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## Original Research

Child and adolescent COVID-19 vaccination status and reasons for non-vaccination by parental vaccination status<sup>☆</sup>K.H. Nguyen<sup>a, \*</sup>, K. Nguyen<sup>b, e</sup>, K. Mansfield<sup>a, e</sup>, J.D. Allen<sup>c</sup>, L. Corlin<sup>a, d</sup><sup>a</sup> Department of Public Health & Community Medicine, Tufts University School of Medicine, Boston, MA, USA<sup>b</sup> Department of Medicine, Children's Hospital, Boston, MA, USA<sup>c</sup> Department of Community Health, Tufts University, Medford, MA, USA<sup>d</sup> Department of Civil and Environmental Engineering, Tufts University School of Engineering, Medford, MA, USA

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## ABSTRACT

**Objectives:** COVID-19 vaccines are recommended for children ages  $\geq 5$  years. To develop effective interventions to increase uptake, this study explores reasons for parental hesitancy of child and adolescent COVID-19 vaccination.

**Study design:** The Household Pulse Survey (HPS) is a nationally representative cross-sectional online household survey of adults aged  $\geq 18$  years that began data collection in April 2020 to help understand household experiences during the COVID-19 pandemic.

**Methods:** Using data from December 29, 2021, to January 10, 2022 ( $n = 11,478$ ), we assessed child and adolescent COVID-19 vaccination coverage and parental intent to vaccinate their children and adolescents. Factors associated with child and adolescent vaccination coverage were examined using multivariable regression models. Reasons for not having had their child or adolescent vaccinated, stratified by parental vaccination status, were compared using tests of differences in proportions.

**Results:** Less than one-half (42.3%) of children and three-quarters (74.8%) of adolescents are vaccinated. Vaccination coverage was lower among households with lower education, as well as among children who had not had a preventive check-up in the past year. Parents of unvaccinated children were more likely to report that they do not trust COVID-19 vaccines, do not trust the government, and do not believe children need a COVID-19 vaccine compared to parents of vaccinated children.

**Conclusion:** Efforts to increase uptake of vaccines by children and adolescents should target those with lower education, reassure parents of the vaccine safety and efficacy for themselves and their children/adolescents, and support yearly preventive care visits for their children.

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## Introduction

While COVID-19 vaccines in the United States were authorized for adolescents (ages 12–17 years) since May 2021,<sup>1</sup> and for children (ages 5–11 years) since November 2021,<sup>2</sup> vaccination among these age groups remains low, despite the vaccine being free of charge. Data collected from January 2–29, 2022, in the Centers for

Disease Control and Prevention (CDC) National Immunization Survey-Child COVID-19 Module, found that only 28% of children ages 5–11 years, and 65% of adolescents ages 12–17 years had received at least one dose of the COVID-19 vaccine.<sup>3</sup> Moreover, 19–31% of parents of children in these age groups reported that they would probably not or definitely not vaccinate their children.<sup>3</sup> However, reasons for parental hesitancy about vaccinating their children and adolescents for COVID-19 are not well understood.

Throughout the winter of 2021–2022, COVID-19 cases and hospitalizations among children reached the highest prevalence since the pandemic started, possibly due to the emergence of the highly transmissible Omicron variant.<sup>4,5</sup> For example, COVID-19 cases among US children in early January 2022 were triple the number of cases at the end of December 2021.<sup>5</sup> Approximately 8.5 million children have tested positive for COVID-19 since the start of

<sup>☆</sup> The data that support the findings of this study are openly available at <https://www.census.gov/programs-surveys/household-pulse-survey/datasets.html>.

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the pandemic, which may have immediate as well as long-lasting impacts on children's physical, mental, and social well-being.<sup>5</sup> Furthermore, COVID-19 ranks as one of the top 10 causes of death for children ages 5–11 years.<sup>6</sup>

Despite vaccine recommendations and demonstrated benefits of vaccinating children and adolescents for COVID-19, many parents remain hesitant.<sup>7</sup> Previous studies have found that some parents are hesitant about routine child and adolescent vaccinations, such as diphtheria, tetanus toxoid, and acellular pertussis, measles, mumps, and rubella, human papillomavirus, and influenza vaccines.<sup>8–10</sup> However, comparatively, the prevalence of non-vaccination against routine child and adolescent illnesses is much lower than it is against COVID-19, suggesting that parents are more hesitant about COVID-19 vaccines than routine childhood vaccines. The limited published research on this issue shows that the primary reason for parents not intending to vaccinate children/adolescents is due to concerns regarding vaccine safety and potential adverse effects of the vaccine.<sup>11–14</sup> Moreover, some parents may be hesitant to get themselves vaccinated for COVID-19, which may carry over to their hesitancy toward child and adolescent COVID-19 vaccines.

The objective of this study was to assess child and adolescent COVID-19 vaccine coverage and parental intent to vaccinate their children and adolescents, factors associated with child and adolescent vaccination coverage, and reasons for non-vaccination using a large, nationally representative survey of US households. It is hypothesized that parents who are hesitant to be vaccinated themselves, due to concerns about safety or efficacy, may also have the same concerns for not vaccinating their children. We compared reasons for non-vaccination among parents with non-vaccination of their children. Understanding factors that are associated with child and adolescent vaccination coverage, as well as reasons why parents are not vaccinating their children/adolescents, is critical for improving uptake in these groups.

