



## Short communication

# Coronavirus disease 2019 vaccination among young children: Associations with fathers' and mothers' influenza vaccination status

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## ABSTRACT

**Objectives:** To examine the association between parents' influenza vaccination and their children's coronavirus disease 2019 (COVID-19) vaccination status.

**Methods:** Participants included father-mother dyads from *Fathers & Families*, a cohort of fathers and their co-parents living in the United States. Parents' influenza vaccination status and children's COVID-19 vaccination status were reported from June 2022–July 2023. Logistic regression was used to examine the association between parental influenza vaccination (both parents vs. neither parent vs. mother only vs. father only vaccinated) and child COVID-19 vaccination (received at least 1 vs. 0 doses). Models were adjusted for recruitment site, income, parent education, child race/ethnicity, child age, and childcare enrollment. Inverse probability weighting was used to account for selection bias into the father-mother dyad sample.

**Results:** Children were predominately non-Hispanic White (56 %) and aged 3–5 years (62 %). In most households, both parents (64 %) received the influenza vaccine and half (53 %) of children received the COVID-19 vaccine. One-in-four fathers (23 %) lacked knowledge about their child's COVID-19 vaccination eligibility. Compared to children with two unvaccinated parents, having only their father (adjusted odds ratio [AOR] = 2.84, 95 % confidence interval [CI]: 1.52–5.36), only their mother (AOR = 4.04, 95 % CI: 2.16–7.68), and both parents (AOR = 10.33, 95 % CI: 6.29–17.53) vaccinated against influenza was associated with higher odds of children receiving the COVID-19 vaccine.

**Conclusions:** Father and mother influenza vaccination is associated with child COVID-19 vaccination. Given many fathers were unaware their child was eligible for the COVID-19 vaccine, it is critical to tailor vaccine messaging for fathers.

## 1. Introduction

The American Academy of Pediatrics recommends children over 6 months receive a coronavirus disease 2019 (COVID-19) vaccine (American Academy of Pediatrics, 2023) to reduce community transmission and protect the child from rare, severe illness (Klass and Ratner, 2021). However, the rate of COVID-19 vaccination in young children is low with rates ranging between 13 % (6 months–4 years) to 39 % (5–11 years) (American Academy of Pediatrics, 2023). A systematic review

(Galanis et al., 2022) of child COVID-19 vaccination intention found that parents with a history of influenza vaccination were more willing to vaccinate their child. This finding mirrors literature indicating parental influenza vaccination is associated with parental willingness to vaccinate their child against other seasonal viruses (i.e., influenza) (Wang et al., 2022). This review (Galanis et al., 2022) also found that fathers, in comparison to mothers from different households, were more willing to vaccinate their child. While this finding may reflect less vaccine hesitancy among men than women (Pandher and Bilszta, 2023), it also

**Abbreviations:** F&F, Fathers & Families; GUTS, Growing Up Today Study; IPW, inverse probability weighting; US, United States; COVID-19, coronavirus disease 2019.

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highlights the potential importance of fathers in childhood vaccination, a topic that has been overlooked.

While few studies have examined the role of fathers in childhood vaccination, a handful of studies have examined the role of parent-dyads. Although not specific to COVID-19, when looking at parents within the same household, both mothers' and fathers' intentions to vaccinate their children are independently associated with their child receiving routine childhood vaccines on-time (Grant et al., 2016). Likewise, in a recent study by Kaufmann et al. (2022) children were more likely to have received all of their routine childhood vaccinations when at least one parent in the household received the influenza vaccine, compared to children with two unvaccinated parents. While the Kaufmann study (Kaufmann et al., 2022) demonstrates parents' and children's vaccination histories are related, their work did not differentiate parent-dyads by parent gender. Therefore, it remains unclear if the impact of parent vaccination on child vaccination differs for fathers versus mothers. Furthermore, this study was conducted prior to the onset of the COVID-19 pandemic, when childhood vaccination rates were higher than they are today (Centers for Disease Control and Prevention, 2023).

Building on these findings, this study aimed to estimate the association between the father-mother dyad's vaccination (i.e., both parents versus father only versus mother only versus neither parent vaccinated) and child COVID-19 vaccination. Amidst COVID-19 vaccine mandates, it is not informative to examine the association between parent and child COVID-19 vaccination; instead, parent influenza vaccination was examined as a proxy, based on prior evidence it may serve as a predictor of COVID-19 vaccination intention (Galanis et al., 2022; Soares et al., 2021).

