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Title

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Permalink

<https://escholarship.org/uc/item/3hm340n4>

Journal

Vaccine, 41(1)

ISSN

0264-410X

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Publication Date

2023

DOI

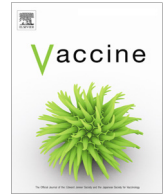
10.1016/j.vaccine.2022.11.001

Peer reviewed



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Parental intentions to vaccinate children against COVID-19: Findings from a U.S. National Survey



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ARTICLE INFO

Article history:

Received 24 February 2022

Received in revised form 9 October 2022

Accepted 1 November 2022

Available online 7 November 2022

Keywords:

COVID-19

Vaccine hesitancy

Vaccine intention

Vaccine requirements

Pediatrician

Parents and children

Survey

ABSTRACT

We examined parents' COVID-19 vaccination intentions for their children, reasons for not vaccinating, and the potential impact of a school/daycare vaccination requirement or pediatrician's recommendation on vaccination intentions. Two online surveys were conducted in June–July and September–October 2021, before pediatric COVID-19 vaccines were authorized for emergency use in children age < 12 years, with an internet-based, non-probability sample of U.S. adults. Respondents with children (age < 18 years) in the household were asked about their intention (likelihood) of vaccinating these children against COVID-19. Weighted Chi-square tests using a Rao-Scott correction were performed. Vaccinated (45.7%) versus unvaccinated (6.9%) parents were almost seven times more likely to have vaccinated their 12–17-year-old children against COVID-19. Approximately 58.4% of respondents with unvaccinated children ages 2–11 years and 42.4% of those with children < 2 years said they are “very” or “extremely likely” to vaccinate these children against COVID-19. Female parents were significantly more likely ($p < .01$ to $p < .001$) to express lower levels of COVID-19 vaccine intentions. Across all age groups of children unvaccinated against COVID-19, parental vaccine intentions increased with increased household income and education levels. COVID-19 vaccine side effects and safety concerns were primary reasons for not vaccinating children. Strategies including school vaccination requirements and recommendations from pediatricians were shown to increase parental COVID-19 vaccination intentions for some. More research is needed on factors that increase/hinder COVID-19 pediatric vaccine uptake.

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1. Introduction

On June 17, 2022, the U.S. Food and Drug Administration (FDA) authorized emergency use of the Pfizer-BioNTech COVID-19 and the Moderna COVID-19 vaccines for the prevention of COVID-19 to include use in children down to 6 months of age [1]. While attitudes toward pediatric COVID-19 vaccination have become more positive since vaccines have become available [2], COVID-19 vaccine hesitancy among parents and caregivers remains a public health challenge. According to U.S. Centers for Disease Control and Prevention (CDC) data, as of November 9, 2022, in the United States, 61.1% of adolescents ages 12–17 years, 31.9% of children

ages 5–11 years, 4.1% of children ages 2–4 years, and 2.4% of children < 2 years old were fully vaccinated against COVID-19 [3]. Previous studies have demonstrated variation in pediatric COVID-19 vaccine intentions and hesitancy by parental age, sex, race, ethnicity, educational attainment, and annual household income [4–15]. Concerns reported by parents about vaccinating children against COVID-19 include vaccine side effects, safety, newness of the COVID-19 vaccines, and the perception that children are at lower risk from experiencing severe symptoms if they become ill with COVID-19 [4,6–8,13–17]. Parental COVID-19 vaccination status has also been shown to be highly associated with the likelihood of these parents vaccinating their children against COVID-19 [7,12–15].

The current study examines parents' COVID-19 vaccination intention for their children ages < 18 years and concerns about vaccinating these children. Our study was conducted in the summer and fall of 2021 before pediatric COVID-19 vaccines were

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authorized for emergency use in children and adolescents < 12 years old and at a time when information was limited about parental hesitancy for COVID-19 vaccination for these age groups. A number of strategies have demonstrated potential for influencing pediatric COVID-19 vaccine uptake. These include vaccine requirements for school attendance, but the issue has been a subject of debate [18,19]. Studies have demonstrated mixed parental attitudes toward school requirements for COVID-19 vaccination [8,20,21]. We therefore investigate the potential impact of a school or daycare vaccination requirement on parents' intention to vaccinate their children. A recommendation from a healthcare provider is another public health strategy that could potentially influence pediatric COVID-19 vaccination [4,15]. Research indicates that pediatric providers are among the most trusted sources of information about COVID-19 [7,15], and parents feel most comfortable having their child vaccinated at their usual doctor's office [22]. Our study therefore also examines a pediatrician's recommendation on parental COVID-19 vaccination intention. Shedding light on parental intentions to vaccinate their children against COVID-19 and reasons for not doing so are critical for developing public health strategies to increase pediatric vaccine uptake, in the current and in future pandemics.

2. Methods

The UCLA COVID-19 Health Project conducted online surveys between June 17–July 6, 2021 ($N = 30,857$; response rate = 67 %) and September 3–October 4, 2021 ($N = 33,088$; response rate = 63 %) with a non-probability opt-in, de-identified sample of respondents representing all 50 U.S. states. The market research firm, Lucid, provided the sample using multiple panel sources [23]. Samples were constructed to match a set of national demographic quotas on age, sex, race, ethnicity, region, income, and education using the 2019 American Community Survey (ACS) of the U.S. Census Bureau.

The sample (June–July, $N = 10,483$; September–October, $N = 12,955$) for the current analysis included those respondents reporting at least one child in their household in one or more of the following age groups: 12–17 years, 2–11 years, and < 2 years old. The three child age groups were considered independently in the analysis. Therefore, the same respondent could contribute one response for each age group in which they had children living in their household.

3. Measures

3.1. Sociodemographic variables

Sociodemographic items include respondent age (18–29; 30–44; 45–64; ≥ 65), sex (male/female), race/ethnicity (White, non-Hispanic; Black, non-Hispanic; Asian American and Pacific Islander (AAPI), non-Hispanic; other race, non-Hispanic; Hispanic), educational attainment (high school or less; some college; bachelor's degree or higher), and household income (<\$30,000; \$30,000–\$54,999; \$55,000–\$89,999; \$90,000–\$149,999; \geq \$150,000). Respondents also indicated the number of children in their household in three groups, ages 12–17 years, 2–11 years, and < 2 years old.

