

Association Between Caregiver Opposition to Topical Fluoride and COVID-19 Vaccines

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Abstract

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Purpose: Caregivers who oppose topical fluoride may be opposed to other preventive treatments, including COVID-19 vaccines. The study objective was to examine the association between caregiver opposition to topical fluoride and COVID-19 vaccines.

Methods: The study took place at the University of Washington in Seattle, WA. English-speaking caregivers of children aged <18 years were eligible to participate. An 85-item REDCap survey was administered from February to September 2021. The predictor variable was topical fluoride opposition (no/yes). The outcome was COVID-19 vaccine opposition (no/yes). The models included the following covariates: child and caregiver age; caregiver race and ethnicity, education level, insurance type, parenting style, political ideology, and religiosity; and household

income. Logistic regression models generated odds ratios (OR) and 95% confidence intervals ($\alpha=0.05$).

Results: Six-hundred-fifty-one caregivers participated, and 403 caregivers were included in the final regression model. Mean child age was 8.5 years (SD 4.2), mean caregiver age was 42.1 years (SD 9.1), 53.0% of caregivers were female, 57.3% self-reported as white, and 65.5% were insured by Medicaid. There was a significant positive association between topical fluoride and COVID-19 vaccine opposition (OR=3.13; 95% CI: 1.87, 5.25; $p<0.001$). Other factors associated with COVID-19 vaccine opposition included conservative political views (OR=2.77; 95% CI: 1.26, 6.08; $p<0.011$) and lower education (OR=3.47; 95% CI: 1.44, 8.38; $p<0.006$).

Conclusions: Caregivers opposed to topical fluoride in dental settings are significantly more likely to oppose COVID-19 vaccines for their child. Future research should identify ways to address both topical fluoride and vaccine opposition to prevent diseases in children.

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INTRODUCTION

Vaccines help prevent and reduce transmission and severity of diseases like coronavirus (COVID-19), but many caregivers are vaccine hesitant or opposed to childhood vaccines. The COVID-19 vaccine first became available in May 2021 for adolescents ages 12 to 15 years and in October 2021 for children ages 5 through 11 years.^{1,2} Current data from the Centers for Disease Control and Prevention (CDC) indicate that only 26.6% of eligible children ages 5 to 11 years old and 57.9% of children ages 12 to 17 years old in the United States (U.S.) are fully vaccinated against COVID-19, despite availability of an approved vaccine.³ Even smaller proportions of children under age 5, who may soon become eligible for the COVID-19 vaccine, are likely to be vaccinated.⁴ Consequently, pediatric COVID-19 prevalence in the U.S. remains high. Of the total cumulative COVID-19 cases in the U.S., 19.0% are attributed to children.⁵ As individuals under the age of 18 comprise approximately 22.1% of the total population in the U.S., this is an essential group to consider in vaccination efforts.^{5,6} This highlights the importance of understanding why caregivers are opposed to childhood vaccines.

Consistent with past research on non-COVID-19 childhood immunizations, recent studies suggest that caregiver hesitancy and opposition of the COVID-19 vaccine stem from similar beliefs. Reasons include the belief that the vaccine was developed too quickly, distrust in the safety and efficacy of the vaccine, fear of adverse reactions or unknown long-term effects, and beliefs that COVID-19 is not a serious disease in children.^{4,7} Surveys of U.S. caregivers indicate that COVID-19 vaccination intention for children is lower among caregivers with a lower education or a conservative political ideology.⁸ Caregiver acceptability of COVID-19 vaccines was also lower among non-white racial and ethnic groups initially.⁹ During the pandemic, some

equity gaps in COVID-19 vaccination narrowed for several underrepresented groups, who now indicate a higher overall acceptance of the vaccine compared to white individuals.⁹ However, disparities persist among the Black population, leaving these caregivers more hesitant about the COVID-19 vaccine compared to other racial groups.^{4,10}

Analogous to the way in which vaccines prevent systemic diseases, fluoride helps prevent dental caries. Recent evidence continues to affirm the effectiveness of topical fluoride in reducing the incidence of dental caries in high-risk children.¹¹ Yet one study found that 13% of caregivers opposed topical fluoride treatment for their children during healthcare visits¹² and even larger proportions are likely to be hesitant – which comprises parents who accept fluoride but may have underlying concerns about it. The caries risk of children whose caregivers refuse topical fluoride has not been formally studied, but anecdotal evidence suggests that a substantial proportion of these children are not low risk for caries. Thus, some children whose caregivers refuse fluoride may have high levels of untreated, preventable dental disease.

