RESEARCH ARTICLE

Parental Vaccine Hesitancy and Declination of Influenza Vaccination Among Hospitalized Children

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ABSTRACT

OBJECTIVES: Parents frequently decline the influenza vaccine for their child during hospitalization. In this study, we aimed to assess the role of vaccine hesitancy in these declinations.

METHODS: This cross-sectional survey study was conducted among English-speaking parents of influenza vaccine-eligible children who were hospitalized between October 2014 and April 2015. Between July 2015 and September 2015, parents were recruited via mail to complete the validated Parent Attitudes about Childhood Vaccines (PACV) survey (modified for influenza vaccination). PACV scores (0–100 scale) were dichotomized into scores of ≥50 (hesitant) and <50 (nonhesitant). The primary outcome was parental declination of the influenza vaccine for their child during hospitalization. A secondary outcome was the declination reason documented during hospitalization. The main independent variable was parental vaccine hesitancy status, determined by the PACV score. Multivariable logistic regression was used to examine the association between vaccine hesitancy and influenza vaccine declination, adjusting for sociodemographic, visit, and clinical characteristics. The relationship between vaccine hesitancy and declination reason was also explored.

RESULTS: Of 199 parents (18% response rate), 24% were vaccine hesitant and 53% declined the influenza vaccine for their child during hospitalization. Vaccine hesitancy (versus nonhesitancy) was associated with declining influenza vaccination (adjusted odds ratio: 6.4; 95% confidence interval: 2.5–16.5). The declination reason differed by vaccine hesitancy status, with a higher proportion of parents who were hesitant versus nonhesitant reporting "vaccine concern" or "vaccine unnecessary."

CONCLUSIONS: Vaccine hesitancy was prevalent in this limited sample of parents of hospitalized children and associated with influenza vaccine declination. Additional investigation in a large, diverse, prospectively recruited cohort is warranted given the potential sampling bias present in this study.

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Influenza infection causes significant morbidity and mortality each year, especially among young children, the elderly, and those with an underlying chronic disease (CD).[1–4] Although the US Advisory Committee on Immunization Practices recommends influenza vaccination of all individuals 6 months of age and older without contraindications,[2] influenza vaccination coverage is suboptimal. Only 59.3% of US children were vaccinated in the 2014–2015 and 2015–2016 seasons.[5,6] Moreover, high-risk populations are often underimmunized against influenza. For example, approximately one-third of children with high-risk conditions were vaccinated against influenza during the 2006–2008 seasons, and only half of children with neurologic or neurodevelopmental conditions received the influenza vaccine in the 2011–2012 season.[7,8]

Influenza vaccination in diverse health care settings is an important strategy for optimizing coverage levels. In 2012, there were ∼2 million hospitalizations of children <18 years old, and two-thirds of these children had ≥1 chronic conditions.[9,10] Therefore, the hospital represents a promising setting for reaching a large number of children at high risk, particularly because missed opportunities for influenza vaccination occur commonly before hospitalization.[11,12] Nonetheless, the authors of 2 recent studies found that approximately half of parents declined the influenza vaccine for their vaccine-eligible child during hospitalization.[13,14] Reasons for this are not fully elucidated, although vaccine hesitancy, an important public health issue nationally,[15–18] could contribute. Using the validated Parent Attitudes about Childhood Vaccine (PACV) survey[19–21] (modified for influenza vaccination), researchers of a recent investigation found that parental vaccine hesitancy was associated with declination of the influenza vaccine in the pediatric emergency department (PED).[22] Additional evaluation of vaccine hesitancy among parents of high-risk children during hospitalization and its role in influenza vaccine declination in the hospital setting is needed.

In this study, we aimed to determine the proportion of parents of children hospitalized at a tertiary-care pediatric hospital who are vaccine hesitant and examine the relationship between parental vaccine hesitancy and parental declination of the influenza vaccine for children during hospitalization.

