Role of Parents' Perceived Risk and Responsibility in Deciding on Children's COVID-19 Vaccination

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abstract

OBJECTIVES: We examined associations between parents' reports for whether their children had been vaccinated against coronavirus disease 2019 (COVID-19) and parents' perceptions of the vaccine's long-term risk, as well as their own sense of responsibility on deciding to vaccinate or not vaccinate their children.

METHODS: During the period when the Omicron variant was dominant (February–March 2022), we surveyed parents from a nationally representative, probability-based Internet panel about vaccination of their school-aged children, perceptions that the vaccine's long-term risk exceeds risks without vaccination (henceforth: comparative long-term risk), their tendency to feel more responsible if their child became sick from vaccination than when unvaccinated (henceforth: anticipated responsibility), and their own vaccination status. We used multivariate analyses to assess associations of children's COVID-19 vaccination with parental comparative long-term risk perceptions, anticipated responsibility, parents' vaccination status, and demographics.

RESULTS: Among 1715 parent respondents (71% of eligible), 45% perceived vaccine-related comparative long-term risk and 18% perceived greater anticipated responsibility from vaccination than no vaccination. After accounting for parental vaccination, parents who were more concerned about comparative long-term risk and who reported greater anticipated responsibility were 6% (95% confidence interval, −0.09 to −0.03; $P < .001$) and 15% (95% confidence interval, −0.19 to −0.11; $P < .001$) less likely to have vaccinated their children, respectively. Findings were driven by vaccinated parents.

CONCLUSIONS: Parents' perceptions of the COVID-19 vaccine's long-term comparative risk and their greater anticipated responsibility for children getting sick if vaccinated (versus not) were associated with lower vaccine uptake among children of vaccinated parents.

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WHAT'S KNOWN ON THIS SUBJECT: Many children remain unvaccinated despite their parents receiving the coronavirus disease 2019 vaccine, in part because of parental hesitancy. Little is known about drivers of parental hesitancy, especially among vaccinated and unvaccinated parents, for pediatric coronavirus disease 2019 vaccines.

WHAT THIS STUDY ADDS: In a nationally representative survey, we found that parents' concern about long-term risk perceptions and anticipated responsibility for children getting sick from the vaccination are associated with lower child vaccination rates, particularly among vaccinated parents.

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The coronavirus disease 2019 (COVID-19) pandemic has threatened the health, education, and development of children and adolescents in the United States. Although parents' intentions to vaccinate their children are positively associated with their own vaccination status,[1] there is concern that parents may be more hesitant to have their children vaccinated than to receive a vaccine themselves. By late September 2022, only 67% of 12- to 17-year-olds and 38% of 5- to 11-year-olds had received at least 1 dose of the vaccine[2] compared with 91% of the US population aged ≥18 years.[3] Surveys suggest even greater parental vaccine hesitancy for preschool-aged children.[4,5] Better understanding of the reasons for parents' hesitancy is needed.

We examined parents' reports of their school-aged children's vaccination status, and how these are associated with 2 factors beyond parents' own vaccination status. The first factor is parents' concern that the COVID-19 vaccine's long-term risk for their children may exceed the health risk of living without the vaccine when the virus is circulating (henceforth: comparative long-term risk). The long-term safety of the COVID-19 vaccine is an emerging concern[1,6] because of the vaccine's rapid development compared with other existing vaccines. The second factor is the anticipated responsibility parents feel if their child were to get sick, after they decide to vaccinate or to not vaccinate their child (henceforth: anticipated responsibility). In the context of other childhood vaccinations, parents' anticipated responsibility has been greater for action than for inaction (referred to as omission bias[7]), leading to higher anticipated regret,[8] which in turn undermines their decisions to vaccinate their children.[7,9,10] However, this topic has not been studied for parents' decisions to vaccinate their children against COVID-19.

