Parental Vaccine Hesitancy and Childhood Influenza Vaccination

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abstract

OBJECTIVES: To quantify the prevalence of parental vaccine hesitancy (VH) in the United States and examine the association of VH with sociodemographics and childhood influenza vaccination coverage.

METHODS: A 6-question VH module was included in the 2018 and 2019 National Immunization Survey-Flu, a telephone survey of households with children age 6 months to 17 years.

RESULTS: The percentage of children having a parent reporting they were "hesitant about childhood shots" was 25.8% in 2018 and 19.5% in 2019. The prevalence of concern about the number of vaccines a child gets at one time impacting the decision to get their child vaccinated was 22.8% in 2018 and 19.1% in 2019; the prevalence of concern about serious, long-term side effects impacting the parent's decision to get their child vaccinated was 27.3% in 2018 and 21.7% in 2019. Only small differences in VH by sociodemographic variables were found, except for an 11.9 percentage point higher prevalence of "hesitant about childhood shots" and 9.9 percentage point higher prevalence of concerns about serious, long-term side effects among parents of Black compared with white children. In both seasons studied, children of parents reporting they were "hesitant about childhood shots" had 26 percentage points lower influenza vaccination coverage compared with children of parents not reporting hesitancy.

CONCLUSIONS: One in 5 children in the United States have a parent who is vaccine hesitant, and hesitancy is negatively associated with childhood influenza vaccination. Monitoring VH could help inform immunization programs as they develop and target methods to increase vaccine confidence and vaccination coverage.

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WHAT'S KNOWN ON THIS SUBJECT: Vaccine hesitancy has contributed to large outbreaks of vaccine-preventable diseases in several countries, including the United States.

WHAT THIS STUDY ADDS: This is the first report on prevalence of vaccine hesitancy among parents of children 6 months through 17 years in the United States using a survey module developed by Centers for Disease Control and Prevention and examining the association with childhood influenza vaccination coverage.

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Vaccine hesitancy (VH) has contributed to large outbreaks of vaccine-preventable diseases in several countries, including the United States.[1–4] Although there is a lack of consensus on the definition of VH, it can be defined as the mental state of holding back in doubt or indecision regarding vaccination.[5,6] VH may or may not lead a person to refuse or delay vaccinations for themselves or their children.[5,7] Understanding the contributions of VH, among other vaccination barriers, is needed to inform improvements to vaccination programs. Researchers have noted a need for strategies to address VH, including monitoring VH over time by using a standard set of questions at the national level and at a level that allows for analysis of geographic clustering of VH.[8,9] In 2018, the National Center for Health Statistics (NCHS) published a set of VH questions developed and tested at the NCHS Questionnaire Design Research Laboratory.[10] This set of 6 questions was included in the National Immunization Survey (NIS) family of surveys to evaluate their performance in the field and collect updated information related to parental VH. Our objectives with this study were to quantify national prevalence of parental VH in the United States for children ages 6 months through 17 years, examine sociodemographic variables associated with VH, and examine the association of VH with childhood influenza vaccination coverage. Influenza vaccination coverage remains low and lags behind other childhood vaccines[11]; for the 2018–2019 influenza season, coverage with at least 1 dose was 62.6% among children.[12] This article expands on some previous studies of the association of parental VH and child influenza vaccination coverage.[13–17]

METHODS

VH Question Development

In 2016–2017, a group of researchers at the Centers for Disease Control and Prevention within a Vaccine Hesitancy Workgroup developed and tested survey questions to measure VH in collaboration with the NCHS Questionnaire Design Research Laboratory. The process used to develop the survey questions has been detailed previously.[10] Briefly, a series of focus groups with parents were conducted to better understand how parents thought about childhood vaccination. The findings from these focus groups were used to reduce a list of survey questions relating to VH, drawn from existing federal health surveys and other question sets such as the Parent Attitudes about Childhood Vaccines survey,[18] to an initial set of 98 questions. Based on cognitive interviews,[19] this list was further reduced to sets of 1-, 3-, and 5-minute VH modules, each designed to be added into other surveys. The resulting 1-minute VH module included 6 questions: (1) Is [child] administered vaccines following a standard schedule, or some other schedule, such as the Sears Schedule? (2) Overall, how hesitant about childhood shots would you consider yourself to be? Would you say not at all hesitant, not that hesitant, somewhat hesitant, or very hesitant? (3) Did concerns about the number of vaccines [child] gets at one time impact your decision to get [child] vaccinated? (4) Did concerns about serious, long-term side effects impact your decision to get [child] vaccinated? (5) Do you personally know anyone who has had a serious, long-term side effect from a vaccine? (6) Is [child]'s doctor or health provider your most trusted source of information about childhood vaccines?

