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Unvaccinated Adolescents' COVID-19 Vaccine Intentions: Implications for Public Health Messaging

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A B S T R A C T

Purpose: COVID-19 vaccine uptake remains low for US adolescents and contributes to excess morbidity and mortality. Most research has assessed parental intention to vaccinate their children. We explored differences between vaccine-acceptant and vaccine-hesitant unvaccinated US adolescents using national survey data.

Methods: A nonprobability, quota-based sample of adolescents, aged 13–17 years, was recruited through an online survey panel in April 2021. One thousand nine hundred twenty seven adolescents were screened for participation and the final sample included 985 responses. We assessed responses from unvaccinated adolescents (n = 831). Our primary measure was COVID-19 vaccination intent (“vaccine-acceptant” defined as “definitely will” get a COVID-19 vaccine and any other response classified as “vaccine-hesitant”) and secondary measures included reasons for intending or not intending to get vaccinated and trusted sources of COVID-19 vaccine information. We calculated descriptive statistics and chi-square tests to explore differences between vaccine-acceptant and vaccine-hesitant adolescents.

Results: Most (n = 831; 70.9%) adolescents were hesitant, with more hesitancy observed among adolescents with low levels of concern about COVID-19 and high levels of concern about side effects of COVID-19 vaccination. Among vaccine-hesitant adolescents, reasons for not intending to

IMPLICATIONS AND CONTRIBUTION

COVID-19 vaccine uptake among adolescents remains challenging. Most existing research focuses on parental intentions for their children; however, adolescents' intentions about COVID-19 vaccination are understudied. This study identified important differences between COVID-19 vaccine-accepting and vaccine-hesitant adolescents, which can inform communication with

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get vaccinated included waiting for safety data and having parents who would make the vaccination decision. Vaccine-hesitant adolescents had a lower number of trusted information sources than vaccine-acceptant adolescents.

Discussion: Differences identified between vaccine-acceptant and vaccine-hesitant adolescents can inform message content and dissemination. Messages should include accurate, age-appropriate information about side effects and risks of COVID-19 infection. Prioritizing dissemination of these messages through family members, state and local government officials, and healthcare providers may be most effective.

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hesitant adolescents in terms of message content and dissemination channels.

Low rates of COVID-19 vaccination have resulted in unnecessary morbidity and mortality among all age groups. As of April, 2023, only 62% of US adolescents aged 12–17 years were considered fully vaccinated (two doses in the primary COVID-19 series) and only 7.5% of fully vaccinated have received an updated (Bivalent) booster dose [1]. To protect adolescents themselves as well as their family and community members, we need to continue refining strong vaccination advocacy that targets both adolescents and their parents. While US parents or guardians have the legal authority to decide whether an adolescent aged 12 to 17 years receives a COVID-19 vaccine in most states, there is increasing evidence that adolescents want to be part of the vaccine decision-making [2–4] as well as growing literature on the use of shared decision-making with younger patients [5–7]. Thus, messaging and communication efforts need to address not only parents but also adolescents [8].

The majority of research related to adolescent COVID-19 vaccination has focused on parental intentions [9–15], with few studies on adolescents' own intentions [16–19]. Understanding adolescents' own intentions around COVID-19 vaccination and identifying factors driving those intentions is vital for guiding message design and dissemination plans to reach yet-to-be-vaccinated adolescents. In this study, we conducted secondary analyses of data from a nonprobability-based internet panel of US adolescents aged 13–17 years to explore factors associated with vaccination intentions, as well as adolescents' trusted sources of information about COVID-19 vaccines. In the initial analysis of these data, all unvaccinated adolescents were grouped together regardless of intention [18]. The objective of the current analyses is to test for differences among unvaccinated adolescents who definitely intended to get a COVID-19 vaccine compared with those who did not to better understand sources of hesitancy and sources of information.

