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Prevalence of influenza-specific vaccination hesitancy among adults in the United States, 2018[★]

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Abstract

Background: The role of vaccine hesitancy on influenza vaccination is not clearly understood. Low influenza vaccination coverage in U.S. adults suggests that a multitude of factors may be responsible for under-vaccination or non-vaccination including vaccine hesitancy. Understanding the role of influenza vaccination hesitancy is important for targeted messaging and intervention to increase influenza vaccine confidence and uptake. The objective of this study was to quantify the prevalence of adult influenza vaccination hesitancy (IVH) and examine association of IVH beliefs with sociodemographic factors and early-season influenza vaccination.

[★]The findings and conclusions in this paper are those of the authors and do not necessarily represent the views of CDC.

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AS conceived and designed the study, obtained the data, proposed and performed the statistical analyses, contributed to the literature search, drafted the manuscript, and reviewed/edited the manuscript. He had access to all data and takes the responsibility for their integrity. P.J.L. contributed to conception and design of the study, data assurance, and reviewed/edited the manuscript. AA, JAD, MS, JLR, PJS, AMF, SMG, KHN, and CLB contributed to conception and design of the study and reviewed/edited the manuscript. All authors have reviewed and approved the submitted version of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Methods: A four-question validated IVH module was included in the 2018 National Internet Flu Survey. Weighted proportions and multivariable logistic regression models were used to identify correlates of IVH beliefs.

Results: Overall, 36.9% of adults were hesitant to receive an influenza vaccination; 18.6% expressed concerns about vaccination side effects; 14.8% personally knew someone with serious side effects; and 35.6% reported that their healthcare provider was *not* the most trusted source of information about influenza vaccinations. Influenza vaccination ranged from 15.3 to 45.2 percentage points lower among adults self-reporting any of the four IVH beliefs. Being female, age 18–49 years, non-Hispanic Black, having high school or lower education, being employed, and not having primary care medical home were associated with hesitancy.

Conclusions: Among the four IVH beliefs studied, being hesitant to receiving influenza vaccination followed by mistrust of healthcare providers were identified as the most influential hesitancy beliefs. Two in five adults in the United States were hesitant to receive an influenza vaccination, and hesitancy was negatively associated with vaccination. This information may assist with targeted interventions, personalized to the individual, to reduce hesitancy and thus improve influenza vaccination acceptance.

Keywords

Influenza vaccination hesitancy; Influenza vaccination; Vaccination acceptance

1. Introduction

Influenza vaccination is the most effective strategy to prevent influenza and influenza-related complications. Previous studies of influenza illnesses and hospitalizations that could be averted by vaccination have indicated that higher vaccination rates could prevent a substantial number of influenza cases and hospitalizations [1,2]. For example, one of the most recent studies showed that a 5% increase in influenza vaccination coverage would result in 785,000 fewer illnesses (56% among those aged 18–64 years) and 11,000 fewer hospitalizations in the U.S. [2]. The Advisory Committee on Immunization Practices in the U.S. recommends that all people six months and older with no contraindications receive an influenza vaccination annually [3]. Yet, influenza vaccination uptake among U.S. adults aged 18 years is low; <50% of adults received the influenza vaccination in the 2021–22 season [4], suggesting that a multitude of factors may be responsible for under-vaccination or non-vaccination including vaccine hesitancy [5].

Factors that may contribute to lower vaccination coverage include concerns about vaccine safety, negative beliefs based on myths, mistrust in healthcare professional or healthcare system, missed opportunities for vaccination during healthcare visits, and vaccine hesitancy [6]. The role of vaccine hesitancy on influenza vaccination is not clearly understood. Understanding the role of influenza vaccination hesitancy (IVH) is important for targeted messaging and intervention to increase influenza vaccine confidence and uptake.

Although there is a lack of consensus on the definition of vaccine hesitancy, it can be defined as a mental state that produces indecision regarding vaccination, resulting in delayed

vaccination or non-vaccination despite availability of vaccination services [7,8]. Concerns about vaccine adverse events, skepticism about vaccine effectiveness, lack of trust in those recommending the influenza vaccination, and perception that risk of (severe) influenza is low have been reported to further hesitancy [9]. Unique features that can affect IVH are perceived low influenza vaccination effectiveness, annual variation in vaccine effectiveness, and that vaccination is required annually [5].

There is no one-size-fits-all approach that will work for addressing the multidimensional nature of vaccine hesitancy. Understanding factors associated with IVH can help the development of interventions to reduce IVH with the goal of increasing vaccination coverage and reducing influenza burden. This study aimed to quantify the prevalence of personal IVH, including specific hesitancy beliefs, among U.S. adults overall and by early-season influenza vaccination status, to examine the independent association of sociodemographic factors on IVH, and to assess population attributable fraction of IVH among adults who did not receive the influenza vaccine.

2. Methods

We analyzed data from the National Internet Flu Survey (NIFS), a nationally representative, probability-based Internet panel survey. The NIFS collects information about early-season influenza vaccination (coverage estimates represent the approximate cumulative proportion of adults vaccinated as of November 15, 2018) and knowledge, attitudes, behaviors, and barriers related to influenza and influenza vaccination in the noninstitutionalized U.S. adult population aged ≥18 years. The NIFS was conducted for the Centers for Disease Control and Prevention (CDC) by RTI International and GfK Custom Research, LLC for the 2014–2018 influenza seasons. Detailed NIFS survey methodology is presented elsewhere [10]. A total of 4,286 respondents completed the survey, with a completion rate of 53.1%. The 2018 NIFS data analyzed here were conducted during November 1–November 15, 2018.