Parents' concern about the COVID-19 vaccine's long-term risks was the most frequently cited concern regarding vaccinating their children before the vaccine became available for children aged <12 years and when pediatric infection was less prevalent.[1,6,11] Because COVID-19 vaccines were developed rapidly, it is impossible to assess long-term risks despite studies showing their short-term safety.[12,13] Additionally, some people have concerns about the newer messenger RNA technology and its unclarified linkage to gene therapy.[14,15] Between December 2021 and February 2022, soon after the vaccine's approval for children aged <12 years, millions of children contracted the virus, leading to the highest rates of pediatric COVID-19 cases and hospitalizations in the United States to date.[16,17]

Parents may have a tendency to feel more responsible for the potential adverse outcomes of an action (ie, deciding to vaccinate one's child) compared with inaction.[18] This anticipated responsibility has been shown to occur even when inaction may be more likely than action to lead to an adverse outcome,[9,19] and is distinct from people's risk perceptions.[20,21] Anticipated responsibility has played a role in parents' hesitancy to vaccinate newborns[22] and children for pertussis[9,23]; measles, mumps, and rubella[24]; influenza[25]; H1N1[26]; and human papillomavirus.[27] Identifying anticipated responsibility has clinical relevance because vaccine uptake may be increased by making vaccination the default,[10] using presumptive communication to indicate that a vaccine is due,[28] or probing the risks associated with inaction.[9]

In this study, we examined:

1. whether parents' reports of children's vaccination status were associated with their perceptions of the vaccine's comparative long-term risk and their feelings of anticipated responsibility, over and above parental vaccination status; and
2. whether these relationships varied by parents' own vaccination status.

METHODS

Participants and Procedures

We analyzed data from the Understanding America Study (UAS),[29] a nationally representative, probability-based Internet panel of ~9500 US residents aged 18+ years,[30] to examine COVID-19 vaccination among school-aged children by March 2022. The UAS panel members receive regular invitations to complete surveys about health, finances, and well-being. Different from opt-in convenience samples that tend to lack representativeness,[31,32] UAS participants are randomly selected from US Postal Delivery Sequence Files. Initial and follow-up contacts are through regular mail. Participants are provided with broadband Internet and a tablet if they have no previous Internet access. This design aims to address incomplete access to the Internet in the population[33] and helps to recruit samples comparable to other well-established, probability-based studies such as the Health and Retirement Study.[34]

Since March 2020, the UAS has been tracking people's behaviors and perceptions related to the COVID-19 pandemic.[35] The data analyzed for this study came from the wave fielded between February 1 and March 30, 2022, immediately after the Omicron variant became dominant. At that time, pediatric COVID-19 infection and

hospitalization reached their peak. All active UAS participants with at least 1 child in the household in the age range of 5 to 17 years (N = 2408) were invited to the survey; 1767 completed the survey (response rate = 73.4%). Parents were asked to list all children by their names. They then received questions pertaining to 1 randomly selected child. Fifty-two participants (3%) did not provide information on or were unsure about the child's vaccination status, the outcome of interest for this study, and were excluded, resulting in an analytic sample of 1715 participants.

The study was approved by the institutional review board of the University of Southern California (UPS 14-00148). Participants provided electronic informed consent for participation.

Measures

Children's and Parents' Vaccination Status

Parents were asked, "Has [the selected child] been vaccinated for the coronavirus?" (coded as 1 = yes and 0 = no; unsure responses were excluded from the analysis as described above). Parent's own vaccination status was elicited by asking whether they were fully vaccinated (assessed by probing about manufacturer and number of doses received), as collected and compiled continuously in UAS tracking surveys. For fully vaccinated parents, a follow-up question asked, "Have you received a booster shot of the coronavirus vaccine?" (coded as 1 = yes and 0 = no, unsure). Responses to these 2 questions were used to allocate parents into 3 groups: not vaccinated (0), vaccinated (1 or 2 vaccinations) but not boosted (1), and vaccinated and boosted (2). Excluding the 86 parents who were unsure of their booster status showed similar results (Supplemental Table 3).

Comparative Long-term Risk

Following previous research about parents' decisions to vaccinate their children for pertussis,[9] we asked participants whether "the long-term risk to [the selected child] would be worse with the coronavirus vaccine than without it" (strongly disagree, disagree, agree, and strongly agree). Responses of strongly agree and agree were coded as 1, and 0 otherwise.