Methods

The survey was administered by the Healthcare and Public Perceptions of Immunizations Survey Collaborative, a cooperative agreement between the Centers for Disease Control and Prevention (CDC) and researchers at the University of Iowa and the RAND Corporation. This study was reviewed and approved by the University of Iowa Institutional Review Board. Additionally, this activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy (see e.g., 45 C F R. part 46, 21 C F R. part 56; 42 U S C. §241(d); 5 U S C. §552a; 44 U S C. §3501 et seq). Adolescents between ages 13 and 17 years were recruited through a national, online panel via Qualtrics during April 15–23, 2021. Sampling quotas were used to obtain

approximately equal and/or representative group sizes for each of the following demographics: gender, race/ethnicity (64% Non-Hispanic White, 12% Non-Hispanic Black, 16% Hispanic, 18% other race or ethnicity), and age (13–15 years; 16–17 years). Data collection occurred just prior to the COVID-19 vaccine Emergency Use Authorization (EUA) being extended to 12-year-olds to 15-year-olds; 16-year-olds and 17-year-olds were already covered by the EUA. Full survey methodology details are reported elsewhere [18]. Here, we report results from adolescents aged 13–17 years who reported not having received a COVID-19 vaccine at the time of the survey ($n = 831$), 84% of the original survey sample.

Our primary measure was COVID-19 vaccination intentions among unvaccinated adolescents. We dichotomized adolescent survey responses to the following question: “How likely are you to get a COVID-19 vaccine when you become eligible?” Adolescents who selected the response option “definitely will” get a COVID-19 vaccine were categorized as “vaccine-acceptant” ($n = 242$) and adolescents who selected any other response (“probably will”, “not sure”, “probably will not”, “definitely will not”) as “vaccine-hesitant” ($n = 589$), as this definition was consistent with the branching logic used to guide respondents through the survey. Additionally, this is consistent with and captures the nuance of established definitions of vaccine hesitancy that summarize the concept as “delay in acceptance or refusal” [20] or “a state of indecisiveness regarding a vaccination decision” [21]. Secondary measures were reasons for getting (asked of adolescents who indicated that they “definitely will” get vaccinated) or not getting vaccinated (asked of adolescents who indicated that they either “probably will”, “not sure”, “probably will not”, or “definitely will not” get vaccinated). The survey was programmed to employ skip logic so that respondents answering anything other than “definitely will” get vaccinated were asked to select the reasons that they were not getting vaccinated and factors that would make them more likely to get vaccinated, while those answering “definitely will” selected reasons why they will get vaccinated. To determine trusted sources of information, we asked “Which of the following sources do you trust for accurate information about the COVID-19 vaccine? Select all that apply.” We calculated frequencies and descriptive statistics for all variables and used chi-square statistics to test for differences between vaccine-acceptant and vaccine-hesitant adolescents. A post-hoc p -value correction ($p = .0025$) was used to account for multiple comparisons [22]. We also conducted a sensitivity analysis in which we defined “vaccine-acceptant” adolescents as those who would “definitely” or “probably will” get a COVID-19 vaccine and all others as vaccine-hesitant.

Table 1
Comparison of demographic characteristics by vaccine intent (n = 831)

	Vaccine-hesitant (n = 589)	Vaccine-acceptant (n = 242)	p value from chi-square test for group differences
	N (%)	N (%)	
Age*			
13–15 years	261 (65.7)	136 (34.3)	
16–17 years	328 (75.6)	106 (24.4)	.002
Gender*			
Male	228 (74.5)	78 (25.5)	
Female	343 (71.0)	140 (29.0)	
Transgender	10 (40.0)	15 (60.0)	
Other	8 (47.1)	9 (52.9)	.004
Rurality*			
Rural	95 (76.0)	30 (24.0)	
Urban	494 (70.0)	212 (30.0)	.17
Ethnicity*			
Hispanic or Latino/a	107 (78.7)	29 (21.3)	
Not Hispanic or Latino/a	479 (69.3)	212 (30.7)	.028
Race ^a *			
American Indian or Alaskan Native	13 (72.2)	5 (27.8)	
Asian	25 (61.0)	16 (39.0)	
Black or African American	104 (78.8)	28 (21.2)	
Native Hawaiian or PI	8 (72.7)	3 (27.3)	
White	435 (68.6)	199 (31.4)	
Concern about COVID-19 infection**			
Not concerned	190 (34.1)	23 (10.0)	
Slightly concerned	136 (24.4)	47 (20.5)	
Somewhat concerned	146 (26.2)	85 (37.1)	
Very concerned	86 (15.4)	74 (32.3)	< .001
Concern about vaccine side effects**			
Not concerned	102 (17.6)	58 (24.0)	
Slightly concerned	152 (25.9)	88 (36.4)	
Somewhat concerned	167 (28.5)	60 (24.8)	
Very concerned	164 (28.0)	36 (14.9)	< .001

^a Race was asked as a check all that apply question, thus we could not compute a chi-square statistic.

