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## COVID-19 and Parent Intention to Vaccinate Their Children Against Influenza

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**Abbreviations:** Coronavirus Disease 2019 (COVID-19)

### Contributors' Statement:

Dr. Sokol conceptualized and designed the study aims, carried out the initial analyses, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Grummon led data collection, supported the conceptualization of the study aims, reviewed and revised the analytic plan, and critically reviewed and revised the manuscript for important intellectual content.

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

### Table of Contents Summary

We evaluated if the COVID-19 pandemic influences parents' intentions to have their children receive the 2020-2021 seasonal influenza vaccination.

### What's Known on this Subject

The convergence of COVID-19 and influenza could result in considerable morbidity and mortality, and pediatric vaccination will be key to mitigating a dual epidemic. Yet, we do not know if the COVID-19 pandemic influences parents' pediatric influenza vaccination intentions.

### What this Study Adds

The COVID-19 pandemic alone does not appear sufficient to encourage the uptake of pediatric seasonal influenza vaccination. Instead, the COVID-19 pandemic may exacerbate polarity in vaccination uptake.

## ABSTRACT

**Objectives.** Evaluate if the COVID-19 pandemic influences parents' intentions to have their children receive the 2020-2021 seasonal influenza vaccination.

**Methods.** In May 2020, we recruited 2,164 US parents and guardians of children ages six months to five years to complete a brief online survey that examined parental behavior and decision-making in response to experimental stimuli and real-world events. We estimated a multivariate multinomial logistic regression (controlling for key demographics) to assess the relationship between a child's 2019-2020 influenza vaccination status and the COVID-19 pandemic's influence on a parent's intentions for their child's 2020-2021 influenza vaccination.

**Results.** Changes in vaccination intentions significantly differed between parents whose children received the 2019-2020 influenza vaccine compared to those whose children did not ( $p < 0.001$ ). Specifically, among parents whose children did not receive the 2019-2020 vaccine, 34% (95% Confidence Interval [CI]: 30%-37%) reported that the COVID-19 pandemic made them less likely to have their child receive the 2020-2021 vaccine. Among those whose children did receive the 2019-2020 vaccine, this figure was just 24% (95% CI: 22%-27%). Conversely, only 21% (95% CI: 18%-24%) of parents whose children did not receive the 2019-2020 vaccine reported that the COVID-19 pandemic made them more likely to have their child receive the 2020-2021 vaccine, compared to 39% (95% CI: 36%-41%) of parents whose children did receive the 2019-2020 vaccine.

**Conclusion.** The COVID-19 pandemic alone does not appear sufficient to encourage the uptake of pediatric seasonal influenza vaccination. Instead, the COVID-19 pandemic may exacerbate polarity in vaccination uptake.

## INTRODUCTION

Experts warn that the convergence of Coronavirus Disease 2019 (COVID-19) and seasonal influenza this year will result in considerable morbidity and mortality.<sup>1</sup> Yet, only about 60% of children in the U.S. receive a seasonal influenza vaccination annually.<sup>2</sup> Pediatric vaccination will be an important component to mitigating a dual influenza/COVID-19 epidemic. Vaccinating children is necessary to not only prevent influenza in children,<sup>3</sup> but also to establish herd immunity within the general population.<sup>4</sup> Recent influenza vaccination coverage has been too low to achieve herd immunity.<sup>4</sup> The COVID-19 pandemic has increased uptake of some health-protective behaviors, including increased hand-washing and social distancing.<sup>5,6</sup> The pandemic may also encourage vaccination behavior, but this remains unknown.

Past behavior consistently emerges as a strong predictor of future behavior across a variety of health behaviors.<sup>7-10</sup> This literature would thus suggest that whether or not a parent vaccinated their child against seasonal influenza in a previous year would strongly predict their intentions for influenza vaccination in the current year. Yet, we have not studied this phenomenon of past vaccination behavior predicting future behavior in the context of a major disruption such as a pandemic.

Ouellette and Wood theorized that novel behaviors are unable to be governed by habit, and are thus more likely the result of conscious and intentional processes.<sup>8</sup> Although pediatric influenza vaccination is not a new behavior, parents are living in new contexts. Living in a pandemic has resulted in parents re-evaluating what used to be their “default options,” such as sending their children to school for in-person instruction. Likewise, prior routine behaviors such as pediatric vaccinations may now be novel decisions that require conscious processing. In this study we explore if the COVID-19 pandemic influences parents’ intentions to have their children

receive the upcoming seasonal influenza vaccination. Specifically, we evaluate if previous influenza vaccination behavior is associated with parents' pediatric influenza vaccination intentions for the 2020-2021 influenza season.

