15000 respondents with ILI in this study. Additionally, although unemployed respondents were not less likely to seek healthcare, those who did were less likely to receive influenza antiviral treatment. Thus, it is possible that access to appropriate medical care, including receipt of influenza antiviral drugs, may have been affected for some persons by their healthcare access or employment status. Unemployment and lack of medical insurance have been associated with delayed or missed medical care or prescriptions because of cost [27, 28] while adults with a personal doctor experience improved health outcomes [29]. Furthermore, the U.S. unemployment rate may be associated with increased state reports of widespread influenza [30], and more severe outcomes from seasonal and H1N1pdm09 influenza infection have been observed in high poverty areas [31, 32]. If receipt of appropriate medical care was affected by access to healthcare or unemployment status, then the 10% of adults who reported unemployment [33], the 15% of adults who

reported foregoing medical care because of cost [34], and the almost 18% of persons aged 18–64 years who reported a lack of health insurance [34] during the 2009 pandemic could represent an unexplored risk group. To prepare for future pandemics, a better understanding of how reduced healthcare access may affect the appropriate treatment of persons with ILI is needed.

Interestingly, we also found that respondents who reported financial barriers to healthcare were more likely to report ILI, even after controlling for age, medical conditions, and employment. The reasons for this are unclear, but adults who report financial barriers to healthcare are more likely to have chronic conditions or poor health status [35]. Therefore, these respondents may have had other chronic conditions not evaluated in this study that place them at increased risk for influenza or may represent persons with poorly controlled chronic medical conditions.

This report is subject to several limitations. First, data in this study are self-reported and subject to recall and social desirability bias. Therefore, report of a clinical diagnosis of influenza or receiving an influenza diagnostic test may not represent actual clinical practice or decision-making. However, most estimates for chronic disease prevalence and high-risk behaviours from the BRFSS are similar when compared to other national surveys [36]. Additionally, the trends in ILI and receipt of influenza antiviral treatment in this report are similar to independent U.S. estimates of the number of H1N1pdm09 cases and the number of antiviral drug prescriptions filled for the treatment of influenza [7, 37]. Second, we only assessed risk factors available in the BRFSS during the 2009–2010 influenza season; we did not have information on other medical conditions known to confer increased risk for complications from influenza, which range in prevalence from  $< 1\%$  to  $4.4\%$  in the U.S. adult population [9, 38]. Therefore, some persons with high-risk conditions could be misclassified as not having high-risk medical conditions. However, we included those who reported any type of disability to capture some of these persons [39]. Third, we did not ascertain the duration between illness onset and first healthcare encounter for persons reporting ILI. Effectiveness of influenza antiviral treatment declines between 2 and 7 days after illness onset [9], and physicians may be less likely to prescribe antiviral treatment to individuals presenting during this period. Thus, the proportion of respondents receiving influenza antiviral treatment we report may

underestimate the fraction that would have been treated if presenting earlier. The 2010–2011 BRFSS ILI survey contains the time from illness onset to first healthcare encounter; inclusion of these data will help address this weakness in future analyses. Fourth, BRFSS data are collected only from households with a landline telephone, and our study is subject to selection bias resulting from exclusion of households with only cellular phones [40]. Finally, the BRFSS is a household survey that does not collect information from persons in institutions, nursing homes, long-term-care facilities, and correctional institutions. Therefore, the results presented in this analysis do not generalize to these populations.

In conclusion, our findings suggest a higher risk for symptomatic influenza in persons with certain underlying medical conditions, behavioural factors, and healthcare access restrictions. It also identified areas of the 2009 pandemic response that could have been improved. Despite recommendations to administer prompt antiviral treatment to high-risk individuals or persons aged  $\geq 65$  years with suspected or confirmed influenza, receipt of influenza antivirals was not significantly higher for these groups. The data on antiviral use in high-risk or persons aged  $\geq 65$  years presented in this report can inform communication efforts to physicians who care for these populations and improve compliance with antiviral treatment guidance. Finally, reduced healthcare access observed in this report may have delayed or prevented appropriate medical care for some respondents with ILI; future pandemic planning efforts should consider individual barriers to healthcare when designing response strategies.

#### SUPPLEMENTARY MATERIAL

For supplementary material accompanying this paper visit <http://dx.doi.org/10.1017/S0950268813000654>.

#### ACKNOWLEDGEMENTS

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

#### DECLARATION OF INTEREST

None.

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