In 2016–17, CDC developed and tested survey questions to measure vaccine hesitancy in collaboration with the National Center for Health Statistics' Questionnaire Design Research Laboratory [11]. Briefly, through a series of focus groups and iterative cognitive interviews conducted with parents, a list of both new and existing questions borrowed from existing federal health and other surveys was reduced to sets of 1-, 3-, and 5-minute vaccine hesitancy stand-alone modules [12,13]. The resulting 1-minute vaccine hesitancy module included six questions designed to measure vaccine hesitancy about *all* childhood vaccinations, as validated and described previously [14–17]. These questions on vaccine hesitancy were validated as individual data-producing questions and not designed to be scaled up to a single metric and were based on modified conceptual framework including elements of the Health Belief Model within the Behavioral Model of Health Service Use [11,15–17]. Briefly, the modified Behavioral Model for Vaccine Hesitancy provides a framework to describe determinants of hesitancy or determinants of vaccination behavior such as the environment, the characteristics of a population, specific health behaviors (e.g., vaccination), and health outcomes (e.g., perceived health, patient satisfaction) as they relate to vaccine hesitancy [11]. Four of the questions from this 1-minute module were adapted for the NIFS, with wording altered slightly to ask about the adult respondent's attitudes towards

personal influenza vaccination: (a) *Overall, how hesitant are you about flu vaccinations?* (not at all hesitant, not that hesitant, somewhat hesitant, very hesitant, don't know/refused); (b) *did concerns about serious, long-term side effects impact your decision to get a flu vaccination?* (yes, no, don't know/refused); (c) *do you personally know anyone who has had a serious, long-term side effect from a flu vaccination?* (yes, no, don't know/refused); and, (d) *is your doctor or health provider your most trusted source of information about flu vaccinations?* (yes, no, don't know/ refused).

For ease of analysis and interpretation, the four response categories for the “Overall how hesitant are you” question were collapsed into two categories: “not at all hesitant” was combined with “not that hesitant,” and “somewhat hesitant” was combined with “very hesitant.” For all four questions, a small percentage of respondents answered “don't know” or refused the question; we did not exclude these respondents from the analyses because we did not consider these responses to be missing at random given the nature of the hesitancy questions, as described previously [15]. The “don't know” and refused responses were recoded as follows for the four questions, respectively: (a) grouped with non-hesitant (2.3% and 0.7%); (b) grouped with no concern (4.9% and 1.1%); (c) grouped with yes (5.5% and 1.1%); and (d) grouped with no (9.5% and 1.3%). As described previously [15], the recoding in this study also did not have an impact on overall results from the small percentages missing.

Early-season influenza vaccination as of mid-November 2018 was assessed with the question: “*Since July 1, 2018, have you had a flu vaccination?*” Sociodemographic characteristics included in this study were sex, age, race/ethnicity, marital status, highest educational level, employment status, annual household income, having a primary care medical home to go when sick, high-risk status for influenza complications, health insurance coverage, and metropolitan statistical area status.

All estimates presented here are calculated with survey weights to reflect the random sampling design and adjustments intended to lower nonresponse bias [10]. Proportions for the four IVH questions were calculated overall and by sociodemographic variables. Unadjusted early-season influenza vaccination rates were estimated by the IVH beliefs. Multivariable logistic regression with predictive marginals was used to calculate early-season influenza vaccination coverage by hesitancy status adjusted for sociodemographic variables and differences in the adjusted coverage by hesitancy status. Multivariable logistic regression models with predictive marginals were also conducted to evaluate independent associations of sociodemographic factors with the IVH beliefs. The dependent variable for each model was a *single* IVH belief variable; the independent variables included all available sociodemographic variables. Adjusted prevalence differences are reported. Because the four NIFS IVH belief questions could have represented the same hesitancy construct, the interrelationships were assessed by cross-tabulations of responses to each question by every other question. In addition, the adjusted population attributable fraction (PAF) previously described elsewhere [14] was calculated to assess the potential contribution of vaccination hesitancy to the observed non-vaccination.

Weighted proportions, 95% confidence intervals, prevalence differences, and statistical tests were calculated using SAS and SAS-callable SUDAAN (Software for the statistical analysis of correlated data, Research Triangle Institute, Research Triangle Park, NC, version 11.00) software to account for the sampling design. All analyses were weighted to the adult noninstitutionalized civilian population of the United States. Differences in early-season influenza coverage by IVH beliefs and by sociodemographic variables were tested using two-tailed *t* tests with a significance level set at $p < 0.05$.

3. Results

National prevalences of adult IVH beliefs are reported in Table 1. Overall, 36.9% of adults aged 18 years reported being hesitant (19.7% very hesitant and 17.2% somewhat hesitant [data not shown]) about influenza vaccination. The prevalence of concern about serious, long-term side effects impacting the respondent's decision to get an influenza vaccination was 18.6%. The prevalence of personally knowing someone who has had a serious, long-term side effect from an influenza vaccination was 14.8%. Additionally, the prevalence of *not* considering their doctor or health provider as the most trusted source of information about influenza vaccinations was 35.6% (Table 1).

The interrelationship of the responses to the four IVH questions is reported in Table 2. Responses to the question “*Overall, how hesitant are you about influenza vaccinations*” were strongly associated with responses to the other three IVH questions. Among adults somewhat/very hesitant about influenza vaccination, 39.4% also reported having concerns about serious, long-term side effects compared with 6.5% for those who were not at all/not that hesitant. Likewise, among those who reported being hesitant about influenza vaccination, 23.3% personally knew someone who had a serious, long-term side effect from an influenza vaccination and 47.7% reported that their doctor or health provider was *not* the most trusted source of information about influenza vaccinations. Among those reporting having concerns about serious, long-term side effects, 78.1% were hesitant, 35.0% personally knew someone who had a serious, long-term side effect from an influenza vaccination, and 45.7% reported that their doctor or health provider was *not* the most trusted source of information about influenza vaccinations. Among those reporting personally knowing someone who has had a serious, long-term side effect from an influenza vaccination, 58.3% were hesitant, 44.1% had concerns about serious, long-term side effects that impacted their decision to get an influenza vaccination, and 55.2% reported that their doctor or health provider was *not* the most trusted source of information about influenza vaccinations. Among those who reported that their doctor or health provider was *not* the most trusted source of information about influenza vaccinations, 49.5% were hesitant, 23.9% had concerns about serious, long-term side effects that impacted their decision to get an influenza vaccination, and 23.0% personally knew someone who had a serious, long-term side effect from an influenza vaccination.