## METHODS

**Participants.** In May 2020, we recruited a diverse national convenience sample of 2,164 US parents or guardians (hereafter referred to as “parents”) of children ages six months to five years through Dynata, a survey research firm, as part of a larger research study that examined parental behavior and decision-making in response to experimental stimuli and real-world events. The primary study examined the effect of different children's storybook messages on parents' message reactions. For that study, we calculated sample size needs to detect a small effect (Cohen's  $f = 0.1$ ) or larger with 90% power.

**Procedures.** Participants provided informed consent, completed a 15-minute online survey, and received incentives from Dynata (e.g., gift cards) for participating. The Harvard TH Chan School of Public Health Institutional Review Board approved this study.

**Measures.** The primary outcome was the extent to which a parent's intentions for getting their child the seasonal influenza vaccination for the 2020-2021 season changed, if at all, as a result of the COVID-19 pandemic. We measured change categorically, with response options ranging from 1 (I became much less likely to get my child the flu shot next year) to 5 (I became much more likely to get my child the flu shot next year).

Our focal predictor was the child's seasonal influenza vaccination status for the previous season (2019-2020). Parents answered the question: “Did your child get the flu shot for the 2019-2020 flu season? This includes a flu shot received between September 2019 and today.” To

obtain a random sampling of ages, we asked parents with more than one child between 6 months and five years old to answer for their child who had the most recent birthday.

We collected demographic characteristics including child's age and gender; parent's age, gender, relationship to the focal child, education, race/ethnicity, and political affiliation; and household income, household size, and the number of children under age 18 living in the household. We assessed household income in the following categories: <\$10,000; \$10,000 to \$14,999; \$15,000 to \$24,999; \$25,000 to \$34,999; \$35,000 to \$49,999; \$50,000 to \$74,999; \$75,000 to \$99,999; \$100,000 to \$149,999; \$150,000 to \$199,999; \$200,000 or more. Given the majority of households included three to four individuals (coinciding with 200% of the federal poverty level ranging from \$43,404-\$52,400), we categorized "low income" as less than \$50,000 annually.

**Analysis.** The analytic sample included respondents with complete information on covariates ( $n = 1,893$ ). Respondents with incomplete information on all covariates had children that were slightly younger, were more likely to be guardians, had slightly lower levels of education, were more likely to be a member of a racial group that was not White or African American, were more likely to affiliate as Republican or Independent, had larger households, and were lower income compared to respondents with complete information (Supplemental Table 1). We do not expect these differences to bias results, however, given the high proportion (i.e., 87%) of respondents with complete information.<sup>11</sup>

We first calculated descriptive statistics, stratified by child's seasonal influenza vaccination status for the 2019-2020 season. We then estimated a multivariate multinomial logistic regression (controlling for the above demographics) to assess the relationship between children's 2019-2020 influenza vaccination status and the COVID-19 pandemic's influence on

parents' intentions for their child's 2020-2021 influenza vaccination. We coded parent intentions as: (1) becoming more likely, (2) no change, or (3) becoming less likely to get their child the influenza vaccination. We report results from the multinomial model as adjusted predicted probabilities of becoming more likely to vaccinate their child, becoming less likely to vaccinate their child, or experiencing no change in vaccination intentions as a result of the COVID-19 pandemic.

## RESULTS

**Table 1** provides descriptive and bivariate statistics for the analytic sample. A majority (60%) of parents reported the COVID-19 pandemic changed their seasonal influenza vaccination intentions for their children. Changes in vaccination intentions significantly differed between parents whose children received the 2019-2020 influenza vaccine compared to those whose children did not ( $p < 0.001$ ). Specifically, among parents whose children did not receive the 2019-2020 influenza vaccine, 34% reported that the COVID-19 pandemic made them *less* likely to have their child receive the 2020-2021 influenza vaccine compared to their plans before the pandemic. Among those whose children did receive the 2019-2020 influenza vaccine, this figure was just 25%. Conversely, only 21% of parents whose children did not receive the 2019-2020 influenza vaccine reported that the COVID-19 pandemic made them *more* likely to have their child receive the 2020-2021 influenza vaccine, compared to 38% of parents whose children did receive the 2019-2020 influenza vaccine.