Previous work reported a significant association between opposition of topical fluoride and childhood vaccines,¹³ but there has been no recent investigation in this line of research, especially during the COVID-19 pandemic. The goals of the current study were to (1) evaluate whether caregiver opposition to topical fluoride is specifically associated with opposition to COVID-19 vaccines and (2) identify other factors associated with COVID-19 vaccine opposition. Knowledge gleaned from this study is expected to support efforts to develop public health and chairside strategies aimed at addressing caregiver opposition to preventive care for their children.

MATERIALS AND METHODS

Study Design, Population and Procedures

A single-site, observational cross-sectional study was administered at the University of Washington's Center for Pediatric Dentistry (**UW CPD**) in Seattle, Washington. All English-speaking parents and caregivers of children aged <18 years who were current patients of record at the UW CPD were eligible. An 85-item electronic survey was administered through REDCap, a secure web tool designed for clinical research and database creation. Caregivers were approached by study staff during patient care visits, defined as a dental checkup or treatment visit, and were asked to participate in the voluntary study. Participant recruitment took place between February 1, 2021 and September 30, 2021. Participants could take the survey on their own electronic device, or a study tablet. One caregiver per household was permitted to participate. Informed consent for the study was requested through the electronic survey prior to enrollment. All survey questions were optional, and participants could discontinue the survey at any time. If the survey could not be completed during their child's visit, participants were given the option to securely access and complete the survey later. All participants who submitted an electronic survey were entered into a raffle for the chance to win a prize, including an Apple iPad, a pair of Philips Sonicare toothbrushes, a \$150 Amazon gift card, one of two \$75 Amazon gift cards, or a \$50 Target gift card, as a thank you for participation. The study was approved by the University of Washington Institutional Review Board.

Survey Development

Survey development was informed by formative qualitative research conducted with caregivers that focused on understanding the causes of topical fluoride opposition (DL Chi, unpublished data, March 2022). The initial survey included questions on oral health knowledge,

beliefs and reasons for opposition to topical fluoride, and beliefs about COVID-19 vaccines. The survey was initially evaluated with caregivers using cognitive interviewing methods, pre-tested with caregivers and dentists, revised, and finalized. A final copy of the 85-item survey is available (see Supplemental Materials—Appendix).

Predictor Variable

Our predictor variable was whether a caregiver expressed any opposition to topical fluoride. Caregivers were asked, “On a scale of 0 to 10 with ‘0’ being ‘not at all opposed’ and ‘10’ being ‘totally opposed,’ how opposed are you to topical fluoride for your children?” We recoded responses into a binary variable with those indicating no opposition (0) versus those indicating any opposition (≥ 1). This is consistent with published conceptualizations of topical fluoride opposition.¹²

Outcome Variable

Our outcome variable was whether a caregiver expressed any opposition to COVID-19 vaccination. Caregivers were asked “On a scale of 0 to 10 with ‘0’ being ‘not at all opposed’ and ‘10’ being ‘totally opposed,’ how opposed are you to a COVID-19 vaccine for your child/children?” Consistent with our predictor variable, we recoded responses into a binary variable with those indicating no opposition (0) versus those indicating any opposition (≥ 1).

Covariates

We included the following caregiver-reported variables as covariates in our regression model: child age; caregiver age, gender, race, ethnicity, education level, insurance type; parenting style, political ideology, religiosity; and household income.