## Methods

### Study design

The Household Pulse Survey (HPS) is a nationally representative cross-sectional online household survey of adults aged  $\geq 18$  years. The survey is conducted by the United States Census Bureau in collaboration with 11 other federal agencies to help understand household experiences during the COVID-19 pandemic. The survey design of the HPS has been described previously.<sup>15</sup> Briefly, the HPS uses the Census Bureau's Master Address File (MAF), which has approximately 140,000,000 valid housing units in the USA, to select a sample large enough to provide representative estimates at the national, state, and local level for 15 Metropolitan Statistical Areas. To rapidly deploy the survey, the HPS uses an Internet and telephone interview system by pairing email and mobile telephone numbers from the Census Bureau Contact Frame with addresses in the MAF, for which there were 80% matches. Unique phone numbers and email addresses were identified and assigned to only one housing unit. The housing units in the MAF were limited to these addresses on the Contact Frame as the final eligible housing units for the HPS.

Newly sampled households were contacted by email and/or text, depending on availability. All non-institutionalized adults aged  $\geq 18$  years in the USA were eligible for the study. The survey was conducted online using Qualtrics as the data collection platform. All questions underwent expert and subject matter review at the Census Bureau and partner agencies, as well as cognitive testing laboratories at the Bureau of Labor Statistics and the National

Center for Health Statistics. These questions are also similar to questions that were added to other national surveys, such as the National Immunization Survey-Adult COVID Module, which is conducted by the CDC.<sup>16</sup> Data collection began in April 2020, with at least one data collection cycle during each month, and approximately 75,000 participants in each data collection cycle. Data collected from December 29, 2021, to January 10, 2022 (response rate = 5.8%) were used in this study.<sup>17,18</sup>

This study included only respondents (hereafter referred to as 'parents') with children ages 5–11 years only or 12–17 years only living in the household ( $n = 11,478$ ). This study was reviewed by the Tufts University Health Sciences Institutional Review Board and determined as not human subjects research (study ID: 00002308).

### Variables

To determine the existence and number of children in each household, respondents were asked: 'In your household, are there ... Children under 5 years old? Children 5 through 11 years old? Children 12 through 17 years old?' The analyses were restricted to households that had children ages 5–11 years or 12–17 years. This was done to allow the analysis of the differences between the factors associated with vaccination status for children (aged 5–11 years) and adolescents (aged 12–17 years) as the survey did not ask to which child(ren) answers to questions applied. Among households with children, respondents were asked: 'Have any of the children living in your household received at least one dose of a COVID-19 vaccine?' [yes/no/don't know]. Among those who did not answer 'no,' respondents were asked about their intent to vaccinate children: 'Now that vaccines to prevent COVID-19 are available to most children, will the parents or guardians of children in your household ...' Response options were definitely, probably, be unsure about, probably not, or definitely not get the children a vaccine, or 'I do not know the plans for vaccination of children living in my household.' Those who responded they would 'definitely' or 'probably' vaccinate their children were combined and referred to as 'intent to vaccinate' and those who stated that they would 'definitely not' or 'probably not' vaccinate their children were combined and referred to as 'reluctant to vaccinate.'

Among respondents who had not already vaccinated their child(ren) and did not 'definitely plan' to get their child(ren) vaccinated or did not answer that they did not know the vaccination plans for children, respondents were asked reasons for not getting children vaccinated. They were asked: 'Which of the following, if any, are reasons that the parents or guardians of children living in your household [only probably will/probably won't/definitely won't/are unsure about whether to] get a COVID-19 vaccine for the children?' Response options, for which respondents could select all that applied, were as follows: 1) concern about possible side-effects of a COVID-19 vaccine for children; 2) plan to wait and see if it is safe and may get it later, 3) not sure if a COVID-19 vaccine will work for children, 4) don't believe children need a COVID-19 vaccine, 5) the children in this household are not members of a high-risk group, 6) the children's doctor has not recommended it, 7) don't trust COVID-19 vaccines, 8) don't trust the government, and 9) other. Additional response options included the following and were recorded as 'other' due to the small number of responses: 1) other people need it more than the children in this household do right now, 2) concern about missing work to have the children vaccinated, 3) unable to get a COVID-19 vaccine for children in this household, 4) parents or guardians in this household do not vaccinate their children, 5) concern about the cost of a COVID-19 vaccine, and 6) other.

**Table 1**  
 Characteristics of parents with children aged 5–11 years and adolescents aged 12–17 years, Household Pulse Survey, December 29, 2021–January 10, 2022.