METHODS

Study Design, Population, and Setting

In this cross-sectional survey study, English-speaking parents were eligible to participate if their child was (1) 6 months to 17 years of age as of October 2014; (2) hospitalized on the medicine, surgery, psychiatry, or rehabilitation services at a tertiary-care pediatric hospital between October 2014 and April 2015 (ie, when the influenza vaccine was offered at the hospital); and (3) eligible for influenza vaccination at the time of hospital admission as determined by the hospital's influenza vaccination screening program (see below). Parents were excluded if a home address was not listed in their child's electronic health record (EHR). Only 1 parent was enrolled per household. This study was approved by the hospital's institutional review board.

Since 2008, the study hospital has had an EHR-based automated influenza vaccination screening program that is used to (1) identify influenza vaccine-eligible children using parental report, previous receipt within the hospital system, or manual verification in the Washington State Immunization Information System; (2) prompt providers to offer the vaccine; (3) document parental acceptance or declination; and, if applicable, (4) record 1 of 4 prespecified reasons for declination ("vaccine concern," "vaccine unnecessary," "want to wait," or "prefer to receive elsewhere"). Follow-up communication with parents who decline influenza vaccination is at the medical team's discretion. There was an 87% screening rate during hospitalization in the 2014–2015 season (A.M.H., D.J.O., D.R., T.D.S., J.A.E., unpublished observations).

Survey Instrument and Procedures

The PACV survey is a valid and reliable tool to identify parents who are hesitant toward childhood immunizations and includes 15 items under 3 domains (behavior, safety and efficacy, and general attitudes).[20,21] The PACV survey has been modified and validated for use with the influenza vaccine specifically.[22] Response formats vary and include dichotomous replies, 5-point Likert scales, and 11-point scales. We also included 8 sociodemographic items and 2 items regarding the child's receipt of the influenza vaccine during hospitalization (in case of an unforeseen event that prohibited matching with vaccine-related data in the EHR) at any location in the 2014–2015 season (to assess influenza vaccine receipt after hospitalization). An electronic version of the survey was created in REDCap.[23]

In July 2015, eligible parents were identified and sent a letter invitation to complete the study survey via mail (paper version) or REDCap (electronic version). Two follow-up recruitment letters were sent to nonrespondents. Surveys received after October 31, 2015, were excluded from the final analytic sample to reduce potential confounding by the 2015–2016 influenza season. All respondents received a $5 gift card for their time.

Survey responses were linked to select data abstracted from the index child's EHR, including demographic (age, sex, and insurance), visit (hospitalization dates and service), and clinical (CD status) information as well as influenza vaccine screening responses and administration data during the child's hospitalization. For children with >1 hospitalization between October 2014 and April 2015 ($n = 38$), these data were specific to the first hospitalization during which study eligibility criteria were fulfilled.

Measures

The primary outcome was parental declination of the influenza vaccine for their child during hospitalization as determined by the influenza vaccination screening responses documented in the EHR. This outcome was selected rather than actual influenza vaccine receipt during the child's hospitalization given our focus on parental decision-making in the study and recognizing that vaccine administration can be hindered by provider or systems-based barriers even when parents have accepted vaccination. Nonetheless, given the potential for parents to change their minds about

vaccination between the time of screening and hospital discharge, we also performed a sensitivity analysis using actual influenza vaccine receipt during the child's hospitalization (as determined by EHR abstraction) as our primary outcome. A secondary outcome of interest was the main parental declination reason documented during the child's hospitalization.

The main independent variable was vaccine hesitancy status. As described previously,[21,22] each of the 15 PACV item responses were collapsed into 3 categories (nonhesitant, not sure, and hesitant) and assigned a score of 0 (nonhesitant), 1 (not sure), or 2 (hesitant). The total raw score was converted to a 0- to 100-point scale by using simple linear transformation that accounted for missing data and then dichotomized into scores of <50 (nonhesitant) and ≥ 50 (hesitant). Other independent variables included sociodemographic characteristics (survey respondent age, race, ethnicity, highest education, marital status, household income, and relation to child; child age, sex, and insurance), CD status, hospital service, and hospitalization season. Insurance status was dichotomized into private versus public or uninsured status for all analyses because only 1 survey respondent had an uninsured child. CD status was determined by using the validated Pediatric Medical Complexity Algorithm, whereby patients are categorized as having complex CD, noncomplex CD, or no CD.[24] Here, these were dichotomized into CD (ie, complex or noncomplex CD) versus no CD status. Hospital service was categorized as medicine, surgery, psychiatry, or rehabilitation. For hospitalization season, the period of influenza vaccine availability at the study hospital was divided into 3 2-month intervals, October 8, 2014, to December 8, 2014; December 9, 2014, to February 9, 2015; and February 10, 2015, to April 14, 2015, denoted here as "fall," "winter," and "spring," respectively.