Both child age and caregiver age were reported in years. Caregiver gender was included as male, female, non-binary, or other. Caregiver race was included as white (reference group) or non-white based on caregivers' self-reported race in one or more categories adopted from the U.S. Census Bureau classification (white, Black, Asian, American Indian or Alaskan Native, Native Hawaiian or other Pacific Islander, other). We included caregiver ethnicity as either non-Hispanic (reference group) or Hispanic. Caregiver education categories¹⁴ were: high school diploma or less, some college, four-year college degree, or more than a four-year degree. The four-year college degree group served as the reference group. Caregiver insurance type was included as: private insurance (reference group), insured by Medicaid, or no insurance. We included caregiver parenting style using caregivers' responses to an item from the Parenting Sense of Competence Scale.¹⁵ This item asked whether caregivers Strongly Agreed or Agreed (reference group) or Strongly Disagreed or Disagreed with the statement, "Children are likely to grow up happy and healthy without much intervention from their parents." Caregiver political ideology¹⁶ was included as: conservative or very conservative, moderate, or liberal or very liberal; with liberal or very liberal serving as the reference group. We included caregiver religiosity¹⁷ ("how important is religion in your life") as very important, somewhat important, not too important, or not at all important; with not too important or not at all important serving as the reference group. Finally, we included annual household income using four categories from the Behavioral Risk Factor Surveillance System Questionnaire¹⁸: <\$25,000, \$25,000 to <\$50,000, \$50,000 to <\$75,000, and \geq \$75,000. Greater than or equal to \$75,000 served as the reference group.

Statistical Analyses

Descriptive statistics and frequencies were generated to describe all variables and were reported as means and percentages. Multiple variable logistic regression models were used to evaluate the unadjusted and adjusted relationship between caregiver opposition to topical fluoride for their children and that caregiver's opposition to the COVID-19 vaccine for their children. Logistic regression models were also used to assess the relationships between covariates and the outcome variable. These models produced odds ratios (OR) and 95% confidence intervals (CI). We treated probability values less than 0.05 as statistically significant. All analyses were conducted using Stata version 15.0 statistical software.

RESULTS

Participant Demographics

A total of 651 caregivers responded to the survey. We excluded 248 caregivers due to missing data on one or more questions, for a final analytical sample of 403 caregivers. The descriptive statistics produced are detailed in Table 1. Of the survey respondents, the mean age of the child was 8.48 years old (SD 4.2), the mean age of caregivers was 42.1 years old (SD 9.1), 53.0% of caregivers were female, 57.3% were white, and 65.5% were insured by Medicaid.

Opposition to Topical Fluoride and COVID-19 Vaccines

From the unadjusted logistic regression analysis as displayed in Table 2, we observed a significant association between topical fluoride opposition and COVID-19 vaccine opposition (OR= 3.52; 95% CI: 2.22, 5.58; $p<0.001$). After adjusting for covariates, caregivers who opposed topical fluoride were 3.13 times as likely to oppose COVID-19 vaccines for their child (95% CI: 1.87, 5.25; $p<0.001$).

Model Covariates and Opposition to COVID-19 Vaccines

Two covariates were significantly associated with caregiver opposition to the COVID-19 vaccine: education level and self-reported political ideology. Of these measures, having a moderate or conservative political ideology was significantly correlated with COVID-19 vaccine opposition (OR=2.03; 95% CI: 1.20, 3.44; $p<0.008$ and OR=2.77; 95% CI: 1.26, 6.08; $p<0.011$ respectively). An education level of a high school diploma or less was also significantly associated with COVID-19 vaccine opposition (OR=3.47; 95% CI: 1.44, 8.38; $p<0.006$).

When we examined the bivariate relationship between caregiver race and COVID-19 vaccine opposition in our data, we also observed a statistically significant relationship between caregiver race and COVID-19 vaccine opposition. Racial minorities were significantly more likely to be opposed to the COVID-19 vaccine for their children compared to white caregivers (OR=2.71; 95% CI: 1.81, 4.06; $p<0.001$; data not shown). However, in our logistic regression model with multiple covariates, race failed to achieve statistical significance. Additionally, child or caregiver's age, ethnicity, religiosity, insurance type and annual household income were not significantly associated with COVID-19 vaccine opposition in the covariate-adjusted regression model.

DISCUSSION

In this observational cross-sectional study, we evaluated the association between caregiver opposition to topical fluoride and to the COVID-19 vaccine. There were two main findings: (1) there is a significant positive association between caregiver opposition to topical fluoride in dental settings and opposition to COVID-19 vaccination for children; and (2)

education level and conservative political ideology are associated with opposition to the COVID-19 vaccine.