3.2. Parental intentions and reasons not to vaccinate their children against COVID-19

Respondents to the September 3–October 4, 2021 survey were asked about the current vaccination status of their children ages 12–17 years. The survey was fielded prior to FDA authorization for emergency use of COVID-19 vaccines in children age 11 years

down to six months of age [1]. Therefore, the survey only asked about COVID-19 vaccination status for children and adolescents ages 12–17-years. Respondents (parents/caregivers, referred to as “parents”) with children in any of the three age groups were asked about their intentions to/likelihood of vaccinating these children against COVID-19 using a Likert-type scale (Extremely likely; Very likely; Somewhat likely; Not at all likely; Not sure). For respondents with children ages 12–17 years, an additional response choice included the following: “They are all vaccinated for COVID-19.” Therefore, the assessment of vaccination intention for children 12–17-years old included only those respondents who had not already vaccinated their children in this age group.

Respondents with children in the two younger age groups and those with unvaccinated children ages 12–17 years who did not indicate that they were “extremely likely” to vaccinate their children against COVID-19 were asked to select from a list of 14 reasons why they might not want their children to receive a COVID-19 vaccine. Topics included COVID-19 vaccine safety, efficacy, immunity, vaccination beliefs, and issues of trust. Respondents could select as many choices that apply (see Supplement A for all response options).

3.3. School or daycare COVID-19 vaccination requirement

Parental attitudes about in-person schooling and daycare were gauged in the September 3–October 4, 2021 survey through a series of yes/no questions. Respondents with children in their household were asked if any of their children were currently attending in-person school, daycare, or camp and if they felt in-person school/daycare/camp was safe. Those with unvaccinated children were also asked: *If your school, daycare, or camp made a COVID-19 vaccination mandatory for all eligible children, would you get your eligible children vaccinated so they could stay enrolled there?* (see Supplement A for other questions).

3.4. Pediatrician recommendation

To assess the potential impact of a pediatrician's recommendation on parental COVID-19 vaccination intention among parents of unvaccinated children ages 12–17 years, a question in the form of a vignette was included on the June 17–July 6, 2021 survey. Specifically, respondents who indicated they were “very”, “somewhat”, or “not at all likely” to vaccinate their unvaccinated children ages 12–17 years or who were not sure were asked to imagine a hypothetical scenario: *Imagine you're having a conversation in your pediatrician's office about the way your neighborhood is getting back to normal after the pandemic. Your pediatrician listens to your concerns about vaccinating your children and understands your worry but assures you the risks are minimal and urges you to get them vaccinated anyway. Would you (select one): Let your pediatrician vaccinate your children in the office that same day; Make an appointment to get them vaccinated later and keep it; Make an appointment to get them vaccinated later and cancel it; Decline to get them vaccinated.*

3.5. Data analysis

All percentages were weighted to represent the U.S. adult population. No adjustments were made for missingness as the mean level of item non-response across the survey waves was < 1 percent. Weighted Chi-square tests of independence were performed to detect differences in the response distribution between groups. These tests of independence used a Rao-Scott correction. Tests were considered statistically significant if p -values were < 0.05. All analyses were conducted in R version 3.6.1.

4. Results

4.1. Vaccination status of 12–17-Year-Old children

Of the 7,298 respondents with children ages 12–17 years in the September 3–October 4, 2021 sample, 37.3 % (95 % CI: 35.4 %–39.1 %) reported that these children were fully vaccinated against COVID-19 (Table 1). Statistically significant ($p < .001$) differences in the percent of children ages 12–17 years fully vaccinated were found by respondent race and ethnicity: AAPI, non-Hispanic (59.8%; 95 % CI: 51.1 %–68.4 %); White, non-Hispanic (38.0 %; 95 % CI: 35.8 %–40.1 %); Hispanic (34.6 %; 95 % CI: 30.4 %–38.8 %); Black, non-Hispanic (31.0 %; 25.9 %–36.1 %); and Other Race, non-Hispanic (25.5 %; 15.5 %–35.6 %). Higher levels of household income and parental education were associated with a higher percentage of fully vaccinated children, with 46.1 % (95 % CI: 42.3 %–50.0 %) vaccinated for incomes \geq \$150,000 (95 % CI: 42.3 %–50.0 %) versus 22.5 % (95 % CI: 18.5 %–26.4 %) vaccinated in households with income $<$ \$30,000 ($p < .001$); 42.5 % (95 % CI: 39.5 %–45.5 %) vaccinated with a bachelor's degree or higher versus 33.5 % (95 % CI: 30.0 %–36.9 %) with a high school education or less ($p < .001$). Lastly, 45.7 % (95 % CI: 43.6 %–47.8 %) of self-reported vaccinated respondents said their children ages 12–17 years were fully vaccinated against COVID-19 as compared to only 6.9 % (95 % CI: 5.0 %–8.9 %) of unvaccinated respondents ($p < .001$) (Table 1).

4.2. Intentions to vaccinate

Among respondents of unvaccinated, 12–17 year-old children, 56.4 % (95 % CI: 54.1 %–58.7 %) said they were “very likely” or “extremely likely” to vaccinate these children, 13.2 % (95 % CI: 11.5 %–14.8 %) said they were “somewhat likely”, 21.2 % (95 % CI: 19.4 %–23.0 %) indicated being “not at all likely,” and 9.2 % (95 % CI: 7.9 %–10.6 %) were “not sure” whether they would vaccinate their 12–17 year-old children against COVID-19 (Table 1).

When considering vaccination status of parents of children ages 12–17 years, more than half (51.4 %; 95 % CI: 47.5 %–55.4 %) of unvaccinated parents indicated they were “not at all likely” to vaccinate these children, as compared to 6.8 % (95 % CI: 5.4 %–8.2 %) of the vaccinated parents.