Anticipated Responsibility

To better suit parents' perceptions of the COVID-19 vaccine and responsibility for their children's health,[6] we created a measure of anticipated responsibility by combining questions adapted from the above study[9] examining parental anticipated responsibility to vaccinate children for pertussis, and another study[36] examining health concerns about flu vaccines: "I would feel responsible if [the selected child] is vaccinated for coronavirus and became sick" and "I would feel responsible if [the selected child] is not vaccinated for coronavirus and became sick" (strongly disagree, disagree, agree, and strongly agree). Participants were then categorized into those feeling more responsible with child vaccinated (coded as 1), those feeling equally responsible (2), or those feeling more responsible if child is unvaccinated (3).

Demographics

Child age was elicited in years. Because the vaccine became available on different schedules for individuals with 12 to 17 or 5 to 11 years of age (approval for ages >16 years on December 12, 2020; ages 12–15 years on May 12, 2021; ages 5–11 years on November 2, 2021; and ages 6 months–4 years on June 18, 2022),[2] we used these age groups (5–11 years coded as 0; 12–17 years as 1) in our analysis because their vaccination rates were expected to differ. Parents' demographic information, including sex (male, female), age (in years), race and ethnicity (non-Hispanic white, non-Hispanic Black, Hispanic, Asian American, and non-Hispanic other), education (less than bachelor, bachelor or higher), whether married or living with partner (yes, no), and household income (<$50 000, $50 000 or more), was collected quarterly for UAS participants and included in our analyses. Measures of parents' race and ethnicity were assessed because of varying vaccination rates and perceptions noted by other studies.[37]

Analysis Strategy

We first assessed whether the percentage of parents reporting comparative long-term risk concerns and anticipated responsibility differed by parents' vaccination status ($P < .05$), using a χ^2 test. We then examined whether children's vaccination status, the outcome of interest, varied by comparative long-term risk concerns and anticipated responsibility, also using a χ^2 test. Further, we estimated a linear probability model using ordinary least squares to explain the child's COVID-19 vaccination status by parents' perception of comparative long-term risk and anticipated responsibility status, after controlling for parents' own vaccination, as well as child's age group and parents' demographics (sex, age, race/ethnicity, education, household income, and whether married or living with partner). The estimated regression weights can be directly interpreted as the percentage point difference in the probability of a child being vaccinated attributable to each factor. We also ran the same models

with the logistic regression and obtained similar results.

To address how the effects of these factors vary by parents' vaccination status, we included interactions between these factors and parents' vaccination status, and then conducted a subgroup analysis by whether parents were unvaccinated, vaccinated not boosted, or boosted, respectively.

All analyses were conducted using Stata 16.1 (Stata Corp, College Station, TX), adjusted with sampling weights. In regression models, the SEs were clustered by state of residence, because vaccination policies may vary across states. Sensitivity analyses including state fixed effects show similar findings (Supplemental Table 4).

RESULTS

Table 1 shows the demographic characteristics of the parent sample and the ages of the randomly selected children (if >1 child aged 5–17 years in the household), overall and by parents' vaccination status. For comparative long-term risk perception, 45% (95% confidence interval [CI], 0.41 to 0.48) of parents considered the long-term risk of vaccinating their children to be higher than not having them vaccinated when the virus is circulating. Regarding anticipated responsibility, 18% (95% CI, 0.16 to 0.21) of parents anticipated feeling more responsible if their child would get sick with the vaccine than without the vaccine; 55% (95% CI, 0.52 to 0.58) felt equally responsible; and 27% (95% CI, 0.24 to 0.30) felt more responsible if the child got sick without the vaccine than with the vaccine. Findings for both variables varied by parents' own vaccination status (for comparative long-term risk, $\chi^2(2) = 255.0$, $P < .001$; for anticipated responsibility, $\chi^2(4) = 442.7$, $P < .001$); parents who received fewer COVID-19 vaccinations were more likely to be concerned about the long-term risk (Fig 1) and more likely to anticipate higher responsibilities if the child was vaccinated than not vaccinated (Fig 2).

Figure 3 shows that fewer children were vaccinated if their parents perceived the vaccine's long-term risk to outweigh the risk of not getting the vaccine ($\chi^2(1) = 192.8$, $P < .001$), or felt more responsible when their child became sick with the vaccine than sick without the vaccine ($\chi^2(2) = 446.9$, $P < .001$).