These bivariate associations were confirmed in the multivariate adjusted analysis (**Figure 1**). Specifically, the multinomial logistic regression model suggests that, among parents whose children did not receive the 2019-2020 influenza vaccine, 34% (95% Confidence Interval [CI]:

30%-37%) reported that the COVID-19 pandemic made them *less* likely to have their child receive the 2020-2021 influenza vaccine. Among those whose children did receive the 2019-2020 influenza vaccine, this figure was just 24% (95% CI: 22%-27%). Conversely, only 21% (95% CI: 18%-24%) of parents whose children did not receive the 2019-2020 influenza vaccine reported that the COVID-19 pandemic made them *more* likely to have their child receive the 2020-2021 influenza vaccine, compared to 39% (95% CI: 36%-41%) of parents whose children did receive the 2019-2020 vaccine.

Given the collinearity between household size and number of children under the age of 18 years in the household, we did not include number of children as a covariate in the final model. However, sensitivity analyses including number of children instead of household size as a covariate revealed nearly identical results (Supplemental Figure 1).

## DISCUSSION

Parents reported polarized intentions regarding their children's future seasonal influenza vaccination in response to the COVID-19 pandemic: those whose children had previously received the influenza vaccination reported a higher likelihood of future vaccination as a result of the pandemic, while those whose children had not received the vaccination reported a decreased likelihood. These results suggest that overall seasonal influenza vaccination rates may not increase simply because of an ongoing infectious disease pandemic. Instead, a significant predictor of future behavior remains past behavior.<sup>5</sup> Thus, targeted efforts are likely to be needed to encourage uptake of the seasonal influenza vaccination.

Overall, we found that the majority of parents (60%) intend to change their pediatric influenza vaccination behavior this year as a result of the COVID-19 pandemic. On the surface,



this suggests that COVID-19 may be disrupting the otherwise powerful influence of past behavior on future behavior for many parents. However, a closer examination of changes in parents' intentions suggests that the opposite may be happening with regard to pediatric influenza vaccination, whereby past behaviors become increasingly entrenched. Ouellette and Wood proposed two pathways by which past behavior relates to future behavior: a direct and indirect pathway.<sup>8</sup> The direct pathway models an automatic and habitual process,<sup>12</sup> while in the indirect pathway past behavior affects future behavior via conscious, intentional processes.<sup>13,14</sup> Before the COVID-19 pandemic, parental vaccination behavior may have existed on the direct (i.e., automatic) pathway. Disruptions caused by the pandemic may have moved parents' vaccination decisions into a more intentional process. However, the influence of the pandemic on vaccination intentions does not appear to operate in the same way for all parents. Instead, it appears that the pandemic could lead to increasing polarization of parents' pediatric influenza vaccination behaviors, whereby those previously not vaccinating report becoming even less likely to vaccinate in the future.

The question remains: How do we increase influenza vaccination uptake during the COVID-19 era? Psychological science offers insight into promising strategies for increasing vaccination.<sup>15</sup> As one example, studies have found that stronger social norms are associated with higher vaccination intentions and uptake,<sup>16,17</sup> suggesting that social norms messaging (e.g., through social media, mass media campaigns, or health care providers) could increase parents' intentions to vaccinate their children. Strategies to close the "intention-behavior" gap, such as sending vaccination reminders<sup>18</sup> and encouraging parents to form implementation intentions,<sup>19</sup> can then help ensure those who intend to vaccinate follow through with these plans. Another approach is presumptive announcements, in which health care providers frame vaccination as the

default behavior. A recent randomized controlled trial with 30 clinics found that training physicians to offer vaccine recommendations as presumptive announcements significantly increased human papilloma virus vaccine initiation among 11- and 12-year-olds.<sup>20</sup> A similar approach could be extended to seasonal influenza vaccination.

One limitation of the present analysis is the reliance on a convenience sample. However, the study team established *a priori* recruitment quotas to ensure a racially and ethnically diverse sample. Specifically, the survey firm recruited parents into the survey so that at least 25% of the sample would be Hispanic and another 25% would be African American (with the remainder recruited as a convenience sample without respect to race and ethnicity). Another limitation is that we surveyed parents in May 2020, and results may not generalize to later in the pandemic. Additionally, we assessed intentions to vaccinate; future research will clarify the COVID-19 pandemic's influence on actual vaccination behaviors.