Survey Description

During April to June of 2018 and 2019, the NCHS VH module of 6 questions was included in the NIS.[20] The NIS is a family of surveys using a national, state-stratified, list-assisted random-digit-dialed cellular telephone sample of households with children in the United States. Households with children aged 19 to 35 months during each calendar quarter of data collection are eligible for the NIS-Child, and households with children aged 13 to 17 years on the date of interview are eligible for the NIS-Teen. During October through June for each influenza season, households with children aged 6 to 18 months or 13 to 17 years not eligible for NIS-Child or NIS-Teen are eligible for a short child influenza module.[12] The 1-minute VH module was included on the child influenza module, NIS-Child, and NIS-Teen. Data from these 3 surveys are routinely combined and referred to as the NIS-Flu.[12] The response rates ranged across the survey components from 22.8% to 24.4% (2018) and 23.1% to 24.6% (2019). The study sample sizes were n = 36 184 (2018) and n = 39 617 (2019). Because the VH questions were designed to measure VH about all childhood vaccinations, they were placed at a point in the survey immediately after influenza vaccination questions and the following introductory text was added: "The next set of questions are about *all* recommended childhood vaccines, not just flu vaccination."

Influenza vaccination status was assessed with the questions: "Since July 1, 2017 [or 2018] has [child] had a flu vaccination? There are two types of flu vaccinations. One is a shot and the other is a spray, mist or drop in the nose." Sociodemographic characteristics were based on respondent report; the variables included in this study were child's age and race and ethnicity, household income or poverty level, number of children in the household, mother's education, urban–rural residence, and the relationship to the child of the person completing the survey.

Respondents to the NIS are those who are knowledgeable about the child's vaccinations. Respondents were predominantly the child's mother (59.3% in 2018, and 61.6% in 2019), whereas approximately one-third were the child's father and <10% were another family member. For the purpose of succinctness in this study, we refer to the respondent as the parent.

Statistical Methods

Proportions of responses to the VH questions were calculated overall and stratified by sociodemographic variables. Adjusted prevalence by each sociodemographic variable was also estimated by using predicted marginals from multivariable logistic regression models including main effects. Adjusted prevalence estimates were similar to unadjusted estimates and are reported in Table 1. For ease of analysis and interpretation, the 4 response categories of the "overall how hesitant are you" question were collapsed into 2 categories, combining "not at all hesitant" and "not that hesitant" responses together and "somewhat" and "very hesitant" responses together. For all 6 questions, a small percentage of respondents said they do not know or did not answer the question; we did not exclude the children of these parents from the analyses because we did not consider these responses to be missing at random given the nature of the hesitancy questions (see Fig 1 footnote for coding details). The recoding did not have an impact on overall results from the small percentages missing (Fig 1). For all sociodemographic variables in the NIS-Flu, except for income, missing responses are routinely imputed during data file processing. There are no missing values for child vaccination status because a completion for the NIS-Flu is defined as completing the survey at least through the vaccination status question.

The association of child influenza vaccination coverage with hesitancy variables was tested by using multivariable logistic regression models. One model for each hesitancy variable was run, with the dependent variable being influenza vaccination status and independent variables being the one hesitancy variable and all of the sociodemographic variables. Adjusted prevalence and adjusted prevalence differences (APDs) were calculated from all models with significance tests based on the APDs. As a partial examination of the interrelationship of the 6 hesitancy variables, we stratified responses by the self-reported overall hesitancy question and calculated the prevalence of the other VH questions. All analyses were weighted to population totals and to adjust for households having multiple telephone lines, unit nonresponse, and noncoverage of noncellular-telephone households. A 2-sided significance level of 0.05 was adopted for all statistical tests; comparisons in the text described as different, higher, or lower were statistically significant. Analyses were conducted using SAS, version 9.4 (SAS Institute, Inc, Cary, NC) and SUDAAN (version 11.0.3) to account for the complex survey design.

