



COVID-19 Parental Vaccine Hesitancy Among Nurses in the State of South Dakota

Filip Viskupič¹ · David L. Wiltse¹

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Introduction

COVID-19 has taken over 6.5 million lives globally and over a million in the United States as of September 2022. Though children are at lesser risk from the virus than adults – typically experiencing milder symptoms – over 17,000 children have died from COVID-19 globally and 1,400 died in the United States [1]. According to a recently published meta-analysis, about 25% of children experience long-COVID, with symptoms including mood changes, fatigue, and sleep disorders [2].

In the United States, highly-effective vaccines have been available for adolescents since May 2021 and for children six months and older since June 2022. Evidence exists that unvaccinated adolescents are ten times more likely to be hospitalized than vaccinated adolescents [3]. However, vaccination rates among children remain low. According to the Centers for Disease Control and Prevention (CDC), only 60% of children 12–17 years old, and only 30% of children 5–11 years old are fully vaccinated as of September 2022 [4]. The low vaccination rate is troubling given the prevalence of the highly infectious and transmissible BA.5 variant, with large proportions of parents not planning to vaccinate their children. According to a July 2022 poll, 43% of parents in the United States said they definitely will not vaccinate their children under five years [5]. According to reports, the newness of the vaccines and the speed of vaccine development are often mentioned by parents as reasons for not vaccinating their children. Some parents question whether children need to be vaccinated against COVID-19 in the first place [5].

Parental vaccine hesitancy is present even among health-care workers (HCWs). While HCWs are generally more likely to vaccinate their children than the general population, parental vaccine hesitancy exists even among this group [6, 7]. A June 2021 poll of over 2,000 HCWs in the United States reported that only half of the registered and licensed practical nurses plan to vaccinate their children under 12 years immediately after vaccines become available [8]. A similar poll conducted in November 2021 on a sample of 4,000 HCWs revealed that only 47% of registered and licensed practical nurses plan to vaccinate their children under the age of 5 right away [9].

We build upon the anecdotal evidence and systematically investigate the drivers of parental COVID-19 vaccine hesitancy among nurses. Our paper makes several unique contributions to the existing scholarship on parents' attitudes toward COVID-19 vaccination—we focus on HCWs, use vaccine uptake as dependent variable, and include parents' political views in the analysis.

First, when it comes to understanding parents' hesitancy to vaccinate their children, most studies examined the general population and few focused on HCWs. The studies that explored parental COVID-19 vaccine hesitancy are few [10–12]. However, none of the studies were conducted in the United States, and none focus specifically on nurses. HCWs are on the front line of efforts to curb the spread of the virus, and they are impacted by the pandemic to a greater extent than the general population. Nurses, together with other HCWs, serve as primary advisers for people when it comes to health decisions, including vaccination [13–15]. The presence of parental vaccine hesitancy among nurses might negatively affect their ability to provide impartial advice to patients regarding vaccination decisions for their families. Vaccine hesitancy among nurses also interferes with the mission of public health officials to increase vaccination rates among children.

Second, existing studies examined parents' attitudes toward a hypothetical vaccine only [6, 16–18]. This is

✉ Filip Viskupič
Filip.viskupic@sdsstate.edu

¹ School of American and Global Studies, South Dakota State University, Brookings, USA

understandable, as vaccines were not available for children when those studies were conducted. For example, in the United States, children ages 12–15 became eligible for vaccination in May 2021, and children ages 5–11 years became also eligible in October 2021. Our study uses vaccination behavior of children 5–17 as a dependent variable as opposed to vaccination intentions. Intentions and behavior do not always correspond [19], particularly when it comes to vaccination [20], and COVID-19 vaccination [12, 21]. Therefore, the dependent variable in our study is vaccination status, whether or not a child received a COVID-19 vaccination.

Third, we control for the effect of partisan self-identification on parents' attitudes toward vaccinating their children. Scholars have noted the unprecedented politicization of the COVID-19 pandemic worldwide, particularly on the issue of vaccination [22, 23]. In the United States, differences exist between Republicans and Democrats across a range of behaviors, such as support for COVID-19 mitigation measures [24], COVID-19 vaccine uptake [25], and support for COVID-19 vaccination mandates [26]. It is therefore likely that we will observe differences between Republicans and Democrats when it comes to vaccinating their children. With the exception of one study based on a general population sample recruited through an online labor marketplace [27], this issue has not been explored. Therefore, we include partisan self-identification in our analysis to evaluate its effect on the decision of nurses to vaccinate their children.