Regression analysis further disentangled the relative contributions of comparative long-term risk perception and anticipated responsibility in parents' decision to vaccinate their children above and beyond vaccinating themselves. Table 2 shows the estimated percentage point difference in the probability that a child was vaccinated for COVID-19, controlling for the parents' demographics and the child's age. Figure 4 shows the predicted probability given parents' perceived comparative long-term risk and anticipated responsibility. The overall model suggests that, after accounting for the parents' own vaccination status, parental concern of the vaccine's long-term risk was associated with a 6% lower child vaccination rate (95% CI, −0.09 to −0.03, $P < .001$; Table 2). This translates into a 43% child vaccination rate (95% CI, 0.40 to 0.46; Fig 4) if parents perceived long-term risks of vaccination to outweigh long-term risks of not vaccinating and 50% (95% CI, 0.47 to 0.52; Fig 4) if parents perceived otherwise. Feeling more responsibility if the child got sick with vaccination versus without was associated with a 15% lower likelihood of the child being vaccinated (95% CI, −0.19 to −0.11, $P < .001$; Table 2) compared with feeling equally responsible; feeling more responsibility if the child got sick without vaccination versus with vaccination was associated with a 19% higher likelihood of vaccinating the child (95% CI, 0.15 to 0.23, $P < .001$; Table 2) compared with feeling equal responsibility. Marginal predicted means show 29% child vaccination likelihood (95% CI, 0.26 to 0.33; Fig 4) if parents feel more responsible with their child vaccinated than unvaccinated, compared with 44% (95% CI, 0.42 to 0.47) of those who felt equally responsible and 64% (95% CI, 0.60 to 0.67) the other way around. If we were to convince parents who anticipated higher responsibility with child vaccinated than unvaccinated to feel indifferent about these 2 scenarios, this would bring the overall child vaccination rate to 49% (95% CI, 0.47 to 0.52; Fig 4). The full regression results can be found in Supplemental Table 5.

Interacting these factors with parents' vaccination status shows that the association with comparative long-term risk concerns is stronger among boosted parents than unvaccinated parents ($P < .05$, Supplemental Table 6), but not significantly different between unvaccinated and vaccinated but not boosted parents ($P > .05$). The association with anticipated responsibility varied significantly ($P < .05$) between unvaccinated parents and the other 2 groups. Splitting the sample by parents' vaccination status (Table 2, Fig 4) reveals that perceived comparative long-term risk and anticipated responsibility predicted lower child vaccination uptake among both vaccinated but not boosted and vaccinated and boosted parents ($P < .05$). In contrast, no

TABLE 1 Characteristics of the Overall Sample and by Parents' Vaccination Status

Variable	Overall (N = 1715)	Parent Vaccination Status			P
		Unvaccinated (N = 419)	Vaccinated Not Boosted (N = 553)	Boosted (N = 735)	
Parent age, y, mean (SD)	43.08 (10.49)	40.74 (9.38)	42.07 (10.40)	45.18 (10.81)	<.001
Parent sex, *n* (%)					<.001
Male	606 (35.3)	123 (29.4)	182 (32.9)	298 (40.5)	
Female	1109 (64.7)	296 (70.6)	371 (67.1)	437 (59.5)	
Parent race/ethnicity, *n* (%)					<.001
Non-Hispanic white	1021 (59.6)	285 (68.0)	288 (52.1)	442 (60.2)	
Non-Hispanic Black	146 (8.5)	41 (9.8)	54 (9.8)	50 (6.8)	
Hispanic	371 (21.7)	61 (14.6)	148 (26.8)	161 (21.9)	
Asian American	84 (4.9)	6 (1.4)	27 (4.9)	51 (7.0)	
Non-Hispanic other	92 (5.4)	26 (6.2)	36 (6.5)	30 (4.1)	
Parent education, *n* (%)					<.001
Less than bachelor's	981 (57.2)	327 (78.0)	357 (64.7)	291 (39.6)	
Bachelor or higher	733 (42.8)	92 (22.0)	195 (35.3)	444 (60.4)	
Married or living with partner, *n* (%)					<.001
No	580 (33.8)	167 (39.9)	213 (38.5)	196 (26.7)	
Yes	1135 (66.2)	252 (60.1)	340 (61.5)	539 (73.3)	
Household income, *n* (%)					<.001
<$50 000	564 (32.9)	207 (49.4)	211 (38.2)	143 (19.5)	
$50 000 or more	1150 (67.1)	212 (50.6)	341 (61.8)	592 (80.5)	
Child age, y, *n* (%)					.007
5–11	796 (46.6)	221 (53.3)	241 (43.8)	330 (44.9)	
12–17	912 (53.4)	194 (46.8)	309 (56.2)	405 (55.1)	

such association was found among unvaccinated parents ($P > .05$), even though these unvaccinated parents perceived higher comparative long-term risk and anticipated responsibility with child vaccinated than not (Fig 1).