Unadjusted and adjusted early-season influenza vaccination coverage by the IVH beliefs are reported in Table 3. All four IVH belief variables were strongly associated with early-season influenza coverage. Adjusted vaccination coverage was 45.2 percentage points lower among adults who reported being somewhat/very hesitant about influenza vaccinations compared

with adults who were not at all/not that hesitant. The adjusted prevalence differences in vaccination coverage ranged from 15.3 to 45.2 percentage points across the four IVH belief variables, thus indicating lower influenza coverage among adults who report elements of vaccination hesitancy as defined by the constructs measured in the NIFS.

Results of the unadjusted prevalences and adjusted prevalence differences based on the multivariable logistic regression analyses of factors associated with each IVH belief are presented in Table 4. Compared with males, females were more likely to be hesitant and have concerns about serious, long-term side effects that impacted their decision to get an influenza vaccination. Compared with adults aged 18–49 years, adults aged ≥ 65 years were more likely to have their doctor or health provider as their most trusted source of information about influenza vaccinations. Compared with non-Hispanic White adults, non-Hispanic Black adults were more likely to be hesitant, have concerns about serious side effects, and personally know someone who had a serious, long-term side effect from an influenza vaccination. Hispanic adults were also more likely to have concerns about serious side effects compared with non-Hispanic White adults. Compared with adults with an annual household income <\$35,000, adults with an annual household income between \$50,000–\$74,999 were more likely to be hesitant. Compared with adults who had a primary care medical home, adults who did not have a primary care medical home were more likely to be hesitant and to report that their doctor or health provider is *not* their most trusted source of information about influenza vaccinations. Compared with adults having health insurance, adults without health insurance were more likely to state that their doctor or health provider is *not* their most trusted source of information about influenza vaccinations. Similarly, compared with adults aged 18–49 years, adults aged ≥ 65 years were less likely to be hesitant and to personally know someone who has had a serious, long-term side effect from an influenza vaccination. Adults having some college or higher education and those not employed/not in the work force were less likely to be hesitant or have concerns about serious side effects compared with adults having high school or lower education and adults who are employed, respectively. Compared with adults with an annual household income <\$35,000, adults with an annual household income between \$50,000–\$74,999 were less likely to personally know someone who had a serious side effect; and adults with annual household income ≥ \$75,000 were less likely to have concerns about serious side effects and to personally know someone who had a serious side effect. Compared with adults having high-risk medical conditions, adults with no high-risk conditions were less likely to have concerns about serious vaccination side effects and to report that their doctor or health provider is *not* their most trusted source of information about influenza vaccinations. Most of the differences observed in the unadjusted prevalences also persisted after adjustment for all the sociodemographic factors included in this study (Table 4). The adjusted PAF calculated to assess the potential contribution of vaccination hesitancy to the observed non-vaccination was 30.8% (95% CI: 28.0%–33.8%) (data not presented).

4. Discussion

Among the four IVH beliefs studied in 2018, being hesitant to receiving influenza vaccination followed by mistrust of healthcare providers were reported by approximately two in five adults aged ≥ 18 in the United States as the most influential influenza

hesitancy beliefs. Overall, the self-reported hesitancy estimate found in this study was higher compared with hesitancy estimates reported elsewhere [18,19]. The differences in point estimates might be due to differences in populations studied, timing, sampling design, mode of the surveys, or other survey attributes. About one fifth of adults were estimated to have concerns about serious, long-term side effects that impacted their decision to get an influenza vaccination and one sixth personally knew someone who had a serious, long-term side effect from an influenza vaccination. An estimated two fifths of adults do *not* feel that their doctor or health provider is their most trusted source of information about influenza vaccinations. The associations shown in this study between the IVH variables and adult influenza vaccination coverage suggest that initiatives to reduce IVH may increase influenza vaccination coverage.

The adjusted PAF helps to identify the proportion of non-vaccination “attributable” to hesitancy; the results obtained in this study suggests that 31% of the non-vaccination among the unvaccinated adults is attributable to hesitancy, and that 31% of the prevalence of non-vaccination could be reduced if hesitancy among adults was eliminated. Efforts are needed to understand and address adults’ concerns about influenza vaccine and to improve motivation to become vaccinated. Resources for healthcare providers to help them address the concerns of vaccine-hesitant adults are available [20–22].

Among adults who reported any of the IVH beliefs studied in the NIFS, influenza vaccination among the hesitant population ranged from 15.3 to 45.2 percentage points lower than adults who did not report such beliefs, consistent with previous research [23]. However, it is important to note that 17%–35% of adults aged 18 years received influenza vaccination despite reporting a hesitancy belief; this suggests a complex association between vaccination hesitancy, and despite having some hesitant beliefs, other motivators for vaccination may be impacting decision making in regard to receipt of influenza vaccination. Following the Standards for Adult Immunization Practice, ensuring that all persons who visit a healthcare provider during the influenza season receive a vaccination recommendation and an offer to vaccinate them during the visit, and using evidence-based interventions such as provider reminder systems and standing orders programs could improve coverage [24,25].