RESULTS

National Prevalence of Parental VH, 2018 and 2019

The percentage of children aged 6 months through 17 years in the United States having a parent who said they were hesitant about childhood shots was 25.8% (7.5% very hesitant and 18.3% somewhat hesitant) in 2018 and 19.5% (5.6% very hesitant and 13.8% somewhat hesitant) in 2019 (Fig 1). In both survey years, 6% of children had a parent reporting using a nonstandard vaccine schedule. The prevalence of concern about the number of vaccines a child gets at one time impacting the parent's decision to get their child vaccinated was 22.8% in 2018 and 19.1% in 2019, whereas the prevalence of concern about serious, long-term side effects impacting the parent's decision to get their child vaccinated was 27.3% in 2018 and 21.7% in 2019. The prevalence of personally knowing anyone who has had a serious long-term side effect from a vaccine was 14.9% in 2018 and 13.5% in 2019. Finally, the prevalence of not considering the child's doctor or health provider as the most trusted source of information about childhood vaccines was 17.3% in 2018 and 14.4% in 2019 (Fig 1).

Association of the Overall Hesitancy Question With the Other 5 VH Questions, 2019

Responses to the question "overall how hesitant about childhood shots would you consider yourself to be" were strongly associated with responses to the other 5 VH questions (Fig 2). Among children with a parent reporting being somewhat or very hesitant about childhood shots, 63.2% had a parent reporting concerns about serious, long-term side effects impacting their decision to get the child vaccinated, whereas this percentage was 11.7% among those with a parent not at all or not that hesitant. Likewise, the prevalence of the other VH constructs was low but not absent among those self-reporting as not at all or not that hesitant about childhood shots (Fig 2).

Sociodemographic Variables Associated With Parental VH, 2019

Child's age was associated with parental self-report of being hesitant about childhood shots; 17.7% of parents of children aged 13 to 17 years compared with 20.3% of parents of children aged 6 to 23 months reported being hesitant (Table 1). The child's age was also associated with parental concern about the number of vaccines a child

TABLE 1 Sociodemographic Variables Associated With Parental Prevalence of VH, United States, 2019, NIS-Flu