	Parents of children aged 5–11 years (n = 4577)			Parents of adolescents aged 12–17 years (n = 6901)		
	Unweighted n	%	95% CI	Unweighted n	%	95% CI
<b>Age group (in years)</b>						
18–29	259	14.9	(12.2, 17.6)	308	17.0	(14.5, 19.5)
30–39	1554	32.7	(30.4, 35.0)	707	11.5	(10.1, 12.9)
40–49	1948	33.1	(31.2, 35.0)	3072	37.1	(35.0, 39.2)
50–64	645	14.8	(13.0, 16.6)	2493	29.2	(27.1, 31.3)
65+	171	4.6	(3.4, 5.7)	321	5.2	(4.3, 6.1)
<b>Gender</b>						
Men	1610	45.8	(43.7, 47.9)	2333	47.3	(44.6, 49.9)
Women	2884	54.2	(52.1, 56.3)	4454	52.7	(50.1, 55.4)
<b>Race/ethnicity</b>						
Hispanic	634	24.1	(21.4, 26.7)	934	24.8	(22.5, 27.2)
Non-Hispanic Asian	357	7.6	(6.3, 8.9)	447	5.7	(4.9, 6.5)
Non-Hispanic black	461	14.6	(13.1, 16.0)	646	11.2	(9.9, 12.6)
Non-Hispanic white	2918	50.1	(47.3, 52.9)	4601	55.1	(53.2, 57.0)
Non-Hispanic other/multiracial	207	3.6	(2.9, 4.3)	273	3.1	(2.5, 3.8)
<b>Educational attainment</b>						
High school equivalent or less	626	38.8	(35.9, 41.7)	986	39.2	(37.1, 41.3)
Some college or Associate's degree	1368	30.2	(28.2, 32.3)	2235	32.9	(31.0, 34.7)
Bachelor's degree	1286	15.3	(14.1, 16.6)	1891	14.5	(13.3, 15.6)
Graduate degree	1297	15.6	(14.3, 16.9)	1789	13.5	(12.6, 14.4)
<b>Annual household income</b>						
<\$35,000	673	19.1	(16.7, 21.5)	1018	17.9	(16.3, 19.6)
\$35,000–\$49,999	351	10.9	(9.2, 12.7)	549	8.7	(7.5, 10.0)
\$50,000–\$74,999	555	11.2	(9.6, 12.8)	815	14.1	(12.3, 15.9)
≥\$75,000	2234	35.4	(33.1, 37.7)	3382	38.0	(36.1, 39.9)
Did not report	764	23.4	(20.6, 26.2)	1137	21.3	(19.3, 23.3)
<b>Health insurance status</b>						
Insured	3816	90.0	(87.7, 92.3)	5803	90.9	(89.1, 92.7)
Not insured	222	10.0	(7.7, 12.3)	338	9.1	(7.3, 10.9)
<b>Parental history of COVID-19 infection</b>						
Yes	1153	30.3	(27.4, 33.3)	1765	28.7	(26.3, 31.1)
No	3334	69.7	(66.7, 72.6)	4971	71.3	(68.9, 73.7)
<b>Parental vaccination status</b>						
Yes	3962	81.4	(54.9, 60.4)	6077	84.2	(82.3, 86.0)
No	613	18.6	(16.2, 20.9)	817	15.8	(14.0, 17.7)
<b>US region</b>						
Northeast	772	14.9	(13.4, 16.4)	1187	16.9	(15.1, 18.7)
Midwest	948	19.0	(17.0, 21.1)	1366	19.5	(17.6, 21.4)
South	1488	41.4	(38.6, 44.2)	2316	40.3	(38.2, 42.4)
West	1369	24.7	(22.2, 27.2)	2032	23.2	(21.2, 25.3)

Note: All percentages and confidence intervals are weighted to the US population.

*Independent variables*

Sociodemographic factors assessed for parents of children ages 5–11 years and 12–17 years were respondent age group [18–29, 30–39, 40–49, 50–64, ≥65 years], gender [men, women], race/ethnicity [Hispanic, non-Hispanic (NH) Asian, NH Black, NH White,

NH other/multiracial], educational attainment [high school equivalent or less, some college or Associate's degree, Bachelor's degree, graduate degree], annual household income [<\$35000, \$35000–49999, \$50000–74999, ≥\$75000, did not report], health insurance status [covered, not covered], parent COVID-19 vaccination status [vaccinated with ≥1 dose, not vaccinated], parental

**Table 2**  
 Parental intent for vaccinating children and adolescents, by parental COVID-19 vaccination status, Household Pulse Survey, December 29, 2021–January 10, 2022.

	Overall			Vaccinated parents		Unvaccinated parents		Prevalence difference	
	Unweighted n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
<b>Children aged 5–11 years</b>									
Vaccinated	2397	42.3	(39.6, 45.1)	50.8	(47.8, 53.9)	5.1	(2.1, 8.2)	45.7	(41.3, 50.2)*
Definitely/probably will vaccinate	763	21.8	(18.7, 24.8)	23.8	(20.7, 26.8)	13.1	(6.5, 19.7)	10.6	(4.2, 17.1)*
Unsure	423	10.5	(8.9, 12.1)	9.0	(7.7, 10.3)	17.2	(11.6, 22.8)	–8.2	(–13.8, –2.5)*
Definitely will not/probably will not vaccinate	818	19.0	(16.8, 21.2)	10.8	(8.9, 12.7)	54.8	(45.8, 63.8)	–44.1	(–53.1, –35.0)*
Don't know vaccination plans	176	6.4	(4.8, 8.0)	5.6	(4.1, 7.2)	9.8	(4.9, 14.7)	–4.1	(–9.3, 1.0)
<b>Adolescents aged 12–17 years</b>									
Vaccinated	5379	74.8	(72.6, 77.0)	86.2	(84.5, 87.9)	14.1	(8.8, 19.4)	72.1	(66.6, 77.6)*
Definitely/probably will vaccinate	320	5.5	(4.4, 6.7)	5.5	(4.3, 6.7)	5.8	(3.1, 8.5)	–0.3	(–3.1, 2.5)
Unsure	237	3.9	(2.9, 4.8)	2.3	(1.7, 2.9)	12.3	(7.6, 17.0)	–10.0	(–14.7, –5.4)*
Definitely will not/probably will not vaccinate	802	12.6	(11.3, 13.9)	3.9	(3.2, 4.6)	59.0	(53.5, 64.4)	–55.1	(–60.5, –49.6)*
Don't know vaccination plans	163	3.2	(2.4, 4.0)	2.1	(1.5, 2.8)	8.8	(4.9, 12.7)	–6.7	(–10.7, –2.7)*

Note: All percentages and confidence intervals are weighted to the US population.