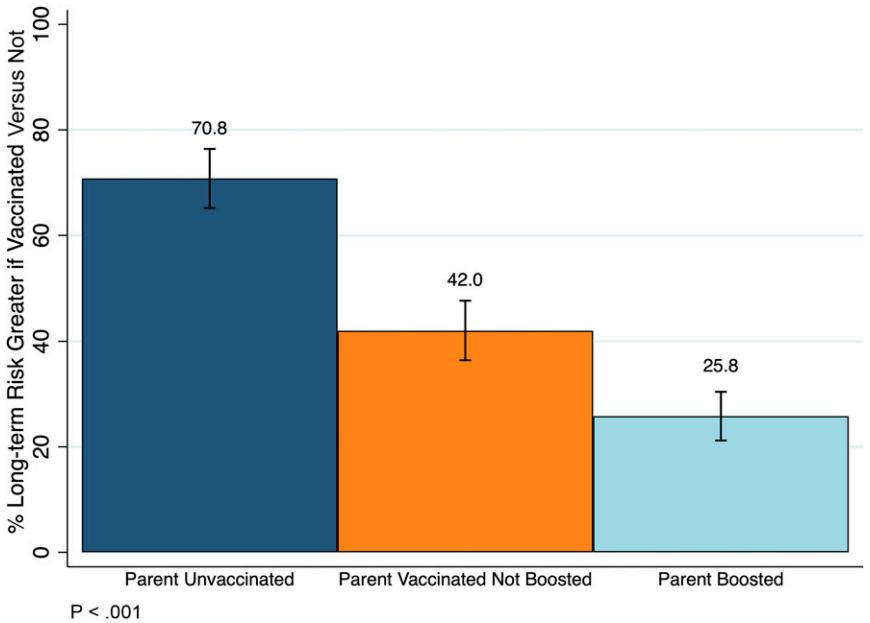

FIGURE 1
Weighted percentage of parents who had greater concern about the COVID-19 vaccine's long-term risk compared with the risk under no vaccination by parents' own vaccination status with 95% CI.

DISCUSSION

The current study highlights the association between a lowered likelihood for a child to receive a COVID-19 vaccine and 2 factors:

1. parents' comparative concerns about the long-term risks of the child getting the vaccine versus not getting the vaccine; and
2. their sense of higher anticipated responsibility if the child became sick with the vaccine than without when the virus is circulating.

Especially among vaccinated parents, regardless of whether they had received booster shots or not, those who were concerned about the vaccine's long-term risk were less likely to have their children vaccinated; similarly, parents who felt more responsible with child vaccinated than without were far less likely to have their children vaccinated. In contrast, such

