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Employment and Socioeconomic Factors Associated with Children's Up-to-Date Vaccination Status

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Abstract

This study examined whether additional information on parents' employment and household characteristics would help explain the differences in children's UTD vaccination status using the 2008 National Immunization Survey and its associated Socioeconomic Status Module. After controlling for basic sociodemographic factors in multivariable analyses, parent's work schedules and ease of taking time off from work were not associated with UTD vaccination status among 19- to 35-month-old children. We also conducted a stratified analysis to test the heterogeneous effects of the factors among children at three age-restricted maternal education levels and found the benefit of paid sick leave had a significant association only among families where the mother had a college degree. Families who had moved since the child's birth, especially if the mother had high school or lower education, were less likely to have children UTD on the vaccine series.

Keywords

Up-to-date vaccination status; socioeconomic factors; employment

Introduction

The 2014–2015 measles outbreak in California reminds us of the importance of timely vaccination[1–3]. While many factors influence children's up-to-date (UTD) vaccination status, commonly used explanatory variables are frequently limited to demographic and basic socioeconomic factors, such as race, family income, parents' education, employment status, and insurance type[4–9]. Studies on parental delay or refusal of their children's vaccination found parents' perceptions, beliefs, and concerns of vaccination strongly influenced timely vaccination[4–5]. Parents' work schedules and time conflicts, as one might

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think of, were not one of the reasons that parents delay their children's vaccination. There is little direct evidence on the extent to which parents' work schedules and time availability would affect children's UTD vaccination status, despite some indirect evidence was found to indicate the connection. One study suggested that flexibility in scheduling an appointment might help urban families keep immunization visits[6]. A limited number of studies on maternal leaves or paid sick leaves confirm that earned sick days help workers and their children access to preventive care[10–14]. The scarcity of studies on parents' work schedule and children's vaccination status might be partially due to the lack of data. Detailed information on parent work schedule and ease of taking time off are rare. This study exploited novel data from the 2008 National Immunization Survey (NIS) and its associated Socioeconomic Status (SES) module and explored whether the additional information on parent employment and household characteristics would help explain the differences in children's UTD vaccination status. The NIS-SES module was incorporated into the NIS only in 2008. The data allowed us to consider additional factors such as parent's work schedule, ease of taking leave from work, availability of paid sick leave, and family mobility in addition to the traditional sociodemographic characteristics. While the distribution of employment and other characteristics among parents has likely changed since these data were collected, we would expect the association between such factors and children's vaccination status to remain relatively constant. We examined the association between these variables and children's UTD status based on completion of the combined (4:3:1:3:3:1:4) vaccine series of ≥4 doses of diphtheria, tetanus toxoid, and acellular pertussis vaccine, ≥3 doses of poliovirus vaccine; ≥1 dose of measles-containing vaccine; ≥3 doses of *Haemophilus influenzae* type b vaccine; ≥3 doses of hepatitis B vaccine; ≥1 dose of varicella vaccine; and ≥4 doses of heptavalent pneumococcal conjugate vaccine. The conclusions drawn from this analysis could expand the understanding of the influence of parent employment and socioeconomic and household characteristics on vaccination. These data may also shed light on issues related to delayed or missed vaccinations[15].

Methods

Study sample

Data from the NIS SES module, administered January through June 2008, were analyzed in conjunction with data from the 2008 NIS. The NIS is a nationally representative random-digit-dialed telephone survey of households with children aged 19–35 months used to monitor childhood vaccination coverage. Household interviews with the child's parent or guardian are followed by a mailed survey to the child's vaccination providers (with consent of the respondent) to obtain provider-reported vaccination histories. Data are weighted to adjust for households with multiple telephone lines, household nonresponse, and exclusion of households without telephones[16]. The SES module, which was included in the NIS in 2008 (but no other years), collected additional employment and socioeconomic status information from primary caregiver of children aged 19 to 35 months. Module questions were answered from the perspective of this person. For the children included in this analysis, over 95% of the primary caregivers were parents. For simplicity, we refer to all primary caregivers as parents, although a small proportion were identified as grandparents, other family members, friends, etc. There were 8,768 parents that completed the SES module and