\*P < 0.05.

**Table 3**  
Prevalence of and factors associated with child and adolescent COVID-19 vaccination, Household Pulse Survey, December 29, 2021–January 10, 2022.

	Child vaccination (aged 5–11 years)				Adolescent vaccination (aged 12–17 years)			
	%	95% CI	aPR <sup>a</sup>	95% CI	%	95% CI	aPR <sup>a</sup>	95% CI
<b>Overall</b>	42.3	(39.6, 45.1)			74.8	(72.6, 77.0)		
<b>Respondent variables:</b>								
<b>Age group (in years)</b>								
18-29 (reference)	36.5	(26.3, 46.7)	1.00	–	80.9	(74.5, 87.3)	1.00	–
30-39	35.7	(31.5, 39.9)	1.07	(0.73, 1.56)	59.6	(51.7, 67.5)	0.82	(0.72, 0.94)
40-49	51.7	(47.6, 55.9)	1.32	(0.91, 1.94)	74.0	(71.2, 76.8)	0.95	(0.89, 1.01)
50-64	40.4	(34.5, 46.2)	1.07	(0.74, 1.54)	78.9	(76.4, 81.5)	0.93	(0.87, 1.00)
65+	47.2	(33.7, 60.8)	1.36	(0.88, 2.09)	70.6	(60.6, 80.7)	0.84	(0.72, 0.97)
<b>Gender</b>								
Men	45.7	(41.6, 49.8)	1.07	(0.96, 1.18)	76.8	(73.3, 80.3)	1.06	(1.01, 1.10)
Women (reference)	40.1	(36.9, 43.3)	1.00	–	73.3	(70.9, 75.7)	1.00	–
<b>Race/ethnicity</b>								
Hispanic	38.8	(32.4, 45.3)	1.20	(1.01, 1.42)	81.3	(77.4, 85.2)	1.05	(0.99, 1.12)
Non-Hispanic Asian	71.8	(62.6, 81.1)	1.12	(1.01, 1.24)	95.0	(92.5, 97.5)	1.07	(1.03, 1.12)
Non-Hispanic black	32.4	(26.5, 38.3)	0.97	(0.80, 1.18)	72.4	(65.6, 79.2)	1.03	(0.95, 1.11)
Non-Hispanic white (reference)	42.6	(39.7, 45.5)	1.00	–	70.5	(68.0, 72.9)	1.00	–
Non-Hispanic other/multiracial	40.4	(31.2, 49.5)	1.01	(0.81, 1.25)	70.9	(63.4, 78.5)	1.04	(0.96, 1.12)
<b>Educational attainment</b>								
High school equivalent or less (reference)	29.5	(24.6, 34.5)	1.00	–	66.4	(61.4, 71.4)	1.00	–
Some college or Associate's degree	39.7	(35.5, 43.9)	1.11	(0.90, 1.37)	75.1	(72.1, 78.1)	1.04	(0.99, 1.11)
Bachelor's degree	51.7	(47.5, 55.9)	1.18	(0.99, 1.42)	84.3	(81.9, 86.7)	1.08	(1.01, 1.15)
Graduate degree	70.0	(65.8, 74.2)	1.47	(1.23, 1.76)	88.3	(86.0, 90.7)	1.11	(1.04, 1.19)
<b>Annual household income</b>								
<\$35,000 (reference)	30.1	(23.5, 36.6)	1.00	–	67.6	(61.6, 73.6)	1.00	–
\$35,000-\$49,999	30.3	(21.4, 39.3)	0.83	(0.57, 1.22)	71.9	(64.7, 79.1)	1.02	(0.91, 1.15)
\$50,000-\$74,999	37.2	(30.6, 43.8)	1.00	(0.73, 1.38)	73.0	(65.7, 80.4)	1.05	(0.95, 1.16)
≥\$75,000	57.4	(53.9, 61.0)	1.15	(0.91, 1.46)	81.1	(78.5, 83.7)	1.06	(0.97, 1.15)
Did not report	37.6	(30.3, 44.9)	0.96	(0.64, 1.45)	71.9	(67.5, 76.4)	1.10	(0.98, 1.23)
<b>Health insurance</b>								
Insured (reference)	45.5	(42.4, 48.7)	1.00	–	77.2	(74.9, 79.5)	1.00	–
Not insured	21.0	(12.2, 29.8)	0.72	(0.49, 1.07)	60.1	(51.0, 69.2)	0.92	(0.82, 1.05)
<b>Parental history of COVID-19 infection</b>								
Yes (reference)	27.9	(23.7, 32.1)	1.00	–	68.3	(64.2, 72.4)	1.00	–
No	48.2	(45.0, 51.3)	1.34	(1.15, 1.55)	77.6	(75.3, 80.0)	1.04	(0.99, 1.10)
<b>Parental COVID-19 vaccination status</b>								
Yes	50.8	(47.8, 53.9)	7.79	(3.69, 16.46)	86.2	(84.5, 87.9)	5.15	(3.41, 7.78)
No (reference)	5.1	(2.1, 8.2)	1.00	–	14.1	(8.8, 19.4)	1.00	–
<b>US region</b>								
Northeast (reference)	52.1	(45.4, 58.7)	1.00	–	81.6	(77.0, 86.3)	1.00	–
Midwest	42.0	(37.1, 46.9)	1.01	(0.86, 1.18)	71.0	(66.6, 75.3)	0.95	(0.89, 1.02)
South	33.2	(29.4, 37.1)	0.79	(0.69, 0.90)	71.3	(67.5, 75.1)	0.94	(0.89, 0.99)
West	52.0	(46.2, 57.8)	1.06	(0.93, 1.21)	79.0	(75.4, 82.7)	0.98	(0.93, 1.03)
<b>Child/Adolescent variables:</b>								
<b>School type</b>								
Public only (reference)	41.5	(38.6, 44.5)	1.00	–	75.3	(72.9, 77.7)	1.00	–
Private only	61.5	(55.4, 67.6)	1.09	(0.97, 1.22)	75.0	(64.9, 85.0)	0.97	(0.91, 1.03)
Other — combined, homeschooled, none	39.4	(32.6, 46.2)	0.94	(0.80, 1.11)	71.9	(65.4, 78.4)	0.99	(0.92, 1.06)
<b>Preventive check-up</b>								
Yes	46.8	(43.4, 50.2)	1.18	(1.02, 1.37)	79.3	(76.8, 81.9)	1.09	(1.04, 1.15)
Some	33.5	(20.0, 47.0)	0.95	(0.63, 1.44)	73.2	(62.1, 84.3)	1.06	(0.95, 1.18)
None (reference)	32.8	(27.9, 37.7)	1.00	–	68.5	(64.3, 72.6)	1.00	–