## 2. Methods

### 2.1. Sample

*Fathers and Families* (F&F) is a cohort of fathers ( $N = 1,272$ ) and their co-parents. Inclusion criteria included biological, adoptive, or social fathers of a child aged 1–6 years, at the time of recruitment, who lived with this child  $\geq 50\%$  of the time and resided in the United States. Co-parents who lived with the father were eligible to participate. Initially, F&F drew from an existing cohort, the Growing Up Today Study (GUTS). Men in GUTS were recruited into F&F via email and mail from July 2021–June 2022 and 750 were enrolled. A second phase of recruitment, conducted in partnership with Michigan Medicine, was initiated to enhance racial/ethnic diversity in F&F from June 2022–June 2023. During this phase of recruitment, 522 fathers were enrolled. Co-parents were recruited into the cohort via contact information provided by participating fathers. Fathers and co-parents completed annual electronic surveys.

Data for this study were drawn from fathers' and their female co-parents' responses to the 2022–2023 survey. In total, 1,085 fathers provided informed consent and participated in the 2022–2023 survey of which 1,019 had a female co-parent. Seventy-two percent ( $n = 737$ ) of these fathers invited their female co-parent (herein referred to as mothers) to participate and 487 mothers provided informed consent and completed the survey. Procedures were approved by our IRB (3/25/2022; protocol: 22.201.01) and met institutional guidelines for protection of human subjects.

### 2.2. Measures

Fathers and mothers independently self-reported their influenza vaccination by responding to the yes/no question, "Have you received a flu vaccine in the past 12 months?" A dyadic variable was created by combining their responses to this question. Response options: "both parents received the vaccine", "father only received the vaccine", "mother only received the vaccine", and "neither parent received the

vaccine".

Child COVID-19 vaccination was assessed using two father-reported items. The first item asked "Is [child-name] eligible to receive the COVID-19 vaccine?", with response options of "yes," "no," and "don't know/not sure." Fathers who stated their child was eligible to receive the vaccine were asked "Has [child-name] received at least one dose of a COVID-19 vaccine?", with response options of "yes," "no," and "don't know/not sure." This was a two-part question, as the 2022–2023 survey was developed prior to authorization of the COVID-19 vaccine for children under 5 years. However, the survey was launched on June 23rd, 2022, approximately one week after children under 5 years were eligible to receive the vaccine (US Food and Drug Administration, 2023).

Sociodemographic variables reported by fathers included household income, fathers' and mothers' education and employment, fathers' and children's race/ethnicity and age, fulltime childcare enrollment, and recruitment site. Two parenting-related father reported variables were also examined: father responsibility (McBride, 1993) and co-parent relationship quality (Feinberg et al., 2012).

### 2.3. Statistical analysis

Demographic and parenting characteristics of father-mother dyads, versus the total sample of fathers with a female co-parent, were examined (Table A1). We conducted logistic regression using backwards selection to determine if any of these characteristics were associated with mother participation. Because several demographic and parenting characteristics (i.e., recruitment site, father race/ethnicity, father age, income, mother education, co-parent relationship quality, father responsibility) were significantly associated with membership in the dyadic sample, there was the potential for selection bias in our sample relative to the scenario where all mothers agreed to participate. To mitigate this, we used inverse probability weighting (IPW), with the weights taken to be the inverse of the predicted probability of membership in the dyad sample in the 2022–2023 survey (relative to the full set of potential dyads for the fathers enrolled in the study) based on a logistic regression of mother participation. In these weights, missing data were retained by creating a 'missing category' for categorical variables and imputing the mean for continuous variables.

Missing data for the dyad sample were assessed. Child COVID-19 vaccination had the highest level of missingness (23.6 %) with all other variables missing  $< 3\%$  of responses. Upon further investigation, a number of fathers reported that their child was not eligible (10.3 %) or were not sure/did not know if their child was eligible (12.5 %) to receive the COVID-19 vaccine (with 1 additional father having missing data); as a result, these fathers were not asked about their child's vaccination. Meanwhile, the survey launch date was after authorization was given for children under 5 years to receive the COVID-19 vaccine therefore all children were eligible to receive it. We examined demographic and vaccination characteristics of fathers who were knowledgeable about their child's COVID-19 vaccination eligibility versus those who were unaware of their child's COVID-19 vaccination eligibility (fathers who reported that their child was not eligible or were not sure/did not know), incorporating IPW to account for potential selection bias.