* Percentages calculated by rows.

** Percentages calculated by column.

Results

A total of 1,927 adolescents aged 13 to 17 years were originally screened for this survey; of those, 59.3% agreed to participate (n = 1,143) and of those, 985 (87.1%) were included in the final sample. Of those 985 adolescents, 154 (15.6%) were excluded because they were already vaccinated, thus we only report results from unvaccinated adolescents (n = 831). The majority of adolescents who were unvaccinated against COVID-19 (70.9%) were classified as COVID-19 vaccine-hesitant (n = 589) (Table 1). When comparing vaccine-hesitant and vaccine-acceptant adolescents on demographic variables, only age group was statistically significant, with older adolescents (aged 16–17 years) being more vaccine-hesitant than younger adolescents (aged 13–15 years). There were no other significant demographic differences between vaccine-hesitant and vaccine-acceptant adolescents using the 0.0025 post-hoc p-value threshold. Compared with vaccine-acceptant adolescents, vaccine-hesitant adolescents reported significantly lower levels of concern about a COVID-19 infection (15.4% “very concerned” vs. 32.3%; $\chi^2 = 65.06$, $p < .001$) and significantly higher of concern about vaccine side effects (28.0% “very concerned about side effects” vs. 14.9%; $\chi^2 = 23.06$, $p < .001$).

The primary reasons for intending to remain unvaccinated among vaccine-hesitant adolescents were concern about side effects (45.0%), waiting to see if it is safe (43.9%), lack of trust in the vaccines (28.0%), and thinking that other people need the vaccine more (27.5%) (Table 2). The main reasons for wanting to be

vaccinated among vaccine-acceptant adolescents were protecting the health of family and friends (87.2%), personal COVID-19 prevention (77.3%), protecting the health of their communities (75.6%), and allowing them to resume social activities (67.8%) (Table 2).

Finally, we compared trusted sources of COVID-19 vaccine information for vaccine-hesitant and vaccine-acceptant adolescents (see Figure 1 for information source options). Vaccine-acceptant adolescents identified more total sources of trusted information ($M = 4.35$, standard deviation = 2.26) compared with vaccine-hesitant adolescents ($M = 2.75$, standard deviation = 2.21), $p < .001$. Top sources of trusted information among both acceptant and hesitant adolescents were government officials (45.8% of hesitant adolescents; 80.2% of acceptant adolescents), state/local health officials (38.7% of hesitant adolescents; 70.7% of acceptant adolescents), usual healthcare provider (37.0% of hesitant adolescents; 64.1% of acceptant adolescents), and family (30.4% of hesitant adolescents; 41.7% of acceptant adolescents). Vaccine-hesitant adolescents were less likely to report trusting information from government agencies, $p < .001$, families, $p = .002$, usual healthcare provider, $p < .001$, state/local health officials, $p < .001$, news sources, $p < .001$, and online publishers of medical info, $p < .001$, compared to vaccine-acceptant adolescents (Figure 1).

We additionally conducted two sensitivity analyses. First, we explored a reclassification of our primary outcome variable (acceptance) in which vaccine-acceptant adolescents were defined as those reporting they would “definitely” or “probably”

Table 2

Factors affecting vaccine decisions for hesitant (n = 589) and acceptant (n = 242)*

