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# Cluster Analysis: Vaccination Attitudes and Beliefs of Healthcare Personnel

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## Abstract

**Objectives:** We sought to identify patterns of knowledge, attitudes, and behaviors (KABs) about influenza and influenza vaccination among healthcare personnel (HCP) and define characteristics associated with these patterns.

**Methods:** Internet panel survey of HCP (N = 2265) during March 27–April 17, 2018; clustered HCP by their vaccination-related KABs.

**Results:** Four clusters were identified: Immunization Champions (61.1% of the sample) received influenza vaccine to prevent disease; Unworried Vaccinators (15.4%) received the influenza vaccine but did not believe influenza is a serious threat to themselves; Fence Sitters (8.1%) believed the vaccine is safe and worth the time and expense but is not effective; Skeptics (15.4%) did not believe the vaccine is safe or effective. Influenza vaccination coverage was 78.4% overall and higher among Immunization Champions (90.2%) and Unworried Vaccinators (87.0%) than Fence Sitters (61.6%) or Skeptics (32.2%).

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Disclaimer

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.

Human Subjects Approval Statement

This project was reviewed by Abt Associates' Institutional Review Board, which determined the study did not meet the definition of research as defined by the federal human subjects regulations.

Informed Consent Requirement

Informed consent was obtained from all participants in the research.

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**Conclusions:** Findings suggest that based on KABs, the 3 clusters comprising 85% of HCP might be vaccinated in the future. Using messages specific to each group may improve vaccination coverage among HCP.

### Keywords

healthcare personnel; influenza vaccination; cluster analysis

The Advisory Committee on Immunization Practices (ACIP) recommends health care personnel (HCP, health care providers who work directly with patients or work in health care settings) receive the influenza vaccine annually.[1] Influenza vaccination is particularly important for HCP to reduce influenza-related morbidity and mortality for themselves as well as their patients, and to reduce absenteeism and presenteeism among HCP.[2–6] Vaccination coverage among HCP remains below the Healthy People 2020 (HP2020) target of 90%[7] at 70.0% in the 2016–17 season,[8] and has been stable for the past 5 years.[9]

Many studies have been published that examined HCP's attitudes and beliefs toward the influenza vaccine.[10–12] A systematic review of studies conducted in hospitals found that if HCP receive influenza vaccination, many do so primarily for their own benefit and not to benefit their patients.[13] The review also found that on average, HCP who were vaccinated were more likely to trust the vaccine's effectiveness and were older than those who did not receive the vaccine, and usually received influenza vaccination annually. Reasons for HCP rejecting the vaccine included misconceptions, such as belief that the vaccine does not work or that it can cause influenza, or lack of knowledge about influenza infection, such as potential risk of transmission by HCP to their patients. One study found that significantly more unvaccinated than vaccinated HCP reported they would be more likely to get vaccinated in a future season as a result of a vaccination requirement than as the result of a targeted intervention.[14] Although specific knowledge, attitudes and beliefs (KAB) about influenza vaccination among HCP are well documented, identifying patterns of KABs could be useful in developing more effective messaging for HCP to improve influenza vaccine acceptance and uptake, and thereby reduce influenza-related morbidity and mortality for themselves and their patients. Thus, the primary objective of our analysis was to determine if patterns of KABs about the influenza vaccine and influenza disease exist among HCP. If so, more specific, effective messaging for HCP could be used to improve vaccination coverage. The secondary objective was to describe the KABs patterns according to demographic characteristics, occupation, work setting, employer requirement for vaccination, and vaccination status, to more precisely identify sub-groups of HCP for effective messaging.

## METHODS

### Study Design and Population

An Internet panel survey of HCP was conducted by Abt Associates, Inc. for the Centers for Disease Control and Prevention (CDC) during March 27–April 17, 2018. HCP were recruited from 2 established national opt-in Internet sources: general population Internet panels operated by Survey Sampling International (assistants, aides, and nonclinical

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personnel [such as administrators, clerical support workers, janitors, food service workers, and housekeepers]) working in health care settings were recruited from general population Internet panels operated by Survey Sampling International. Additional information on Survey Sampling International and its incentives for online survey participants is available at http://www.surveysampling.com. and panels of health care providers operated by Medscape, a medical website managed by WebMD Health Professional Network (physicians, nurse practitioners, physician assistants, nurses, dentists, pharmacists, allied health professionals, technicians, and technologists were recruited from the current membership roster of Medscape. Additional information on Medscape is available at http://www.medscape.com. Data from this non-probability sample were weighted to approximate the 2016–2017 U.S. population of HCP by age, sex, race/ethnicity, occupation, work setting, and Census region. Of the 2382 HCP who entered the survey, 2310 completed the survey for a completion rate of 97.0%. Forty-three respondents were excluded from analysis because they were unlikely to have contact with patients or to have worked in one of the health care settings of interest for this analysis; and 2 additional respondents were excluded because they did not work in the United States. The final sample size for this analysis was 2265 HCP.