The first finding is that caregiver opposition to topical fluoride is significantly associated with opposition to COVID-19 vaccines. Besides prior work by Chi reporting a significant association between topical fluoride opposition and opposition to general childhood immunizations,¹⁹ there is no other published material to which we can compare our current findings. Caregivers who are concerned about topical fluoride may generally be more hesitant or opposed to other preventive measures introduced during healthcare visits.^{19,20} The concerns caregivers have about topical fluoride and COVID-19 vaccines are mainly rooted in fears about safety and perceived long-term health impacts on their children.^{4,7,20,21} Opposition to preventive measures may also be an indicator of lower health literacy among caregivers, reinforcing the need for targeted public health efforts to reduce childhood diseases.²²⁻²⁴ Future research should identify the specific mechanisms by which opposition to topical fluoride and COVID-19 vaccines are linked.

The second finding from our study is that other factors, including education level and a conservative political ideology, are significantly associated with caregiver COVID-19 vaccine opposition. This is consistent with literature postulating reasons for COVID-19 vaccine hesitancy and opposition.^{4,8,10,25} Regarding education level, we found that caregivers who had a high school diploma or less were more likely to oppose COVID-19 vaccines for their children. Current data show that adults in the U.S. who remain unvaccinated against COVID-19 generally have a lower level of education.^{8,10,24,25} Regarding political ideology, the vaccine has been largely politicized in the U.S. and this has significantly influenced COVID-19 vaccination rates.^{10,26} Specifically, individuals who subscribe to conservative politics are more opposed to COVID-19 vaccines,

which is consistent with our findings.²⁷⁻²⁹ Because of the influence politics have had on the pandemic, it is necessary to understand opposition patterns among political conservatives and how mistrust and doubt in science, healthcare and experts affect a caregiver's decision to oppose COVID-19 vaccines for their child.^{30,31}

One finding from our study that warrants more attention is how COVID-19 vaccine opposition is related to race. We found that caregiver race is an inconclusive predictor of COVID-19 opposition when several other predictors of opposition are accounted for. However, current research has established significant differences in hesitancy and opposition to the COVID-19 vaccine between minority and white racial groups.^{9,10} In particular, studies identified that Black caregivers in the U.S. had an overall lower acceptance of the COVID-19 vaccine for their children.^{4,32,33} Research on vaccine hesitancy suggests that this behavioral trait is unstable and may change over time.³⁴ Thus, a caregivers' intention and willingness to accept the COVID-19 vaccine for their child may deviate from their eventual vaccine-seeking behavior.^{34,35} Furthermore, attitudes about COVID-19 vaccination could also be influenced by longstanding health disparities and distrust in the healthcare system dating back to historical injustices,^{30,36} rather than opposition to the COVID-19 vaccine in and of itself. Further research is needed to understand the role race may have on COVID-19 hesitancy and opposition behaviors.

Our study has important implications for dental education and clinical practice. First, improving communication strategies between healthcare providers and caregivers is essential to address gaps in preventive care and promote better health outcomes for children. A targeted approach to resolve this could involve earlier training of dental students on how to deploy effective communication strategies.³⁷ This prepares dentists during their training with the foundational skills to eventually engage in open-ended conversations with caregivers about

topics like fluoride without judgement.^{12,37-39} These conversations could help build trust between caregivers and providers.³⁸ To supplement communication strategies, the survey data analyzed for this study included items, as previously mentioned, to identify the reasons why caregivers are opposed to topical fluoride. Having this knowledge is critical in understanding the most effective approaches in communicating with caregivers who are opposed to fluoride. Use of a fluoride opposition screening tool could help providers identify hesitant caregivers.¹² Such a screener may also have important clinical implications during the pandemic due to the anticipated number of children who have not received a COVID-19 vaccine,³⁹ which means that caregivers who oppose topical fluoride based on responses to the screener could also have unvaccinated children.