	Which of the following, if any, are reasons that you are not sure/probably will not/definitely will not get a COVID-19 vaccine? (select all that apply)	N	%
Factors for vaccine-hesitant (n = 589)	I am concerned about possible side effects	265	45.0
	I plan to wait and see if it is safe and may get it later	258	43.9
	My parent(s)/caregivers will decide whether I get a COVID-19 vaccine	216	36.7
	I don't trust the COVID-19 vaccines	165	28.0
	I think other people need it more than I do right now	162	27.5
	I don't like needles	122	20.7
	I don't know if the COVID-19 vaccine will work	122	20.7
	I don't believe I need a COVID-19 vaccine	118	20.0
	I am concerned about having an allergic reaction	108	18.3
	I don't think COVID-19 is that big of a threat	101	17.1
	There are obstacles that may prevent me from getting a vaccine	50	8.5
	Other people in my community are choosing not to get vaccinated	39	6.6
	I am concerned about the cost of a COVID-19 vaccine	33	5.6
		Which of the following would make you more likely to get a COVID-19 vaccine? (select all that apply)	
Factors for vaccine-acceptant (n=242)	It would protect the health of my friends and family	211	87.2
	It would prevent me from getting COVID-19	187	77.3
	It would protect the health of my community	183	75.6
	It would allow me to resume or do more social activities	164	67.8
	It would allow me to travel	124	51.2
	I am concerned about the severity of COVID-19 if I get it	119	49.2
	It was recommended to me by a family member or friend	102	42.1
	It would help me get back to school	104	43.0
	I saw people in my community getting vaccinated	84	34.7
	It would allow me to get back to school	83	34.3
	I personally know someone who became seriously ill or died from COVID-19	67	27.7
	It was recommended to me by a healthcare provider	40	15.6
	My school requires it	25	10.3
	My workplace requires it	6	2.5

* 0.83% of vaccine-acceptant adolescents selected none of these reasons; 8.2% of vaccine-hesitant adolescents selected none of these reasons.

be vaccinated against COVID-19 (as opposed to “definitely” only). This resulted in 48.4% of the sample (n = 402) being defined as vaccine-hesitant. In terms of statistical significance, findings were virtually identical to our primary analysis, with the exception that vaccine-acceptant adolescents were significantly more likely than vaccine-hesitant adolescents to report Instagram as a trustworthy information source (9.3% vs. 4.0%, respectively), $p = .002$. Next, we conducted an age-stratified analysis to assess potential differences between adolescents aged 13–15 years and 16–17 years to account for the fact that older adolescents would have been eligible for vaccination prior to the timing of the survey. As previously stated, a significantly higher percentage of younger adolescents were classified as vaccine-acceptant (34.3% vs. 24.4%, respectively), $p = .002$. The directionality for all other analyses in terms of reasons for vaccination hesitancy/acceptance and trusted sources of information were similar to the overall analysis. Therefore, we only report overall results here.

Discussion

Data from a national, nonprobability-based internet panel survey of US adolescents aged 13–17 years revealed critical insights into differences between those who are vaccine-hesitant and those who are vaccine-acceptant. We found that at the time of this survey (April 2021), just prior to adolescents aged 12–15 years becoming eligible for vaccination, most unvaccinated adolescents expressed some level of hesitancy about getting a COVID-19 vaccine. Given the persistently low rates of COVID-19 vaccine uptake of both the primary series and

booster doses in this age group, this hesitancy has clearly persisted. Underscoring the importance of vaccination in this age group is the finding that during the Omicron surge in December 2021, COVID-19 hospitalization rates among unvaccinated adolescents were six times higher than that among fully vaccinated adolescents [23]. In this study comparing vaccine-acceptant and vaccine-hesitant adolescents, our results offer additional information for how to effectively create messaging to encourage primary vaccination among unvaccinated adolescents and increase uptake of booster doses among the fully vaccinated.

Understanding how best to design these COVID-19 vaccine promotion messages for adolescents is vital. However, to date, most research around intentions and reasons for COVID-19 vaccine hesitancy has focused on adults aged 18 years or older [24–26] or parents of children and adolescents aged 0–18 years [9–15], with few studies focused on this perspectives of adolescents aged 12–17 years. In general, we found that vaccine-hesitant adolescents had low levels of concern about the severity of COVID-19 and high levels of concern about side effects from the vaccine. These are similar factors identified in another survey of adolescents conducted approximately six months after ours; researchers found that risk perceptions were highest among unvaccinated adolescents who did not plan to get vaccinated [19]. Moreover, the factors identified in our survey are similar to general factors that have been identified in the broader, and now extensive, vaccine hesitancy literature [20]. To promote vaccination among hesitant adolescents, messaging could focus on addressing fears and concerns about side effects while simultaneously communicating COVID-19 risk information for this age group and promoting the positive effects of vaccination