Note: All percentages and confidence intervals are weighted to the US population.

Abbreviations: aPR = adjusted prevalence ratio; CI = confidence interval.

<sup>a</sup> Model adjusted for age group, gender, race/ethnicity, educational attainment, annual household income, health insurance status, parental history of COVID-19 infection, parent COVID-19 vaccination status, region, child school type, and child preventive check-up in the past year.

history of COVID-19 infection [yes, no], child preventive check-ups in the past year [all, some, none of children in the household], child school type [only public school, only private school, other (including combination of school types, homeschooling, and no school) for children in the household], geographic region [North-east, Midwest, South, and West].

*Statistical analysis*

Sociodemographic characteristics of parents of children ages 5–11 years and 12–17 years were assessed. Child and adolescent COVID-19 vaccination coverage and parental intentions regarding vaccinating their children were assessed overall and stratified by

parental COVID-19 vaccination status. Differences in child and adolescent COVID-19 vaccination and parental intentions to vaccinate their children between vaccinated and unvaccinated parents were assessed. Parents who have children in both age groups (5–11 and 12–17 years) were excluded from the analyses because it could not be determined which child the parent referred to for the childhood vaccination questions (*n* = 4069). Factors associated with child and adolescent vaccination coverage were examined using multivariable regression models. Independent variables in the model included age group, gender, race/ethnicity, educational attainment, annual household income, health insurance status, parental history of COVID-19 infection, parental COVID-19 vaccination status, geographic region, child school type, and child

preventive check-up in the past year. Reasons for not getting their child and adolescents vaccinated, stratified by parental vaccination status, were compared using tests of differences in proportions. An ecologic association between state-level parental vaccination coverage and child/adolescent vaccination coverage was also assessed using linear regression. All results presented discussed in the text (though not necessarily tables) are statistically significant at  $P < 0.05$ . Analyses accounted for the survey design and weights to ensure a representative sample in SAS (version 9.4; SAS Institute, Inc.) and Stata (version 16.1).