Characteristic	VH Survey Question, Adjusted[a] % (95% CI)					
	Overall, How Hesitant About Childhood Shots Would You Consider Yourself to Be?	Is Child Administered Vaccines Following a Standard Schedule, or Some Other Schedule, Such as the Sears Schedule?	Did Concerns About the Number of Vaccines Child Gets at One Time Impact Your Decision to Get Child Vaccinated?	Did Concern About Serious, Long-Term Side Effects Impact Your Decision to Get Child Vaccinated?	Do You Personally Know Anyone Who Has Had a Serious, Long-Term Side Effect From a Vaccine?	Is Child's Doctor or Health Provider Your Most Trusted Source of Information About Childhood Vaccines?
	Percentage Reporting Somewhat or Very Hesitant	Percentage Reporting Some Other Schedule	Percentage Reporting Yes	Percentage Reporting Yes	Percentage Reporting Yes	Percentage Reporting No
Child's age						
6–23 mo (referent)	20.3 (18.1–22.4)	6.7 (5.3–8.1)	22.4 (20.2–24.5)	21.9 (19.7–24.2)	12.3 (10.5–14.1)	14.5 (12.4–16.5)
2–4 y	21.1 (19.0–23.2)	7.0 (5.8–8.2)	22.7 (20.5–24.8)	21.8 (19.7–23.8)	13.8 (11.9–15.7)	14.9 (12.9–16.8)
5–12 y	19.9 (18.8–21.0)	6.4 (5.8–7.1)	18.4 (17.4–19.5)*	22.1 (20.9–23.2)	13.0 (12.1–14.0)	14.4 (13.4–15.3)
13–17 y	17.7 (16.4–19.1)*	5.1 (4.3–6.0)	17.3 (16.0–18.7)*	21.0 (19.6–22.4)	14.3 (13.1–15.5)	14.3 (13.1–15.5)
Child's race and ethnicity[b]						
Non-Hispanic white only (referent)	17.5 (16.4–18.5)	5.9 (5.3–6.6)	18.0 (17.1–19.0)	19.9 (18.9–20.9)	13.6 (12.7–14.5)	14.5 (13.6–15.4)
Non-Hispanic Black only	29.4 (26.6–32.3)*	5.5 (4.2–6.7)	22.1 (19.7–24.4)*	29.8 (27.1–32.5)*	12.4 (10.3–14.6)	15.5 (13.4–17.6)
Hispanic	18.1 (16.3–19.9)	7.1 (5.8–8.3)	19.2 (17.2–21.2)	19.7 (17.8–21.6)	13.5 (11.6–15.4)	13.1 (11.4–14.8)
Non-Hispanic, other or multiple races	18.9 (16.9–20.9)	5.6 (4.5–6.7)	19.8 (17.6–22.1)	24.3 (22.0–26.5)*	13.9 (12.1–15.8)	15.4 (13.2–17.5)
Household income or poverty level[c]						
Over poverty level, >$75 000/y (referent)	15.9 (14.6–17.2)	5.6 (4.7–6.4)	17.6 (16.2–18.9)	19.0 (17.7–20.3)	13.1 (12.0–14.3)	14.1 (13.1–15.2)
Over poverty level, ≤$75 000/y	21.2 (19.7–22.7)*	5.9 (5.1–6.6)	20.2 (18.7–21.7)*	23.1 (21.6–24.7)*	13.8 (12.5–15.2)	15.0 (13.6–16.4)
At or below poverty level	20.8 (18.5–23.1)*	6.3 (5.1–7.5)	18.7 (16.6–20.8)	23.3 (20.9–25.6)*	12.2 (10.4–14.1)	12.6 (10.8–14.4)
Income not reported	25.2 (22.7–27.6)*	8.5 (6.9–10.0)*	22.4 (20.0–24.8)*	25.9 (23.5–28.3)*	15.3 (13.2–17.4)	16.3 (14.2–18.4)
No. children living in the household						
1 child (referent)	18.4 (17.0–19.8)	5.4 (4.6–6.2)	19.1 (17.7–20.6)	22.1 (20.6–23.6)	11.8 (10.6–12.9)	13.6 (12.4–14.8)
2 children	19.1 (17.8–20.4)	5.7 (5.0–6.4)	18.4 (17.2–19.6)	20.9 (19.7–22.1)	12.8 (11.8–13.9)	13.5 (12.5–14.6)
3 or more children	20.8 (19.3–22.3)*	7.4 (6.4–8.3)*	19.8 (18.4–21.3)	22.3 (20.9–23.8)	15.8 (14.4–17.3)*	16.4 (15.0–17.7)*
Mother's education level						
Less than high school (referent)	21.0 (18.0–24.0)	6.5 (4.9–8.1)	16.6 (14.2–18.9)	17.6 (15.1–20.1)	9.4 (7.1–11.6)	10.8 (8.8–12.9)
High school or equivalent	22.2 (20.2–24.2)	6.0 (4.9–7.0)	18.6 (16.8–20.5)	23.7 (21.8–25.7)*	12.6 (10.9–14.2)*	11.9 (10.4–13.3)
Some college	21.0 (19.3–22.6)	6.6 (5.6–7.5)	20.1 (18.5–21.8)*	24.3 (22.5–26.0)*	16.2 (14.6–17.8)*	16.0 (14.6–17.5)*
≥ college degree	16.9 (15.8–18.1)*	5.9 (5.1–6.6)	19.3 (18.0–20.6)	20.5 (19.3–21.7)	13.3 (12.3–14.4)*	15.4 (14.2–16.6)*
Who completed the survey?						
Child's mother (referent)	19.8 (18.8–20.8)	5.9 (5.3–6.4)	19.4 (18.4–20.4)	21.6 (20.6–22.6)	14.3 (13.4–15.2)	13.2 (12.3–14.0)
Child's father	20.0 (18.5–21.6)	6.5 (5.6–7.4)	19.2 (17.7–20.6)	22.9 (21.4–24.4)	11.6 (10.3–12.9)*	16.3 (14.9–17.7)
Other	15.6 (13.3–17.8)*	6.8 (4.9–8.7)	16.2 (13.9–18.5)*	18.5 (16.0–20.9)*	14.2 (11.7–16.8)	17.1 (14.5–19.8)*
Urban–rural residence[d]						
Urban (MSA, central city) (referent)	19.1 (17.6–20.6)	5.9 (5.0–6.7)	19.6 (18.0–21.3)	20.5 (19.0–22.1)	11.8 (10.5–13.1)	14.2 (12.8–15.6)
Suburban (MSA, noncentral city)	19.2 (18.1–20.2)	6.0 (5.4–6.6)	18.7 (17.7–19.6)	22.2 (21.1–23.2)	14.1 (13.1–15.0)*	14.2 (13.3–15.1)
Rural (non-MSA)	21.6 (19.6–23.5)*	7.3 (6.0–8.6)	19.9 (18.1–21.7)	22.0 (20.1–23.9)	13.8 (12.2–15.4)	16.0 (14.4–17.7)

MSA, metropolitan statistical area.