Given that fathers who were knowledgeable about their child's vaccination eligibility differed from those who were unaware, we retained the fathers who lacked knowledge about their child's COVID-19 vaccination eligibility by assuming their child was unvaccinated. Of the fathers who received the COVID-19 vaccination question, there were 4 (0.8 %) missing responses. Due to low levels of missingness for all other variables, 25 dyads with missing data were dropped resulting in a final analytic sample of 462 father-mother dyads.

To understand differences in fathers' and mothers' vaccination behaviors, we conducted logistic regression to examine the association between parent influenza vaccination and child COVID-19 vaccination, incorporating IPW. Unadjusted and adjusted (adjusting for recruitment site, income, parent education, child race/ethnicity, child age, and

**Table 1**

Weighted vaccination characteristics for the father-mother dyad sample stratified by child COVID-19 vaccination; child vaccinated (n = 243) and child unvaccinated (n = 219). Data were collected in the United States from June 2022-July 2023.

	Total Father-Mother Dyad Sample	Child COVID-19 Vaccination Status	
		Child Vaccinated	Child Unvaccinated
	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>
<b>Parent influenza vaccination</b>			
Father only vaccinated	10.2	7.5	13.3
Mother only vaccinated	9.3	8.3	10.4
Both parents vaccinated	64.2	79.1	47.5
Neither parent vaccinated	16.2	5.1	28.7
<b>Father received at least 1 dose of the COVID-19 vaccine</b>	72.4	99.5	42.1
<b>Mother received at least 1 dose of the COVID-19 vaccine</b>	91.5	99.5	82.7
<b>Child received at least 1 dose of the COVID-19 vaccine</b>	52.8	-	-

<sup>a</sup> Applied inverse probability weighting to account for selection bias into the father-mother dyad sample.

**Table 2**

Associations between fathers' and mothers' influenza vaccination and child COVID-19 vaccination (n = 462). Data were collected in the United States from June 2022-July 2023.

	Dyadic Parental Vaccination <sup>a</sup>	
	OR (95 % CI)	AOR (95 % CI)
<b>Primary Outcome</b>		
<b>Parent flu vaccination<sup>b</sup></b>		
Father only vaccinated	3.21 (1.80-5.83)***	2.84 (1.52-5.36)**
Mother only vaccinated	4.47 (2.50-8.14)***	4.04 (2.16-7.68)***
Both parents vaccinated	9.65 (6.23-15.48)***	10.33 (6.29-17.53)***
<b>Parent Characteristics</b>		
<b>Household income</b>		1.00 (1.00-1.00)
<b>Father education<sup>c</sup></b>		
Bachelor's degree		1.86 (1.10-3.17)*
Postgraduate degree		1.35 (0.79-2.31)
<b>Mother education<sup>c</sup></b>		
Bachelor's degree		1.00 (0.59-1.70)
Postgraduate degree		1.47 (0.84-2.59)
<b>Child race/ethnicity<sup>d</sup></b>		
Hispanic/Latino		1.12 (0.65-1.95)
Non-Hispanic Asian		0.51 (0.30-0.88)*
Non-Hispanic Black		0.43 (0.20-0.91)*
Non-Hispanic Multi-Racial		1.91 (1.12-3.33)*
Non-Hispanic Other		0.65 (0.22-1.93)
<b>Child age</b>		1.04 (1.03-1.05)***
<b>Fulltime childcare<sup>e</sup></b>		1.34 (0.94-1.91)
<b>Recruitment site<sup>f</sup></b>		
GUTS	1.03 (0.79-1.36)	0.52 (0.33-0.80)***

Note: OR = odds ratio; CI = confidence interval; AOR = adjusted odds ratio; <sup>a</sup>applied inverse probability weighting to account for selection bias into the father-mother dyad sample; <sup>b</sup>reference group is neither parent vaccinated; <sup>c</sup>reference group is some college or less; <sup>d</sup>reference group is Non-Hispanic White; <sup>e</sup>reference group is not enrolled in fulltime childcare; <sup>f</sup>reference group is Michigan Medicine; \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$ .

childcare enrollment) are presented. As a sensitivity analysis, we fit the logistic regression model with a sample that *only* included father-mother dyads where fathers reported that their child was eligible (n = 358) for the COVID-19 vaccine. Since results were consistent with results from

the full sample, results from the full sample are only presented below. Analyses were conducted in R 4.3.1 (RStudio: Integrated development for R., 2020).