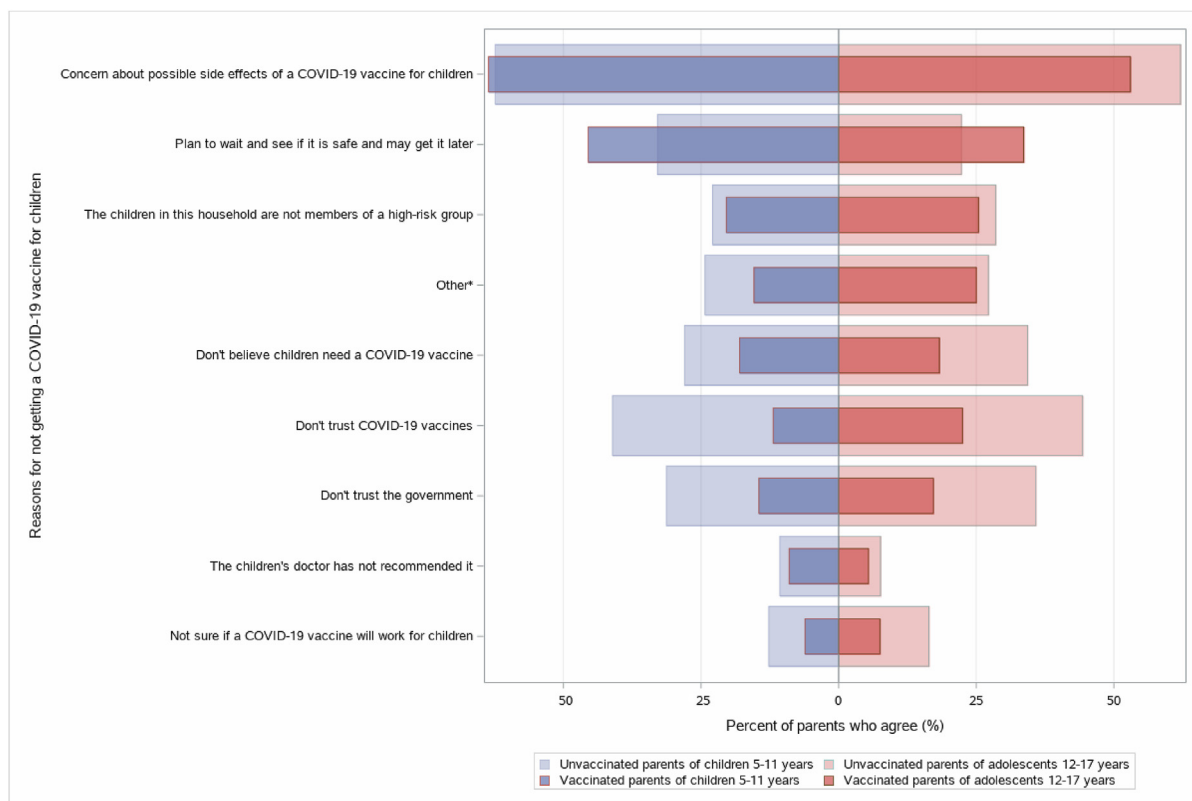
### Results

There were 4577 parents with children ages 5–11 years and 6901 parents with adolescents ages 12–17 years (Table 1). Approximately 81–84% of parents of children and adolescents were vaccinated against COVID-19. Overall, 42.3% of children and 74.8% of adolescents were vaccinated (Table 2). Among all children and adolescents, over a fifth (21.8%) of parents intended to vaccinate their child, and 5.5% intended to vaccinate their adolescent. On the other hand, 19.0% and 12.6% parents of children and adolescents, respectively, were reluctant about vaccinating their children. Childhood vaccination status also differed by parental vaccination status. Among vaccinated parents, 50.8% of children were vaccinated compared to 5.1% of children among unvaccinated parents (prevalence difference = 45.7, 95% CI: 41.3, 50.2). Similarly, among adolescents, 86.2% were vaccinated compared to 14.1% of adolescents among unvaccinated parents (prevalence difference = 72.1, 95% CI: 66.6, 77.6). Unvaccinated parents were also more likely to be reluctant toward childhood vaccination. For example, 54.8% and

59.0% of unvaccinated parents of children and adolescents, respectively, were reluctant about vaccinating their children, whereas only 10.8% and 3.9% of vaccinated parents were reluctant toward childhood vaccinations.

Factors associated with child COVID-19 vaccination included being non-Hispanic Asian (adjusted prevalence ratio [aPR] = 1.12, 95% confidence interval [CI]: 1.01–1.24), Hispanic (aPR = 1.20, 95% CI: 1.01–1.42), having a graduate degree (aPR = 1.47, 95% CI: 1.23–1.76), never having a previous parental history of COVID-19 infection (aPR = 1.34, 95% CI: 1.15–1.55), having child preventive check-ups in the past year (aPR = 1.18, 95% CI: 1.02–1.37), and the parent being vaccinated against COVID-19 (aPR = 7.79, 95% CI: 3.69–16.46) (Table 3). Similarly, factors associated with adolescent COVID-19 vaccination included being non-Hispanic Asian (aPR = 1.07, 95% CI: 1.03–1.12), having a Bachelor's (aPR = 1.08, 95% CI: 1.01–1.15) or graduate degree (aPR = 1.11, 95% CI: 1.04–1.19), and parent being vaccinated against COVID-19 (aPR = 5.15, 95% CI: 3.41–7.78) having child preventive check-ups in the past year (aPR = 1.09, 95% CI: 1.04–1.15) (see Table 3).

Reasons for not vaccinating children and adolescents differed by parental vaccination status (Fig. 1). Although the main reason for not vaccinating children was concern about possible side-effects among vaccinated parents (63.6%) and unvaccinated parents (62.4%), a higher percentage of vaccinated parents planned to wait and see (45.5%) compared to unvaccinated parents (32.9%). On the other hand, a higher proportion of unvaccinated parents did not trust COVID-19 vaccines (41.1%), did not trust the government (31.3%), and did not believe children need a COVID-19 vaccine (28.0%), compared to vaccinated parents (11.9%, 14.5%, and 18.0%, respectively see Table 4). Similarly, the main reasons for not



**Fig. 1. Reasons for not vaccinating children and adolescents for COVID-19, by parental vaccination status, Household Pulse Survey, December 29, 2021–January 10, 2022.** \*Other category includes 1) other people need it more than the children in this household do right now, 2) concern about missing work to have the children vaccinated, 3) unable to get a COVID-19 vaccine for children in this household, 4) parents or guardians in this household do not vaccinate their children, 5) concern about the cost of a COVID-19 vaccine, and 6) other.

**Table 4** Reasons for not vaccinating children and adolescents for COVID-19, by parental vaccination status, Household Pulse Survey, December 29, 2021–January 10, 2022.