[a] Adjusted estimates are based on multivariable logistic regression models with the hesitancy question as the dependent variable and the following variables as independent variables: child's age, child's race and ethnicity, household income, number of children in the household, mother's education, respondent relationship to the child, and MSA of residence.

[b] Race of child was reported by parent or guardian respondent. Children of Hispanic ethnicity may be of any race. Children identified as multiple races had >1 race category selected.

[c] Income and poverty level was defined on the basis of total family income in the past calendar year, and the US Census poverty thresholds for that year specified for the applicable family size and number of children <18 y. Poverty thresholds are available at http://www.census.gov/hhes/www/poverty/data/threshld/index.html.

[d] MSA was based on parent or guardian respondent-reported city, state, county, and zip code of residence by using the MSA definition file (https://www.census.gov/programs-surveys/metro-micro.html).

* Statistically significant at $P < .05$ in the APD compared with the referent group.

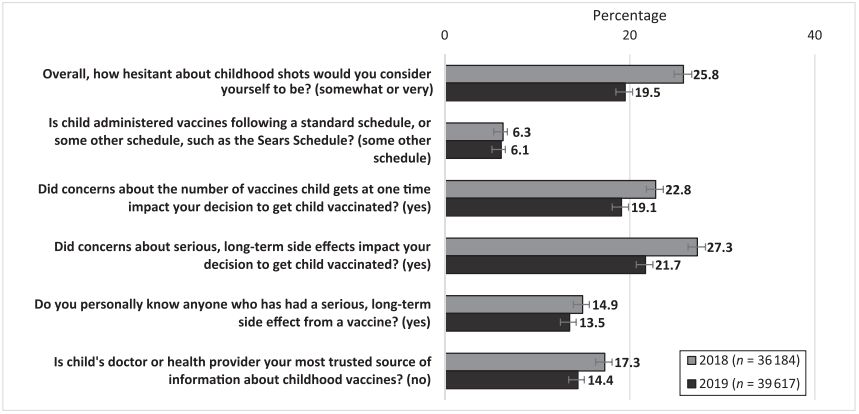

FIGURE 1

Prevalence of VH in the United States among parents of children age 6 months to 17 years, United States, 2018 and 2019, NIS-Flu. The recoding of do not know and refused responses to the 6 questions and their combined prevalence follows, ordered according to presentation in this figure: (1) grouped with nonhesitant (0.7% and 0.7%, for 2018 and 2019, respectively), (2) grouped with "standard schedule" (6.7% and 5.1%), (3) grouped with no concern (1.1% and 0.9%), (4) grouped with no concern (1.0% and 0.8%), (5) grouped with yes (1.1% and 1.0%), (6) grouped with no (1.0% and 1.0%).

gets at one time affecting their decision to vaccinate, with lower prevalence of concern among parents of children aged 5 to 17 years compared with children aged 6 to 23 months (Table 1). Parents of non-Hispanic Black children, compared with parents of non-Hispanic white children, had higher prevalence of self-reported hesitancy about childhood shots (29.4% vs 17.5%), concerns about the number of shots (22.1% vs 18.0%), and concerns about side effects (29.8% vs 19.9%); these are the largest differences in Table 1. Parents of non-Hispanic other or multiple race children also had a higher prevalence of concerns about side effects compared with parents of non-Hispanic white children (24.3% vs 19.9%).

Parents in the highest income group had lower prevalence of self-reported hesitancy about childhood shots than all other income groups (15.9% vs 20.8%–25.2%), and likewise, they had lower prevalence of concern about side effects than all other income groups (19.0% vs 23.1%–25.9%; Table 1). Parents who did not report income on the survey had a higher prevalence of not following the standard schedule compared with the highest income group (8.5% vs 5.6%; Table 1).

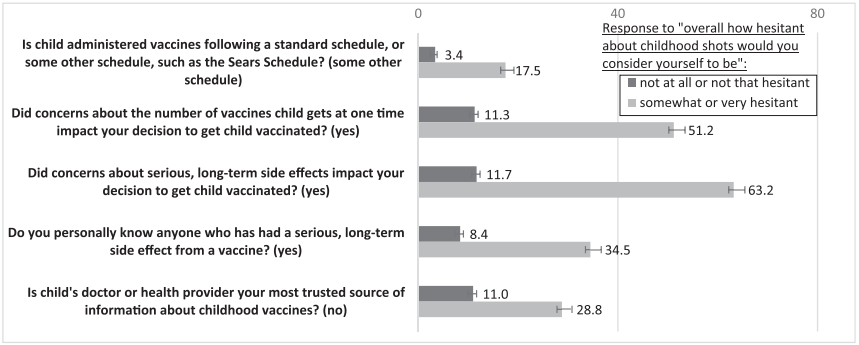

FIGURE 2

Association of self-reported hesitancy with other VH questions, United States, 2019, NIS-Flu.