Method

Data

Our data comes from a survey of nurses based in South Dakota, United States. The contact information of 23,854 registered nurses in the state was purchased from the South Dakota Board of Nursing; a nearly exhaustive list of those in the profession. The membership file contained all Certified Nurse Practitioners, Registered Nurses, and Licensed Practical Nurses. We obtained 20,980 email addresses and sent an email invitation to each nurse on the lists to complete an online survey. The survey was administered on the *Questionpro* survey platform and was open from June 24th to July 9th, 2022. Participants did not receive compensation for completing the survey. The survey, fielded by the authors, received approval from the institutional review board at South Dakota State University, approval number IRB-2206004-EXM.

A total of 1,084 completed surveys were returned, yielding a response rate of 5.2%. Based on population benchmarks obtained from the Board of Nursing, our sample

closely resembles the state's population of nurses (see Table S1). Descriptive statistics of the sample are presented in Tables S2 and S3, and the correlation matrix is in Table S4 in the appendix. We used two sub-samples for analysis: nurses with children 5 to 17 years old living in their homes and nurses with children six months to 4 years old in the sample. The sample sizes are 298 and 123, respectively.

Measures

The two dependent variables are based on questions asked about the vaccination status of children living in the homes of respondents. The first measure for children 5 to 17 is an ordinal measure (1 = not vaccinated; 2 = one dose of Pfizer or Moderna; 3 = two doses of Pfizer or Moderna; 4 = boosted). Given the timing of the survey, and the approval of vaccines for children 4 and under being announced on June 18, 2022, our measure was primarily of vaccination *intent* for this group. This outcome had values of (1 = very unlikely; 2 = somewhat unlikely; 3 = not sure; 4 = somewhat likely; 5 = very likely). Three respondents indicated that their youngsters had already been vaccinated; they were coded as 5.

Age is treated as an interval variable coded in years. Ordinal variables include: Respondent COVID-19 vaccination status (1 = not vaccinated; 2 = one dose of Pfizer or Moderna; 3 = two doses of Pfizer or Moderna OR 1 dose of Johnson and Johnson; and 4 = fully vaccinated and boosted); education (1 = LPN certificate; 2 = Associates degree; 3 = Baccalaureate degree; 4 = Master's degree; 5 = Doctoral degree); and partisan self-identification (1 = Democrat; 2 = independent; 3 = Republican). Partisan self-identification in American politics can be treated as an ordinal variable since nearly all self-identified independents place themselves spatially between Democrats and Republicans. This is common practice in political science and psychological research [28, 29, 25]. Binary indicators are included for gender (1 = female) and evangelical identification (1 = evangelical). Nursing credentials are treated as multinomial (indicators for LPNs and NPs, RNs excluded reference group). We provide the full text of all questions in the Appendix.

Analysis

We estimate ordered logistic regressions on two dependent variables: Vaccination status of children aged 5 to 17 years and vaccination intention of children aged six months to 4 years. We use the other variables discussed above as independent variables in both models. We present the full results of the regressions and utilize predicted probabilities to aid in the interpretation of the non-linear coefficients.

Table 1 Predictors of Parental Vaccine Hesitancy Amongst Nurses

	Older Children	Young Children
Parental Vaccination Status	1.800*** (0.232)	2.112*** (0.431)
Parental Age	0.061*** (0.018)	-0.001 (0.031)
Female	0.034 (0.415)	-0.322 (0.576)
Evangelical Identity	-0.373 (0.278)	-0.229 (0.404)
Partisan Self-Identification	-0.464** (0.163)	-0.634* (0.258)
Nurse Practitioner	-0.396 (0.395)	0.625 (0.767)
Licensed Practical Nurse	-0.615 (0.590)	-1.328 (0.921)
Education	0.222 (0.197)	-0.309 (0.346)
N	282	118
Pseudo r-square	0.256	0.225