Because caregivers are critical in health decision making for children, the problem of topical fluoride opposition may be a bellwether for future challenges.⁴⁰ For example, use of amalgam, at one time a common pediatric dental restorative material, has substantially declined in the past decade.⁴¹ This stems from various debates about perceived environmental and health effects of mercury in amalgams.⁴² Though dental amalgam is proven to be safe and effective for use in children, its use has largely been phased out in most of Europe and the U.S. because of caregiver concerns and opposition.^{43,44} Topical fluoride opposition in dental settings that we see today may lead to a similar phenomenon in the future, leaving children at high-risk for caries even more susceptible to dental disease.^{12,13,20} Likewise, there could be future disputes raised over other effective dental treatments like silver diamine fluoride (**SDF**). Though caregivers are generally accepting of SDF when indicated for their children,⁴⁰ perceived safety concerns could arise in the future and impair its use. As caregiver acceptance of preventive health interventions continues to evolve, it is important to address the underlying factors for opposition.⁴⁵

There are two main study limitations. First, there may be shared factors associated with both topical fluoride and COVID-19 vaccine opposition that were not directly tested. The common risk factor approach (**CRFA**) was previously found to be an alternative conceptual model in addressing topical fluoride opposition.¹³ The CRFA may be applied in the future to address topical fluoride and COVID-19 vaccine opposition concurrently.^{13,46} Second, opposition behaviors are not likely to be binary as modeled in our analyses. Because hesitancy is a continuous phenomenon, distinct cut off points are unclear. Therefore, future work is needed in this area.

CONCLUSIONS

The following conclusions can be drawn from the findings of this study:

1. Caregiver topical fluoride opposition in dental settings is significantly associated with COVID-19 vaccine opposition for their children.
2. Caregiver educational level and self-reported political ideology are also significantly associated with COVID-19 vaccine opposition.
3. Additional research is needed to develop clinical interventions, including tailored and evidence-based communication strategies and a clinical screening tool for fluoride opposition; this tool could also identify children who are unvaccinated against COVID-19.
4. Future research should identify ways to use the common risk factor approach to address topical fluoride and vaccine opposition concurrently for disease prevention and improving the health of children.

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Table 1. Description of Sociodemographic Characteristics of Caregivers Who Participated in a Survey Study on Topical Fluoride Opposition at the University of Washington (n = 403)*

| Variable | | Overall | Topical Fluoride Opposition | | Covid-19 Vaccine Opposition | |
|--------------------------------|----------------------|----------------|-------------------------------|---------------------------|-------------------------------|---------------------------|
| | | Mean (SD) % | Not Opposed Mean (SD) % | Opposed Mean (SD) % | Not Opposed Mean (SD) % | Opposed Mean (SD) % |
| Child Age | | 8.48 (4.2) | 8.5 (4.1) | 8.4 (4.5) | 9.0 (4.2)‡ | 7.8 (4.2)‡ |
| Caregiver Age | | 42.1 (9.1) | 42.2 (9.1) | 41.8 (8.9) | 43.3 (8.4)‡ | 40.4 (9.7)‡ |
| Gender | Male | 47.0 | 46.7 | 47.7 | 44.7 | 50.0 |
| | Female | 53.0 | 53.3 | 52.3 | 55.3 | 50.0 |
| Race | White | 57.3 | 63.6‡ | 40.4‡ | 67.4‡ | 43.9‡ |
| | Non-White | 42.6 | 36.4 | 59.6 | 32.6 | 56.1 |
| Ethnicity | Non-Hispanic | 86.6 | 86.4 | 87.2 | 87.8 | 85.0 |
| | Hispanic | 13.4 | 13.6 | 12.8 | 12.2 | 15.0 |
| Education Level | High School Or Less | 14.6 | 14.6 | 14.7 | 9.1‡ | 22.0‡ |
| | Two Years Of College | 33.3 | 31.6 | 37.6 | 31.3 | 35.8 |
| | Four Year Degree | 25.1 | 23.8 | 28.4 | 25.2 | 24.9 |
| | More Than Four Years | 27.1 | 29.9 | 19.3 | 34.4 | 17.3 |
| Insurance Type | Private | 29.0 | 31.6 | 22.0 | 33.9† | 22.5† |
| | Medicaid/Public | 65.5 | 63.3 | 71.6 | 61.3 | 71.1 |
| | No Insurance | 0.99 | 1.36 | 0.00 | 1.74 | 0.00 |
| | Other | 4.47 | 3.74 | 6.42 | 3.04 | 6.36 |
| Parenting Style | Not Involved | 80.9 | 82.3 | 77.1 | 82.6 | 78.6 |
| | Involved | 19.1 | 17.7 | 22.9 | 17.4 | 21.4 |
| Political Ideology | Very/Conservative | 12.7 | 10.9** | 17.4** | 8.3‡ | 18.5‡ |
| | Moderate | 41.4 | 39.5 | 46.8 | 33.5 | 52.0 |
| | Very/Liberal | 45.9 | 49.7 | 35.8 | 58.3 | 29.5 |
| Religiosity | Very Important | 32.8 | 30.3** | 39.5** | 26.1‡ | 41.6‡ |
| | Somewhat Important | 25.8 | 24.5 | 29.4 | 23.5 | 28.9 |
| | Not Too/Not At All | 41.4 | 45.2 | 31.2 | 50.4 | 29.5 |
| Annual Household Income | < \$25k | 14.1 | 11.9‡ | 20.2‡ | 13.5† | 15.0† |
| | \$25 - \$50k | 24.1 | 20.8 | 33.0 | 18.3 | 31.8 |
| | \$50k - \$75k | 19.9 | 21.1 | 16.5 | 20.0 | 19.7 |
| | ≥ \$75k | 41.9 | 46.3 | 30.3 | 48.3 | 33.5 |