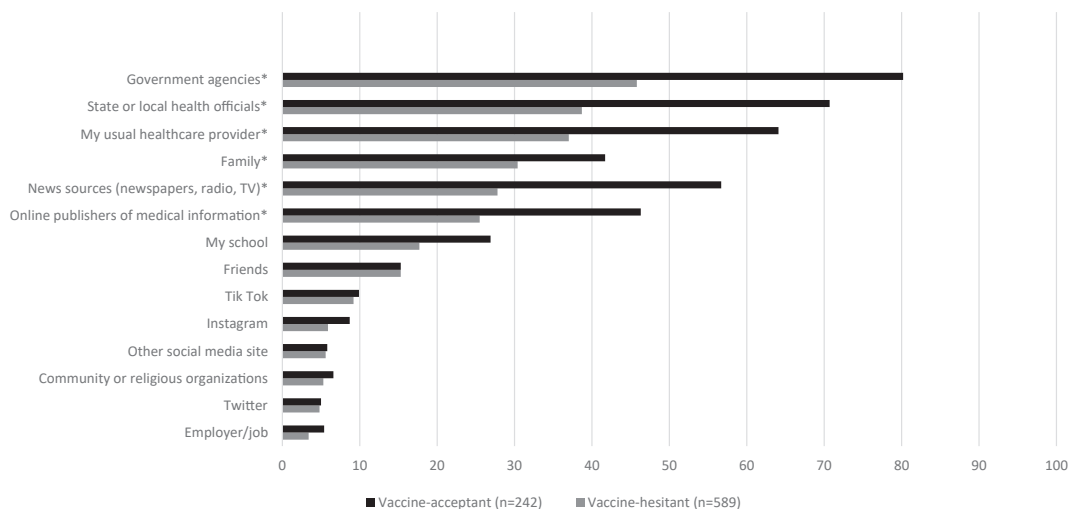


Figure 1. Percentage of hesitant (n = 589) and acceptant (n = 242) adolescents who reported trusting sources for accurate information about COVID-19 vaccination. *Indicates significant difference $p < .0025$.

(e.g., protection of one's family and reducing risk of long-term health issues from infection). It is notable that in our survey, among vaccine-acceptant adolescents, the most selected reason driving their decision to get vaccinated was that it would protect the health of friends and family (n = 211; 87.2%). There is increasing literature exploring the positive relationship between external motivation (i.e., protecting for friends/family or the general public) and vaccine uptake [27,28]; however, less is known about how to leverage these motivations in vaccine-hesitant populations. This is certainly an important area to explore more fully, especially given the high percentage of adolescents in our study who reported this is a factor driving their decision to get vaccinated. Finally, an important trend to note is that among vaccine-hesitant adolescents, the common reasons for hesitancy were selected by less than 50% of this group. This is in contrast to the vaccine-acceptant adolescents; many of the reasons for acceptance were selected by more than 50% of the group. This pattern suggests substantial heterogeneity in the vaccine-hesitant group that merits further research to understand what other factors may be contributing to this hesitancy.

One guide for message design could come from health communication theory. In a study surveying an adult population to examine the relationship between constructs from health behavioral theories and COVID-19 vaccine intention, higher levels of fear and perception of benefits to one's community were associated with higher intention [29]. A similar study, again with adults, tested messaging strategies for COVID-19 vaccination and found that emphasizing both personal and public risks for not getting vaccinated were likely to increase intentions [30]. This research provides an important foundation for message creation but is limited to adults. Future work should explore these theoretical constructs among the adolescent population.