## Survey Instrument

Questions related to KAB's about the influenza vaccine are presented in Table 1. Responses included agree, strongly agree, disagree, and strongly disagree. Other variables used in this analysis include receipt of the influenza vaccine, age, sex, race and ethnicity, education, occupation, work setting, region, illness during the influenza season, availability of paid sick leave, and employer requirement to get the influenza vaccine.

## Statistical Analysis

Cluster analysis was used to determine if patterns of knowledge, attitudes and beliefs about the influenza vaccine exist among HCP using the FASTCLUS procedure in Statistical Analysis Software (SAS), release 9.3 (SAS Institute, Cary, NC).[15] Generally, cluster analysis inputs many attributes of individuals and determines if there are groups, or clusters, of people in the sample with similar or patterns of attributes. We would expect that groups of HCP with optimistic KABs related to influenza would be larger than those with more pessimistic KABs. Therefore k-means clustering is a good method because it works well when there are varying sizes of clusters. First, we used the 17 KAB questions referred to in Table 1 to determine if clusters existed. PROC FASTCLUS requires variables to be binary, so recoding of the 17 KAB variables referred to previously was done as follows: If a respondent said they 'strongly agreed' or 'agreed' with the statement they were considered to have agreed. If they said they 'strongly disagreed' or 'disagreed' they were considered to have disagreed. Because no information is available about the true number of clusters (ie, patterns of vaccination-related knowledge and attitudes) in the data set, a 2-step process was used to determine the most appropriate number of clusters. The first step included several runs of cluster analysis with varying numbers of clusters (2 to 6). The second step was to assess ratios of between-cluster variance to within-cluster variance of the clusters in each run. Variables with low ratios were excluded because they did not contribute to forming clusters. A higher overall ratio indicates a better separation of clusters. Because the overall ratio increases with the number of clusters examined, the ideal number of clusters to choose

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is the number (n) with the highest overall ratio compared with one additional cluster (n +1) that has a smaller ratio.[16]

Clusters were identified and then described by characteristics that did not contribute to the identification of the clusters; these include demographic variables such as age, sex, and race/ethnicity; occupation, work setting, region, and employer requirement for vaccination; vaccination status; and other 12 KAB variables that did not contribute to the definition of the clusters. Chi-squared tests reported in the tables were performed using PROC MULTILOG in SUDAAN v11 to assess factors for statistically significant associations with clusters at the $p < .05$ level. To test clusters pairwise within each level of characteristics of interest, t-tests were used to assess statistically significant differences across the predicted margins. All comparisons of characteristics by clusters reported in the text of the results section are significantly different ($p < .05$) unless stated otherwise. A sub-analysis was conducted among the cluster with the most negative vaccine-related KABs to determine if, counter-factually, one difference could have resulted in overall vaccination coverage meeting the HP2020 goal of 90%.

## RESULTS

### Cluster Description

We found 4 clusters that best separated groups of HCP by patterns of KABs. Each cluster was named based on responses to key knowledge and attitudes questions; some clusters and their names resemble those found in a similar study among parental attitudes toward childhood vaccination[17] (Table 2). The 5 KAB variables that contributed to and defined clusters included beliefs that influenza is a serious threat to oneself, perceived protection of oneself and others by influenza vaccination, and perception of influenza vaccine as safe and worth the time and the expense to obtain. The 2 factors that contributed most to separation of clusters (ie, had the highest ratio of between-cluster variance to within-cluster variance) were “flu is a serious threat to my health” and “flu vaccination can protect me from getting flu”. The 4 clusters were:

1. Immunization Champions N = 1439 (61.1% of the sample). All believed influenza is a serious threat to themselves. Nearly all believed that the vaccine is safe, will protect themselves and others from influenza, and that it is worth the time and expense.
2. Unworried Vaccinators N = 378 (15.4% of the sample). None believed that influenza is a serious threat to themselves. Nearly all believed that the vaccine is safe (95.1%), will protect them (98.3%) and others (100.0%) from influenza, and that it is worth the time and expense to be vaccinated (90.4%).
3. Fence Sitters N = 170 (8.1% of the sample). Few (22.1%) believed that influenza is a serious threat to themselves. Nearly all believed the vaccine is safe (98.9%) and most believed it is worth the time and expense to obtain (74.1%), but few believed that the influenza vaccine will protect themselves (25.1%) or others from influenza (22.9%).