* Abbreviation used in this table: SD=standard deviation

** Level of significance for P -value <0.05

† Level of significance for P -value <0.01

‡ Level of significance for P -value <0.001

Table 2: Covariate Unadjusted Regression Model for Surveyed Caregivers Demonstrating Any COVID-19 Vaccine Opposition (n = 403)*

| Variable | Adjusted Odds Ratio (95% CI) | p Value |
|------------------------------------|---|------------------|
| Topical Fluoride Opposition | | |
| Any Opposition | 3.52 (2.22-5.58) | <0.001 |
| No Opposition** | - | - |
| Child Age (Years) | 0.93 (0.89-0.98) | 0.01 |
| Caregiver Age (Years) | 0.96 (0.94-0.99) | 0.002 |
| Caregiver Gender | 0.80 (0.50-1.27) | 0.34 |
| Race | | |
| White** | - | - |
| Non-white | 2.64 (1.75-3.97) | <0.001 |
| Ethnicity | | |
| Non-Hispanic** | - | - |
| Hispanic | 1.28 (0.72-2.27) | 0.41 |
| Education Level | | |
| High school equivalent or less | 4.77 (2.42-9.39) | <0.001 |
| Some college/2-year college degree | 2.27 (1.32-3.89) | 0.003 |
| Four-year college degree | 1.95 (1.10-3.47) | 0.02 |
| More than 4 years** | - | - |
| Insurance Type | | |
| Other Insurance | 2.00 (0.80-5.02) | 0.14 |
| Medicaid/Public | 1.74 (1.11-2.75) | 0.02 |
| Private Insurance** | - | - |
| Parenting Style | | |
| Not Involved** | - | - |
| Involved | 1.29 (0.79-2.13) | 0.31 |
| Political Ideology | | |
| Very Conservative or Conservative | 4.43 (2.30-8.50) | <0.001 |
| Moderate | 3.07 (1.97-4.78) | <0.001 |
| Very Liberal or Liberal** | - | - |
| Religiosity | | |
| Very Important | 2.73 (1.70-4.39) | <0.001 |
| Somewhat Important | 2.11 (1.27-3.49) | 0.004 |
| Not Very or Not Important** | - | - |
| Annual Household Income | | |
| <\$25,000 | 1.61 (0.87-2.96) | 0.13 |
| \$25,000 to <\$50,000 | 2.51 (1.50-4.18) | <0.001 |
| \$50,000 to < \$75,000 | 1.41 (0.82-2.44) | 0.21 |
| ≥\$75,000** | - | - |

* Abbreviation used in this table: SD=standard deviation

** Reference Group

Table 3: Covariate Adjusted Regression Model for Surveyed Caregivers Demonstrating Any COVID-19 Vaccine Opposition (n = 403)*