Statistical Analysis

Sociodemographic, clinical, and visit characteristics, influenza vaccine screening responses, influenza vaccine administration (EHR-documented and parent-reported), and PACV scores were summarized by using descriptive statistics. Demographic, clinical, visit, and hospital influenza vaccine screening and administration data were compared between survey respondents and nonrespondents by using χ^2 and Fisher's exact tests. Concordance of EHR-documented and parent-reported influenza vaccination during the child's hospitalization was described. Parental declination reasons documented during the child's hospitalization were compared between hesitant and nonhesitant parents by using Fisher's exact test. Logistic regression was used to assess the association between individual PACV item responses and influenza vaccine declination. Multivariable logistic regression was used to examine the association between parental vaccine hesitancy and influenza vaccine declination, adjusting for sociodemographic, clinical, and visit characteristics significant at $P < .20$ in bivariate analysis. A sensitivity analysis was also performed to examine the relationship between vaccine hesitancy and actual influenza vaccine receipt during the child's hospitalization. Analyses were performed by using SAS version 9.4 (SAS Institute, Inc, Cary, NC).

RESULTS

In total, 1215 eligible parents were sent the initial recruitment mailing. Of these, 77 were undeliverable and 208 parents responded (18% response rate). Of the latter, 5 parents returned the survey after October 31, 2015, and 4 parents declined participation. The final sample included 199 respondents (hereafter denoted as "parents") who were mostly older, white, and college educated (Table 1). Most children were privately insured and had a CD. There was no difference between survey respondents and nonrespondents with respect to the child's age, sex, or CD status. A higher proportion of parents with a privately insured child responded to the survey (21%) compared with those with a child who was publicly insured or uninsured (10%; $P < .001$). The proportion of parents who responded to the survey also differed on the basis of the child's hospital service (19% for medicine, 16% for surgery, 11% for psychiatry, and 0% for rehabilitation; $P < .05$) and hospitalization season (20% for fall, 15% for winter, and 14% for spring; $P < .05$).

TABLE 1 Study Characteristics ($n = 199$)

Characteristic	% (*n*)
Relation to child	
Mother	86 (172)
Father	13 (25)
Grandparent	1 (2)
Age[a]	
≥30 y	95 (188)
18–29 y	5 (10)
Race[a]	
White	86 (159)
African American	2 (3)
Asian American	7 (12)
Multiracial or other	5 (10)
Ethnicity[a]	
Hispanic	5 (10)
Non-Hispanic	95 (185)
Highest education[a]	
>4-y college degree	29 (57)
4-y college degree	32 (63)
Some college or 2-y degree	29 (57)
High school graduate or GED	8 (16)
Some high school, but not graduate	3 (5)
Marital status[a]	
Married	77 (152)
Divorced	9 (17)
Single	6 (12)
Living with partner	6 (11)
Widowed	3 (5)
Household income[a]	
>$75 000	52 (92)
$50 001–$75 000	17 (29)
$30 001–$50 000	17 (29)
≤$30 000	15 (26)
Child age	
6–23 mo	15 (30)
24–59 mo	19 (37)
5–17 y	66 (132)
Child sex	
Male	53 (105)
Female	47 (94)
Child insurance	
Private	75 (150)
Public	24 (48)
Uninsured	1 (1)
Child CD status[a]	
Complex CD	40 (77)
Noncomplex CD	36 (70)
No CD	24 (47)

TABLE 1 Continued

Characteristic	% (*n*)
Hospital service	
Medicine	62 (124)
Surgery	27 (53)
Psychiatry	11 (22)
Rehabilitation	0 (0)
Hospitalization season[b]	
Fall	49 (97)
Winter	26 (52)
Spring	25 (50)

GED, general equivalency diploma.
[a] Some missing data. Percent calculated among those with available data.
[b] Fall: October 8, 2014–December 8, 2014; winter: December 9, 2014–February 9, 2015; spring: February 10, 2015–April 14, 2015.