Cell entries are logistic coefficients with standard errors in parentheses. $p|t|<0.05$ two-tailed *; $p|t|<0.01$ two-tailed **; $p|t|<0.001$ two-tailed ***

Table 2 Predicted Probabilities of Vaccination and Vaccination Intent

	Older Children	Younger Children
Parental Vaccination Status		
Unvaccinated	0.031	0.002
One Dose	0.152	0.014
Fully Vaccinated	0.475	0.107
Fully Vaccinated and Boosted	0.819	0.459
Parental Age		
20	0.383	.
30	0.480	.
40	0.572	.
50	0.653	.
Partisan Self-Identification		
Democrats	0.668	0.413
Independents	0.608	0.311
Republicans	0.541	0.271
N	282	118

Cell entries are predicted probabilities. Older Children: Having one or more vaccinations; Younger Children: "Somewhat Likely" or "Very Likely" to have been vaccinated

Results

Of the 1,084 respondents in our survey, 380 indicated that they had children six months to 17 years old living in their homes. The model of the vaccination status of the older children had a total of 282 respondents after case-wise deletion of missing data. In the model of younger children, 118 respondents remained after case-wise deletion of missing values. We present the results of the models in Table 1. Both

models had very similar results. The independent variable with the strongest effect was the nurse's COVID-19 vaccination status. In the model of older children's vaccination status, a parent's vaccination status was strongly associated with their child's likelihood of vaccination ($\beta = 1.800$, $p < 0.001$). Whilst in the model of the intent to vaccinate younger children there was an even stronger relationship in the same direction ($\beta = 2.112$, $p < 0.001$). Partisan self-identification is also a critical factor shaping the decision to vaccinate children in the household. The results show that Republicans are less likely to vaccinate their children than Democrats or independents (for older children ($\beta = -0.464$, $p = 0.004$) and for younger children ($\beta = -0.061$, $p = 0.014$). Age was significant in the predicted direction only in the model of older children ($\beta = -0.634$, $p = 0.001$). None of the other independent variables reached statistical significance.

We estimated predicted probabilities of all statistically significant variables, presented in Table 2, to give a better sense of the substantive impact on the dependent variables modeled. Amongst Republican respondents, the probability of 5 to 17 year-olds in their homes receiving any COVID-19 vaccination was 0.541, whereas with Democratic respondents it was 0.668. The effect of respondents' vaccination status was even more profound. Amongst nurses who simply followed the mandate and were fully vaccinated, the probability of the children being vaccinated to any degree was 0.475, whilst for vaccinated and boosted respondents, the probability was 0.819. Stronger effects were seen on the intent to vaccinate 6 month to 4 year-olds. Republican respondents showed a probability of being "somewhat" or "very likely" getting the children in the household vaccinated of 0.271, as opposed to 0.413 for Democrats. Again, respondent vaccination status mattered most, with those fully vaccinated respondents showing a probability of 0.107 having their youngest children vaccinated, compared to 0.459 of boosted respondents. Parental age was also important when examining the vaccination status of older children. The probability of a child 5 or over being vaccinated to any degree was 0.383 for 20-year-old respondents. The probabilities went up to 0.480, 0.572, and 0.653 for 30, 40, and 50-year-old respondents, respectively.

Discussion

Contributions to the Existing Literature

Our findings contribute to and extend the existing scholarship. Overall, it seems that the factors that drive vaccination attitudes among HCWs also shape their preferences for children's vaccination. For example, the extant literature shows that the vaccination status of the parent is a strong predictor

of the willingness to vaccinate children. Parents who are vaccinated and have confidence in COVID-19 vaccines are more likely to vaccinate their children [31–33]. Vaccinated HCW parents are also more likely to vaccinate their children [11, 12]. Our results show that those nurses who are boosted are far more likely to vaccinate their children. These findings are in line with the existing scholarship, the only difference is that the mandate shifts the decision point of the respondent from getting vaccinated in the first instance to getting boosted. Put differently, rather than being “vaccine hesitant,” one would be “booster hesitant.” Our results also suggest that the decision to vaccinate is taken by and for the entire household. Overall, while other factors are at play, the vaccination choices of the parent are seemingly the most important determinant of vaccine uptake for children be they toddlers or teenagers.