7,450 (85%) children had adequate provider-reported vaccination records and were assigned final weights. We restricted this analysis to children who had adequate provider data and whose responding parent reported s/he was employed based upon a positive response to the question “Are you currently employed?” Information on number of hours worked per week was not collected; therefore, we were unable to distinguish part-time from full-time employment. In total, 4,160 out of the 7,450 children (56% of the sample) had a responding parent that was employed and were included in the analysis.

Vaccination UTD status

Based on the ACIP-recommended vaccine schedule in place during the survey period, sampled children were determined to be UTD if their provider-reported vaccination history included ≥4 doses of diphtheria, tetanus toxoid, and acellular pertussis vaccine, ≥3 doses of poliovirus vaccine; ≥1 dose of measles-containing vaccine; ≥3 doses of *Haemophilus influenzae* type b vaccine; ≥3 doses of hepatitis B vaccine; ≥1 dose of varicella vaccine; and ≥4 doses of heptavalent pneumococcal conjugate vaccine. This is referred to as the combined (4:3:1:3:3:1:4) vaccine series[17].

Additional employment and socioeconomic measures

In addition to traditional sociodemographic variables (child’s gender, child’s age, mother’s racial/ethnic group, mother’s education, number of children under 18 years in the household, family income, and insurance status), we also included in this analysis the parent’s ease of taking leave from work, work schedule, the availability of paid sick leave, family mobility, child care participation, and parent’s concerns about vaccine safety and effectiveness. Ease of taking time off from work was assessed with the question “In general, how easy is it for you to take time off from your job?” Respondents were asked to choose from “very easy”, “somewhat easy”, “somewhat hard”, “very hard to do”, or “impossible”.

For our analyses, we collapsed the responses into two levels –easy (very or somewhat easy) and hard (somewhat or very hard or impossible). Work schedule was classified into three categories — daytime, nighttime or evening, or other schedules, such as rotating shifts. The availability of paid sick leave was determined by asking whether the parent was able to take time off from work and still be paid if s/he or another family member was sick. To measure family mobility, we determined the number of times the family had moved since the child’s birth and whether moves were in-state or out-of-state. We analyzed mobility since the child’s birth using three categories — never moved, out-of-state move, and in-state move. Child care participation was defined as attending a child care center or day care at least once a week during the past month. Parents were asked whether they had ever refused or delayed administration of a particular vaccine; those that responded in the affirmative (n=720; 17.3% of the sample) were asked an open-ended question as to their reason(s) for this decision. Responses were reviewed, and parents were considered to have safety/effectiveness concerns if they explicitly mentioned safety or effectiveness as the reason or if their response was related to: perceived risk of intussusception or autism, concerns about thimerosal or mercury, having heard or read bad things in the media, concern about there being too many shots, fear of side effects, having other children who experienced a reaction to a vaccine, an assertion that the child is healthy, or a report that the child had an egg allergy. Those who

provided an explanation not deemed to be related to safety or effectiveness (e.g. cost or inability to get an appointment) and those that did not refuse/delay any vaccinations were considered to not have safety / effectiveness concerns.

Statistical Analyses

Logistic regression was used to estimate the association between child's UTD status and the work-related variables, after controlling for basic sociodemographic characteristics. Among children with adequate provider data and an employed parent, we first conducted bivariable analyses to examine the association between UTD status and each of the individual socioeconomic and work-related variables (see Table 1 for a full list of variables); we then conducted multivariable analyses. We also performed a stratified analysis by mother's age-restricted education level. Children with mothers aged 20 and above were stratified into three groups—mothers who had received college degrees, mothers who had some college, and mothers with high school or lower education. We restricted mother's age to 20 and above, since individuals of these ages are old enough to complete or have some college education. We did not consider mothers aged 19 or below as a separate group, because the sample size of this group was too small (n=22) and many variables had missing values. In all multivariable analyses, we also included state fixed effects to control for any unobservable variation across states. Prevalence ratios of the estimates were reported because of the cross-sectional study design[18].