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4. Skeptics N = 278 (15.4% of the sample). Less than half (42.4%) believed influenza is a serious threat to themselves. Very few (<10%) believed the vaccine is safe, will protect themselves or others from influenza, or is worth the time and expense.

## Comparisons

**Demographics of clusters.—**Larger proportions of women were in the Fence Sitters (76.1%) and Skeptics (73.5%) clusters than were in the Unworried Vaccinators (61.4%) (Table 3). There were no statistically significant differences by age group or race/ethnicity across clusters. Larger proportions of HCP with less than a high school education were in the Fence Sitters (62.0%) and Skeptics (64.5%) clusters than were in the Immunization Champions (45.0%) and Unworried Vaccinators (44.0%). Similar proportions of HCP with greater than a high school education were in the Immunization Champions (25.7%) and Unworried Vaccinators (24.3%) clusters, and they both were larger proportions than those in the Skeptics (14.6%) and Fence Sitters (9.3%). A larger proportion of HCP in the Western region was in the Immunization Champions (25.1%) compared with the other clusters (each <20.0%). Larger proportions of HCP in the Northeastern region were in the Skeptics (25.4%) and Unworried Vaccinators (23.4%) compared with the Immunization Champions (17.5%) and Fence Sitters (13.7%).

**Vaccination characteristics of clusters.—**The vast majority of Immunization Champions (90.2%) and Unworried Vaccinators (87.0%) received influenza vaccination and believed that HCP should be required to receive the vaccine (87.2% and 82.0%, respectively) (Table 4). Sixty-two percent of the Fence Sitters received the vaccine and 56.8% believed HCP should be required to receive the vaccine. Only 32.2% of Skeptics received the vaccine and 16.7% believed HCP should be required to receive the vaccine.

**Employment-related characteristics of clusters.—**Similar proportions of HCP who are clinical professionals were in the Immunization Champions (37.4%), Unworried Vaccinators (36.0%) and Fence Sitters (32.8%) but the proportion of clinical professionals was lower among the Skeptics (16.8%) (Table 3). The cluster with the greatest proportion of non-clinical support staff was the Skeptics (41.5%), compared with other clusters (Immunization Champions [32.3%] Unworried Vaccinators [25.2%], and Fence Sitters [27.3%]). More Immunization Champions (39.7%), Unworried Vaccinators (35.8%), and Fence Sitters (40.6%) than Skeptics (23.4%) worked in hospitals; whereas a larger proportion of Skeptics (40.6%) than Immunization Champions (25.2%) and Fence Sitters (26.3%) worked in long-term care facilities. Half of Immunization Champions (49.3%) and Unworried Vaccinators (49.4%) reported an employer vaccination requirement whereas 41.0% of Fence Sitters and 19.9% of Skeptics did. Larger proportions of Immunization Champions (71.6%), Unworried Vaccinators (70.9%), and Fence Sitters (63.6%) reported having paid sick leave compared with 55.9% of Skeptics who reported the benefit.

**Knowledge of influenza across clusters.—**The vast majority of respondents believed influenza is worse than a cold, although this statement was endorsed by larger proportions of Immunization Champions (99.0%), Unworried Vaccinators (97.8%), and Fence Sitters

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(96.5%) than Skeptics (86.4%) (Table 4). There were no statistically significant differences across clusters mistakenly believing that the influenza virus is transmitted by contact with blood and body fluids (range: 30.4%–43.4%), nor were there statistically significant differences across clusters in correctly identifying signs and symptoms of influenza (range: 92.9%–98.5%). A larger proportion of Immunization Champions (97.4%) than Skeptics (89.8%) were aware that people with influenza can transmit the virus before they have symptoms. Larger proportions of Skeptics (72.8%) and Fence Sitters (53.3%) than Immunization Champions (37.2%) or Unworried Vaccinators (36.1%) mistakenly believe that the influenza vaccine can cause influenza.

**Counter-factual sub-analysis.—**Skeptics were 15.4% of the sample, and only 32.2% were vaccinated. Of the 19.9% who worked where there was an employer requirement for vaccination, 89.0% were vaccinated. Among the 67.8% who were unvaccinated, 98.1% worked where there was no employer vaccination requirement. Assuming all the unvaccinated Skeptics who did not work where there was an employer requirement *had worked where there was an employer requirement and they had been vaccinated due to a mandate*, the overall vaccination coverage would have increased from 78.4% to 89.0%.