Among respondents of children $<$ age 12, 58.4 % (95 % CI: 56.7 %–60.1 %) of those with children ages 2–11 years and 42.4 % (95 % CI: 39.1 %–45.7 %) with children $<$ 2 years old indicated being “very likely” or “extremely likely” to vaccinate these children, while 19.2 % (95 % CI: 17.8 %–20.5 %) of respondents with children ages 2–11 years and 25.9 % (95 % CI: 23.0 %–28.8 %) of respondents with children $<$ 2 years old indicated being “not at all likely” to vaccinate these children against COVID-19 (Table 1). Significantly greater percentages of unvaccinated respondents with children ages 2–11 (53.7 % [95 % CI: 50.4 %–57.0 %]) and with children $<$ age 2 years (56.9 % [95 % CI: 51.1 %–62.6 %]) indicated they were “not at all likely” to vaccinate their children against COVID-19 versus vaccinated respondents (7.0 % [95 % CI: 6.0 %–8.0 %] with children ages 2–11 and 11.4 % [95 % CI: 8.9 %–13.9 %] with children $<$ age 2 years) (Table 1).

Statistically significant differences in respondents' intentions to vaccinate children (of any age) were observed by respondent sex, race and ethnicity, age, household income, and education (Table 1). For example, there were statistically significant differences (ranging from $p < .01$ to $p < .001$) between male and female respondents' reported intentions to vaccinate children across all age groups, with females being more hesitant than males in the sample (Table 1). Overall, parental vaccine intentions increased with increased household income and education levels, across all age groups of unvaccinated children (Table 1).

4.3. Reasons for not vaccinating against COVID-19

Data from the September 3–October 4, 2021 survey indicated that the primary reasons provided by parents of children in all three age groups for not vaccinating children against COVID-19 were: concerns about side effects; COVID-19 vaccine is not safe; COVID-19 vaccine is not effective; COVID-19 is not a big threat to children's health; and don't trust government's motives (Appendix 2). Approximately 40 % of parents of unvaccinated children across the three age groups indicated concern about the side effects of the COVID-19 vaccine. Concerns about COVID-19 vaccine safety were reported by 34.2 % (95 % CI: 31.6 %–36.8 %), 36.0 % (95 % CI: 34.1 %–38.0 %), and 37.9 % (95 % CI: 34.2 %–41.5 %) of parents of children ages 12–17, 2–11, and under 2 years, respectively. Approximately 20 % of respondents across the age groups indicated that the reason for not vaccinating their children against COVID-19 was that the vaccine is not effective (see Appendix 2 for the complete list of reasons and distribution of responses). Reasons for not vaccinating were similar across most respondent demographic groups, with concerns about COVID-19 vaccine side effects and safety being the leading reason (data not shown).

4.4. Return to in-person schooling

At the time the September–October survey was fielded, 70.7 % (95 % CI: 69.4 %–71.9 %) of respondents indicated that their children were attending in-person school, daycare, or camp. Significantly ($p < .001$) fewer unvaccinated parents (61.6 %; 95 % CI: 50.9 %–64.3 %) compared to vaccinated parents (73.7 %; 95 % CI: 72.2 %–75.1 %) indicated that their children were attending in-person school/day care/camp, with 55.5 % (95 % CI: 53.9 %–57.2 %) of the vaccinated and 58.5 % (95 % CI: 55.8 %–61.2 %) of the unvaccinated parents indicating that they think/thought in-person school/daycare/camp (in the fall of 2021) is/was safe (Table 2).

More than half (55.3 %; 95 % CI: 53.8 %–56.8 %) of respondents with unvaccinated children say that they would get their eligible child vaccinated if their school, daycare, or camp required it (Table 2). Male parents (58.4 %; 95 % CI: 56.2 %–60.5 %) were more likely than female parents (52.7 %; 95 % CI: 50.7 %–54.7 %) to say that they would vaccinate their children in response to this requirement ($p < .001$). About half of the Black, non-Hispanic (50.3 %; 95 % CI: 46.1 %–54.6 %), other race, , non-Hispanic (47.5 %; 95 % CI: 37.7 %–57.4 %), and young (ages 18–29 years; 47.5 %; 95 % CI: 44.2 %–50.7 %) parents indicated they would comply with COVID-19 vaccine requirements. Unvaccinated parents had the lowest percentage, with only 27.0 % (95 % CI: 24.6 %–29.4 %) indicating they would vaccinate their children against COVID-19 in response to a requirement.

Among parents who had indicated that they were “not at all likely” to vaccinate their children, a COVID-19 vaccine requirement for school, daycare, or camp attendance would change intentions for some: 15.7 % (95 % CI: 12.2 %–19.2 %) of parents with children ages 12–17; 15.2 % (95 % CI: 12.4 %–17.9 %) with children ages 2–11; and 21.8 % (95 % CI: 16.4 %–27.3 %) of parents with children $<$ 2 years old. Even more of the parents who had indicated they were “not sure”, would vaccinate their children against COVID-19 because of a requirement: 23.3 % (95 % CI: 16.7 %–29.9 %) of respondents with children ages 12–17 years, 34.7 % (95 % CI: 28.4 %–40.9 %) with children ages 2–11, and 32.9 % (95 % CI: 23.3 %–42.4 %) of parents with infants $<$ 2 years of age (Table 3).

4.5. Influence of pediatrician's recommendation

When investigating the influence of a pediatrician's recommendation on parent's intention to vaccinate their unvaccinated children ages 12–17 years against COVID-19, our results indicate

Table 1
Parental COVID-19 vaccination intention for children in their household by child age and parental characteristics, percentage and 95% confidence interval, COVID-19 UCLA Health Survey, United States, September 3–October 4, 2021.