Understanding whether a similar strategy of using messaging that communicates susceptibility and potential severity while highlighting the positive effects of vaccination for adolescents could help to increase uptake. However, there must be a balance of how much fear to instill. For example, the Extended Parallel Process Model posits that if threat of a potential negative outcome is low, individuals will be less likely to take action;

however, if threat is too high, it could lead to avoidance of the behavior [31]. Additionally, this messaging needs to build both perceived self-efficacy (belief in ability to get vaccinated) and response-efficacy (belief that the vaccine will be effective) at the same time to ensure that adolescents are confident they can get vaccinated and believe that vaccination will be effective. Messaging that provides accurate, age-appropriate information about the side effects of the vaccines, as well as about the risks of COVID-19 infection to adolescents, could help vaccine-hesitant adolescents to make informed choices about vaccination.

Our results also offer insights into dissemination channels. Family, government officials (including state and local), healthcare providers, news sources, and online medical websites were identified as being the primary sources of information among our adolescent respondents. Thus, these channels should be prioritized for dissemination of vaccine-promotion messaging for this age-group. While adolescents are often considered "digital natives," they report significant challenges in finding what they consider to be credible health information online [32]. Moreover, while there are recommendations to rely on social media applications like Facebook, Instagram, and TikTok to reach adolescents with information about COVID-19 [33,34], these were very rarely cited as being trusted sources for accurate information in our study. However, if using social media, efforts could consider how to increase trust in messages received over social media among adolescents. Additionally, messaging campaigns may consider prioritizing dissemination through more traditional trusted sources of information like healthcare providers and news sources.

Finally, while only age group was found to be statistically significant, our results also identified nonsignificant demographic patterns in vaccine hesitancy that merit further exploration, especially as our findings differ from the literature. For example, while rurality has been associated with lower COVID-19 vaccination intention [35] and higher rates of adolescent vaccination have been observed for the Hispanic/Latino population [36], we did not find any differences by rurality or ethnicity. Overall, it is clear that more research is needed to understand the nuances of intention among different

populations and how that has evolved over time, especially those who are traditionally under-represented (e.g., gender minorities [37]) and those who have been most disproportionately impacted by the pandemic [38]. Further research to understand intentions and strategies for messaging to these adolescent populations will be crucial to increase vaccine uptake.

Strengths and limitations

This study begins to address important gaps in the current literature on COVID-19 vaccine hesitancy among adolescents and our results have implications for how to create messaging for vaccine-hesitant compared to more vaccine-acceptant adolescents. Collecting data from adolescents across the country provides critical insights into this understudied population and actionable information for those working on vaccine promotion efforts. However, there are several limitations to note. This was a nonprobability survey, offered only in English, and we did not collect sufficient sample sizes for some demographic comparisons (i.e., insurance status, household income), both factors that limit the generalizability of these data. Additionally, we do not have data about adolescents' hesitancy toward other vaccines to know whether their vaccine hesitancy is specific to COVID-19 or all vaccines. Data collection occurred prior to EUA of COVID-19 vaccines for the 12-year-old to 15-year-old population. Now that vaccination has been authorized and widely available to all age groups in this study for over a year, adolescents may have different perspectives and intentions as the context of COVID-19 continues to evolve. Additionally, in April 2021, the first reports of vaccination-associated myocarditis and pericarditis were released [39] and it is possible this news may have impacted adolescents' survey responses. While this survey was conducted in April 2021, vaccine hesitancy clearly remains a challenge as evidenced by low rates of vaccination uptake for both the primary series and booster doses among adolescents [1]. Moreover, increasing the relevancy of our findings is that many of the factors that we identified in our survey are similar to general factors observed in vaccine hesitancy research [20].

Conclusion

Unfortunately, COVID-19 vaccination rates among adolescents remain low resulting in avoidable morbidity and mortality from COVID-19 infections. Directed and specific efforts must be made to reach the most vaccine-hesitant populations, including vaccine-hesitant adolescents, for whom there are now three authorized vaccine options. This analysis offers insights into potential message content and dissemination channels, specifically that messaging should focus on accurate, age-appropriate information about side effects of vaccination as well as potential risks of COVID-19 infection. Moreover, while there is often a focus on social media messaging for adolescents, we found that most adolescents did not report social media as a trusted source of information about COVID-19 vaccines, suggesting that disseminating messaging through more interpersonal approaches (e.g., family members, healthcare professionals) may be more effective. Researchers and practitioners alike can use this information in communication development efforts to improve COVID-19 vaccination of adolescents.

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