**3. Results**

*Knowledge of vaccination eligibility* (Table A2). The prevalence of father vaccination was higher among fathers who were knowledgeable about their child's vaccination eligibility (influenza, 78.9 %; COVID-19, 81.8 %) than among fathers who were unaware of their child's vaccination eligibility (influenza, 60.6 %; COVID-19, 37.9 %). Of the fathers who were unaware that their child was eligible for the COVID-19 vaccine, approximately one quarter (22.5 %, n = 25) completed the survey prior to September 2022 and nearly half (45.9 %, n = 51) prior to November 2022 (data not shown).

*Sample characteristics* (Table A3): Fathers and mothers had high educational attainment (50.9 % of fathers and 50.2 % of mothers received a postgraduate degree). Children were predominately non-Hispanic White (56.4 %) and aged 3–5 years (62.1 %).

*Vaccination characteristics* (Table 1): Approximately 50 % of children were vaccinated for COVID-19. In most households (64.2 %), both parents were vaccinated against influenza. COVID-19 vaccination rates were high among parents (fathers, 72.4 %; mothers, 91.5 %).

*Associations between fathers' and mothers' influenza vaccination and child COVID-19 vaccination* (Table 2): Parent influenza vaccination was associated with higher odds of children receiving at least 1 dose of the COVID-19 vaccine. Compared to children with 2 unvaccinated parents, children whose parents were both vaccinated against influenza had 10 times greater odds of receiving the COVID-19 vaccine (adjusted odds ratio [AOR] = 10.33, 95 % confidence interval [CI]: 6.28–17.53). Additionally, children with only 1 parent vaccinated against influenza, versus 2 unvaccinated parents, was also more likely to have had the COVID-19 vaccine; this association was moderately stronger when their mother was vaccinated versus their father (AOR = 2.84, 95 % CI: 1.52–5.36 and AOR = 4.04, 95 % CI: 2.16–7.68 for mothers and fathers respectively).

**4. Discussion**

Young children whose parents were both immunized against influenza (vs. none) were 10 times more likely to have received the COVID-19 vaccine. This evidence underscores the critical linkage between vaccination decisions parents make for themselves and those made for their children (Kaufmann et al., 2022; Robison and Osborn, 2017). While the magnitude of association was considerably smaller, among households with only one of the two parents vaccinated (vs. none), children also had increased odds of receiving the COVID-19 vaccine. Parent gender made a slight difference, with the association among mothers estimated to be approximately 150 % higher than that among fathers.

A substantial proportion of fathers were unaware their child was eligible for the COVID-19 vaccine, with many fathers remaining unaware 3–6 months after authorization was granted for young children to receive the vaccine. Given that education around childhood vaccination typically occurs within the context of well-child visits (Opel et al., 2013) and many well-child visits are attended by only one parent, typically the mother (Garfield and Isacco, 2012; Zvara et al., 2013), there is an urgent need to develop vaccination messaging for fathers. Recognizing the barriers fathers face to attending well-child visits (i.e., inconvenient pediatrician office hours, low parenting-efficacy) (Garfield and Isacco, 2012; Yogman and Garfield, 2016), identifying spaces through which education can be provided outside of a well-child visit alone is an important area of future research. Leveraging virtual communication tools (Odone et al., 2015) so pediatricians can develop relationships, establish trust (Glanz et al., 2013), and provide education may be essential to reaching and engaging fathers. Additionally, rapid

**Table A1**

Characteristics of 2022–2023 F&F father participants (N = 1,019). Data were collected in the United States from June 2022–July 2023.