Analyses were conducted using SAS-callable SUDAAN, version 11.0 (Research Triangle Institute, Research Triangle Park, NC), a statistical package that accounts for complex, weighted survey designs when calculating variances. All estimates in the analysis were weighted to be representative of the geographic area of the sample and nationally.

Results

Descriptive statistics for all characteristics included in the analysis for children aged 19 to 35 months with adequate provider data and an employed parent in the 2008 NIS-SES module are presented in Table 1. Numbers of observations (unweighted), weighted percentages, and 95% confidence intervals are reported by UTD status. Statistically significant differences in percentages of various categories of each variable were evaluated using Chi-square tests. There were 2,981 children (72%) UTD and 1,179 (28%) not UTD. There were no statistically significant differences in UTD status by child's gender, mother's race/ethnicity, responding parent's ease of taking leave, or work schedule (all p-values>0.10). However, UTD children appeared to be older, had a higher percentage of being insured, with more-educated mothers, and with a higher percentage of child care participation than children who were not UTD. Among parents of the UTD children, a higher percentage, relative to those of the not-UTD children, had access to paid sick leave, while a lower percentage had concerns about vaccine safety/effectiveness. UTD children also tended to live in households with fewer children, higher incomes, and less mobility, compared to children who were not UTD (all p-values<0.05).

The association between child's UTD status and social factors was examined in bivariable as well as multivariable logistic regressions (Table 2). Some factors showed a significant

association (p-value<0.05) with UTD status in the bivariable analysis but not in the multivariable analysis, including mother being black, mother having a high school diploma, being in the highest income group (income-to-poverty ratio greater than or equal to 4), child care participation, and no paid sick leave. In both bivariable and multivariable models, uninsured children, children of mothers with less than high school education, children from families with four or more children in the household or those who had moved within or out of state, and children with parents who had concerns about vaccine safety/effectiveness were less likely to be UTD on the vaccine series.

We further stratified the sample by mother's age-restricted education level and examined whether the effects of the factors varied by subgroup. In Table 3, results of the stratified analysis among mothers aged 20 or above at three education levels are reported. More significant associations were identified among mothers aged 20 and above with college degrees compared to less-educated mothers. This group also had the most observations among the three groups. In the regression among this group, child's age, insurance status, and parent's concerns about vaccine safety/effectiveness were significantly associated with UTD status, which was the same as in the overall multivariable results (Table 2). Children of black mothers, higher family income, represented by greater income-to-poverty ratios, or children of parents without paid sick leave were less likely to be UTD compared to the reference. Results for children of mothers in the two lower maternal education groups varied. Children aged 30–35 months were still more likely to be UTD, but not those 24–29 months among mothers with some college education. For children of mothers aged 20 and above with some college, uninsured children or children whose parent had concerns about vaccine safety/effectiveness were still less likely to be UTD compared to the reference. All other factors failed to show a statistically significant association with children's UTD status in this group. For children of mothers aged 20 and above with high school education or less, uninsured status or parent's concerns about vaccine safety/effectiveness were no longer associated with UTD status. However, family mobility significantly lowered the likelihood of being UTD with vaccination.