## CONCLUSION

The COVID-19 pandemic alone does not appear sufficient to encourage the uptake of pediatric seasonal influenza vaccination. Instead, the COVID-19 pandemic may exacerbate polarity in vaccination uptake.

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**Table 1.** Descriptive statistics, stratified by child's 2019-2020 seasonal influenza vaccination status

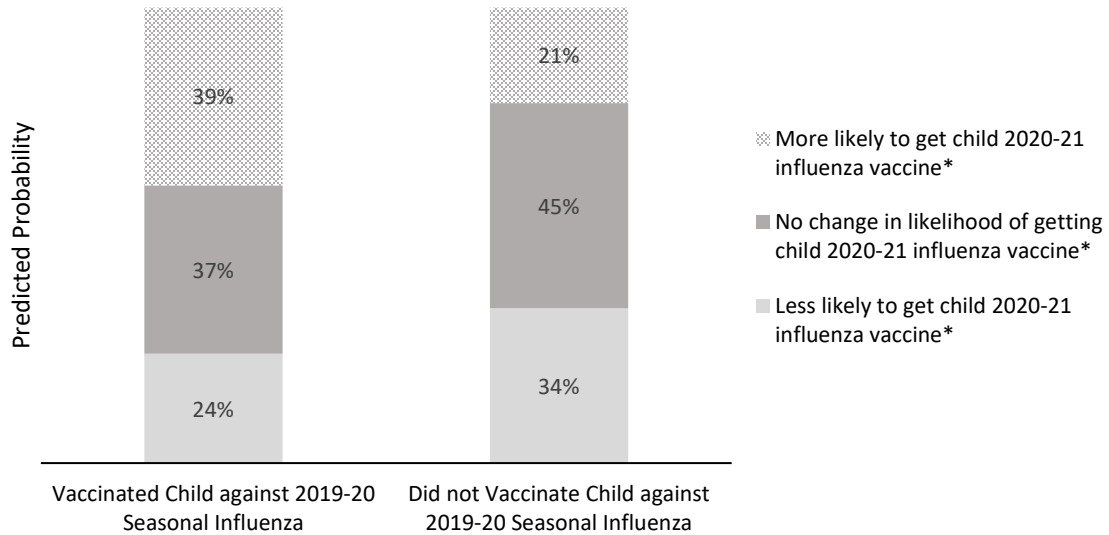
	Total N=1,893	Did not receive 2019- 20 influenza vaccine N=674	Received 2019-20 influenza vaccine N=1,219	<i>p</i>
<b>Change in Child's 2020-21 Influenza Vaccination Intentions due to COVID-19</b>				
Less likely	532 (28%)	230 (34%)	302 (25%)	<b>&lt;0.001</b>
No change	753 (40%)	303 (45%)	450 (37%)	
More likely	608 (32%)	141 (21%)	467 (38%)	
<b>Child age</b>				
6-11 months	281 (15%)	94 (14%)	187 (15%)	0.55
12-23 months	239 (13%)	81 (12%)	158 (13%)	
2 years	340 (18%)	119 (18%)	220 (18%)	
3 years	359 (19%)	128 (19%)	231 (19%)	
4 years	310 (16%)	125 (19%)	185 (15%)	
5 years	365 (19%)	127 (19%)	238 (20%)	
<b>Child gender</b>				
Male	934 (49%)	320 (47%)	614 (50%)	0.42
Female	912 (48%)	335 (50%)	577 (47%)	
Transgender, non-binary, or another gender	47 ( 2%)	19 ( 3%)	28 ( 2%)	
<b>Relationship to child</b>				
Parent	1,584 (84%)	550 (82%)	1,034 (85%)	0.07
Guardian	309 (16%)	124 (18%)	185 (15%)	
<b>Parent gender</b>				
Male	545 (29%)	176 (26%)	369 (30%)	<b>0.001</b>
Female	1,306 (69%)	473 (70%)	833 (68%)	
Transgender, non-binary, or another gender	42 ( 2%)	25 ( 4%)	17 ( 1%)	
<b>Parent age</b>				
18-24	549 (29%)	191 (28%)	358 (29%)	0.75
25-34	819 (43%)	293 (43%)	526 (43%)	
35-44	420 (22%)	148 (22%)	272 (22%)	
45-54	63 ( 3%)	23 ( 3%)	40 ( 3%)	
55+	42 ( 2%)	19 ( 3%)	23 ( 2%)	
<b>Parent education</b>				
Less than high school	93 ( 5%)	37 ( 5%)	56 ( 5%)	<b>0.04</b>
High school	368 (19%)	151 (22%)	217 (18%)	
Some college	354 (19%)	129 (19%)	225 (18%)	
College graduate	1,078 (57%)	357 (53%)	721 (59%)	
<b>Parent race</b>				
White	644 (34%)	212 (31%)	432 (35%)	0.06
Black or African American	855 (45%)	322 (48%)	533 (44%)	
American Indian or Alaska Native	62 ( 3%)	30 ( 4%)	32 ( 3%)	
Asian or Pacific Islander	47 ( 3%)	15 ( 2%)	32 ( 3%)	
Other or Multiracial	285 (15%)	95 (14%)	190 (16%)	