	Parents of children ages 12–17 years (N = 7,298)					Parents of children ages 2–11 years (N = 8,450)				Parents of children ages < 2 years (N = 2,417)			
	All	Extremely or Very Likely to Vaccinate (n = 2,433)	Somewhat Likely to Vaccinate (n = 622)	Not At All Likely to Vaccinate (n = 1,117)	Not Sure (n = 436)	Extremely or Very Likely to Vaccinate (n = 4,900)	Somewhat Likely to Vaccinate (n = 1,228)	Not At All Likely to Vaccinate (n = 1,691)	Not Sure (n = 631)	Extremely or Very Likely to Vaccinate (n = 1,070)	Somewhat Likely to Vaccinate (n = 438)	Not At All Likely to Vaccinate (n = 645)	Not Sure (n = 264)
Overall	37.3 (35.4,39.1)	56.4 (54.1,58.7)	13.2 (11.5,14.8)	21.2 (19.4,23.0)	9.2 (7.9,10.6)	58.4 (56.7,60.1)	15.0 (13.7,16.2)	19.2 (17.8,20.5)	7.5 (6.5,8.4)	42.4 (39.1,45.7)	19.4 (16.6,22.1)	25.9 (23.0,28.8)	12.4 (10.0,14.7)
Sex													
Male	36.5 (33.9,39.1)	61.0 (57.7,64.3)	14.5 (12.0,17.0)	17.4 (14.9,19.9)	7.1 (5.3,8.9)	63.5 (61.1,65.9)	16.3 (14.4,18.3)	14.5 (12.7,16.2)	5.7 (4.6,6.8)	49.4 (44.1,54.7)	20.1 (15.8,24.4)	21.1 (16.8,25.4)	9.4 (6.2,12.5)
Female	38.0 (35.5,40.5)	52.1 (48.9,55.4)	11.9 (9.8,14.0)	24.8 (22.2,27.4)	11.3 (9.2,13.3)	54.0 (51.6,56.3)	13.8 (12.2,15.5)	23.2 (21.3,25.2)	9.0 (7.6,10.4)	37.6 (33.5,41.7)	18.9 (15.2,22.5)	29.1 (25.3,32.9)	14.4 (11.1,17.7)
p-value	–	–	–	–	***	–	–	–	***	–	–	–	**
Race/Ethnicity													
White, non-Hisp. (NH)	38.0 (35.8,40.1)	51.9 (49.2,54.7)	14.4 (12.3,16.6)	25.1 (22.8,27.4)	8.5 (7.1,9.9)	56.7 (54.8,58.7)	14.9 (13.4,16.4)	20.8 (19.2,22.4)	7.6 (6.5,8.7)	43.4 (39.5,47.4)	17.6 (14.2,20.9)	29.1 (25.4,32.7)	9.9 (7.6,12.3)
Black, NH	31.0 (25.9,36.1)	48.3 (41.7,54.8)	14.8 (9.9,19.6)	25.8 (20.2,31.5)	11.1 (6.9,15.4)	44.1 (39.2,49.0)	18.8 (14.9,22.8)	27.2 (22.9,31.5)	9.8 (6.9,12.8)	37.7 (29.6,45.8)	16.2 (10.2,22.3)	29.5 (21.7,37.3)	16.6 (9.3,23.9)
Hispanic	34.6 (30.4,38.8)	71.9 (67.0,76.8)	11.2 (7.8,14.6)	10.1 (6.8,13.3)	6.8 (3.9,9.8)	73.1 (69.2,77.0)	13.8 (10.8,16.8)	9.5 (6.9,12.1)	3.6 (1.9,5.3)	44.4 (36.0,52.9)	27.8 (20.1,35.5)	16.7 (10.5,23.0)	11.0 (5.2,16.8)
AAPI, NH	59.8 (51.1,68.4)	51.7 (38.4,65.0)	8.2 (0.9,15.5)	18.0 (9.4,26.6)	22.1 (9.9,34.2)	49.3 (40.5,58.0)	15.4 (9.0,21.8)	23.0 (15.7,30.3)	12.4 (6.4,18.4)	37.6 (20.5,54.8)	17.7 (4.5,30.9)	21.9 (6.1,37.7)	22.7 (7.1,38.3)
Some other race, NH	25.5 (15.5,35.6)	37.8 (23.4,52.2)	8.0 (- 1.2,17.2) [§]	34.9 (20.8,48.9)	19.3 (8.0,30.7)	49.7 (37.8,61.6)	9.7 (3.8,15.6)	23.4 (13.3,33.6)	17.2 (8.4,26.1)	38.9 (17.9,59.9)	11.1 (3.1,25.3) [§]	21.1 (5.7,36.5)	28.9 (8.8,49.0)
p-value	+++	–	–	–	***	–	–	–	***	–	–	–	**
Age													
18–29	28.7 (24.5,32.8)	46.3 (40.8,51.9)	21.3 (16.6,26.0)	21.6 (17.0,26.1)	10.8 (7.3,14.3)	44.2 (40.3,48.0)	19.2 (16.1,22.3)	25.7 (22.4,28.9)	11.0 (8.5,13.5)	32.0 (27.1,37.0)	24.2 (19.4,29.0)	30.9 (26.1,35.6)	12.9 (9.1,16.7)
30–44	33.9 (31.4,36.4)	62.1 (59.1,65.1)	11.2 (9.2,13.2)	18.2 (16.0,20.5)	8.5 (6.6,10.3)	64.0 (61.9,66.1)	14.2 (12.7,15.8)	15.7 (14.1,17.3)	6.0 (5.0,7.1)	51.1 (46.3,55.9)	16.3 (12.7,19.9)	21.4 (17.4,25.4)	11.2 (7.9,14.5)
45–64	46.0 (42.6,49.3)	56.6 (52.3,60.9)	11.1 (8.3,13.9)	24.5 (21.1,28.0)	7.7 (5.6,9.9)	61.3 (57.3,65.3)	11.7 (9.0,14.4)	20.3 (17.0,23.6)	6.7 (5.0,8.4)	52.2 (42.0,62.5)	15.1 (7.7,22.5)	22.9 (14.4,31.3)	9.8 (4.2,15.3)
≥65	45.2 (35.1,55.4)	38.4 (25.3,51.4)	6.3 (0.5,12.1) [§]	32.6 (19.8,45.4)	22.7 (11.0,34.4)	46.7 (35.4,58.0)	14.9 (5.4,24.4)	26.8 (17.1,36.6)	11.5 (4.2,18.9)	30.6 (13.7,47.6)	11.5 (- 1.6,24.6) [§]	30.3 (13.4,47.1)	27.5 (9.5,45.6)
p-value	+++	–	–	–	***	–	–	–	***	–	–	–	***
Household Income													
≤\$29,999	22.5 (18.5,26.4)	46.8 (41.3,52.3)	13.1 (9.3,16.8)	24.4 (20.2,28.7)	15.7 (11.6,19.8)	37.4 (33.0,41.7)	16.0 (12.8,19.3)	33.0 (28.9,37.0)	13.6 (10.6,16.7)	32.6 (26.1,39.2)	20.9 (15.1,26.8)	27.8 (22.0,33.6)	18.7 (13.1,24.2)
\$30,000–\$54,999	34.6 (30.0,39.1)	34.3 (28.6,39.9)	14.8 (10.2,19.4)	37.6 (32.1,43.0)	13.4 (9.4,17.3)	40.1 (35.8,44.5)	14.8 (11.8,17.9)	32.8 (28.8,36.9)	12.2 (9.2,15.1)	32.7 (25.7,39.8)	15.5 (9.7,21.3)	35.0 (27.9,42.1)	16.7 (10.6,22.8)
\$55,000–\$89,999	38.6 (34.4,42.8)	52.3 (47.0,57.6)	12.2 (8.6,15.8)	24.6 (20.2,29.1)	10.9 (7.3,14.4)	51.8 (47.9,55.7)	17.4 (14.3,20.6)	22.1 (18.8,25.3)	8.7 (6.5,10.9)	33.5 (26.0,41.0)	17.2 (10.7,23.6)	37.7 (29.7,45.7)	11.6 (6.3,16.9)
\$90,000–\$149,999	37.0 (33.5,40.4)	64.0 (59.7,68.2)	12.9 (9.9,15.9)	16.6 (13.3,19.9)	6.6 (4.4,8.8)	68.0 (64.9,71.0)	13.3 (11.1,15.6)	13.5 (11.2,15.8)	5.2 (3.7,6.7)	45.0 (37.6,52.5)	18.5 (12.7,24.2)	26.5 (19.3,33.7)	10.0 (4.8,15.2)
≥\$150,000	46.1 (42.3,50.0)	73.3 (68.7,78.0)	13.2 (9.6,16.8)	10.3 (7.2,13.5)	3.2 (1.3,5.1)	76.3 (73.3,79.4)	14.3 (11.8,16.9)	6.8 (5.0,8.5)	2.6 (1.4,3.7)	65.7 (58.8,72.7)	23.3 (16.8,29.8)	6.8 (3.7,9.9)	4.2 (1.0,7.4)
p-value	+++	–	–	–	***	–	–	–	***	–	–	–	***
Education													
High school or less	33.5 (30.0,36.9)	47.3 (43.1,51.6)	15.2 (12.0,18.4)	26.3 (22.7,29.8)	11.2 (8.5,13.9)	45.5 (42.0,48.9)	17.2 (14.6,19.8)	27.5 (24.6,30.4)	9.9 (7.9,11.8)	37.7 (32.2,43.2)	20.6 (15.7,25.4)	28.4 (23.6,33.3)	13.3 (9.4,17.2)
Some college	36.6 (33.7,39.5)	57.5 (53.8,61.3)	11.4 (9.0,13.9)	21.7 (18.8,24.6)	9.3 (7.1,11.5)	61.9 (59.3,64.6)	13.4 (11.5,15.3)	17.9 (15.9,20.0)	6.7 (5.4,8.0)	40.9 (35.7,46.2)	18.8 (14.5,23.1)	27.2 (22.3,32.1)	13.1 (9.2,17.0)