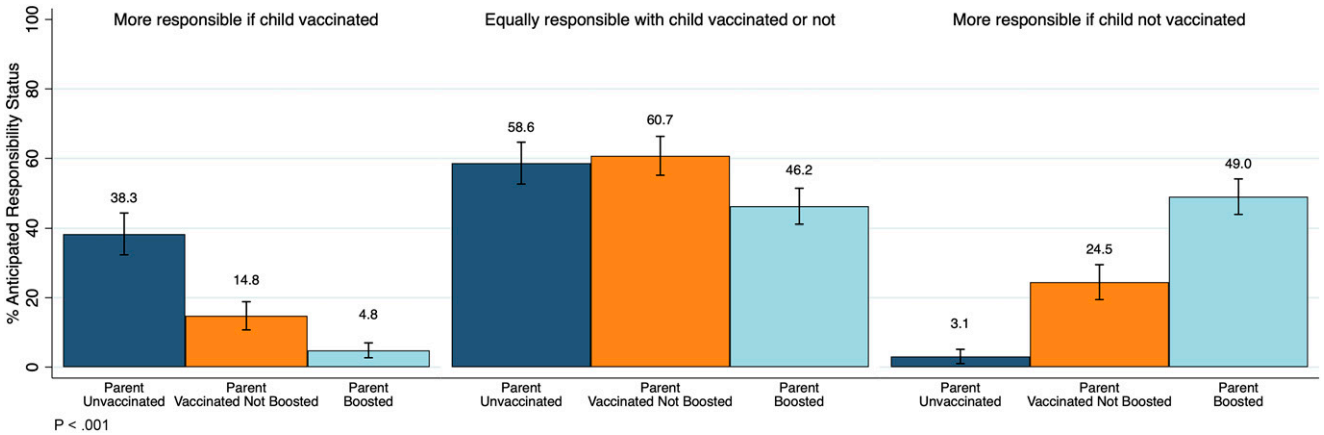

FIGURE 2

Weighted percentage of parents who felt more responsible if child vaccinated, equally responsible with child vaccinated or not, or more responsible if child not vaccinated, by parents' own vaccination status with 95% CIs.

associations were not found among unvaccinated parents.

Our findings suggest 2 strategies to potentially improve children's vaccine uptake. The first follows our finding that nearly half (45%) of all parents considered the vaccine's long-term risks to outweigh the long-term risks of not vaccinating their child. To address this issue, pediatric clinicians could reassure these parents with the following information: the rare cases of vaccine-associated myocarditis were mild and resolved[38]; myocarditis from COVID-19 infection is far more common and severe than the rare and mild myocarditis from the vaccine[39]; vaccine-associated myocarditis among young children is extremely rare and even rarer than among adults[39]; and there is no evidence and no plausible mechanism for why messenger RNA vaccines could alter the genetic makeup of a child.[15]

The second communication strategy derives from the finding that some parents' higher anticipated responsibility if their child got sick while vaccinated than unvaccinated was strongly associated with COVID-19 vaccine hesitancy in our study. When it comes to medical decisions, many people are more conservative when deciding for others than for themselves,[40,41] and this may extend to their children. Fear of potential regret[42] if an active decision to vaccinate a child were to lead to adverse consequences can make parents delay or forgo the

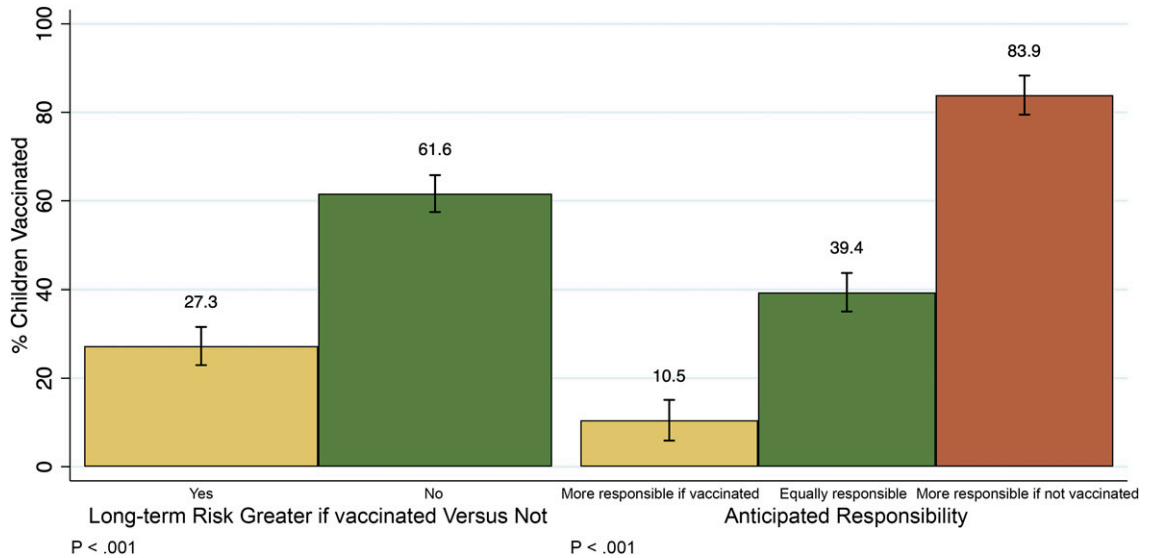

FIGURE 3

Weighted percentage of children vaccinated by comparative long-term risk concern (left panel) and anticipated responsibility (right panel) with 95% CI.