Adults who did not have a primary care medical home were more likely to report being hesitant to receive influenza vaccination and to *not* trust a doctor or health provider as their primary source for information about influenza vaccinations. Also, among those adults who were hesitant, about half also did *not* designate their healthcare provider as their most trusted source for information about influenza vaccinations; for those who did *not* report their provider as the most trusted source, about half were hesitant to receive influenza vaccination, suggesting one hesitancy belief may accentuate the other. Examining the interrelationship with the other IVH beliefs also revealed similar findings, further emphasizing the complexity of the vaccination hesitancy construct. These findings suggest that adults less likely to access healthcare have less opportunity to discuss vaccination hesitancy concerns with a provider or receive strong provider recommendations for vaccination, alleviate concerns, and improve trust in their healthcare providers, possibly leading to a higher likelihood of the adult being unvaccinated and sustained vaccination

hesitancy, and may also have a general distrust in the medical system. Not having a regular source of care (e.g., primary care physician) has been reported to hinder vaccination uptake and increase vaccination hesitancy [26–31]. In this study, however, an estimated 65% of adults report that their doctor or health provider is the most trusted source of information about influenza vaccinations, suggesting healthcare providers are positioned to normalize and increase acceptance for vaccines by strongly recommending routine vaccination of adults. These findings further reinforce the importance of having a primary care medical home and access to a healthcare provider in reducing vaccination hesitancy and increasing coverage. Having a primary care medical home and strong provider recommendation have been linked with higher influenza vaccination [30,32–37]. In addition, awareness of the need for adults to be vaccinated is low among the general population, and adult patients rely on provider recommendations for vaccination [34,36,38,39]. Lastly, overcoming myths and misinformation about vaccines requires educating stakeholders and engaging with trusted messengers to provide accurate and reliable information about vaccines. Recommendations, information, or assurances from healthcare providers have increased acceptance of vaccination and changed patients' intent to delay or refuse vaccination [40,41]. Patients usually trust the opinions of healthcare providers regarding vaccination more so than opinions from others [25,42].

The prevalence of people reporting knowing someone with a serious, long-term side effect was high relative to, for example, the prevalence measured in the Vaccine Adverse Effect Reporting System and other reporting systems [43], which suggests that these beliefs may be based on their perceptions of risk rather than true events, and some people are misusing this argument to avoid vaccination. There may be an upward bias in respondents reporting they know someone personally who has had a serious, long-term side effect from a vaccine, because serious side effects are rare according to vaccine safety data [43]. Possible solutions to mitigate this could include clear education on true population-based prevalence of rare adverse events after vaccination, more public communication about vaccine safety monitoring systems, or provider communication about common expected side effects and emphasis that these common side effects are temporary.

This study used multivariable logistic models to identify factors associated with four IVH beliefs. Non-Hispanic Black adults and Hispanic adults were more likely to report being hesitant or have concerns than non-Hispanic White adults, and these results persisted even after adjusting for other sociodemographic factors. Racial and ethnic disparities in adult vaccination coverage are well documented [30,44]. Differences in attitudes toward vaccination and preventive care, propensity to seek and accept vaccination, variations in the likelihood that providers recommend vaccination, differences in quality of care received by racial and ethnic populations, and differences in concerns about vaccination including vaccine safety may help explain the racial and ethnic difference in hesitancy and concerns as observed in this study [35,45–47].

Some studies reported being female and older decreased vaccination acceptance, while other studies suggest the opposite [28,30,48–51]; consequently, the reasons why these variables either decrease or increase vaccine acceptance are not well understood. However, characteristics like ethnicity or gender have been suggested as carrier variables [52] of

explanatory factors rather than explanatory factors of hesitancy themselves, meaning that these variables are potential confounders of variables that actually determine vaccination hesitancy [5]. It has been suggested that while such variables may be significantly related to vaccination hesitancy, they cannot be used to explain its emergence or intensity, and though they may have some value in determining the target group of interventions, psychological variables instead should be used to inform the design of the intervention [5]. In the analyses presented here, however, no specific causal model or hypothesis was posed for the relationship between each IVH belief and the sociodemographic characteristics in this study. Thus, although multiple factors were identified as having independent association with a higher or lower likelihood of IVH belief, the relative importance of these factors with respect to their association with IVH belief cannot be determined from this analysis.

4.1. Strengths and limitations

This study is subject to several limitations. First, vaccination was reported early in the vaccination season; respondents might have been vaccinated after the survey was completed. Second, data for this study were collected by self-report and vaccination was not verified by medical records; consequently, the estimates may be subject to social desirability bias though the direction of the bias is unclear [53]. However, self-reported influenza vaccination status among adults has been shown to be sensitive and specific with vaccination status ascertained from medical records [54]. Third, the NIFS is an Internet panel survey and although the Internet panel was probability-based, the estimates may not represent all adults in the United States (for example, interviews were conducted only in English and institutionalized adult populations were excluded from the survey), and positive or negative coverage bias may remain after the weighting adjustments [55]. Fourth, the survey asked about hesitancy toward vaccines in general and not specifically about influenza vaccination. It is possible that the results might have been different had the survey asked about vaccinespecific hesitancy [15,16]. Fifth, the response rate was relatively low (approximately 53%) but consistent and comparable with the other nationally representative, probability-based Internet panel survey [38]. Sixth, the sample was based on respondents who self-select to participate in the Internet panel and agree to participate in the NIFS through an invitation that references influenza vaccination. Estimates obtained from this study might be biased if the participation processes (panel and NIFS) were related to receipt of vaccination, and nonresponse bias was not corrected through weighting. Seventh, though we examined the interrelationship between the IVH beliefs, we did not examine the impact of clustering or interactions among the IVH beliefs in this analysis. Finally, the differences in findings observed in this study with respect to other studies could be due to differences in the definition and construction of the concept of hesitancy across studies.

4.2. Conclusions

Among the four IVH beliefs studied, being hesitant to receiving influenza vaccination followed by mistrust of healthcare providers were identified as the most influential hesitancy beliefs identified for action. Two in five adults in the United States were influenza vaccination hesitant, and hesitancy has a strong negative association with adult influenza vaccination. Influenza vaccination hesitancy beliefs varied by sociodemographic characteristics. This information may assist public health policy makers in developing

targeted interventions to reduce influenza vaccination hesitancy among adults and ultimately improve influenza vaccination coverage. For example, personalized recommendations from a healthcare professional or information tailored to a patient's personal risk or health status may be more persuasive than general messages about vaccine safety and effectiveness [56]. Improvements in influenza vaccination acceptance among adults may in turn impact overall influenza disease burden.