Compared with there being only 1 child in the household, having ≥3 children living in the household was associated with higher prevalence of hesitancy about childhood shots (20.8% vs 18.4%), using a nonstandard schedule (7.4% vs 5.4%), reporting knowing someone with side effects from vaccines (15.8% vs 11.8%), and the doctor not being the most trusted source for vaccine information (16.4% vs 13.6%; Table 1). Higher mother's education (college degree) was associated with lower prevalence of self-reported hesitancy compared with mothers with less than a high school degree (16.9% vs 21.0%). However, higher education was generally associated with higher prevalence of concerns about the number of vaccines and side effects as well as reporting personally knowing someone with vaccine side effects and not having the child's doctor as the most trusted source of information about vaccines (Table 1). Respondents who were not the child's mother or father had a lower prevalence of self-reported hesitancy. There was a slightly higher prevalence of self-reported hesitancy in rural areas (21.6%) compared with urban areas (19.1%) but no differences on any other VH variable except for a higher prevalence of suburban parents reporting knowing someone affected by side effects compared with urban parents (14.1% vs 11.8%; Table 1).

Influenza Vaccination Coverage and Parental VH, 2018 and 2019

All 6 VH variables were strongly associated with child influenza vaccination coverage. Adjusted influenza vaccination coverage was 25.8 percentage points lower in the 2017–2018 season and 25.6 percentage points lower in the 2018–2019 season among children of parents who self-reported being somewhat or very hesitant about childhood shots compared with children of parents who were not at

all or not that hesitant (Table 2). The APDs in vaccination coverage were of similar magnitude for the other 5 VH variables (Table 2). The APDs in vaccination coverage ranged from 18.1 to 25.8 percentage points across the 2 influenza seasons and the 6 VH variables, thus indicating lower influenza vaccination coverage of children of parents who report elements of VH defined by the 6 survey questions.

VH varied widely between states according to the 2019 estimates for the "overall how hesitant about childhood shots" question, with prevalence of parents reporting being somewhat or very hesitant ranging from 12.9% (95% confidence interval [CI]: 9.2–17.9) in Vermont to 25.4% (95% CI: 20.7–30.9) in Mississippi. These state-level VH estimates were inversely correlated with the state-level final influenza vaccination coverage estimates published on FluVaxView for the 2018–2019 influenza season (Fig 3).[12]

DISCUSSION

Approximately one-fifth of children in the United States had a parent reporting they were hesitant about childhood shots in 2019. Similar prevalence of VH has been found in some other studies but was higher than in a recent US study.[21–23] The proportion varied between 2018 and 2019, supporting the need to continuously monitor VH, as pointed out in the literature.[8,9] The associations shown in this study between the VH variables and child influenza vaccination coverage may suggest a role for reduction in VH in increasing vaccination coverage with influenza.[24] However, even among children of parents who reported being vaccine hesitant, 34% to 47% were vaccinated against influenza. The causal relationship between VH and other barriers to vaccination and decision-making is complex. Provider recommendation has been found to be associated with higher child influenza vaccination coverage.[25] Resources for providers to help them speak to VH parents are available.[26–28]

We also found an association of state-level estimates of parental VH with state-level child influenza vaccination coverage. As shown in the literature, there are geographical pockets of VH.[4] The association of state-level parental hesitancy variables with vaccination coverage could be an avenue for future study, taking into account possible confounding and state-level vaccination program variables. Although we could not reliably estimate levels of local area VH in this study, the fact that the state-level estimates of VH show variability and association with vaccination coverage suggests that it could be worth exploring variability across smaller geographic areas as well as to identify differences in vaccine confidence at a more granular level.