Discussion

Although one might expect that parents who felt it was hard to take leave from work or always had day-time work schedules would experience difficulties in keeping their young children UTD on vaccinations. However, our results based on NIS-SES module data did not show such an association among children aged 19 to 35 months. Availability of paid sick leave was associated with UTD status only among children of mothers aged 20 years or above with college degrees, but not among children of mothers age 20 or above with less education. Children who experienced residential moves, regardless of whether with-in-state or out-of-state moves, were less likely to be UTD than those that did not move. The association was significant and strongest among children of mothers with the lowest education level and may reflect the challenge of keeping accurate vaccination records when multiple providers are involved. Parents' concerns about vaccine safety/effectiveness appeared to be a strong predictor of lower likelihood of being UTD on the combined 4:3:1:3:3:1:4 series, except among children of mothers with the lowest education. This might be expected, given that, by definition, those categorized as having safety/effectiveness

concerns refused or delayed at least one vaccine. It is not known, however, whether the vaccine(s) refused or delayed were part of the combined series. This relationship should be examined in greater detail, with vaccine-specific data. In almost all regression analyses, children in older age groups had a higher likelihood of being UTD. A possible explanation is, as children get older, there is more time for parents to catch up with vaccine schedules. Child care participation was not significantly associated with UTD status after controlling for other factors in multivariable analyses. Family income, as a traditional socioeconomic measure, did not have a significant association with UTD status among children of mothers aged 20 or above with less-than-college education. For children of mothers aged 20 or above with college degrees, income was found to be negatively associated with UTD status. It is possible that income accounted for the effects of some unobserved variables in this group. In the multivariable analysis based on the whole sample (Table 2), income was not significant when we included mother's education as a covariate.

The heterogeneous effects of factors shown in the stratified analysis also have some program implementation implications. Vaccination programs targeting different sociodemographic groups may need to adjust their strategies according to different risk factors. Among parents with college education, more efforts would be needed to address their concerns about vaccine safety/effectiveness, which was negatively related to UTD status. For mothers with a high school education or less, more mobile families and those with more children appear to have faced challenges in obtaining all the necessary childhood vaccinations. Additional research is needed to identify the particular needs of this subpopulation.

This study is subject to several limitations. First, data collected in 2008 may not reflect current employment, sociodemographic, and household characteristics of parents with young children. However, relationships between these characteristics and the children's vaccination status would not be expected to vary dramatically over this time. Many of the factors associated with UTD status, such as family mobility, insurance status, and parental concerns, have been observed in other studies. The lack of association with parental paid sick leave and work schedules was not anticipated and requires further study. One previous work[10] described the association of paid leave and vaccination among employees, rather than that among employees' children. Three other studies[11,12,14] looked at the effect of maternity leave on the uptake of vaccines recommended for newborns and infants. There is little available information on the relationship between parental leave and vaccination among young children more than 1-year-old. The NIS-SES module data are among the most comprehensive available for this purpose. Another potential limitation is that employment factors used in this study were based on information only as it related to the child's primary caregiver. Employment data on other adult household members were not collected and thus were not available to our analysis. Also, the survey assessed employment status at the time of the interview, not necessarily at the time that the child was due to receive vaccinations. Our UTD definition was based on the 4:3:1:3:3:1:4 vaccine series, which was also used in national vaccination coverage estimates using NIS data[15]. We did not include influenza and hepatitis A vaccines. Coverage rates could differ if these two additional vaccines were included. Additionally, vaccination histories may be incomplete if not all relevant providers were contacted and able to return accurate vaccination information. Finally, nonresponse bias may remain even after the weighting adjustment.

Conclusion

Our findings based on the 2008 NIS-SES module revealed associations between a variety of social factors and vaccination UTD status of children aged 19 to 35 months. Family mobility, parents' concerns about vaccine safety, number of children in the household, child's age, and insurance status were strongly associated with UTD vaccination status. Few associations were found between parental employment and UTD vaccination status. Different sociodemographic groups had different risk factors for vaccination. Results could help expand the understanding of barriers to UTD vaccination status among young children with working parents. Future research may look at children of other age groups and examine whether parental employment has a stronger association with UTD status among older children.