Data availability

The authors do not have permission to share data.

Abbreviations:

IVH	Influenza Vaccination Hesitancy
NIFS	National Internet Flu Survey
PAF	Population Attributable Fraction

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Table 1

Sociodemographic characteristics overall and by influenza vaccination hesitancy beliefs among adults aged 18 years, United States—National Internet Flu Survey, 2018.

Characteristic	Overall ^a % (95% CI)	Somewhat/very hesitant about influenza vaccinations ^b % (95% CI)	Concerns about serious, long- term side effects impacted decision to get an influenza vaccination ^c % (95% CI)	Personally know someone who has had a serious, long-term side effect from an influenza vaccination ^d % (95% CI)	Doctor or health provider is not most trusted source of information about influenza vaccinations ^e % (95% CI)
Total	4,286 (100)	36.9 (35.2, 38.7)	18.6 (17.3, 20.1)	14.8 (13.5, 16.2)	35.6 (33.8, 37.4)
Sex					
Male	48.4 (46.6, 50.2)	44.0 (41.0, 47.1)	41.8 (37.6, 46.0)	49.1 (44.1, 54.0)	48.7 (45.5, 52.0)
Female	51.6 (49.8, 53.4)	56.0 (52.9, 59.0)	58.2 (54.0, 62.4)	50.9 (46.0, 55.9)	51.3 (48.0, 54.5)
Age group (in years)					
18–49	54.2 (53.6, 54.9)	60.3 (58.0, 62.6)	57.4 (53.8, 61.0)	61.8 (57.7, 65.8)	63.3 (61.0, 65.6)
50–64	25.2 (24.8, 25.7)	25.9 (24.1, 27.9)	24.9 (22.2, 27.9)	23.0 (19.9, 26.4)	23.6 (21.8, 25.6)
65	20.5 (20.1, 20.9)	13.7 (12.4, 15.2)	17.7 (15.5, 20.1)	15.2 (12.9, 17.8)	13.1 (11.7, 14.6)
Race/ethnicity					
Non-Hispanic White only	63.5 (62.6, 64.4)	60.6 (58.1, 63.0)	53.6 (49.7, 57.5)	54.5 (49.9, 59.1)	62.1 (59.5, 64.7)
Non-Hispanic Black only	11.9 (11.3, 12.5)	14.7 (13.2, 16.4)	17.5 (14.9, 20.4)	17.5 (14.5, 21.1)	12.7 (11.0, 14.5)
Hispanic	15.9 (15.3, 16.6)	16.8 (15.0, 18.9)	20.4 (17.4, 23.7)	19.0 (15.6, 22.9)	15.9 (14.0, 18.0)
Non-Hispanic other or multiple races	8.7 (7.9, 9.5)	7.9 (6.5, 9.5)	8.5 (6.5, 11.1)	8.9 (6.6, 11.9)	9.3 (7.7, 11.1)
Marital Status					
Married/living with partner	61.2 (59.4, 62.9)	59.7 (56.7, 62.7)	60.3 (56.1, 64.4)	53.4 (48.4, 58.3)	56.6 (53.4, 59.8)
Widowed/divorced/separated	16.8 (15.7, 18.0)	17.7 (15.7, 20.0)	18.3 (15.6, 21.4)	18.2 (15.1, 21.8)	15.8 (13.8, 18.0)
Never married	22.0 (20.5, 23.7)	22.5 (19.9, 25.4)	21.4 (17.9, 25.3)	28.4 (23.8, 33.4)	27.6 (24.6, 30.8)
Education level					
High school or lower	39.3 (37.5, 41.1)	45.1 (42.0, 48.2)	50.3 (46.1, 54.5)	50.7 (45.8, 55.6)	42.1 (38.9, 45.4)
Some college or college graduate	46.5 (44.7, 48.3)	44.5 (41.5, 47.5)	39.5 (35.6, 43.5)	39.2 (34.7, 44.0)	44.5 (41.3, 47.6)
Above college graduate	14.2 (13.2, 15.4)	10.5 (9.0, 12.2)	10.2 (8.2, 12.7)	10.1 (7.8, 13.0)	13.4 (11.6, 15.4)
Employment status					
Employed	62.5 (60.9, 64.1)	66.5 (63.6, 69.3)	65.0 (61.1, 68.8)	59.4 (54.5, 64.0)	67.3 (64.3, 70.2)

	Overall ^a	Somewhat/very hesitant about influenza vaccinations ^b	Concerns about serious, long-term side effects impacted decision to get an influenza vaccination ^c	Personally know someone who has had a serious, long-term side effect from an influenza vaccination ^d	Doctor or health provider is not most trusted source of information about influenza vaccinations ^e
Not employed/not in work force	37.5 (35.9, 39.1)	33.5 (30.7, 36.4)	35.0 (31.2, 38.9)	40.6 (36.0, 45.5)	32.7 (29.8, 35.7)
Annual household income					
<\$35,000	23.0 (21.5, 24.5)	24.6 (22.0, 27.3)	30.2 (26.4, 34.3)	34.7 (30.0, 39.6)	24.4 (21.7, 27.3)
\$35,000-\$49,999	10.7 (9.6, 11.9)	11.0 (9.2, 13.1)	12.8 (10.2, 16.1)	11.7 (8.9, 15.2)	10.8 (9.0, 13.0)
\$50,000-\$74,999	16.7 (15.4, 18.1)	19.7 (17.4, 22.3)	17.4 (14.4, 20.7)	14.7 (11.5, 18.5)	16.8 (14.5, 19.4)
\$75,000	49.7 (47.9, 51.4)	44.7 (41.6, 47.7)	39.6 (35.6, 43.7)	39.0 (34.3, 43.8)	47.9 (44.7, 51.1)
Has a primary care medical home					
Yes/more than one	87.8 (86.5, 89.1)	82.6 (80.0, 85.0)	84.9 (81.2, 88.0)	84.4 (79.9, 88.0)	76.5 (73.4, 79.4)
No	12.2 (10.9, 13.5)	17.4 (15.0, 20.0)	15.1 (12.0, 18.8)	15.6 (12.0, 20.1)	23.5 (20.6, 26.6)
Have high-risk conditions for influenza complications					
Yes	33.5 (31.9, 35.1)	31.2 (28.4, 34.0)	38.6 (34.6, 42.8)	33.9 (29.5, 38.6)	25.8 (23.2, 28.6)
No	66.5 (64.9, 68.1)	68.8 (66.0, 71.6)	61.4 (57.2, 65.4)	66.1 (61.4, 70.5)	74.2 (71.4, 76.8)
Health insurance					
Yes	91.1 (89.8, 92.2)	87.2 (84.7, 89.4)	88.1 (84.6, 90.9)	84.8 (80.2, 88.5)	83.5 (80.6, 86.1)
No	8.9 (7.8, 10.2)	12.8 (10.6, 15.3)	11.9 (9.1, 15.4)	15.2 (11.5, 19.8)	16.5 (13.9, 19.4)
Metropolitan statistical area status					
Metro	86.4 (85.1, 87.7)	85.2 (82.8, 87.4)	85.3 (82.0, 88.1)	84.0 (79.9, 87.5)	87.1 (84.7, 89.2)
Non-metro	13.6 (12.3, 14.9)	14.8 (12.6, 17.2)	14.7 (11.9, 18.0)	16.0 (12.5, 20.1)	12.9 (10.8, 15.3)