Although many of the sociodemographic variables showed some group differences for the 6 VH questions, most were small differences but statistically significant because of our large sample size. The exceptions to the small differences were the substantially higher prevalence of hesitancy about childhood shots (11.9 percentage points) and prevalence of self-reported concerns about serious, long-term side effects (9.9 percentage points) among parents of Black compared with white children. Racial disparities in influenza vaccination coverage have long persisted in the United States, among both adults and children.[29,30] Early studies of reasons for nonvaccination showed racial differences in belief in misinformation, such as the influenza vaccination causing influenza.[16]

Examining the interrelationship of the 6 VH module variables emphasized the complexity of the VH construct. For the most part, parents who self-identified as being "hesitant about childhood shots" selected responses indicating aspects of VH for the other 5 questions. Yet there were parents who did not self-identify as being "hesitant about childhood shots" but did have concerns about vaccines, used alternate vaccine schedules, and did not consider their child's doctor as the most trusted source of information. This is consistent with the findings from the cognitive evaluation of these questions, in which parents' interpretation of the term "hesitant" related to their overall perception of the benefits and/or risks of childhood vaccination.[10] Thus, although a parent may indicate they have specific concerns in regard to vaccines (ie, the number of vaccines their child receives at once), they might still weigh the benefits of vaccination as greater than the risks and thus not identify as vaccine hesitant.

This study is subject to several limitations. Influenza vaccination was parent-reported so there may be reporting bias; authors of some studies have shown that parents over-report child influenza vaccination coverage.[30,31] There may be an upward bias in parents 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.[32] The survey weighting adjustments may not eliminate all bias from using incomplete sample frames that excluded households with no telephones or only landline telephones. The response rate for the survey was low; hesitancy prevalence and vaccination coverage may differ between respondents and nonrespondents, and survey weighting may not adequately control for these differences. The VH module questions were not influenza-specific but referred to all vaccines; parents

TABLE 2 Parental Hesitancy Response Prevalence by Their Child's Influenza Vaccination Status Subgroup, and Child Influenza Vaccination Coverage by Parental Hesitancy Response, Children Age 6 Months to 17 Years, United States, 2017–2018 and 2018–2019 Influenza Seasons, NIS-Flu

	Parental VH Question Responses by Subgroup Defined by Child's Influenza Vaccination Status				Child's Influenza Vaccination Coverage (≥1 dose)	
	2017–2018 Influenza Season		2018–2019 Influenza Season		2017–2018 Influenza Season	2018–2019 Influenza Season
	Vaccinated Subgroup, % (95% CI)	Unvaccinated Subgroup, % (95% CI)	Vaccinated Subgroup, % (95% CI)	Unvaccinated Subgroup, % (95% CI)	Adjusted[a] % (95% CI)	Adjusted % (95% CI)
Overall, how hesitant about childhood shots would you consider yourself to be?						
Somewhat or very hesitant	17.1 (16.1–18.0)	37.5 (36.0–39.1)	12.7 (11.9–13.6)	30.4 (28.9–32.0)	38.2 (36.3–40.1)*	41.4 (39.2–43.6)*
Not at all or not that hesitant	82.9 (82.0–83.9)	62.5 (60.9–64.0)	87.3 (86.4–88.1)	69.6 (68.0–71.1)	63.9 (62.8–65.1)*	67.0 (65.9–68.0)*
APD					−25.8	−25.6
Is child administered vaccines following a standard schedule, or some other schedule, such as the Sears schedule?						
Standard schedule	96.2 (95.7–96.6)	90.4 (89.5–91.2)	96.1 (95.6–96.5)	90.3 (89.3–91.2)	58.9 (57.8–59.9)*	63.5 (62.5–64.4)*
Some other schedule	3.8 (3.4–4.3)	9.6 (8.8–10.5)	3.9 (3.5–4.4)	9.7 (8.8–10.7)	34.1 (30.6–37.7)*	39.7 (36.0–43.4)*
APD					24.7	23.7
Did concerns about the number of vaccines child gets at one time impact your decision to get child vaccinated?						
Yes	16.6 (15.7–17.5)	31.2 (29.7–32.6)	14.6 (13.8–15.5)	26.3 (24.9–27.7)	41.4 (39.4–43.4)*	47.3 (45.2–49.5)*
No	83.4 (82.5–84.3)	68.8 (67.4–70.3)	85.4 (84.5–86.2)	73.7 (72.3–75.1)	62.0 (60.9–63.1)*	65.4 (64.4–66.5)*
APD					−20.6	−18.1
Did concern about serious, long-term side effects impact your decision to get child vaccinated?						
Yes	19.0 (18.1–20.0)	38.3 (36.8–39.8)	14.8 (14.0–15.7)	32.9 (31.4–34.4)	40.6 (38.7–42.4)*	43.2 (41.2–45.2)*
No	81.0 (80.0–81.9)	61.7 (60.2–63.2)	85.2 (84.3–86.0)	67.1 (65.6–68.6)	63.6 (62.4–64.7)*	67.2 (66.2–68.3)*
APD					−23.0	−24.1
Do you personally know anyone who has had a serious, long-term side effect from a vaccine?						
Yes	9.5 (8.8–10.3)	22.1 (20.8–23.5)	8.8 (8.1–9.5)	21.2 (19.8–22.5)	37.7 (35.3–40.2)*	41.4 (38.8–44.1)*
No	90.5 (89.7–91.2)	77.9 (76.5–79.2)	91.2 (90.5–91.9)	78.8 (77.5–80.2)	60.7 (59.6–61.8)*	65.2 (64.2–66.2)*
APD					−23.0	−23.8
Is child's doctor or health provider your most trusted source of information about childhood vaccines?						
Yes	87.4 (86.5–88.2)	76.6 (75.1–77.9)	89.3 (88.6–90.0)	79.5 (78.1–80.8)	60.5 (59.4–61.6)*	64.7 (63.7–65.7)*
No	12.6 (11.8–13.5)	23.4 (22.1–24.9)	10.7 (10.0–11.4)	20.5 (19.2–21.9)	41.9 (39.5–44.2)*	45.8 (43.3–48.3)*
APD					18.6	18.9