## DISCUSSION

We identified 4 patterns of KABs about influenza and the influenza vaccine among HCP. Clusters varied by sex, level of education, occupation, work setting, and region. Notably, clusters did not vary by age or race/ethnicity. The largest cluster of HCP identified, Immunization Champions (61.1%), was the only group with vaccination coverage that met the HP2020 target of 90%. Virtually all HCP in that cluster believed the vaccine is safe, effective, worth the time and expense, and that influenza is a serious threat to them; half reported an employer vaccination requirement. The Unworried Vaccinators strongly believed the vaccine is safe and effective, but none believed influenza is a serious threat to themselves. Yet, the CDC estimated influenza and influenza related complications led to over 60,000 deaths and 800,000 hospitalizations during the period covered by this study.[18] Vaccination coverage among the Unworried Vaccinators was within 3 percentage points of the HP2020 target (87%), which could likely be easily reached in this cluster. Notably, HCP in the Immunization Champions and Unworried Vaccinators clusters more frequently reported having an employer requirement for the vaccine (49%) than the other 2 clusters (41% and 19%). Perhaps knowing one's employer requires the vaccine positively influences KABs, or perhaps greater experience receiving influenza vaccination as a result of such requirements leads to more positive beliefs.

The 2 clusters with the most pessimistic KABs accounted for 23.5% of the sample. The smaller of the 2, Fence Sitters (8.1%), who appear to have had contradictory beliefs, may well receive the vaccine if targeted for vaccination. They believed the vaccine is safe and worth the time and expense, with 61.6% accepting the vaccine, yet they did not believe the vaccine is effective. The 2 variables that contributed the most to defining the clusters, believing "flu is a serious threat to my health" and "flu vaccination can protect me from getting flu", are consistent with the results of a systematic review that found HCP who receive influenza vaccination do so primarily for their own benefit.[13] Approximately one-

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fourth of Fence Sitters endorsed either of these beliefs. Stressing the potential severity of influenza infection and the concurrent personal benefits of vaccination might be a good strategy to improve vaccination coverage in this group.

The Skeptics, who comprised 15.4% of the HCP population, appear especially resistant to vaccination. Increasing coverage among this group will be imperative to meet HP2020 goals and to protect their patients and themselves from influenza and its complications. Though Skeptics do feel that influenza is a threat to their health, they did not think the vaccine is a useful way to counter it. Educational interventions including knowledge-testing may be a strategy for this group.[19] However, the most effective strategy for this group may include an employer requirement[20] and/or mandatory declination.[21] If all unvaccinated Skeptics had been subject to and complied with an employer vaccination requirement, overall coverage would have been 89%, essentially meeting the HP2020 target.

Of the 20% of Skeptics who reported an employer requirement, 89% of those HCP were vaccinated for influenza. A substantial proportion of Skeptics worked in long-term care (LTC), which are less likely to have employer requirements compared with hospitals and other settings.[9] LTC facilities, particularly for-profit facilities, are chronically under-resourced and have high staff turnover: about half of staff are replaced every year, at a cost estimated at about 16% of the salary for each position under $30,000, or more for those in higher paid positions.[22] A facility policy that mandates HCP vaccination to continue employment, an approach often unpopular among employees, can put the facility in the difficult position of finding replacements for existing staff who choose to leave. However, if long-term care facilities universally mandated vaccine, the mandatory policy would not disadvantage any specific facility for hiring. Had the unvaccinated Skeptics working in LTC with no employer requirements been vaccinated, overall coverage would have been 89.0% rather than 78.4%. Another option to improve coverage among Skeptics, whether they work in hospitals, LTCs, or ambulatory care, would be for facilities to have their enthusiastic HCP promote culture change regarding vaccination,[23] as a fair number of Immunization Champions are employed in all work settings.