	Total 2022-2023 Sample of Fathers with a Female Co-parent (N = 1,019)	Father-Mother Dyad Sample (n = 487)
	%	%
<b>Household income (\$)</b>		
<\$50,000	9.9	13.3
\$50,000-\$99,999	15.6	16.2
\$100,000-149,999	24.6	25.3
\$150,000-\$199,999	17.2	16.4
\$200,000-\$249,999	12.3	11.5
\$250,000+	19.7	16.4
Missing	0.7	0.8
<b>Fathers' education</b>		
Some college or less	15.0	16.2
Bachelor's degree	35.2	31.2
Postgraduate degree	49.4	52.2
Not listed	0.4	0.4
Missing	0.0	0.0
<b>Father race/ethnicity</b>		
Hispanic/Latino	6.2	7.4
Non-Hispanic Asian	15.5	18.9
Non-Hispanic Black	8.6	9.0
Non-Hispanic White	62.6	55.9
Non-Hispanic Multi-Racial	5.0	6.4
Non-Hispanic Other	1.7	2.3
Missing	0.4	0.2
<b>Father age</b>		
20-29 years	2.7	3.9
30-39 years	77.9	76.6
40-49 years	18.3	18.5
50 + years	1.0	1.0
Missing	0.1	0.0
<b>Father employment</b>		
Full time	92.2	90.6
Not full time	7.8	9.4
Missing	0.0	0.0
<b>Mother employment (father report)</b>		
Full Time	56.7	53.8
Not full time	43.3	46.2
Missing	0.0	0.0
<b>Mothers' education (father report)</b>		
Some college or less	14.1	12.7
Bachelor's degree	35.8	32.6
Postgraduate degree	49.9	54.6
Not listed	0.2	0.0
Missing	0.0	0.0
<b>Child age</b>		
1-2 years	26.0	31.2
3-5 years	60.5	56.9
6 years+	13.4	11.9
Missing	0.1	0.0
<b>Fulltime childcare</b>		
Child enrolled full-time	60.4	54.8
Child not enrolled full-time	39.5	45.2
Missing	0.1	0.0
<b>Recruitment site</b>		
GUTS	52.6	39.2
Michigan Medicine	47.4	60.8

Note: fathers reported on all items; <sup>a</sup>includes fathers who identify as American Indian or Alaskan Native.

messaging systems (i.e., text message or social media campaigns) targeting fathers through health departments or vaccine manufacturers may prove critical in efforts to bolster child vaccination outcomes.

**Table A2**

Weighted demographic and vaccination characteristics among fathers who had a female co-parent enrolled in F&F stratified by fathers who were knowledgeable about (n = 375) and unaware of (n = 111) their child's COVID-19 eligibility. Data were collected in the United States from June 2022–July 2023.

	Fathers' knowledge of child COVID-19 vaccination eligibility	
	Fathers who were knowledgeable	Fathers who were unaware
	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>
<b>Father Demographic Characteristics</b>		
<b>Household income (\$)</b>		
<\$50,000	9.7	15.7
\$50,000-\$99,999	12.3	21.9
\$100,000-149,999	25.2	22.4
\$150,000-\$199,999	17.1	15.8
\$200,000-\$249,999	13.8	10.5
\$250,000+	21.4	13.2
Missing	0.3	0.6
<b>Education</b>		
Some college or less	13.2	25.1
Bachelor's degree	32.2	35.0
Postgraduate degree	54.2	39.9
Missing	0.4	0.0
<b>Race/ethnicity</b>		
Hispanic/Latino	6.4	7.3
Non-Hispanic Asian	16.4	14.5
Non-Hispanic Black	7.9	10.9
Non-Hispanic White	63.3	56.9
Non-Hispanic Multi-Racial	4.7	6.4
Non-Hispanic Other	1.3	2.6
Missing	0.0	1.5
<b>Age</b>		
20-29 years	2.3	5.1
30-39 years	79.4	71.6
40-49 years	17.8	21.3
50 + years	0.6	2.0
Missing	0.0	0.0
<b>Child age</b>		
1-2 years	24.8	33.0
3-5 years	60.7	61.3
6 years+	14.5	5.7
Missing	0.0	0.0
<b>Fulltime childcare</b>		
Child enrolled full-time	64.2	50.1
Missing	0.0	0.0
<b>Employment</b>		
Employed full time	90.5	92.2
Missing	0.0	0.0
<b>Parent Vaccination</b>		
<b>Father influenza</b>		
Received vaccine	78.9	60.6
Missing	0.2	0.0
<b>Mother influenza</b>		
Received vaccine	77.6	49.3
Missing	2.2	6.1
<b>Father COVID-19</b>		
Received the vaccine	81.8	37.9
Missing	0.3	52.9
<b>Mother COVID-19</b>		
Received the vaccine	93.6	72.2

(continued on next page)

**Table A2 (continued)**

	Fathers' knowledge of child COVID-19 vaccination eligibility	
	Fathers who were knowledgeable	Fathers who were unaware
	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>
Missing	2.0	5.2
Recruitment site		
GUTS	52.5	52.9
Michigan Medicine	47.5	47.1

<sup>a</sup> Applied inverse probability weighting to account for selection bias into the father-mother dyad sample.