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Table 1

Demographic and Socioeconomic Characteristics by Up-To-Date (UTD) Status on the 4:3:1:3:3:1:4 Series[a] among Children Aged 19 to 35 Months with At Least One Employed Parent in the United States: National Immunization Survey Socioeconomic Status Module, 2008

	UTD Children (N=2,981)		Not UTD Children (N=1,179)		p-value[b]
	N	Weighted % (95% CI)	N	Weighed % (95% CI)	
Child's gender					0.72
Female	1,445	49.7 (46.9–52.4)	577	48.7 (44.1–53.3)	
Male	1,536	50.4 (47.6–53.1)	602	51.3 (46.7–55.9)	
Child's age					0.00
19–23mo	797	27.1 (24.7–29.7)	432	39.0 (34.6–43.7)	
24–29mo	1,029	34.6 (32.0–37.3)	386	32.8 (28.7–37.2)	
30–35mo	1,155	38.2 (35.6–41.0)	361	28.2 (24.3–32.4)	
Mother's race/ethnicity					0.11
Non-Hispanic White	1,999	57.6 (54.8–60.4)	754	51.3 (46.7–55.9)	
Non-Hispanic Black	283	13.5 (11.6–15.7)	128	17.1 (13.6–21.1)	
Hispanic	421	20.3 (17.9–23.0)	192	23.7 (19.6–28.5)	
Non-Hispanic Asian	99	2.6 (2.0–3.4)	36	3.2 (1.9–5.2)	
Other races	179	5.9 (4.7–7.3)	69	4.7 (3.4–6.6)	
Child's insurance					0.00
Insured	2,887	96.5 (95.2–97.4)	1,090	91.1 (88.3–93.3)	
Uninsured	94	3.6 (2.6–4.8)	89	8.9 (6.8–11.7)	
Mother's education level					0.00
<High school	151	8.8 (7.1–10.8)	105	15.7 (12.4–19.8)	
High school grad	402	26.5 (23.7–29.4)	186	31.8 (27.2–36.8)	
Some college	813	22.3 (20.2–24.6)	338	18.4 (15.7–21.3)	
College grad	1,615	42.5 (39.9–45.1)	550	34.1 (30.2–38.2)	
No. Children under 18					0.00
One	910	29.8 (27.3–32.3)	291	24.8 (21.1–28.8)	
Two or three	1,810	61.2 (58.4–63.8)	729	59.7 (55.2–64.1)	
Four or more	261	9.1 (7.6–10.9)	159	15.5 (12.4–19.2)	
Income-to-poverty ratio[c]					0.00

	UTD Children (N=2,981)		Not UTD Children (N=1,179)		p-value[b]
	N	Weighted % (95% CI)	N	Weighed % (95% CI)	
<1.3	502	15.7 (13.9–17.8)	240	20.3 (17.0–24.1)	
1.3-<4	1,233	46.8 (44.0–49.6)	553	49.6 (45.1–54.2)	
≥4	1,246	37.5 (34.9–40.1)	386	30.1 (26.1–34.3)	
Childcare participation[d]					0.00
Attended day care	1,543	47.8 (45.1–50.6)	518	38.8 (34.5–43.3)	
Not attended	1,437	52.2 (49.4–54.9)	658	61.2 (56.7–65.5)	
Ease of taking leave[d]					0.51
Easy	2,067	77.3 (74.5–79.8)	747	75.6 (71.2–79.6)	
Hard	499	22.7 (20.2–25.5)	240	24.4 (20.4–28.8)	
Work schedule[d]					0.43
Daytime schedule	2,037	79.2 (76.5–81.6)	748	79.0 (75.0–82.6)	
Night time or evening	252	11.1 (9.3–13.3)	124	12.8 (10.0–16.3)	
Other	211	9.7 (8.0–11.7)	88	8.1 (6.0–10.9)	
Paid sick leave[d]					0.04
Yes	1,793	67.7 (64.8–70.5)	644	61.7 (56.7–66.5)	
No	768	32.3 (29.5–35.2)	343	38.3 (33.5–43.3)	
Family mobility					0.00
Never moved	1,974	64.5 (61.7–67.1)	713	52.8 (48.1–57.4)	
Out-of-state move	161	5.3 (4.2–6.6)	84	6.7 (4.9–9.3)	
In-state move	846	30.2 (27.7–32.9)	382	40.5 (35.9–45.2)	
Parent's concerns[d]					0.00
No concern	2,607	87.7 (85.7–89.4)	911	81.0 (77.4–84.2)	
Has concerns	372	12.3 (10.6–14.3)	267	19.0 (15.8–22.6)	