Unsettling was the significant proportion of HCP who believed that the influenza vaccination may cause influenza, including the majority of Fence Sitters (53.3%) and Skeptics (72.8%). Skeptics were more likely to be non-clinical support staff compared with the other clusters. Non-clinical support staff are not likely to receive the same level of training about influenza or influenza vaccine as would clinical personnel. Over 90% of Fence Sitters and 85% of Skeptics had less than or equal to a high-school education. This result suggests that health literacy likely plays a role in KABs among the Fence Sitters and Skeptics. However, nearly three-fourths of both the highly vaccinated Immunization Champions and Unworried Vaccinators had less than or equal to a high school education. This suggests health literacy may not play a strong role among all HCP with less than or equal to a high school education. Still, more than one-third of the highly vaccinated Immunization Champions (37.2%) and Unworried Vaccinators (36.1%) reported the inaccurate belief that the influenza vaccination may cause influenza. Our findings show high vaccination coverage is possible even among HCP with erroneous beliefs, but

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correcting misperceptions like this one is important as HCP are trusted sources of vaccine information for their patients.[24]

Specific attitudes and beliefs about influenza vaccination among HCP are well-documented, but understanding patterns of such attitudes and beliefs and their associated characteristics could be useful in effectively messaging to HCP to improve influenza vaccination coverage. A strength of this study is that the method allows for identifying people with *patterns* of knowledge, attitudes, and beliefs related to vaccination. It works well if clusters vary in size, which we would expect for KABs among HCP. Factor analysis identifies variables, not people, that define to a latent construct. Agglomerative hierarchical clustering identifies clusters of people but assumes the clusters to be similar in size. Logistic regression can only assess the interaction or effect modification of 2 to 3 variables at a time. Using cluster analysis, many variables can be assessed simultaneously to see if people are similar across all of them. Unlike the logistic regression model, statistical significance is not assessed — rather, a determination is made as to whether there are patterns or clusters in the data. Guidelines are used to determine the accuracy of the clusters; but these guidelines do not involve statistical significance testing to isolate or identify an association. If clusters are identified, they can then be assessed across other attributes or variables to determine if they vary statistically. Companies use this method frequently to determine all the attributes of a person interested in buying their product, as well as when and where, so they can target them more precisely and cost effectively. Our findings show this method could be used by healthcare providers and flu vaccination campaigns to better target HCP who are not likely to get vaccinated using messages that specifically address their concerns, since methods which may work for HCP with one pattern of KABs likely differ from those effective for HCP with another pattern of KABs.

This study has several limitations. First, the study used a nonprobability sample of volunteer members of Internet panels, which can result in selection bias. We weighted the sample to the distribution of the U.S. population of health care personnel by occupation, age, sex, race/ethnicity, work setting, and Census region to be representative of U.S. HCP, but this may not have eliminated all bias. Standard errors reported here assume that the weighted estimates are approximately unbiased; we did not conduct analyses to validate this assumption.[25] Moreover, because the sample was not random, the statistical measures of association presented here should be used as guides to crafting health care messages and implementing interventions that may increase influenza vaccination coverage among HCP. Second, vaccination status was self-reported and therefore is subject to recall bias. Third, the survey was cross-sectional and therefore we could not determine if some attitudes towards influenza and influenza vaccination are influenced by an employer vaccination requirement. Finally, vaccination coverage results from Internet panel surveys have differed from population-based estimates from the National Health Interview Survey (NHIS). A study comparing our Internet panel survey with the NHIS found that the Internet survey may underrepresent HCP who are high school educated or less, older, of Hispanic ethnicity or non-Hispanic Black race, lower income, working in an “other” health care setting, and working as assistants or aides.[26] This may have influenced our finding that clusters did not vary by race or ethnicity, as underrepresentation could mean the sample size was not adequate to detect a difference. Additionally, the Fence Sitter and Skeptic clusters may be a

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larger proportion of the U.S. HCP population than we report, due to the underrepresentation of those who are high school educated or less. Our survey did not collect data on health insurance status or income, which may affect HCP vaccination decisions. For example, most adults aged 65 years and older are eligible for Medicare and therefore may have more incentive to receive the vaccine.

What this study adds to the literature is identification of sub-groups of HCP with varying KABs related to influenza and the influenza vaccine. This knowledge empowers flu vaccination campaigns and providers to create effective messaging to sub-groups of HCP, as perhaps the same message or 'one size fits all' may not motivate all HCP to be vaccinated. Briefly, three-fourths of the HCP, Immunization Champions and Unworried Vaccinators, are highly likely to be vaccinated in the future, given opportunities for vaccination. Vaccination campaigns with fact-filled messaging targeted to the Fence Sitters, and/or vaccination promotion of their enthusiastic Immunization Champion peers,[23] may improve coverage among this group. The 15% of HCP with knowledge-attitudes-belief patterns like the Skeptics will be the most difficult to target to improve vaccination coverage. Only 20% worked in facilities with employer vaccination requirements, which may be the most effective strategy to improve coverage among this group.