We find that the partisan self-identification of the parent strongly shapes the decision to vaccinate their children. The COVID-19 pandemic has been strongly politicized in the United States, particularly vaccination [34]. Prominent Republican Party politicians, such as former President Donald Trump and South Dakota Governor Kristi Noem have downplayed the severity of the virus when the pandemic started and voiced skepticism about mandatory vaccination [35]. Republican and Democratic respondents are taking cues from their respective party leadership. For example, Republicans are less likely to receive vaccination and to comply with mitigation protocols, such as mask-wearing and social distancing [36, 37]. Republicans are also less likely to vaccinate their children [27] and more likely to oppose a vaccine mandate for schoolchildren [38]. Partisan self-identification affects vaccination decisions of healthcare workers as well, with Republican HCWs showing lower vaccination likelihood [39, 40]. Studies conducted in Austria [41], Australia [42], and France [43] likewise reported a link between partisan self-identification and COVID-19-related attitudes and behaviors. Our findings are consistent with this literature and illustrate the strong effect of political identities on our health-related decisions.

Age is statistically significant in the model of parents of children aged 5–17 years, but not in the model with parents of children six months to five years. We suspect this is an artifact of the smaller range of respondents’ ages for those with children four years or younger, relative to those with 5 to 17-year-olds. The extant literature provided mixed findings on the effects of parents’ age on children’s vaccine uptake. Some studies reported no effect of parents’ age on the decision to vaccinate their children amongst the general population [16, 33, 44] or amongst HCWs [12]. Other studies found that older adults are more likely to vaccinate their children [32, 45].

We did not uncover a difference between male and female parents in our sample. The previous findings regarding the effect of the parent’s gender on the decision to vaccinate children are split. Some general population studies report no effect [16, 33]. Some provided evidence that mothers are less likely to vaccinate their children than fathers [32, 46], while others reported that mothers are more likely to do so than fathers [45, 47, 48]. A study based on HCWs in China found no effect of parents’ gender on the decision to vaccinate their children [12]. The different findings might be due to the differences in the design of the studies. Most of the studies were conducted before COVID-19 vaccines were available for children, and studies asked about vaccines for children of different ages. More research is needed to clarify the relationship between parents’ gender and children’s vaccination attitudes.

Our results show no effect of education on child vaccination preferences. We also did not uncover differences between NPs, RNs, and LPNs. Some studies of the general population showed a positive relationship between parent education and child vaccination preferences [33, 46]). However, not all studies found such a connection [31, 32]. When found, the differences are between those parents with a university degree and those without. Participants in our sample had at least an LPN certificate, which might explain the lack of statistically significant results in our relatively well-educated sample. Our findings comport with a study of HCWs that reported no difference between nurses and doctors [12].

Limitations

We note several limitations of this study. We contacted participants based on the information we obtained from the South Dakota Board of Nursing. We used email as the recruitment method and could not invite those nurses that did not provide an email address. The response rate to our survey was 5.3%, which is not uncommon given the challenges in surveying HCWs. Studies that examine vaccination attitudes among HCWs [40, 49], including parental vaccination attitudes among HCWs [12, 47] are often based on convenience samples or utilize snowball sampling, and therefore do not report response rates. While we cannot rule out the presence of some response bias, by all measures our sample does appear representative of nurses statewide.

We only included RNs, LPNs, and NPs, the three largest classes of nurses, and therefore our study does not contain participants who are registered nurse anesthetists or licensed clinical nurse specialists. Also, our survey did not include a question on whether respondents’ children had any baseline diseases that may preclude vaccination.

The timing of our study could have also affected the results. Vaccines for children six months and older were

approved at the same time our survey was fielded. We could therefore only ask about parents' intentions when it comes to vaccinating children from six months to five years. Finally, we acknowledge the limited generalizability of our results. Our data come from a single state that is more politically and socially conservative, more rural, and that has a lower than average COVID-19 vaccination rate in the United States.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10900-022-01167-4>.

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Data Availability Contact the corresponding author.

Code Availability N/A.

Declarations

Conflicts of interest/Competing Interests The authors declare no relevant conflicts of interest or financial relationships.

Ethics Approval This study received approval from South Dakota State University's research compliance officer.

Consent to Participate All participants consented to participate in our study.

Consent for publication N/A.

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