[a]The 4:3:1:3:3:1:4 vaccine series includes ≥4 doses of diphtheria, tetanus toxoids, and any acellular pertussis vaccine including diphtheria and tetanus toxoids vaccine or diphtheria, tetanus toxoids, and pertussis vaccine, ≥3 doses of poliovirus vaccine; ≥1 dose of measles-containing vaccine; ≥3 doses of *Haemophilus influenzae* type b vaccine; ≥3 doses of hepatitis B vaccine; ≥1 dose of varicella vaccine; and ≥4 doses of heptavalent pneumococcal conjugate vaccine.

[b]The p-values were for Chi-square tests on differences in each variable between UTD and not UTD groups.

[c]Income-to-poverty ratios represent the ratio of family income to their appropriate poverty threshold and were based on the 2007 Census poverty thresholds.

[d] Due to missing values, the following variables had fewer observations: childcare participation (2980, 1176), easing of taking leave (2566, 987), work schedule (2500, 960), paid sick leave (2561, 987), parents' concerns (2979, 1178), with the first and second number in parenthesis representing the observations for UTD and not-UTD children respectively.

Table 2

Bivariable and Multivariable Analyses of Factors Associated with Up-To-Date (UTD) Vaccination Status on the 4:3:1:3:3:1:4 Series[a] among Children Aged 19 to 35 Months with At Least One Employed Parent in the United States: National Immunization Survey Socioeconomic Status Module, 2008

	Bivariable (N=4,160)[c]		Multivariable[b] (N=3,418)	
	Prevalence ratio (95% CI) (N=?)	**p-value**	**Prevalence ratio (95% CI) (N=?)**	**p-value**
Child's gender				
Female (reference)				
Male	1.0 (0.9–1.1)	0.72	1.0 (0.9–1.0)	0.46
Child's age				
19–23mo (reference)				
24–29mo	1.1 (1.1–1.3)	0.00	1.2 (1.1–1.3)	0.00
30–35mo	1.2 (1.1–1.3)	0.00	1.2 (1.1–1.4)	0.00
Mother's race/ethnicity				
Non-Hispanic White (reference)				
Non-Hispanic Black	0.9 (0.8–1.0)	0.03	0.9 (0.8–1.0)	0.09
Hispanic	0.9 (0.8–1.0)	0.07	1.0 (0.9–1.1)	0.81
Non-Hispanic Asian	0.9 (0.8–1.1)	0.31	0.9 (0.7–1.1)	0.26
Other races	1.0 (0.9–1.1)	0.65	1.1 (0.9–1.2)	0.39
Child's insurance				
Insured (reference)				
Uninsured	0.7 (0.6–0.8)	0.00	0.8 (0.7–1.0)	0.00
Mother's education level				
<High school	0.8 (0.7–0.9)	0.00	0.9 (0.7–1.0)	0.04
High school grad	0.9 (0.8–1.0)	0.00	1.0 (0.9–1.0)	0.25
Some college	1.0 (0.9–1.1)	0.84	1.0 (0.9–1.1)	0.69
College grad (reference)				
No. Children under 18				
One (reference)				
Two or three	1.0 (0.9–1.0)	0.20	0.9 (0.9–1.0)	0.07
Four or more	0.8 (0.7–0.9)	0.00	0.82 (0.71–0.95)	0.00
Income-to-poverty ratio				