TABLE 2 Estimated Difference in the Probability of a Child Receiving the COVID-19 Vaccination (95% CI), Depending on Parents' Perception of Long-Term Risk if Vaccinating the Child or Not (Comparative Long-Term Risk), and Parents Feeling More Responsible if the Child Became Sick if Vaccinated or Not (Anticipated Responsibility)

Predictor	Overall[a] (N = 1715)	Parent Unvaccinated (N = 419)	Parent Vaccinated Not Boosted (N = 553)	Parent Boosted (N = 735)
Comparative long-term risk[b]	−0.06*** (−0.09 to −0.03)	−0.01 (−0.05 to 0.04)	−0.06 (−0.13 to 0.01)	−0.08** (−0.14 to −0.03)
More responsible if child vaccinated than unvaccinated[c]	−0.15*** (−0.19 to −0.11)	−0.04 (−0.08 to 0.01)	−0.22*** (−0.30 to −0.14)	−0.24* (−0.45 to −0.04)
More responsible if child unvaccinated than vaccinated[c]	0.19*** (0.15 to 0.23)	0.04 (−0.06 to 0.14)	0.20*** (0.09 to 0.32)	0.15*** (0.09 to 0.21)
R^2	0.50	0.07	0.30	0.16

All regression estimates are based on a linear probability model, controlling for child's age, as well as parents' age, sex, race/ethnicity, education, whether married or living with partner, and household income. For example (row 2, column 1), a child is 15% less likely (95% CI, −0.19 to −0.11) to have been vaccinated if the parent felt more responsible vaccinating versus not vaccinating the child, compared with a child whose parent felt indifferently. R^2, coefficient of determination, indicating the collective proportion of variance explained by all predictors.

[a] The overall model also controlled for parents' vaccination status.

[b] Compared with the parents who did not perceive the vaccine's long-term risk to outweigh the long-term risk with no vaccination.

[c] Compared with the parents who felt equally responsible if the child became sick with or without vaccination.

* $P < .05$; ** $P < .01$; *** $P < .001$.

vaccination. Others have therefore suggested that pediatric clinicians may consider ways to make not vaccinating an active rather than a passive decision. For example, pediatric clinicians may do so by making vaccination the default,[10] using presumptive communication to indicate that a vaccine is due,[28] or probing the risks associated with inaction.[9]

Studies have shown that parents trust their child's physician more than other sources and often prefer to have their children vaccinated in their pediatric offices.[1,43] Generic communication strategies that have worked for other vaccinations could further complement the specific communication strategies described above; for example, using personal stories (eg, that the clinicians' children or grandchildren are vaccinated),[44,45] describing social norms (eg, stating many parents are clamoring for the vaccine, or many parents in their