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Parent ethnicity				
Hispanic	922 (49%)	312 (46%)	610 (50%)	0.12
Non-Hispanic	971 (51%)	362 (54%)	609 (50%)	
Political affiliation				
Democrat	973 (51%)	330 (49%)	643 (53%)	0.28
Republican	413 (22%)	156 (23%)	257 (21%)	
Independent	507 (27%)	188 (28%)	319 (26%)	
Household size, Mean (SD)	3.6 (2.5)	3.7 (2.5)	3.6 (2.5)	0.68
Household income				
Low-income	913 (48%)	347 (51%)	566 (46%)	<b>0.04</b>
Middle/high-income	980 (52%)	327 (49%)	653 (54%)	

Notes: p-values according to Pearson's Chi-squared test. **Bold** indicates significant differences at  $\alpha = 0.05$ . Low-income defined as < \$50,000 per year.

**Figure 1.** Adjusted predicted probabilities for parents' changes in intentions for children's influenza vaccination as a result of the COVID-19 pandemic, according to 2019-2020 influenza vaccination status



*Note:* \*Indicates significant differences in adjusted predicted probabilities between parents whose child did vs. did not receive the 2019-2020 influenza vaccination. Model adjusted for child's age and gender; caregiver's relationship to child, parent age, gender, education, race/ethnicity, and political affiliation; and household income (low income: < \$50,000 annual) and size.

**Supplemental Table 1.** Descriptive statistics comparing the analytic sample (n=1,893) to incomplete cases (n = 271)

	Total N=2,164	Incomplete cases N=271	Analytic sample N=1,893	p-value
<b>Change in Child's 2020-21 Influenza Vaccination Intentions due to COVID-19</b>				
Less likely	619 (29%)	87 (32%)	532 (28%)	0.070
No change	866 (40%)	113 (42%)	753 (40%)	
More likely	676 (31%)	68 (25%)	608 (32%)	
<b>Child age</b>				
6-11 months	345 (16%)	64 (24%)	281 (15%)	<0.001
12-23 months	278 (13%)	39 (14%)	239 (13%)	
2 years	392 (18%)	53 (20%)	339 (18%)	
3 years	390 (18%)	31 (11%)	359 (19%)	
4 years	356 (16%)	46 (17%)	310 (16%)	
5 years	403 (19%)	38 (14%)	365 (19%)	
<b>Child gender</b>				
Male	1,048 (49%)	114 (43%)	934 (49%)	<0.001
Female	1,044 (48%)	132 (50%)	912 (48%)	
Transgender, non-binary, or another gender	66 ( 3%)	19 ( 7%)	47 ( 2%)	
<b>Relationship to child</b>				
Parent	1,776 (82%)	192 (72%)	1,584 (84%)	<0.001
Guardian	388 (18%)	79 (28%)	309 (16%)	
<b>Parent gender</b>				
Male	599 (28%)	54 (20%)	545 (29%)	<0.001
Female	1,490 (69%)	184 (70%)	1,306 (69%)	
Transgender, non-binary, or another gender	68 ( 3%)	26 (10%)	42 ( 2%)	
<b>Parent age</b>				
18-24	610 (29%)	61 (28%)	549 (29%)	0.54
25-34	923 (44%)	104 (48%)	819 (43%)	
35-44	463 (22%)	43 (20%)	420 (22%)	
45-54	70 ( 3%)	7 ( 3%)	63 ( 3%)	
55+	44 ( 2%)	2 ( 1%)	42 ( 2%)	
<b>Parent education</b>				
Less than high school	123 ( 6%)	30 (11%)	93 ( 5%)	<0.001
High school	435 (20%)	67 (25%)	368 (19%)	
Some college	411 (19%)	57 (22%)	354 (19%)	
College graduate	1,187 (55%)	109 (41%)	1,078 (57%)	
<b>Parent race</b>				
White	700 (32%)	56 (21%)	644 (34%)	<0.001
Black or African American	957 (44%)	102 (39%)	855 (45%)	
American Indian or Alaska Native	77 ( 4%)	15 ( 6%)	62 ( 3%)	
Asian or Pacific Islander	66 ( 3%)	19 ( 7%)	47 ( 2%)	
Other or Multiracial	354 (16%)	69 (26%)	285 (15%)	