Table 1 (continued)

	Parents of children ages 12–17 years (N = 7,298)			Parents of children ages 2–11 years (N = 8,450)			Parents of children ages < 2 years (N = 2,417)						
Bachelor's or higher	42.5 (39.5,45.5)	67.3 (63.7,70.8)	12.8 (10.1,15.4)	13.5 (11.0,16.1)	6.4 (4.4,8.5)	67.4 (64.7,70.1)	14.8 (12.8,16.8)	11.9 (10.1,13.8)	5.9 (4.4,7.4)	53.0 (46.8,59.2)	18.1 (13.1,23.0)	19.4 (14.6,24.2)	9.6 (5.4,13.8)
p-value	+++	-	-	-	***	-	-	-	***	-	-	-	*
Parent Vaccination Status													
Vaccinated	45.7 (43.6,47.8)	74.1 (71.6,76.6)	14.1 (12.0,16.1)	6.8 (5.4,8.2)	5.1 (3.9,6.3)	72.7 (70.9,74.5)	15.8 (14.3,17.3)	7.0 (6.0,8.0)	4.6 (3.7,5.4)	55.8 (51.7,59.9)	23.6 (19.9,27.3)	11.4 (8.9,13.9)	9.2 (6.7,11.7)
Unvaccinated	6.9 (5.0,8.9)	19.4 (16.2,22.6)	11.3 (8.6,13.9)	51.4 (47.5,55.4)	17.9 (14.6,21.1)	17.8 (15.3,20.2)	12.8 (10.6,15.1)	53.7 (50.4,57.0)	115.7 (13.3,18.2)	13.7 (9.9,17.6)	10.3 (7.1,13.5)	56.9 (51.1,62.6)	19.1 (14.2,24.1)
p-value	+++	-	-	-	***	-	-	-	***	-	-	-	***