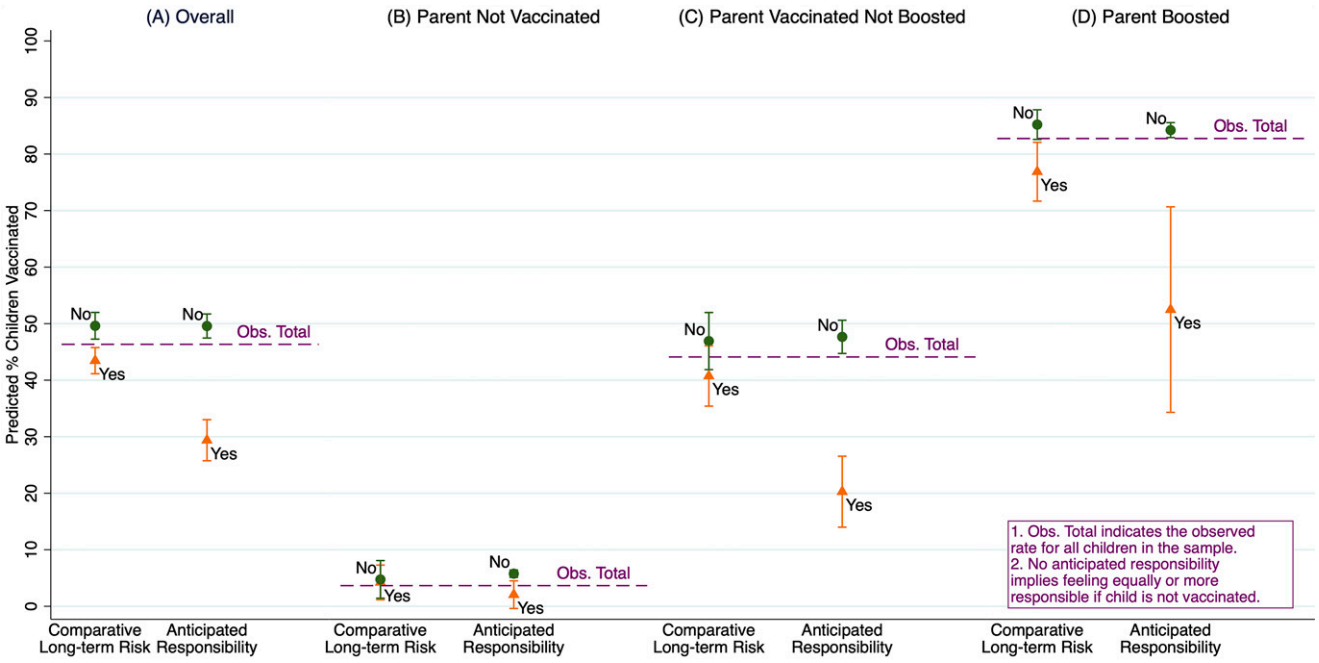

FIGURE 4

Predicted percentage of children vaccinated given parents' status on perceived comparative long-term risk (yes, orange triangle; no, green circle) and anticipated responsibility (yes, orange triangle; no, green circle), with 95% CI. The observed child vaccination rates for all children in the sample are shown by the dashed lines, stratified by parent vaccination status.

practice have considered benefits and risks and decided to vaccinate),[46] using motivational interviewing techniques (eg, starting by asking permission to discuss vaccination),[47] and gently bringing up COVID-19 vaccination at future visits even among parents who deferred vaccination.

Figure 4 showcases the estimated potential increase in vaccine coverage if we could eliminate parents' concerns about greater long-term risk or higher anticipated responsibility of vaccinating the child versus not. The overall coverage rate could potentially increase from the current 46% to 50% if 1 issue was addressed, and up to 52% if both were addressed. For children with unvaccinated parents, the increase is less pronounced, from 4% to 5% to 6%. It is likely that unvaccinated parents' vaccine hesitancy for themselves also affected their decisions to not vaccinate their children.

Our study has some limitations. First, children's vaccination status was collected through parents' reports, without proof or documentation. However, previous studies suggest relatively accurate parental recall for influenza vaccination in the previous season[48–50]; we suspect that parental report of their child's COVID-19 vaccination status may be even more accurate because influenza vaccination is annual, whereas COVID-19 vaccination is unusual. Secondly, the UAS only collected limited background information on that child. More work is needed to understand the extent to which the above findings may vary by the child's characteristics (eg, general health conditions). Thirdly, the data used in this study are cross-sectional, limiting the study's capability to draw causal conclusions. Lastly, we framed the long-term risk as a general concern rather than specific long-term risk concerns about, for example, vaccine-induced myocarditis or altering children's genetic makeup. People's perceptions of risk are highly correlated[51] and parents often have a difficult time pinpointing their exact concerns. We also focused on the perception of relative risk rather than absolute risk because parents' risk perception may be different when potential benefit is also referred versus not in the same question.[52] Future studies could further disentangle finer components.

CONCLUSIONS

Our nationally representative survey found lower COVID-19 vaccine uptake among children associated with parents' concerns of the vaccine's long-term risk and their anticipated responsibility if child became sick after the vaccination, particularly among parents who have been vaccinated themselves. The findings point to potential ways to promote pediatric COVID-19 vaccination.

ABBREVIATIONS

CI: confidence interval
COVID-19: coronavirus disease 2019
UAS: Understanding America Study

of the University of Southern California, the Understanding America Study, the National Institute on Aging of the National Institutes of Health, or the Social Security Administration.

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