^aA total of 4,286 respondents completed the survey.

^bFor this analysis, respondents who answered “don’t know” (n = 99; 2.3% of the sample) and who skipped the question (n = 29; 0.7% of the sample) about hesitancy were recoded as being non-hesitant.

^cFor this analysis, respondents who answered “don’t know” (n = 208; 4.9% of the sample) and who skipped the question (n = 45; 1.1% of the sample) about concerns were recoded as having no concern.

^dFor this analysis, respondents who answered “don’t know” (n = 236; 5.5% of the sample) and who skipped the question (n = 47; 1.1% of the sample) about side effects were recoded as yes.

^eFor this analysis, respondents who answered “don’t know” (n = 407; 9.5% of the sample) and who skipped the question (n = 54; 1.3% of the sample) about trusted source were recoded as no.

^fRespondents were defined as being at high risk for complications from influenza if they reported currently having any of the following conditions: asthma, diabetes, a lung condition other than asthma, heart disease (other than high blood pressure, heart murmur, or mitral valve prolapse), a kidney condition, sickle cell anemia or other anemia, a neurologic or neuromuscular condition, obesity, a liver condition, a weakened immune system caused by chronic illness or by medicines taken for a chronic illness such as cancer, chemotherapy, HIV/AIDS, steroids, and transplant medicines, or being currently pregnant.

Interrelationship of responses to the four hesitancy questions, United States—National Internet Flu Survey, 2018.

Table 2

Row percentages are in the table matrix	Overall, how hesitant are you about influenza vaccinations? ^a		Did concerns about serious, long-term side effects impact your decision to get an influenza vaccination? ^b		Do you personally know anyone who has had a serious, long-term side effect from an influenza vaccination? ^c		Is your doctor or health provider your most trusted source of information about influenza vaccinations? ^d	
	Somewhat hesitant/very hesitant	Not at all hesitant/not that hesitant	Yes	No	Yes	No	Yes	No
Overall, how hesitant are you about influenza vaccinations?	100.0	0.0	39.4	60.6	23.3	76.7	52.3	47.7
Did concerns about serious, long-term side effects impact your decision to get an influenza vaccination?	Somewhat hesitant/very hesitant							
	Yes	Not at all hesitant/not that hesitant	6.5	93.5	9.8	90.2	71.5	28.5
Do you personally know anyone who has had a serious, long-term side effect from an influenza vaccination?	Yes	Yes	100.0	0.0	35.0	65.0	54.3	45.7
	No	No	0.0	100.0	10.2	89.8	66.7	33.3
Is your doctor or health provider your most trusted source of information about influenza vaccinations?	Yes	Yes	44.1	55.9	100.0	0.0	44.8	55.2
	No	No	14.2	85.8	0.0	100.0	67.8	32.2
	Yes	Yes	15.7	84.3	10.3	89.7	100.0	0.0
	No	No	23.9	76.1	23.0	77.0	0.0	100.0

^aFor this analysis, respondents who answered “don’t know” (n = 99; 2.3% of the sample) and who skipped the question (n = 29; 0.7% of the sample) about hesitancy recorded as being non-hesitant.

^bFor this analysis, respondents who answered “don’t know” (n = 208; 4.9% of the sample) and who skipped the question (n = 45; 1.1% of the sample) about concerns were recorded as having no concern.

^cFor this analysis, respondents who answered “don’t know” (n = 236; 5.5% of the sample) and who skipped the question (n = 47; 1.1% of the sample) about side effects were recorded as yes.

^dFor this analysis, respondents who answered “don’t know” (n = 407; 9.5% of the sample) and who skipped the question (n = 54; 1.3% of the sample) about trusted source were recorded as no.

Table 3
 Early-season influenza vaccination coverage^a among adults aged 18 years by influenza vaccination hesitancy beliefs, United States—National Internet Flu Survey, 2018.