Note: Survey weights were used in the calculation of all percentages. P-values indicated with stars are from weighted Chi-square tests using the Rao-Scott adjustment testing the independence of all four levels of vaccine intention and child age group for each subgroup. Individual rows within each age group may not total 100% due to rounding. Statistical significance levels: 0.05 * 0.01 ** 0.001 ***. Statistical significance was also assessed for parents of vaccinated children ages 12–17 years versus parents of unvaccinated children ages 12–17 years. In this weighted Chi-square test, all outcome categories other than “All Vaccinated” were collapsed. This combined column is omitted from the table. Statistical significance for these tests is indicated as: 0.05 + 0.01 ++ 0.001 +***. † Each age group was considered independently. Therefore, the same respondent could be counted more than once if they had children in multiple age groups. § Cell count < 10.

that among the parents who reported they were “very likely to vaccinate” their unvaccinated children in this age group, 27.6 % (95 % CI: 23.0 %–32.3 %) would agree to do so during the child’s pediatrician visit if the physician urged vaccination, 57.9 % (95 % CI: 52.8 %–63.0 %) would make and keep a future appointment for vaccination, 11.0 % (95 % CI: 7.9 %–14.1 %) would make and cancel a future appointment, and 3.4 % (95 % CI: 2.1 %–4.8 %) would decline vaccination (Table 4). Among parents who indicated they were “not at all likely” to vaccinate their 12–17-year-old children, only 3.1 % (95 % CI: 1.7 %–4.5 %) would vaccinate their child/ren during the pediatrician visit if the physician urged vaccination, 3.7 % (95 % CI: 2.2 %–5.3 %) would make and keep a future appointment for vaccination, 5.3 % (95 % CI: 3.2 %–7.4 %) would make and cancel a future appointment, and 87.9 % (95 % CI: 85.0 %–90.7 %) would decline vaccination. For those respondents indicating they were “not sure” about vaccinating” their 12–17-year-old children, 12.2 % (95 % CI: 8.5 %–15.9 %) would vaccinate their child/ren during the visit upon recommendation from the pediatrician, 14.7 % (95 % CI: 10.2 %–19.2 %) would make and keep a future vaccination appointment, 6.4 % (95 % CI: 3.2 %–9.7 %) would make and cancel a future appointment, and 66.6 % (95 % CI: 60.8 %–72.5 %) would decline vaccination (see Table 4 for full results).

5. Discussion

Results from the UCLA COVID-19 Health Project survey conducted online between September 3–October 4, 2021 indicate that approximately half of the respondents with unvaccinated children in their household would get their child/ren vaccinated if it were required for school or daycare attendance. Notably, a proportion of parents who had indicated that they were “not at all likely” (approximately 15 % to 22 %) or “not sure” (approximately 23 % to 35 %) whether they would vaccinate their children against COVID-19, would do so across all age groups if it were a requirement for school, daycare, or camp attendance. The issue of COVID-19 vaccine requirements for school attendance has been contested,[18,19] with parents expressing mixed views on the issue.[7,20–21] CDC research indicates that among parents of unvaccinated adolescents ages 12–17 years included in a national survey, a school requirement for COVID-19 vaccination was an important factor for increasing intent for adolescent COVID-19 vaccination.[22] However, more research is needed on parental attitudes towards and acceptance of vaccine requirements.

Another major finding of our study is that parents of unvaccinated 12–17-year-old children indicating they were “very likely to vaccinate” their unvaccinated children in this age group, approximately 86 % would agree to vaccinate their child/ren against COVID-19 during the child’s pediatrician visit or would make and keep a future appointment for vaccination if the physician urged vaccination. However, among respondents indicating they were “not sure” about vaccinating their children, approximately 27 % indicated they would accept vaccination of their child if the pediatrician urged it during the child’s regularly-scheduled visit or would make and keep a future appointment for vaccination. Far fewer respondents (approximately 7%) indicating they were “not at all likely” to vaccinate their children against COVID-19 would do so upon a pediatrician’s recommendation. These results suggest that parents expressing limited hesitancy to vaccinate their children might be influenced to vaccinate their children if their pediatrician recommended it. Some hesitant respondents, especially those who were unsure, could also be influenced by a pediatrician’s recommendation to vaccinate their children against COVID-19. However, the vast majority of those who were “not at all likely” to vaccinate their children continued to be unlikely to do so even in the face of a provider recommendation. A national survey con-

Table 2

Parents' response and attitude towards in-person school, day care, or camp and COVID-19 vaccination requirement, percentage and 95% confidence interval, UCLA COVID-19 Health Survey, United States, September 3–October 4, 2021.

	Children currently attending in-person school, daycare, or camp (response N = 12,907)	Parent believes in-person school/daycare/camp is safe for fall 2021 (response N = 12,860)	Parents would vaccinate if required for school, daycare, or camp attendance (response N = 11,313)
Overall	70.7 (69.4,71.9)	56.3 (54.9,57.7)	55.3 (53.8,56.8)
Sex			
Male	71.4 (69.5,73.3)	56.9 (54.9,59.0)	58.4 (56.2,60.5)
Female	70.0 (68.2,71.8)	55.7 (53.8,57.6)	52.7 (50.7,54.7)
<i>p</i> -Value			***
Race/Ethnicity			
White, non-Hispanic (NH)	73.1 (71.6,74.6)	64.4 (62.8,66.0)	57.5 (55.7,59.2)
Black, (NH)	60.0 (56.0,64.0)	49.0 (45.0,53.1)	50.3 (46.1,54.6)
AAPI, (NH)	66.7 (60.4,73.0)	53.6 (46.8,60.3)	60.0 (52.6,67.4)
Other, (NH)	65.8 (57.0,74.6)	60.5 (51.4,69.7)	47.5 (37.7,57.4)
Hispanic	71.5 (68.4,74.6)	41.0 (37.6,44.3)	52.2 (48.5,55.9)
<i>p</i> -Value	***	***	**
Age			
18–29	58.5 (55.5,61.6)	50.9 (47.8,54.0)	47.5 (44.2,50.7)
30–44	74.3 (72.6,76.0)	57.0 (55.1,58.9)	60.8 (58.8,62.7)
45–64	76.6 (74.2,79.0)	59.3 (56.4,62.1)	51.2 (47.9,54.5)
≥65	61.4 (53.3,69.5)	63.1 (54.7,71.4)	54.1 (44.8,63.5)
<i>p</i> -Value	***	***	***
Parent Vaccination Status			
Vaccinated	73.7 (72.2,75.1)	55.5 (53.9,57.2)	66.6 (64.9,68.3)
Unvaccinated	61.6 (59.0,64.3)	58.5 (55.8,61.2)	27.0 (24.6,29.4)
<i>p</i> -Value	***		***