	Children aged 5–11 years				Adolescents aged 12–17 years							
	Vaccinated parents		Unvaccinated parents		Vaccinated parents		Unvaccinated parents					
	Unweighted n	%	95% CI	Unweighted n	%	95% CI	Unweighted n	%	95% CI			
Concern about possible side-effects of a COVID-19 vaccine for children	652	63.6	(57.9, 69.3)	329	62.4	(55.8, 69.0)	317	53.0	(45.9, 60.1)	393	62.1	(56.0, 68.2)
Plan to wait and see if it is safe and may get it later	518	45.5	(40.2, 50.8) <sup>a</sup>	136	32.9	(26.2, 39.6)	209	33.6	(27.8, 39.4) <sup>a</sup>	142	22.3	(17.6, 27.0)
Not sure if a COVID-19 vaccine will work for children	92	6.1	(4.3, 7.8) <sup>a</sup>	75	12.7	(7.8, 17.5)	44	7.5	(4.3, 10.8) <sup>a</sup>	88	16.4	(11.2, 21.6)
Don't believe children need a COVID-19 vaccine	202	18.0	(14.0, 21.9) <sup>a</sup>	193	28.0	(22.2, 33.7)	104	18.3	(13.3, 23.3) <sup>a</sup>	232	34.3	(27.6, 41.0)
The children in this household are not members of a high-risk group	281	20.4	(16.1, 24.7)	167	22.9	(18.6, 27.2)	155	25.4	(20.6, 30.2)	215	28.5	(22.7, 34.2)
The children's doctor has not recommended it	93	9.0	(5.7, 12.3)	72	10.7	(6.7, 14.8)	43	5.4	(3.2, 7.7)	71	7.6	(4.9, 10.3)
Don't trust COVID-19 vaccines	137	11.9	(8.4, 15.4) <sup>b</sup>	243	41.1	(33.3, 49.0)	97	22.5	(16.8, 28.1) <sup>b</sup>	297	44.3	(37.0, 51.7)
Don't trust the government	152	14.5	(10.8, 18.1) <sup>a</sup>	204	31.3	(25.3, 37.3)	84	17.2	(11.7, 22.8) <sup>a</sup>	214	35.8	(28.8, 42.8)
Other <sup>b</sup>	181	15.4	(12.1, 18.8) <sup>b</sup>	147	24.3	(18.6, 30.1)	133	25.0	(17.8, 32.2)	173	27.2	(21.4, 32.9)

Note: All percentages and confidence intervals are weighted to the US population.

<sup>a</sup> Response for the category was statistically significant comparing vaccinated parents against unvaccinated parents for children aged 5–11 years and adolescents aged 12–17 years.

<sup>b</sup> Other category includes 1) other people need it more than the children in this household do right now, 2) concern about missing work to have the children vaccinated, 3) unable to get a COVID-19 vaccine for children in this household, 4) parents or guardians in this household do not vaccinate their children, 5) concern about the cost of a COVID-19 vaccine, and 6) other.

vaccinating adolescents were concerns about side-effects (53.0% and 62.1% among vaccinated and unvaccinated parents, respectively). Lack of trust in COVID-19 vaccines (44.3% vs 22.5%), lack of trust in the government (35.8% vs 17.2%), and belief that children do not need the vaccine (34.3% vs 18.3%) were higher among unvaccinated parents compared to vaccinated parents. For adolescents, parental uncertainty of the vaccine's effectiveness was higher among unvaccinated (16.4%) than vaccinated (7.5%) parents.

An ecological analysis also showed that states with high parental vaccination coverage also had higher child and adolescent vaccination coverage than states with lower parent vaccination coverage (adjusted R-squared = 0.45; Fig. 2). For example, in Vermont where parental vaccination was 94.5%, child and adolescent vaccination was 81.6%. On the other hand, in Montana where parental vaccination was lower at 61.8%, child and adolescent vaccination was 45.4%.

### Discussion

Although it is commended that the majority of parents have vaccinated or intended to vaccinate their children or adolescents, a small percentage of parents are reluctant toward vaccinations. This is among the first studies to quantify the association between parental vaccination status and child and adolescent vaccination status. As expected, parents who were hesitant about getting vaccinated against COVID-19 themselves were significantly less likely to report that they would vaccinate their children, compared to those who had received a vaccine. Approximately 10% and 4% of vaccinated parents were reluctant toward vaccination for their children and adolescents, respectively. This study shows that vaccinated parents who have not vaccinated their children or adolescents were more likely to report that they would like to wait and see if it is safe. As a result, a targeted messaging campaign to explain the benefits and any potential side-effects, address misinformation, and the misconception that the vaccine is not needed for children is important for ameliorating concerns or reducing other barriers to vaccination.<sup>19</sup>

Approximately one in 10 parents of children reported that lack of a healthcare provider recommendation was a reason for not vaccinating their children. Studies have shown that healthcare provider recommendation is significantly associated with COVID-19 vaccination status and confidence in the safety of vaccines.<sup>20</sup> Empowering healthcare providers to have discussions about, and recommend, COVID-19 vaccines for parents as well as their children are important for protecting families from the serious effects of COVID-19.