| Variable | Adjusted Odds Ratio (95% CI) | p Value |
|------------------------------------|---------------------------------|------------------|
| Topical Fluoride Opposition | | |
| Opposed | 3.13 (1.87-5.25) | <0.001 |
| Not Opposed** | - | - |
| Child Age (Years) | 0.94 (0.89-1.00) | 0.06 |
| Caregiver Age (Years) | 0.98 (0.96-1.01) | 0.29 |
| Caregiver Gender | 0.67 (0.38-1.19) | 0.17 |
| Race | - | - |
| White** | - | - |
| Non-white | 1.55 (0.94-2.54) | 0.09 |
| Ethnicity | - | - |
| Non-Hispanic** | - | - |
| Hispanic | 0.82 (0.42-1.60) | 0.56 |
| Education Level | - | - |
| High school equivalent or less | 3.47 (1.44-8.38) | 0.01 |
| Some college/2-year college degree | 1.85 (0.97-3.53) | 0.06 |
| Four-year college degree | 1.80 (0.92-3.52) | 0.09 |
| More than 4 years** | - | - |
| Insurance Type | - | - |
| Other Insurance | 1.24 (0.39-3.93) | 0.71 |
| Medicaid/Public | 1.15 (0.62-2.12) | 0.66 |
| No Insurance** | - | - |
| Parenting Style | - | - |
| Not Involved** | - | - |
| Involved | 1.27 (0.72-2.26) | 0.41 |
| Political Ideology | - | - |
| Very Conservative or Conservative | 2.77 (1.26-6.08) | 0.01 |
| Moderate | 2.03 (1.20-3.44) | 0.01 |
| Very Liberal or Liberal** | - | - |
| Religiosity | - | - |
| Very Important | 1.28 (0.69-2.36) | 0.44 |
| Somewhat Important | 1.37 (0.76-2.48) | 0.30 |
| Not Very or Not Important** | - | - |
| Annual Household Income | - | - |
| <\$25,000 | 0.58 (0.25-1.33) | 0.20 |
| \$25,000 to <\$50,000 | 1.05 (0.53-2.06) | 0.89 |
| \$50,000 to < \$75,000 | 0.81 (0.41-1.60) | 0.55 |
| ≥\$75,000** | - | - |

* Abbreviation used in this table: SD=standard deviation

** Reference Group

APPENDIX: SURVEY

Page 2

UNIVERSITY OF WASHINGTON CONSENT FORM

Title of Study: Developing Topical Fluoride Hesitancy Measures for Causal Modeling and Intervention Research
Principal Investigator: Donald Chi, Professor of Oral Health Sciences, 206-616-4332

CONSENT TO TAKE PART IN A RESEARCH STUDY

This online consent form is part of an informed consent process for a research study. It will give you information to help you decide whether to be in the study or not. Please read the form carefully. It is your choice to take part or not. You may ask questions if anything on this form is not clear. If you decide to take part, the instructions at the end of the document will tell you what to do next.

Who is conducting this research study?

You are being asked to take part in research conducted by Dr. Donald Chi who is a researcher at the University of Washington School of Dentistry.

What is this research study about?

The purpose of this study is to better understand why some parents and caregivers of children are concerned about topical fluoride for their children. Topical fluoride is the sticky stuff painted onto teeth at visits to the dentist or doctor. It is used to prevent cavities. We will develop and test 2 tools for dentists to use: 1) a tool to identify parents and caregivers who are hesitant about topical fluoride for their children and, 2) a tool to identify the reasons why parents and caregivers are hesitant about topical fluoride for their children.

What will I be asked to do if I take part?

The online survey will take 10-15 minutes to complete. The survey will have questions about topical fluoride and your child, as well as questions asking for other information about your health. The questions are not personal in nature. The most sensitive questions will be about your health and dental insurance status.

Your participation is voluntary. You can refuse to participate or withdraw your participation at any time with no penalty or loss of benefits to which you are otherwise entitled.

What are the risks and/or discomforts I might experience if I take part in the study?

While we do not anticipate any risks from taking part in the study, it is possible some questions may cause slight stress or discomfort. Breach of confidentiality is a risk, but there is a data security plan in place to minimize this risk. There is a low likelihood of these risks. If you feel uncomfortable with a question, you can refuse to answer that question or quit the study altogether. If you decide to quit the study before you have finished the survey, your answers will NOT be recorded.

Are there any benefits to me if I choose to take part in this study?

There are no direct benefits to you for taking part in this research. We hope that the information you provide will help researchers develop interventions to improve communication between health providers and caregivers of children about preventing cavities.

Will I be paid to take part in this study?