Note: Survey weights were used in the calculation of all percentages. Parents of children ages 12–17 years who were vaccinated were not asked the question about mandatory vaccination. P-values are from weighted Chi-square tests using the Rao-Scott adjustment repeated for each subgroup. The test assesses whether the question response (Yes/No) is independent of the subgroups. Stars indicate statistical significance levels: 0.05 * 0.01 ** 0.001 ***.

Table 3

Percent (and 95% confidence interval) of parents indicating they would vaccinate their children if there were a COVID-19 vaccination requirement for school, daycare, or camp attendance, by parental vaccine intention, UCLA COVID-19 Health Survey, United States, September 3–October 4, 2021.

Response to Vaccination Requirement	Parents of children ages 12–17 years (N = 4,797)		Parents of children ages 2–11 years (N = 8,367)		Parents of children ages < 2 years (N = 2,385)	
	Would	Would Not	Would	Would Not	Would	Would Not
	Vaccinate	Vaccinate	Vaccinate	Vaccinate	Vaccinate	Vaccinate
All Parents	51.0 (48.7,53.4)	49.0 (46.6,51.3)	58.0 (56.3,59.7)	42.0 (40.3,43.7)	51.8 (48.5,55.2)	48.2 (44.8,51.5)
Parents' Intention to Vaccinate*						
Extremely likely (21 %–33 %)	70.2 (66.4,74.0)	29.8 (26.0,33.6)	80.0 (77.7,82.3)	20.0 (17.7,22.3)	76.5 (70.6,82.5)	23.5 (17.5,29.4)
Very likely (22 %–29 %)	62.0 (57.1,66.9)	38.0 (33.1,42.9)	67.6 (64.4,70.8)	32.4 (29.2,35.6)	73.2 (67.0,79.3)	26.8 (20.7,33.0)
Somewhat likely (13 %–19 %)	59.9 (53.4,66.4)	40.1 (33.6,46.6)	62.3 (57.8,66.7)	37.7 (33.3,42.2)	54.3 (46.2,62.4)	45.7 (37.6,53.8)
Not at all likely (19 %–26 %)	15.7 (12.2,19.2)	84.3 (80.8,87.8)	15.2 (12.4,17.9)	84.8 (82.1,87.6)	21.8 (16.4,27.3)	78.2 (72.7,83.6)
Not sure (7 %–12 %)	23.3 (16.7,29.9)	76.7 (70.1,83.3)	34.7 (28.4,40.9)	65.3 (59.1,71.6)	32.9 (23.3,42.4)	67.1 (57.6,76.7)

Note: Survey weights were used in the calculation of all percentages. Parents of vaccinated children ages 12–17 years are excluded from that age group. Cell entries are row percentages within age group columns.

The percentages in the row headers in parentheses are the range of that level of vaccination intent across age groups. *Parent's intention to vaccinate was asked prior to the question on vaccination requirement for school/daycare.

Table 4

Parents' response (percentage and 95% confidence interval) to pediatrician urging them to vaccinate their children 12–17 years against COVID-19, by parental vaccine intention, UCLA COVID-19 Health Survey, United States, June 17–July 6, 2021.

	Vaccinate During Same Visit	Make and Keep Appointment	Make but Cancel	Decline
			Appointment	Vaccination
Parents of children ages 12–17 years (N = 3,372)	14.1 (12.3,15.9)	26.8 (24.5,29.2)	8.6 (7.1,10.1)	50.4 (47.8,53.0)
Parental intention to vaccinate*				
Very likely	27.6 (23.0,32.3)	57.9 (52.8,63.0)	11.0 (7.9,14.1)	3.4 (2.1,4.8)
Somewhat likely	20.9 (15.6,26.1)	44.4 (38.1,50.6)	14.9 (10.6,19.2)	19.9 (14.9,24.8)
Not at all likely	3.1 (1.7,4.5)	3.7 (2.2,5.3)	5.3 (3.2,7.4)	87.9 (85.0,90.7)
Not sure	12.2 (8.5,15.9)	14.7 (10.2,19.2)	6.4 (3.2,9.7)	66.6 (60.8,72.5)
<i>p</i> -value	–	–	–	***

Note: Survey weights were used in the calculation of all percentages. This question was asked of parents with children ages 12–17 years who had responded that they were *Very Likely, Somewhat Likely, Not at All Likely, or Not sure* as to vaccinating their children ages 12–17 years. The *p*-value is from a weighted Chi-square test, using the Rao-Scott adjustment, assessing whether the question response (columns) is independent of the current parent vaccination intent (rows). *Parent's intention to vaccinate was asked prior to the question on vaccination requirement for school/daycare. *** = *p* < .001.

ducted by Kaiser Family Foundation from August 2021 indicated that parents whose child's pediatrician recommended vaccination are about 2.5 times more likely to report having vaccinated their child(ren) against COVID-19 compared to parents who did not talk to their pediatrician or their pediatrician did not recommend COVID-19 vaccination [6]. However, the extent to which a pediatrician's recommendation was a deciding factor is unclear [7]. Pediatricians have been shown to play an important role in answering questions about COVID-19 vaccines and promoting vaccination among their patients [26,27] as well as in reducing existing disparities and addressing barriers to accessing COVID-19 vaccines [26]. Given that a healthcare professional's recommendation has been demonstrated to be a strong predictor of vaccination [22,27], public health officials and healthcare professionals can reinforce COVID-19 vaccine safety and efficacy which may increase COVID-19 vaccination coverage among children and adolescents [4,22].