	Unadjusted Coverage (95% CI)	Adjusted Coverage ^b (95% CI)	Adjusted Prevalence Difference ^b (95% CI)
Overall, how hesitant are you about influenza vaccinations?			
Somewhat/very hesitant	15.3 (13.2, 17.6)	16.6 (14.2, 18.9)	-45.2 (-48.5, -41.8)
Not that/not at all hesitant	62.4 (60.1, 64.6)	61.8 (59.4, 64.1)	Referent
Did concerns about serious, long-term side effects impact your decision to get an influenza vaccination?			
Yes	26.5 (23.1, 30.3)	26.8 (23.1, 30.5)	-22.9 (-27.1, -18.7)
No	49.1 (47.2, 51.1)	49.7 (47.7, 51.7)	Referent
Do you personally know anyone who has had a serious, long-term side effect from an influenza vaccination?			
Yes	29.9 (25.6, 34.6)	31.0 (26.4, 35.6)	-16.7 (-21.6, -11.7)
No	47.5 (45.6, 49.4)	47.7 (45.7, 49.6)	Referent
Is your doctor or health provider your most trusted source of information about influenza vaccinations?			
Yes	52.8 (50.6, 55.0)	50.4 (48.2, 52.7)	Referent
No	30.5 (27.7, 33.4)	35.1 (32.1, 38.1)	-15.3 (-19.4, -11.5)

Note: Boldface indicates statistical significance compared to reference group using *t*-test (*p* < 0.05).

^aSeparate multivariable logistic regression models were run for each influenza vaccination hesitancy question for a total of four individual models. The outcome variable is receipt of early-season influenza vaccination by mid-November 2018.

^bThe model adjusted for sex, age, race/ethnicity, marital status, education level, employment status, annual household income, having a usual place to go when sick, had high-risk conditions for influenza complications, having health insurance, and metropolitan statistical area status.

Table 4

Sociodemographic factors^a associated with influenza vaccination hesitancy beliefs among adults aged 18 years, United States—National Internet Flu Survey, 2018.

	Somewhat/very hesitant about influenza vaccinations		Concerns about serious, long-term side effects impacted decision to get an influenza vaccination		Personally know someone who has had a serious, long-term side effect from an influenza vaccination		Doctor or health provider is not most trusted source of information about influenza vaccinations	
	Unadjusted Prevalence (95% CI)	APD ^b (95% CI)	Unadjusted Prevalence (95% CI)	APD (95% CI)	Unadjusted Prevalence (95% CI)	APD (95% CI)	Unadjusted Prevalence (95% CI)	APD (95% CI)
Sex								
Male	33.6 (31.1, 36.2)	Reference	16.1 (14.2, 18.1)	Reference	15.0 (13.1, 17.1)	Reference	35.9 (33.3, 38.5)	Reference
Female	40.0 (37.6, 42.5)	6.4 (2.9, 10.0)	21.0 (19.0, 23.1)	4.2 (1.3, 7.1)	14.6 (12.9, 16.4)	-0.0 (-2.6, 2.5)	35.3 (33.0, 37.7)	2.4 (-1.0, 5.8)
Age group (in years)								
18–49	41.1 (38.3, 43.9)	Reference	19.7 (17.6, 22.1)	Reference	16.9 (14.8, 19.2)	Reference	41.5 (38.7, 44.4)	Reference
50–64	38.0 (35.2, 40.9)	-2.4 (-6.7, 1.8)	18.4 (16.3, 20.7)	-0.8 -4.2, 2.6)	13.5 (11.6, 15.5)	-0.3 (-3.4, 2.8)	33.3 (30.6, 36.1)	-0.6 (-4.7, 3.5)
65	24.7 (22.3, 27.3)	-14.5 (-19.3, -9.7)	16.0 (14.1, 18.2)	-1.7 (-5.6, 2.2)	11.0 (9.3, 12.8)	-3.8 (-7.1, -0.4)	22.7 (20.3, 25.2)	-9.3 (-14.1, -4.6)
Race/ethnicity								
Non-Hispanic White only	35.2 (33.0, 37.5)	Reference	15.7 (14.1, 17.5)	Reference	12.7 (11.2, 14.4)	Reference	34.8 (32.6, 37.1)	Reference
Non-Hispanic Black only	45.8 (41.1, 50.6)	8.0 (2.6, 13.4)	27.5 (23.3, 32.0)	9.9 (5.1, 14.74)	21.9 (18.0, 26.3)	5.8 (1.7, 9.9)	38.0 (33.4, 42.8)	-0.4 (-5.6, 4.8)
Hispanic	39.1 (34.6, 43.7)	-0.9 (-6.1, 4.3)	23.8 (20.1, 28.0)	4.9 (0.6, 9.2)	17.7 (14.3, 21.6)	3.5 (-0.4, 7.4)	35.6 (31.2, 40.2)	-2.7 (-7.7, 2.2)
Non-Hispanic other or multiple races	33.5 (28.1, 39.5)	-2.6 (-8.8, 3.6)	18.3 (14.0, 23.5)	3.2 (-1.9, 8.4)	15.1 (11.3, 20.0)	0.5 (-3.6, 4.6)	38.0 (32.2, 44.0)	-1.2 (-7.4, 5.0)
Marital Status								
Married/living with partner	36.1 (33.9, 38.3)	Reference	18.4 (16.6, 20.2)	Reference	12.9 (11.4, 14.6)	Reference	32.9 (30.8, 35.1)	Reference
Widowed/divorced/separated	39.1 (35.4, 42.9)	3.5 (-1.3, 8.2)	20.3 (17.4, 23.6)	-0.5 (-4.2, 3.1)	16.1 (13.4, 19.2)	1.9 (-1.7, 5.5)	33.5 (29.9, 37.3)	3.7 (-0.8, 8.2)
Never married	37.8 (33.5, 42.2)	-4.9 (-9.9, 0.1)	18.1 (15.0, 21.7)	-3.5 (-7.5, 0.5)	19.0 (15.7, 22.9)	0.3 (-3.3, 3.8)	44.5 (40.1, 49.1)	3.7 (-1.3, 8.6)
Education level								
High school or lower	42.4 (39.2, 45.6)	Reference	23.9 (21.2, 26.7)	Reference	19.1 (16.6, 21.8)	Reference	38.2 (35.1, 41.4)	Reference