Over half of the survey respondents (53%) declined the influenza vaccine for their eligible child during hospitalization. A similar proportion of nonrespondents (55%) declined the influenza vaccine for their child during hospitalization. The main declination reason documented during the child's hospitalization also did not differ significantly between survey respondents and nonrespondents.

Nearly one-fourth of survey respondents (24%) had a total PACV score ≥50 (ie, hesitant). The median total PACV score was 21.4 (interquartile range: 7.1–46.7). A higher proportion of parents who were vaccine hesitant declined influenza vaccination compared with parents who were nonhesitant (85% vs 43%; $P < .001$; Fig 1). For most individual PACV items, a hesitant response was associated with influenza vaccine declination (Table 2). The association between parental vaccine hesitancy (versus nonhesitancy) and influenza vaccine declination remained significant after adjusting for parental age, ethnicity, education, CD status, insurance, and hospitalization season (adjusted odds ratio: 6.4; 95% confidence interval [CI]: 2.5–16.5). A sensitivity analysis revealed that vaccine hesitancy (versus nonhesitancy) was associated with actual failure to receive the influenza vaccine during the child's hospitalization (adjusted odds ratio: 4.0; 95% CI: 1.4–10.9; adjusting for CD status, hospital service, and hospitalization season).

The main declination reason that was documented at the time of the EHR-based screening during the child's hospitalization differed by vaccine hesitancy status. Specifically, a higher proportion of parents who were hesitant cited "vaccine concern" or "vaccine unnecessary" as the main reason compared with a higher proportion of parents who were nonhesitant and cited "want to wait" or "prefer to receive elsewhere" as the main reason (Fig 2).

There was 88% concordance between EHR documentation and parental report of influenza vaccination during the child's hospitalization. Nearly half of all surveyed parents (49%) reported that their child who was hospitalized received the influenza vaccine during the 2014–2015 season. Of the parents who declined the influenza vaccine for their child during hospitalization, only 17% reported that their child received the vaccine by the season's end. This proportion differed by parental declination reason during the child's hospitalization (53% "prefer to receive elsewhere," 14% "want to wait," 10% "vaccine unnecessary," 0% "vaccine concern"; $P < .001$).

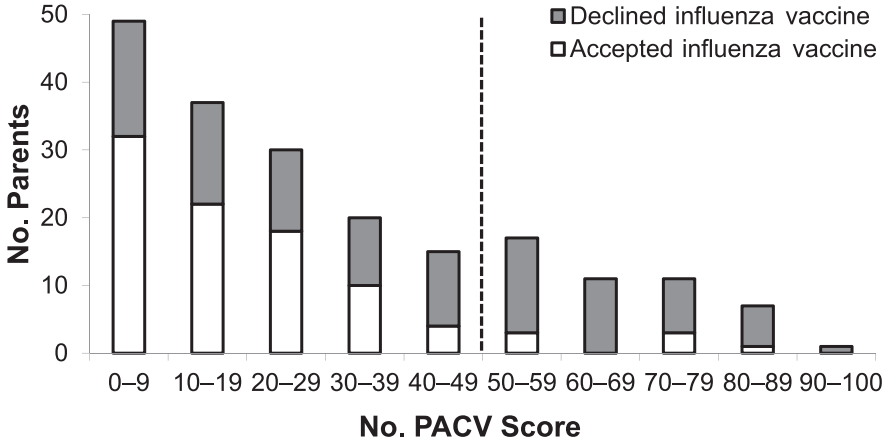

FIGURE 1 Parental decision-making about influenza vaccination of their child during hospitalization by PACV score. A PACV score ≥50 equals vaccine hesitant.