## Conflict of Interest Disclosure Statement

BHB, MCL, SWB, MAdP, and SL have no conflicts of interest to report. SG reports conflicts with vaccine manufacturers related to grants, consulting and speaking engagements: Sanofi, Seqirus, Pfizer. SG also consults with other pharmaceutical companies such as Longevoron, Janssen, and Merck. SG has grants with Sunovion and Essity.

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**Table 1**

Survey Questions Related to Knowledge and Attitudes about Influenza and the Influenza Vaccine:

| |
|---|
| 1) “I am at risk of getting flu” |
| 2) “People around me are at risk of getting flu” |
| 3) “Flu is a serious threat to my health” |
| 4) “Flu is a serious threat to the health of people around me” |
| 5) “Flu vaccination can protect me from getting flu” |
| 6) “If I get a flu vaccination, people around me will be better protected from flu” |
| 7) “Flu vaccination is safe” |
| 8) “Getting vaccinated for flu is worth the time and expense” |
| 9) “Health care workers should be rewarded for getting vaccinated for flu” |
| 10) “Health care workers should be required to be vaccinated for flu” |
| 11) “Flu is more serious than a bad cold” |
| 12) “Flu virus is transmitted by contact with blood and body fluids” |
| 13) “Flu virus is transmitted by coughing and sneezing” |
| 14) “Health care workers are less susceptible to flu infections than other people” |
| 15) “The signs and symptoms of flu include fever, headache, sore throat, cough, nasal congestion, and aches and pains” |
| 16) “People with flu can transmit the virus before they experience symptoms” |
| 17) “The flu vaccination may cause some people to get flu” |

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## Table 2

Patterns of Immunization-Related Attitudes among Health Care Personnel and the Individual Beliefs that Define them, Internet Panel Survey, 2017–18 Influenza Season

| | Immunization Champions | | Unworried Vaccinators | | Fence Sitters | | Skeptics | |
|---|---|---|---|---|---|---|---|---|
| | N = 1439 (61.1%) | wth% ± SE[a] | N = 378 (15.4%) | wth% ± SE[a] | N = 170 (8.1%) | wth% ± SE[a] | N = 278 (15.4%) | wth% ± SE[a] |
| | Factors that defined clusters | | | | | | | |
| **Believe flu is serious threat to self** | 1439 | 100.0 ± 0.0 | 0 | 0 ± 0.0 | 32 | 22.1 ± 4.3 | 138 | 42.4 ± 3.8 |
| **Believe vaccine will protect me from flu** | 1375 | 95.6 ± 0.7 | 374 | 98.3 ± 1.0 | 43 | 25.1 ± 4.5 | 7 | 2.9 ± 1.5 |
| **Believe vaccine will protect others from flu** | 1370 | 93.0 ± 1.1 | 378 | 100.0 ± 0.0 | 37 | 22.9 ± 4.5 | 23 | 9.1 ± 2.3 |
| **Believe flu vaccine is safe** | 1399 | 95.6 ± 0.8 | 365 | 95.1 ± 1.6 | 168 | 98.9 ± 1.0 | 24 | 5.8 ± 1.7 |
| **Believe flu vaccine is worth the time and expense** | 1399 | 96.4 ± 0.8 | 358 | 90.4 ± 2.4 | 119 | 74.1 ± 4.5 | 12 | 4.3 ± 1.6 |

Note.

*a:* wtd % ± SE: Weighted percent and Standard Error percent

*b:* $\chi^2$ p-value <.001 for all factors

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## Table 3

Patterns of Immunization-Related Attitudes among Health Care Personnel and the Individual Beliefs that Define them by Demographic Characteristics, Internet Panel Survey, 2017–18 Influenza Season