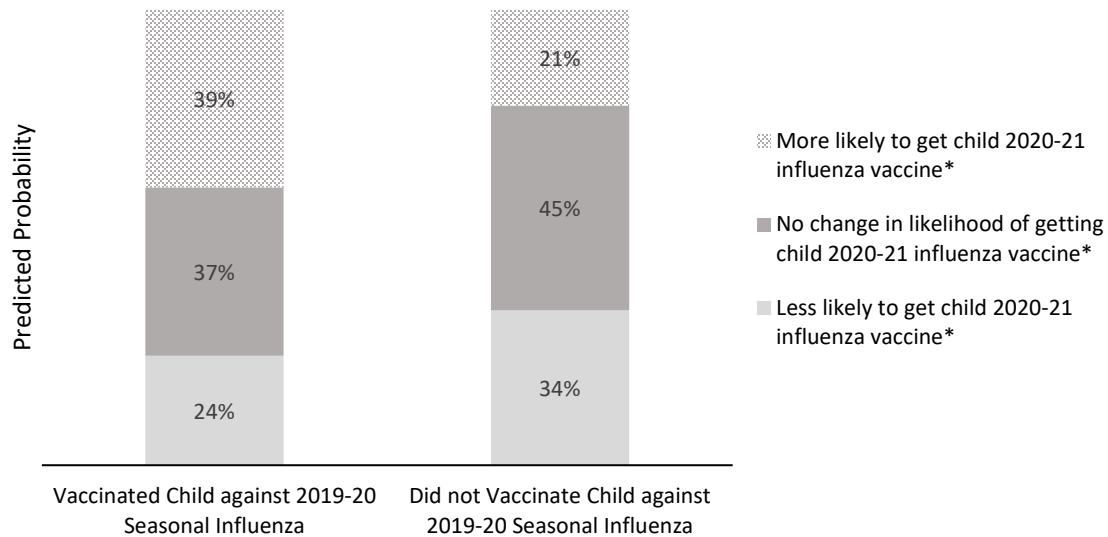


## Prepublication Release

Parent ethnicity				
Hispanic	1,065 (49%)	143 (54%)	922 (49%)	0.085
Non-Hispanic	1,099 (51%)	128 (46%)	971 (51%)	
Political affiliation				
Democrat	1,023 (50%)	50 (38%)	973 (51%)	0.006
Republican	454 (22%)	41 (31%)	413 (22%)	
Independent	549 (27%)	42 (32%)	507 (27%)	
Household size, Mean (SD)	3.7 (2.7)	4.2 (3.9)	3.6 (2.5)	<0.001
Household income				
Low-income	1,085 (50%)	172 (65%)	913 (48%)	<0.001
Middle/high-income	1,079 (50%)	99 (35%)	980 (52%)	

*Note.* p-values according to Pearson's Chi-squared test, comparing the analytic sample to incomplete cases. Low-income defined as < \$50,000 per year.

**Supplemental Figure 1.** Adjusted predicted probabilities for parents’/guardians’ changes in intentions for children’s influenza vaccination as a result of the COVID-19 pandemic, according to 2019-2020 influenza vaccination status



*Note:* \*Indicates significant differences in adjusted predicted probabilities between parents/guardians whose child did vs. did not receive the 2019-2020 influenza vaccination. Model adjusted for child’s age and gender; caregiver’s relationship, parent/guardian age, gender, education, race/ethnicity, and political affiliation; and household income (low income: < \$50,000 annual) and number of children in the household.

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