DISCUSSION

In this study, we found that vaccine hesitancy was prevalent in a sample of parents of hospitalized children. We also showed that parental vaccine hesitancy was associated with their declining influenza vaccination during their child's hospitalization. Our findings, along with those from previous studies,[13,14] support the need for strategies to improve influenza vaccine uptake among children who are hospitalized, many of whom have an underlying CD and are at an increased risk of influenza and influenza-related complications.[25–30]

It is important to acknowledge at the outset that our results need to be interpreted within the context of a low survey response rate and the sampling bias this potentially introduces. Survey respondents and nonrespondents differed by the child's insurance status, hospital service, and hospitalization season, which favors the presence of such a bias. However, they were similar with respect to other demographic, clinical, and visit characteristics. Importantly, they were also similar with respect to influenza vaccine declination and the main declination reason documented during the child's hospitalization. Thus, we feel that the survey respondents and their beliefs and practices regarding influenza vaccination are largely representative of the sampling frame.

Our finding that nearly one-fourth of surveyed parents of hospitalized children were vaccine hesitant is consistent with PACV studies conducted among parents of children who were cared for in the hospital's PED[22] as well as parents of 19- to 35-month-old infants who were cared

TABLE 2 Association Between Individual PACV Item Responses and Parental Declination of the Influenza Vaccine for Their Child During Hospitalization

Item	Response Option	Response, % (*n*)[a]	Declination, % (*n*)[b]	OR (95% CI)[c]
1. Have you ever delayed having your child get a shot for reasons other than illness or allergy?	Yes[d]	29 (57)	70 (40)	2.7 (1.4–5.3)[e]
	No	71 (137)	46 (63)	Referent group
	Don't know	Excluded[f]	—	—
2. Have you ever decided not to have your child get a shot for reasons other than illness or allergy?	Yes[d]	34 (65)	77 (50)	5.0 (2.5–9.8)[e]
	No	66 (128)	40 (51)	Referent group
	Don't know	Excluded[f]	—	—
3. How sure are you that following the recommended shot schedule is a good idea for your child?	0–5[d]	26 (50)	80 (40)	5.7 (2.6–12.4)[e]
	6–7	7 (14)	64 (9)	2.6 (0.8–8.1)
	8–10	67 (132)	41 (54)	Referent group
4. Children get more shots than are good for them	Agree[d]	24 (48)	75 (36)	4.2 (1.9–9.0)[e]
	Not sure	26 (52)	54 (28)	1.6 (0.8–3.2)
	Disagree	50 (99)	42 (41)	Referent group
5. I believe that many of the illnesses that shots prevent are severe	Disagree[d]	5 (9)	44 (4)	0.7 (0.2–2.8)
	Not sure	8 (16)	69 (11)	2.0 (0.7–6.1)
	Agree	87 (174)	52 (90)	Referent group
6. It is better for my child to develop immunity by getting sick than to get a shot	Agree[d]	13 (26)	62 (16)	2.0 (0.8–4.6)
	Not sure	17 (33)	79 (26)	4.6 (1.9–11.2)[e]
	Disagree	70 (139)	45 (62)	Referent group
7. It is better for children to get fewer vaccines at the same time	Agree[d]	48 (94)	69 (65)	3.6 (1.6–8.2)[e]
	Not sure	35 (69)	38 (26)	1.0 (0.4–2.3)
	Disagree	17 (34)	38 (13)	Referent group
8. How concerned are you that your child might have a serious side effect from a shot?	Concerned[d]	39 (78)	64 (50)	2.3 (1.2–4.1)[e]
	Not sure	5 (10)	60 (6)	1.9 (0.5–7.1)
	Not concerned	56 (110)	44 (48)	Referent group
9. How concerned are you that any 1 of the childhood shots might not be safe?	Concerned[d]	41 (81)	70 (57)	3.8 (2.1–7.1)[e]
	Not sure	8 (15)	60 (9)	2.4 (0.8–7.3)
	Not concerned	52 (103)	38 (39)	Referent group
10. How concerned are you that a shot might not prevent the disease?	Concerned[d]	40 (79)	62 (49)	2.1 (1.2–3.9)[e]
	Not sure	9 (18)	67 (12)	2.6 (0.9–7.4)
	Not concerned	51 (102)	44 (44)	Referent group
11. If you had another infant today, would you want him or her to get all the recommended shots?	No[d]	14 (27)	93 (25)	15.3 (3.5–66.7)[e]
	Don't know	5 (10)	80 (8)	4.9 (1.0–23.7)[e]
	Yes	81 (161)	45 (72)	Referent group
12. Overall, how hesitant about childhood shots would you consider yourself to be?	Hesitant[d]	26 (52)	85 (44)	7.9 (3.5–18.1)[e]
	Not sure	3 (6)	50 (3)	1.4 (0.3–7.4)
	Not hesitant	71 (140)	41 (57)	Referent group
13. I trust the information I receive about shots	Disagree[d]	13 (25)	80 (20)	5.0 (1.8–13.9)[e]
	Not sure	12 (23)	78 (18)	4.5 (1.6–12.6)[e]
	Agree	76 (151)	45 (67)	Referent group
14. I am able to openly discuss my concerns about shots with my child's doctors	Disagree[d]	4 (7)	71 (5)	2.4 (0.5–12.9)
	Not sure	6 (12)	75 (9)	2.9 (0.8–11.2)
	Agree	90 (179)	51 (90)	Referent group
15. All things considered, how much do you trust your child's doctor?	0–5[d]	6 (12)	75 (9)	3.0 (0.8–11.3)
	6–7	6 (12)	67 (8)	2.0 (0.6–6.8)
	8–10	88 (174)	50 (87)	Referent group