APD, adjusted prevalence difference.

[a] Adjusted estimates are based on multivariable logistic regression models, 1 model for each hesitancy question included, with vaccination status as the dependent variable and the hesitancy question and the following variables as independent variables to test for the independent effects of the hesitancy question on vaccination status: child's age, child's race and ethnicity, household income, number of children in the household, mother's education, respondent relationship to the child, and metropolitan statistical area of residence (categories of the sociodemographic variables are the same as those in Table 1).

* Vaccination coverage estimates are significantly different, $P < .05$, when comparing the 2 groups defined by the hesitancy question responses.

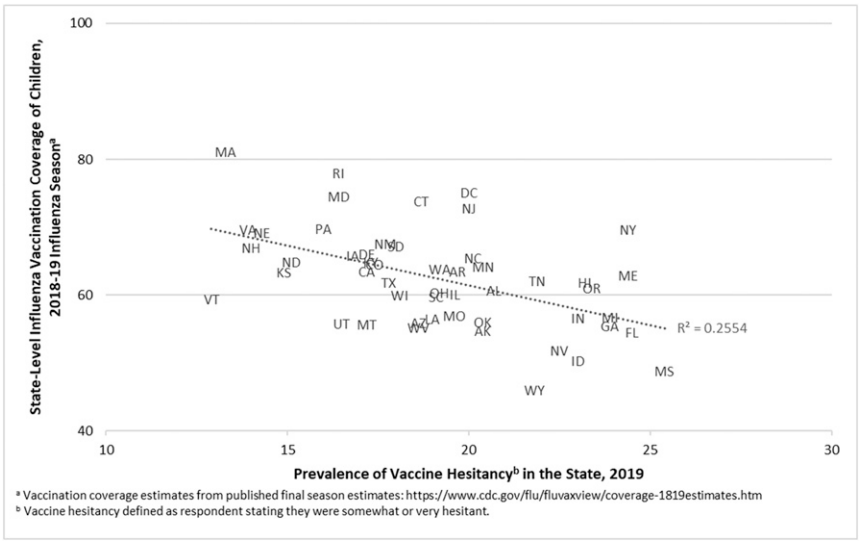

FIGURE 3
State-level parental VH and state-level influenza vaccination coverage, cshildren age 6 months to 17 years, United States, 2018–2019 Influenza Season, NIS-Flu.

may be hesitant about some vaccines more than others.[33] Researchers of future studies with the NIS data can examine the association of VH with receipt of childhood vaccines other than influenza. In this study, we did not examine the interaction of VH with other barriers to vaccination such as cost, access-to-care, or lack of convenience.

CONCLUSIONS

One in 5 children in the United States have a vaccine hesitant parent, and VH has a strong negative association with childhood influenza vaccination coverage. Consistently monitoring changes in VH, including socioeconomic differences in VH, could inform immunization programs in targeting interventions, provide resources to facilitate provider-patient vaccine conversations, and ultimately increase confidence in vaccinations and improve vaccination coverage to protect children from disease.

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.

ABBREVIATIONS

ASD: adjusted prevalence difference
CI: confidence interval
NCHS: National Center for Health Statistics
NIS: National Immunization Survey
VH: vaccine hesitancy

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