	Somewhat/very hesitant about influenza vaccinations		Concerns about serious, long-term side effects impacted decision to get an influenza vaccination		Personally know someone who has had a serious, long-term side effect from an influenza vaccination		Doctor or health provider is not most trusted source of information about influenza vaccinations	
	Unadjusted Prevalence (95% CI)	APD ^b (95% CI)	Unadjusted Prevalence (95% CI)	APD (95% CI)	Unadjusted Prevalence (95% CI)	APD (95% CI)	Unadjusted Prevalence (95% CI)	APD (95% CI)
Some college or college graduate	35.3 (33.0, 37.8)	-8.0 (-12.3, -3.7)	15.8 (14.1, 17.7)	-6.2 (-9.8, -2.6)	12.5 (10.9, 14.2)	-1.4 (-4.3, 1.5)	34.0 (31.7, 36.5)	-2.7 (-6.8, 1.4)
Above college graduate	27.2 (23.7, 31.0)	-14.0 (-19.5, -8.4)	13.4 (10.8, 16.4)	-7.7 (-12.3, -3.2)	10.5 (8.2, 13.4)	-1.7 (-5.8, 2.4)	33.5 (29.6, 37.6)	-1.2 (-6.8, 4.3)
Employment status								
Employed	39.3 (37.0, 41.6)	Reference	19.4 (17.6, 21.3)	Reference	14.0 (12.4, 15.8)	Reference	38.3 (36.0, 40.6)	Reference
Not employed/not in work force	33.0 (30.4, 35.8)	-4.9 (-9.2, -0.6)	17.4 (15.4, 19.6)	-4.4 (-7.5, -1.2)	16.0 (14.0, 18.3)	2.2 (-0.9, 5.3)	31.1 (28.4, 33.9)	-3.1 (-7.3, 1.0)
Annual household income								
<\$35,000	39.5 (35.8, 43.4)	Reference	24.5 (21.3, 28.0)	Reference	22.3 (19.1, 25.9)	Reference	37.8 (34.1, 41.7)	Reference
\$35,000-\$49,999	38.1 (32.8, 43.7)	-0.6 (-7.4, 6.1)	22.3 (17.9, 27.5)	-1.5 (-7.2, 4.2)	16.2 (12.4, 20.8)	-3.1 (-8.0, 1.9)	36.1 (30.8, 41.7)	0.8 (-5.6, 7.1)
\$50,000-\$74,999	43.8 (39.4, 48.2)	7.6 (1.6, 13.7)	19.4 (16.2, 23.1)	-2.1 (-7.0, 2.8)	13.0 (10.2, 16.5)	-5.3 (-9.6, -0.9)	35.9 (31.7, 40.4)	1.3 (-4.3, 7.0)
\$75,000	33.2 (30.8, 35.7)	-0.8 (-6.2, 4.5)	14.8 (13.1, 16.7)	-5.6 (-10.0, -1.1)	11.6 (10.0, 13.4)	-5.2 (-9.3, -1.0)	34.3 (31.9, 36.8)	2.2 (-3.0, 7.4)
Has a primary care medical home								
Yes/more than one	34.8 (33.0, 36.7)	Reference	18.2 (16.8, 19.7)	Reference	13.2 (11.9, 14.5)	Reference	29.6 (27.9, 31.4)	Reference
No	52.9 (46.9, 58.7)	14.2 (7.8, 20.6)	23.4 (18.7, 28.9)	4.8 (-0.6, 10.1)	17.6 (13.5, 22.7)	1.1 (-3.5, 5.7)	65.5 (59.8, 70.8)	28.1 (21.7, 34.5)
Have high-risk conditions for influenza complications								
Yes	34.4 (31.5, 37.3)	Reference	21.5 (19.1, 24.1)	Reference	15.0 (12.9, 17.3)	Reference	27.4 (24.8, 30.3)	Reference
No	38.2 (36.0, 40.5)	2.0 (-1.7, 5.8)	17.2 (15.6, 19.0)	-3.8 (-7.0, -0.6)	14.7 (13.1, 16.5)	-1.0 (-3.7, 1.7)	39.7 (37.5, 42.0)	5.5 (1.9, 9.2)
Health insurance								
Yes	35.5 (33.7, 37.3)	Reference	18.1 (16.7, 19.6)	Reference	12.7 (11.5, 14.0)	Reference	31.8 (30.0, 33.6)	Reference
No	53.2 (45.9, 60.3)	5.9 (-1.9, 13.7)	24.9 (19.2, 31.7)	2.1 (-3.9, 8.2)	23.2 (17.7, 29.9)	5.1 (-0.7, 10.9)	63.9 (56.9, 70.4)	17.2 (9.1, 25.3)
Metropolitan statistical area status								
Metro	36.4 (34.6, 38.3)	Reference	18.4 (16.9, 19.9)	Reference	14.4 (13.0, 15.8)	Reference	35.9 (34.0, 37.8)	Reference
Non-metro	40.2 (35.2, 45.3)	2.4 (-2.9, 7.7)	20.2 (16.4, 24.6)	1.1 (-3.2, 5.3)	17.4 (13.7, 21.9)	3.4 (-0.8, 7.7)	33.9 (29.1, 39.0)	-1.6 (-6.8, 3.6)

Note: Boldface indicates statistical significance (p < 0.05 by t-test when compared with reference group within column).

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^aSeparate multivariable logistic regression models were run for each influenza vaccination hesitancy question for a total of four individual models. The outcome variables were the self-reported influenza vaccination hesitancy beliefs.

^bAdjusted prevalence difference. The model adjusted for sex, age, race/ethnicity, marital status, education level, employment status, annual household income, having a usual place to go when sick, had high-risk conditions for influenza complications, having health insurance, and metropolitan statistical area status.

^cRespondents were defined as being at high risk for complications from influenza if they reported currently having any of the following conditions: asthma, diabetes, a lung condition other than asthma, heart disease (other than high blood pressure, heart murmur, or mitral valve prolapse), a kidney condition, sickle cell anemia or other anemia, a neurologic or neuromuscular condition, obesity, a liver condition, a weakened immune system caused by chronic illness or by medicines taken for a chronic illness such as cancer, chemotherapy, HIV/AIDS, steroids, and transplant medicines, or being currently pregnant.