OR, odds ratio; —, not applicable.

[a] Percent calculated among those who responded to the given item.

[b] Percent calculated among those with a given item response.

[c] Association between the individual PACV item response and parental declination of influenza vaccine was examined by using logistic regression (nonhesitant response equals referent group).

[d] Hesitant response.

[e] $P < .05$.

[f] "Don't know" response was excluded as missing data because it likely reflects poor recall rather than vaccine hesitancy.[19]

for in a regional health maintenance organization.[20] Lower hesitancy levels (9%–15%) were observed in PACV studies conducted prospectively among parents of 2-month-old infants in this region and parents of 2-week-old infants in a private pediatric clinic in Tennessee.[21,31] In the current study, approximately one-third of parents reported delaying or declining

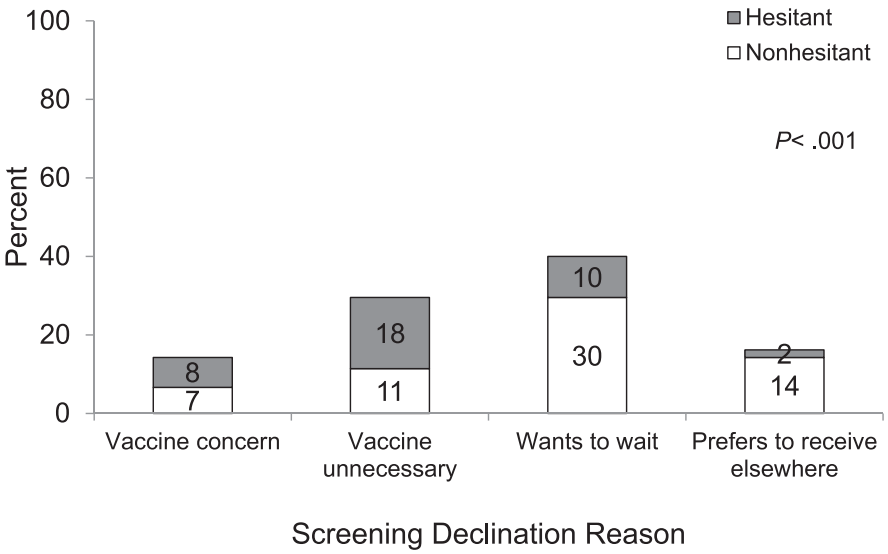

FIGURE 2 Main reason for parental declination of the influenza vaccine for their child during hospitalization by vaccine hesitancy status.

vaccination, which is comparable to recent data from the PED[22] but higher than that observed in previous PACV studies.