Additional findings from these research indicate that parental intention to vaccinate children against COVID-19 varied significantly by demographic characteristics of parents, with parental vaccination status being one of the most highly associated factors. At the time the survey was fielded, before COVID-19 vaccines were FDA-authorized for emergency use in children < 12 years [1], vaccinated parents in the sample were almost seven times more likely to have already vaccinated their 12–17-year-old children against COVID-19 compared to unvaccinated parents (45.7 % versus 6.9 %). Our findings align with previous studies demonstrating that the likelihood of parents vaccinating their children against COVID-19 is highly associated with parental vaccination status [7,12–15]. Given this strong association between child and parent COVID-19 vaccination uptake, more research is needed to determine whether efforts to decrease vaccine hesitancy and increase vaccination among parents may expand vaccine coverage among children and adolescents.

Notably, we found that 56.4 % of parents of children 12–17 years old who had not yet been vaccinated against COVID-19 said they were “very” or “extremely likely” to vaccinate these children but had not yet done so at the time that the survey was fielded (October 2021). However, our survey did not allow us to determine the reasons for delays among parents of children in this age group for obtaining COVID-19 vaccinations. Further investigation is needed on the environmental and structural barriers to pediatric vaccination—such as lack of transportation and time off work [4]—now that COVID-19 vaccinations are authorized for emergency use in children down to six months old.

Consistent with previous studies [4–15], our results reveal important differences in respondents' intentions to vaccinate children by respondent sex, race and ethnicity, parental age, household income, and education. Female parents were significantly more likely to express lower levels of COVID-19 vaccine intentions across all three child age groups. Our results also indicate that lower parental household income and lower levels of educational attainment demonstrate decreased likelihood of vaccinating children across all child age groups. Female respondents [12,15,22,25], and those with lower levels of household income [5,7,9,13,24] and lower parental educational attainment [7,12,13,15,22,24,25] have been found in other studies to report increased COVID-19 vaccine hesitancy/reduced vaccination intentions for their children. Findings from the current study may be used to inform public health outreach efforts to increase COVID-19 vaccination uptake for children of hesitant parents. This is critical given the current (as of November 2022) low rates of vaccination in the U.S. among the youngest child age groups [3].

Study results indicate lower levels of intention to vaccinate against COVID-19 for children in the youngest age group included in the survey (<two years). Previous research supports this relationship demonstrating increased hesitancy/decreased intentions

to vaccinate children against COVID-19 among parents of younger children [4,14,15]. As previously demonstrated in other studies [4,6–8,13–17], our findings indicate that the primary reasons provided by parents of children in all age groups for not vaccinating their children include concerns about COVID-19 vaccine side effects and safety. Addressing concerns by providing more information about the safety and efficacy of COVID-19 vaccines for children and adolescents may potentially increase parental intentions to vaccinate [15,22].

The findings in this report are subject to at least four limitations. First, we used a nonprobability, quota-based sample, potentially increasing bias and limiting generalizability [28]. Second, the surveys were administered online in English, potentially excluding participation by adults without internet access and those with limited English proficiency. Third, the data are based on self-report and are subject to recall and social desirability biases. Finally, the timing of the survey is such that assessments of parental vaccine intentions for children in the 12–17-years-old group is only among those who had not already been vaccinated against COVID-19 when vaccination was available. Therefore, because a proportion of children had already been vaccinated, this age group is different than the other two included in the analysis.

6. Conclusion

Results of this study indicate that, at the time the survey was fielded in the summer and fall of 2021, a substantial proportion of individuals with children under age 18 in their households, especially those who are unvaccinated, female, and among those in the lower education and income levels, expressed lower intentions to vaccinate these children against COVID-19. The primary reasons provided by parents of children in all age groups for not vaccinating their children included concerns about COVID-19 vaccine side effects and safety. A majority of respondents had their children attend in-person schooling and daycare in the fall of 2021 although only half thought it was safe. Vaccination requirements from schools/daycares and recommendations from pediatricians were shown to increase self-reported parental COVID-19 vaccine intentions for some respondents. Given that the issue of parental COVID-19 vaccine hesitancy continues to be a public health concern, it is important to gain an in-depth understanding of the strategies and factors that have served as barriers and facilitators to pediatric COVID-19 vaccine uptake to inform the current and future pandemic responses.

CRedit authorship contribution statement

Rebecca J. Guerin: Conceptualization, Resources, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition. **Arash Naeim:** Conceptualization, Methodology, Writing – review & editing. **Ryan Baxter-King:** Formal analysis, Data curation, Writing – review & editing. **Andrea H. Okun:** Conceptualization, Writing – original draft, Writing – review & editing. **Derek Holliday:** Formal analysis, Writing – review & editing. **Lynn Vavreck:** Conceptualization, Methodology, Resources, Writing – review & editing, Project administration.

Data availability

The authors do not have permission to share data.

Declaration of Competing Interest

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

Acknowledgements

We are grateful for the methodological expertise of Aaron Rudkin (Department of Political Science, UCLA) and for substantive feedback from Alex Rossell Hayes (Department of Political Science, UCLA).

Contributions

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Institutional Review Board Statement

This activity was reviewed by NIOSH and was conducted consistent with applicable federal law and CDC policy [See, 45 C.F.R. part 46.102(I)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq]. UCLA has a standing Institutional Review Board exemption for this project.

Funding/Support

This research was supported by internal CDC funding. Additional support was provided by the Marvin Hoffenberg Chair of America Politics at UCLA, the Neria and Manizheh Yomtoubian Endowed Chair in Cancer and Risk Sciences, UCLA David Geffen School of Medicine–Eli and Edythe Broad Center of Regenerative Medicine and Stem Cell Research Award Program, Patient-Centered Outcomes Research Institute COVID Enhancement, WISDOM in the age of COVID, and federal funds from NIH/NCATS (grant #UL1TR001881).

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2022.11.001>.

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