| | Immunization Champions | | Unworried Vaccinators | | Fence Sitters | | Skeptics | |
|---|---|---|---|---|---|---|---|---|
| | N = 1439 (61.1%) | wtd% ± SE[a] | N = 378 (15.5%) | wtd% ± SE[a] | N = 170 (8.1%) | wtd% ± SE[a] | N = 278 (15.4%) | wtd% ± SE[a] |
| **Demographics** | | | | | | | | |
| **Sex** * | | | | | | | | |
| Male | 513 | 33.0 ± 1.9 | 148 | 38.6 ± 3.8 | 53 | 23.9 ± 4.8 | 65 | 26.5 ± 3.8 |
| Female | 926 | 67.0 ± 1.9 | 230 | 61.4 ± 3.8 | 117 | 76.1 ± 4.8 | 213 | 73.5 ± 3.8 |
| **Age Group** | | | | | | | | |
| 18–49 years | 985 | 64.2 ± 1.9 | 293 | 71.3 ± 3.6 | 127 | 66.3 ± 5.1 | 205 | 67.0 ± 3.8 |
| 50–64 years | 375 | 28.5 ± 1.8 | 78 | 25.2 ± 3.5 | 38 | 30.7 ± 5.0 | 65 | 28.2 ± 3.7 |
| ≥65 years | 79 | 7.3 ± 1.1 | 7 | 3.5 ± 1.6 | 5 | 3.0 ± 2.2 | 8 | 4.8 ± 1.9 |
| **Race/Ethnicity** | | | | | | | | |
| Non-Hispanic White | 915 | 63.4 ± 1.9 | 236 | 62.4 ± 3.7 | 108 | 55.2 ± 5.3 | 181 | 63.3 ± 3.9 |
| Non-Hispanic Black | 160 | 13.4 ± 1.4 | 29 | 10.4 ± 2.5 | 23 | 24.9 ± 5.0 | 44 | 19.3 ± 3.2 |
| Hispanic | 221 | 13.9 ± 1.3 | 75 | 15.4 ± 2.6 | 23 | 12.9 ± 3.7 | 31 | 9.8 ± 2.4 |
| Non-Hispanic Other | 142 | 9.3 ± 1.2 | 37 | 11.8 ± 2.8 | 16 | 7.1 ± 2.2 | 21 | 7.7 ± 2.2 |
| **Education** * | | | | | | | | |
| <High school | 878 | 45.0 ± 1.9 | 137 | 44.0 ± 3.7 | 105 | 62.0 ± 5.1 | 182 | 64.5 ± 3.9 |
| High school diploma or equivalent | 455 | 29.3 ± 1.8 | 81 | 31.7 ± 3.7 | 34 | 28.8 ± 4.9 | 50 | 20.9 ± 3.4 |
| >High school | 931 | 25.7 ± 1.6 | 160 | 24.3 ± 3.1 | 31 | 9.3 ± 2.5 | 46 | 14.6 ± 2.8 |
| **Occupation** * | | | | | | | | |
| Clinical Professional[b] | 825 | 37.4 ± 1.8 | 187 | 36.0 ± 3.6 | 56 | 32.8 ± 5.0 | 61 | 16.8 ± 2.8 |
| Clinical Paraprofessional[c] | 423 | 30.4 ± 1.7 | 151 | 38.9 ± 3.6 | 89 | 39.9 ± 5.0 | 158 | 41.7 ± 3.7 |
| Non-Clinical Support Staff[d] | 191 | 32.3 ± 2.0 | 40 | 25.2 ± 3.6 | 25 | 27.3 ± 4.9 | 59 | 41.5 ± 4.1 |
| **Work Setting** * | | | | | | | | |
| Hospital | 433 | 39.7 ± 2.0 | 87 | 35.8 ± 4.0 | 45 | 40.6 ± 5.4 | 37 | 23.4 ± 3.9 |
| Ambulatory Care | 689 | 35.1 ± 1.9 | 182 | 31.0 ± 3.6 | 79 | 33.1 ± 5.0 | 111 | 36.0 ± 3.8 |
| Long Term Care | 285 | 25.2 ± 1.6 | 90 | 33.2 ± 3.5 | 41 | 26.3 ± 4.4 | 122 | 40.6 ± 3.7 |
| **Region** * | | | | | | | | |
| Northeast | 193 | 17.5 ± 1.5 | 59 | 23.4 ± 3.3 | 20 | 13.7 ± 3.8 | 51 | 25.4 ± 3.6 |
| Midwest | 183 | 20.0 ± 1.6 | 65 | 26.1 ± 3.4 | 35 | 25.0 ± 4.6 | 67 | 24.6 ± 3.2 |
| South | 846 | 37.4 ± 1.8 | 188 | 31.5 ± 3.3 | 92 | 44.0 ± 5.1 | 126 | 31.2 ± 3.5 |
| West | 217 | 25.1 ± 1.8 | 66 | 19.0 ± 3.1 | 23 | 17.3 ± 4.2 | 34 | 18.8 ± 3.4 |

* Statistically significant difference among clusters at the p < .05 level using chi-squared test.

Note.

[a]wtd % ± SE: Weighted percent and Standard Error percent. HCP: healthcare personnel.

[b]Physicians, dentists, nurse practitioners, physician assistants, nurses, allied health professionals, pharmacists, and students in a medical-related field.

[c]Technicians/technologists; emergency technicians, paramedics, and EMTs; and assistants/aides.