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	Bivariable (N=4,160)[c]		Multivariable[b] (N=3,418)	
	Prevalence ratio (95% CI) (N=?)	**p-value**	**Prevalence ratio (95% CI) (N=?)**	**p-value**
<1.3 (reference)				
1.3-<4	1.1 (1.0–1.2)	0.17	1.0 (0.9–1.1)	0.69
≥4	1.2 (1.1–1.3)	0.00	0.9 (0.8–1.1)	0.30
Childcare participation[c]				
Attended day care	1.1 (1.1–1.2)	0.00	1.0 (1.0–1.1)	0.22
Not attended (reference)				
Ease of taking leave[c]				
Easy (reference)				
Hard	1.0 (0.9–1.1)	0.51	1.1 (1.0–1.1)	0.13
Work schedule[c]				
Daytime schedule (reference)				
Night time/evening	1.0 (0.9–1.1)	0.42	1.0 (0.9–1.1)	0.88
Other	1.0 (1.0–1.2)	0.37	1.1 (1.0–1.2)	0.28
Paid sick leave[c]				
Yes (reference)				
No	0.9 (0.9–1.0)	0.03	1.0 (0.9–1.0)	0.26
Family mobility				
Never moved (reference)				
Out-of-state move	0.9 (0.8–1.0)	0.04	0.8 (0.7–1.0)	0.00
In-state move	0.9 (0.8–0.9)	0.00	0.9 (0.8–1.0)	0.00
Parent's concerns[c]				
No concern (reference)				
Has concerns	0.8 (0.8–0.9)	0.00	0.9 (0.8–1.0)	0.00

[a]The 4:3:1:3:3:1:4 vaccine series includes ≥4 doses of diphtheria, tetanus toxoids, and any acellular pertussis vaccine including diphtheria and tetanus toxoids vaccine or diphtheria, tetanus toxoids, and pertussis vaccine, ≥3 doses of poliovirus vaccine; ≥1 dose of measles-containing vaccine; ≥3 doses of *Haemophilus influenzae* type b vaccine; ≥3 doses of hepatitis B vaccine; ≥1 dose of varicella vaccine; and ≥4 doses of heptavalent pneumococcal conjugate vaccine.

[b]In the multivariable analysis, state fixed effects were also included.

[c]Due to missing values, the following variables had fewer observations: childcare participation (4156), easing of taking leave (3553), work schedule (3460), paid sick leave (3548), parents' concerns (4157) with number in parenthesis representing the observations.

Table 3

Stratified Multivariable Analyses of Factors Associated with Up-To-Date (UTD) Vaccination Status on the 4:3:1:3:3:1:4 series[a] Among Children Aged 19 to 35 Months in the United States by Mother's Age-Restricted Education Level: National Immunization Survey Socioeconomic Status Module, 2008

	Mother with college degree (N=1,670)		Mother with some college (N=887)		Mother with high school education or less (N=618)	
	Prevalence ratio	p-value	Prevalence ratio	p-value	Prevalence	p-value
Child's gender						
Female (reference)						
Male	1.0 (0.9–1.1)	0.95	1.0 (0.9–1.1)	0.65	1.0 (0.8–1.1)	0.74
Child's age						
19–23mo (reference)						
24–29mo	1.2 (1.0–1.3)	0.02	1.1 (1.0–1.3)	0.17	1.3 (1.0–1.5)	0.03
30–35mo	1.2 (1.1–1.4)	0.00	1.2 (1.1–1.4)	0.00	1.2 (1.0–1.5)	0.07
Mother's race/ethnicity						
Non-Hispanic White (reference)						
Non-Hispanic	0.8 (0.7–1.0)	0.02	1.1 (0.9–1.2)	0.54	0.8 (0.6–1.1)	0.11
Hispanic	1.0 (0.9–1.2)	0.62	0.9 (0.8–1.0)	0.11	1.0 (0.8–1.2)	0.79
Non-Hispanic	0.8 (0.6–1.1)	0.08	NA[b]	NA[b]	NA[b]	NA[b]
Other races	1.0 (0.9–1.2)	0.64	1.0 (0.8–1.2)	0.96	1.0 (0.7–1.5)	0.86
Child's insurance						
Insured (reference)						
Uninsured	0.6 (0.3–1.0)	0.00	0.7 (0.5–1.0)	0.02	0.9 (0.7–1.2)	0.26
No. Children under 18						
1 (reference)						
2 or 3	0.9 (0.9–1.0)	0.10	1.0 (0.9–1.1)	0.99	0.9 (0.8–1.1)	0.18
≥4	0.9 (0.8–1.1)	0.20	0.9 (0.7–1.1)	0.26	0.8 (0.6–1.0)	0.05
Income-to-poverty ratio						
<1.3 (reference)						
1.3–<4	0.8 (0.7–0.9)	0.03	1.0 (0.8–1.1)	0.44	1.0 (0.8–1.1)	0.50
≥4	0.8 (0.7–0.9)	0.03	1.0 (0.9–1.2)	0.93	0.8 (0.6–1.1)	0.16
Childcare participation						
Attended day care	1.1 (1.0–1.2)	0.07	1.0 (0.9–1.1)	0.61	1.0 (0.8–1.2)	0.87