Over half of surveyed parents (53%) declined influenza vaccination for their child during hospitalization, consistent with earlier studies.[13,14] Only half of parents reported that their child was vaccinated against influenza at any point during the 2014–2015 season, falling below national levels (59%)[5,6] and Healthy People 2020 target levels (70%).[32] Parental misreporting due to recall bias may have occurred, although concordance between parent-reported and EHR-documented vaccine receipt in the hospital setting was high. Only half of parents who declined influenza vaccination during their child's hospitalization citing that they "prefer[red] to receive elsewhere" and only 1 in 7 parents who declined vaccination citing that they "want[ed] to wait" reported that their child was vaccinated by the season's end. Although most influenza vaccinations occur in outpatient settings, many children who are hospitalized do not follow-up with their outpatient provider after discharge.[33,34] Moreover, missed opportunities for influenza vaccination in outpatient settings are common.[12,35–37] This information highlights the need to capture all vaccination opportunities when they occur, including during the child's hospitalization.

In accordance with earlier work,[20–22,31] this study revealed an association between vaccine hesitancy and influenza vaccine declination among parents of hospitalized children. The findings suggest that the PACV survey could be a useful tool for not only identifying vaccine-hesitant parents in the hospital setting but also helping providers tailor their vaccine communication with them. For example, they could use evidence-based approaches, such as a presumptive vaccine recommendation or motivational interviewing, for parents who are identified as vaccine hesitant.[38–41] They also could address concerns raised in response to individual survey items. In this study, the association of some PACV items (eg, recommended number of vaccines) but not other items (eg, vaccine-preventable infection severity) with influenza vaccine declination suggests that certain topics may be more relevant to parental decision-making about influenza vaccination during the child's hospitalization. Moreover, in the current study, parental declination reasons that were documented during the EHR-based screening differed significantly by vaccine hesitancy status. Therefore, the addition of PACV survey items to a hospital influenza vaccination screening program may be beneficial. It could allow providers to better understand and address the general and influenza-specific, vaccine-related informational needs of both hesitant and nonhesitant families who do not initially accept the influenza vaccine for their child during hospitalization. This is particularly important given evidence that providers play a crucial role in changing the minds of parents who initially delay or decline vaccination.[18] Exploration of both the challenges to influenza vaccine acceptance in the hospital setting and the unique opportunities for discussion with patients and families during hospitalization would be valuable.

This study has several additional limitations. First, parental beliefs at the time of survey administration may have differed from beliefs during the child's hospitalization. Moreover, parents could have responded in ways that reflect consistency with previous actions rather than true preferences. However, the association between PACV scores and parental vaccine behaviors observed here is consistent with previous PACV studies, including those that were conducted prospectively.[19–22,31] In addition, EHR-based screening responses may have been entered incorrectly by the health care staff or provider. Moreover, not all parental vaccine decision-making may have been documented by the EHR-based screening program, although a sensitivity analysis in which actual influenza vaccine receipt during the child's hospitalization was used as the outcome variable did not change the overall findings. Finally, the study included primarily white, college-educated, high-income parents who were seeking care for their child at a single, urban, pediatric, tertiary-care center in a state with a high vaccine exemption rate.[42] Although the study population demographics and setting limit the generalizability of our findings, preliminary studies such as ours that are designed to gain greater insight into parental vaccine hesitancy and its role in the hospital setting are often only possible in areas with high hesitancy.

CONCLUSIONS

This study is among the first in which parental vaccine hesitancy and decision-making about influenza vaccination in the

hospital setting are assessed. Importantly, we found that nearly one-fourth of sampled parents of hospitalized children are vaccine hesitant, and these parents more commonly decline the influenza vaccine for their child during hospitalization. This is particularly worrisome given that these children may be at high risk of influenza and influenza-related complications. The findings also highlight the potential use of the PACV survey, including in conjunction with ongoing hospital influenza vaccination screening, to help tailor provider communication with families to increase influenza vaccine uptake.

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