[d]Administrative support staff/managers, housekeeping and food service staff, and other nonclinical support staff.

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## Table 4

Patterns of Immunization-Related Attitudes among Health Care Personnel and the Individual Beliefs that Define them by Descriptive Characteristics, Internet Panel Survey, 2017–18 Influenza Season

| | Immunization Champions | | Unworried Vaccinators | | Fence Sitters | | Skeptics | |
|---|---|---|---|---|---|---|---|---|
| | N = 1439 (61.1%) | wtd% ± SE[a] | N = 378 (15.5%) | wtd% ± SE[a] | N = 170 (8.1%) | wtd% ± SE[a] | N = 278 (15.4%) | wtd% ± SE[a] |
| **Received flu vaccine** * | 1313 | 90.2 ± 1.3 | 330 | 87.0 ± 2.4 | 91 | 61.6 ± 5.0 | 77 | 32.2 ± 3.8 |
| **Believe flu is serious threat to others** * | 1431 | 99.1 ± 0.4 | 273 | 71.1 ± 3.4 | 112 | 69.9 ± 4.8 | 201 | 65.9 ± 3.8 |
| **Believe I'm at risk of getting influenza** * | 1261 | 84.3 ± 1.4 | 266 | 63.9 ± 3.7 | 109 | 61.3 ± 5.1 | 150 | 45.6 ± 3.9 |
| **Believe others are at risk of getting influenza** * | 1358 | 92.9 ± 1.0 | 328 | 82.1 ± 3.0 | 131 | 72.4 ± 4.8 | 211 | 71.2 ± 3.6 |
| **Believe HCP less susceptible to influenza than others** * | 1269 | 87.5 ± 1.3 | 349 | 90.4 ± 2.3 | 143 | 84.8 ± 3.7 | 240 | 86.7 ± 2.8 |
| **Believe HCP should be required to get flu shot** * | 1266 | 87.2 ± 1.3 | 307 | 82.0 ± 2.8 | 88 | 56.8 ± 5.2 | 42 | 16.7 ± 2.9 |
| **Believe HCP should be rewarded for getting flu shot** * | 998 | 70.5 ± 1.7 | 252 | 65.9 ± 3.6 | 94 | 55.8 ± 5.2 | 120 | 47.8 ± 3.9 |
| **Believe influenza is worse than a cold** * | 1432 | 99.0 ± 0.4 | 372 | 97.8 ± 1.1 | 164 | 96.5 ± 1.9 | 247 | 86.4 ± 3.0 |
| **Believe flu virus is transmitted by contact with blood and body fluids** | 598 | 43.4 ± 1.9 | 156 | 39.8 ± 3.7 | 58 | 30.4 ± 4.8 | 122 | 42.2 ± 3.9 |
| **Believe signs/symptoms of flu include: fever, headache, sore throat, cough, nasal congestion, aches and pains** | 1425 | 98.1 ± 0.6 | 370 | 98.5 ± 0.7 | 161 | 92.9 ± 2.9 | 269 | 94.3 ± 2.3 |
| **Believe people with flu can transmit virus before they have symptoms** * | 1397 | 97.4 ± 0.6 | 362 | 93.0 ± 2.2 | 161 | 93.2 ± 2.6 | 257 | 89.8 ± 2.7 |
| **Believe flu virus is transmitted by coughing and sneezing** * | 1430 | 99.2 ± 0.4 | 373 | 97.6 ± 1.2 | 166 | 94.5 ± 2.8 | 265 | 93.3 ± 2.3 |
| **Believe flu vaccine causes influenza** * | 424 | 37.2 ± 1.9 | 109 | 36.1 ± 3.6 | 89 | 53.3 ± 5.2 | 206 | 72.8 ± 3.7 |
| **Get paid sick leave** * | 998 | 71.6 ± 1.7 | 256 | 70.9 ± 3.3 | 107 | 63.6 ± 4.9 | 145 | 55.9 ± 3.9 |
| **Got sick during flu season this year** * | 402 | 29.8 ± 1.8 | 87 | 21.8 ± 3.0 | 49 | 25.1 ± 4.3 | 85 | 30.7 ± 3.7 |
| **Employer requires getting flu shot** * | 665 | 49.3 ± 3.8 | 151 | 49.4 ± 3.8 | 54 | 41.0 ± 5.2 | 51 | 19.9 ± 3.3 |

* Statistically significant difference among clusters at the $p < .05$ level using chi-squared test.

Note.

a: wtd % ± SE: Weighted percent and Standard Error percent

HCP: healthcare personnel

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