	Mother with college degree (N=1,670)		Mother with some college (N=887)		Mother with high school education or less (N=618)	
	Prevalence ratio	**p-value**	**Prevalence ratio**	**p-value**	**Prevalence**	**p-value**
Not attended						
Ease of taking leave						
Easy (reference)						
Hard	1.0 (0.9–1.1)	0.62	1.0 (0.9–1.2)	0.74	1.1 (0.9–1.3)	0.34
Work schedule						
Daytime schedule (reference)						
Night time/evening	1.0 (0.9–1.2)	0.97	1.0 (0.8–1.1)	0.45	1.1 (0.9–1.3)	0.31
Other	1.0 (0.9–1.2)	0.81	1.0 (0.9–1.2)	0.89	1.0 (0.8–1.3)	0.76
Paid sick leave						
Yes (reference)						
No	0.9 (0.8–1.0)	0.03	1.0 (0.9–1.1)	0.91	1.0 (0.8–1.1)	0.51
Family mobility						
Never moved (reference)						
Out-of-state move	0.9 (0.7–1.1)	0.16	1.1 (0.9–1.3)	0.59	0.6 (0.4–0.9)	0.00
In-state move	1.0 (0.9–1.1)	0.29	1.0 (0.9–1.1)	0.70	0.7 (0.6–0.8)	0.00
Parent’s concerns						
No concern						
Has concerns	0.8 (0.7–0.9)	0.00	0.8 (0.7–1.0)	0.00	1.0 (0.7–1.3)	0.76
Hosmer-Lemeshow	Wald-F= 0.75		Wald-F=0.73		Wald-F=1.49	
Goodness of fit test[c]	p-value: 0.66		p-value: 0.68		p-value: 0.15	

In all the three models, state fixed effects were also included.

[a]The 4:3:1:3:3:1:4 vaccine series includes ≥4 doses of diphtheria, tetanus toxoid, and any acellular pertussis vaccine including diphtheria and tetanus toxoid vaccine or diphtheria, tetanus toxoid, and pertussis vaccine, ≥3 doses of poliovirus vaccine; ≥1 dose of measles-containing vaccine; ≥3 doses of *Haemophilus influenzae* type b vaccine; ≥3 doses of hepatitis B vaccine; ≥1 dose of varicella vaccine; and ≥4 doses of heptavalent pneumococcal conjugate vaccine.

[b]Due to small sample size, the estimates were not reported.

[c]Wald-F statistics and p-values from the Hosmer-Lemeshow goodnessness of fit tests were reported. The null phypothesis is that the observed number of events in a given group is equal to the predicted number of events in the same group, across all groups. Larger p-values indicate the null hypothesis is not rejected and the model is good fit for the data.