Child and adolescent COVID-19 vaccination were higher among those who had preventive check-ups in the past year, underscoring the need to address disparities in vaccination among families who may not have regular access to healthcare services. Studies have found that children's preventive services and routine vaccinations were delayed, missed, or skipped during the pandemic due to medical office closures and parental fears about COVID-19 exposure in doctors' offices.<sup>21–23</sup> The CDC and the American Academy of Pediatrics (AAP) recommend that children see their doctor for well-child visits annually to receive preventive health services and routine vaccines.<sup>24</sup> Catch-up of preventive services and routine vaccines can be improved by reminding parents of the continued need for preventive services during emergencies, providing parents with timely notices when preventive services are due, and promoting tools to conduct reminders and recalls.<sup>25</sup> Although the COVID-19 vaccine is available for free, other routine vaccines can be provided at no cost for eligible children (those who are Medicaid-eligible, uninsured, underinsured, or American Indian/Alaskan Native) through the Vaccines for Children (VFC) program.<sup>26</sup> Making

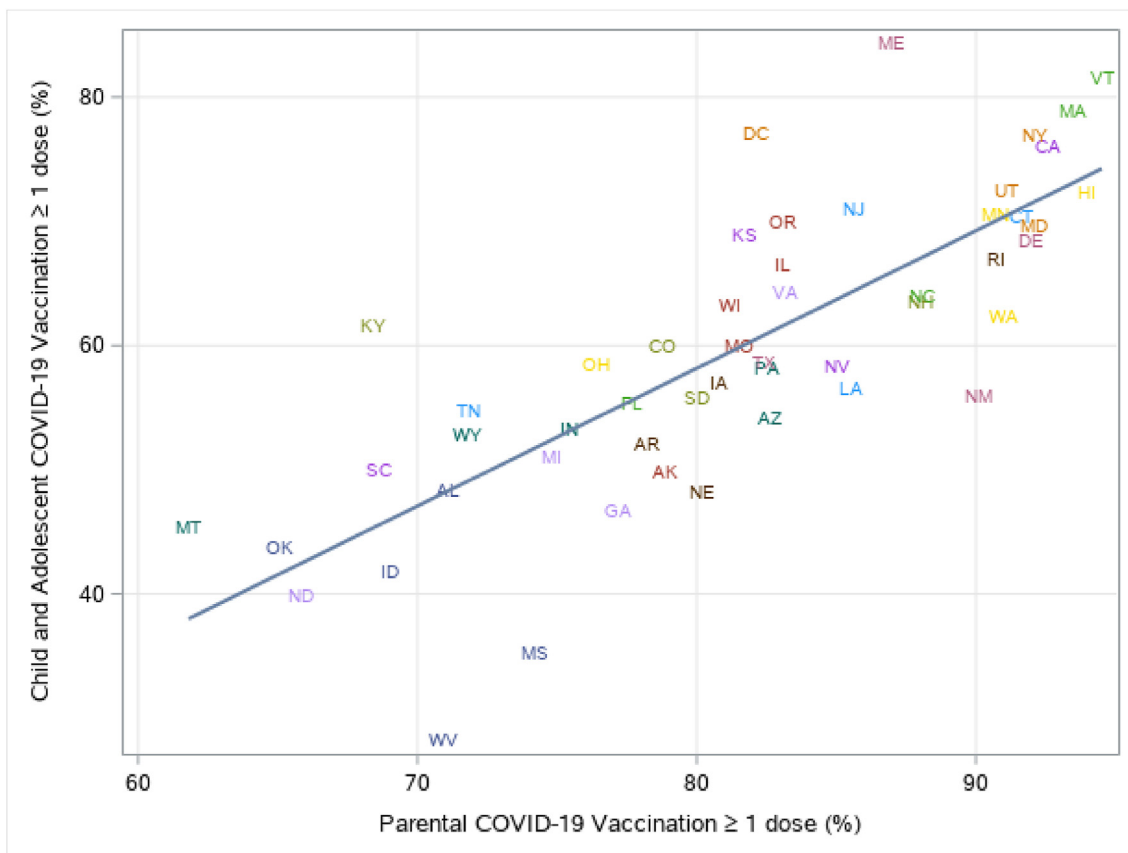


Fig. 2. Prevalence of children and adolescent COVID-19 vaccination and parental COVID-19 vaccination by state, Household Pulse Survey, December 29, 2021–January 10, 2022.

sure that children see their doctor for each well-child visit and recommended vaccines can protect children and prevent serious diseases.

These findings are subject to several limitations. First, although sampling methods and data weighting were designed to produce nationally representative results, respondents might not be fully representative of the general US adult population.<sup>27</sup> Second, vaccination status for respondents and their children was self-reported and is subject to social desirability bias. Furthermore, the analyses were limited to only households with children ages 5–11 years or 12–17 years, and results may be different for households with children in multiple age ranges. For example, parents who have children across all age ranges may be more likely to vaccinate younger children if they had already vaccinated their older children. Finally, the HPS has a low response rate (<10%); although non-response bias assessment conducted by the Census Bureau found that the survey weights mitigated most of this bias.<sup>27</sup>

**Conclusions**

With the winter 2021–2022 rise in COVID-19 cases due to the highly transmissible Omicron variant,<sup>7</sup> the resumption of in-person education and social activities, and the removal of mask mandates, having high and equitable vaccination coverage is important for preventing infection, transmission, and adverse health consequences. With COVID-19 as one of the top 10 causes of death for children aged 5–11 years; vaccination among this population is critical.<sup>28</sup> Healthcare providers and government leaders can help increase adult and child vaccinations by emphasizing that COVID-19 vaccines are safe, effective, and authorized for all children and

adults ages 6 months and older, and emphasizing that serious side-effects are rare. Targeting parents who themselves are not vaccinated, building trust and/or having trusted messengers (i.e., healthcare providers) deliver information may be effective in increasing confidence in vaccines and protecting families and communities.

**Author statements**

*Ethical approval*

This study was reviewed by the Tufts University Health Sciences Institutional Review Board and determined as not human subjects research (study ID: 00002308).

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*Competing interests*

The authors have no conflicts of interest relevant to this article to disclose. None of the authors have financial relationships relevant to this article to disclose.



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