**4.1. Limitations and strengths**

With regard to limitations, our sample includes father-mother households, a majority of whom were non-Hispanic White with high socioeconomic status. This limits the generalizability of our findings to populations most affected by COVID-19 vaccine hesitancy (Pan et al., 2021). Relatedly, our sample's vaccination rates are higher than national averages (American Academy of Pediatrics, 2023). Finally,

**Table A3**

Weighted demographic characteristics among father-mother dyads (n = 462) stratified by parent influenza vaccination status; both parents (n = 296), father only (n = 45), mother only (n = 42) and neither parent (n = 79), vaccinated. Data were collected in the United States from June 2022-July 2023.

	Parent Influenza Vaccination				
	Total Father-Mother Dyad Sample	Both Parents Vaccinated	Father Only Vaccinated	Mother Only Vaccinated	Neither Parent Vaccinated
	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>	Weighted % <sup>a</sup>
Household income (\$)					
<\$50,000	10.7	7.6	19.6	11.8	16.6
\$50,000-\$99,999	14.3	10.0	13.4	11.5	33.8
\$100,000-149,999	25.1	20.7	24.7	42.7	32.6
\$150,000-\$199,999	17.2	21.5	14.0	9.5	6.6
\$200,000-\$249,999	13.2	16.9	15.5	7.9	0
\$250,000+	19.5	23.3	12.9	16.6	10.3
Fathers' education					
Some college or less	15.7	8.9	18.2	28.8	33.3
Bachelor's degree	33.5	30.9	36.7	36.3	39.9
Postgraduate degree	50.9	60.2	45.0	34.9	26.8
Mothers' education					
Some college or less	13.1	7.4	23.0	16.8	27.5
Bachelor's degree	36.7	31.2	45.0	44.6	48.6
Postgraduate degree	50.2	61.4	32.0	38.5	23.9
Child race/ethnicity					
Hispanic/Latino	9.2	7.9	10.2	12.7	11.9
Non-Hispanic Asian	14.2	15.3	8.8	13.5	13.5
Non-Hispanic Black	6.0	4.8	2.6	6.1	13.0
Non-Hispanic White	56.4	58.5	62.8	44.9	50.5
Non-Hispanic Multi-Racial	12.4	12.1	11.8	19.6	10.3
Non-Hispanic Other	1.8	1.5	3.8	3.1	0.9
Child age					
1-2 years	25.5	28.1	15.9	26.1	21.3
3-5 years	62.1	62.3	65.5	57.0	61.
6 years+	12.4	9.6	18.6	16.8	16.9
Fulltime childcare					
Child enrolled full-time	60.6	66.5	52.6	62.0	41.7
Recruitment site					
GUTS	52.8	53.0	64.4	48.4	47.1
Michigan Medicine	47.2	47.0	35.6	51.6	52.9

<sup>a</sup> Applied inverse probability weighting to account for selection bias into the father-mother dyad sample.

vaccination status was self-reported, introducing social desirability- and recall-bias. Moreover, as indicated by the number of fathers who were unaware of their child's vaccination eligibility, asking *only* fathers about childhood vaccination may result in measurement error. Notwithstanding the limitations, our study uses rigorous methods to add to the dearth of information on the role of fathers in childhood vaccination.

**5. Conclusion**

Our findings demonstrate a strong association between parent influenza vaccination and child COVID-19 vaccination. Tailoring vaccine communication strategies for fathers is important, as our findings demonstrate many fathers lack knowledge around, yet have substantial influence over, child vaccination.

**CRedit authorship contribution statement**

**Natalie Grafft:** Writing – original draft, Formal analysis, Data curation, Conceptualization. **Cristina Gago:** Writing – review & editing, Writing – original draft. **In Young Park:** Writing – review & editing, Data curation. **Katherine W. Bauer:** Writing – review & editing, Resources. **Sebastien Haneuse:** Writing – review & editing, Supervision, Methodology. **Jess Haines:** Writing – review & editing, Funding

acquisition. **Kirsten K. Davison:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization.

### Declaration of competing interest

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

### Data availability

The data that has been used is confidential.

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### Appendix A

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