You will have the option to enter a drawing for one of four prizes: a \$150 Amazon gift card (1 available), 2) a \$75 Amazon gift card (2 available), or 3) a \$50 Target gift card (1 available). After you complete the survey, you will be asked to click a link that will launch a separate survey where you can enter your email address. The randomized drawing will take place in September 2021. We will contact winners via email no later than September 30th, 2021. Your email will NOT be linked with any data collected and will not be shared with anyone outside the research team.

How will information about me be kept private or confidential?

All efforts will be made to keep your data confidential. The link between any personal identifiers and the research data will be destroyed after the records retention period required by state and/or federal law. The National Institute for Dental and Craniofacial Research (NIDCR), the funding agency for this research, will have access to identifiable data. At the end of the survey, you will have the option to provide your email address to enter a drawing. This information will NOT be stored with your responses and will NOT be linked with any data collected.

We have a Certificate of Confidentiality from the United States National Institutes of Health. These protections only apply to data held in the United States. This helps us protect your privacy. The certificate means that we do not have to give out information, documents, or samples that could identify you even if we are asked to by a court of law in the United States. We will use the Certificate to resist any demands for identifying information.

We cannot use the Certificate to withhold your research information if you give your written consent to give it to an insurer, employer, or other person. Also, you or a member of your family can share information about yourself or your part in this research if you wish.

There are some limits to this protection. We will voluntarily provide the information to:

03/24/2022 9:51 AM a member of the United States government who needs it in order to audit or evaluate the research; REDCap®

- individuals at the University of Washington, the funding agency, and other groups involved in the research, if they need the information to make sure the research is being done correctly;
- individuals who want to conduct secondary research if allowed by federal regulations and according to your consent for future research use as described in this form;
- to relevant authorities as required by other Federal, State, or local laws.

The Certificate expires when the US NIH funding for this study ends. Currently this is 08/31/2021. Any data collected after expiration is not protected as described above. Data collected prior to expiration will continue to be protected.

Who is funding this research study?

The study team and the University of Washington are receiving financial support from the National Institute for Dental and Craniofacial Research (NIDCR) to conduct this research.

Who can I call if I have questions?

If you have questions about this study, or feel you have been harmed by participating, you can contact the Principal Investigator: Dr. Donald Chi at the University of Washington School of Dentistry, at (206)616-4332 or email dchi@uw.edu.

If you have questions about your rights as a research participant, you can call the University of Washington IRB Human Subject Division at (206)543-0098 or call collect at (206)221-5940 or hsdinfo@uw.edu

Please print out this consent form if you would like a copy of it for your files.

If you do not want to take part in the research, close this webpage. If you do want to part in this research, follow the directions below:

By beginning this research, I acknowledge that I am 18 years of age or older and have read and understand the information. I agree to take part in the research, with the knowledge that I am free to withdraw my participation in the research without penalty. Click "Next Page" to confirm informed consent and begin the survey.

We are interested in your thoughts about topical fluoride for your child. Topical fluoride is sometimes called fluoride varnish or tooth vitamins. Your child's dentist or doctor may offer topical fluoride during check-ups to help prevent cavities. The first set of questions are about you and your household.

How many children under the age of 18 years live in your household? _____

What is the age of the youngest child in your household? _____ years

The next questions are about topical fluoride.

As a reminder topical fluoride is sometimes called fluoride varnish or tooth vitamins. Your child's dentist or doctor may offer topical fluoride during check-ups to help prevent cavities.

Have you ever been offered topical fluoride for any of your children?

- Yes
 No

Have you ever been offered topical fluoride for your child?

- Yes
 No

Have any of your children ever received topical fluoride?

- Yes
- No

Has your child ever received topical fluoride?

- Yes
- No

On a scale of 0 to 10 with "0" being "not at all opposed" and "10" being "totally opposed", how opposed are you to topical fluoride for your children?

Not at all opposed Totally opposed

0 1 2 3 4 5 6 7 8 9 10

On a scale of 0 to 10 with "0" being "not at all opposed" and "10" being "totally opposed", how opposed are you to topical fluoride for your child?

Not at all opposed Totally opposed

0 1 2 3 4 5 6 7 8 9 10

On a scale of 0 to 10 with "0" being "not at all concerned" and "10" being "extremely concerned", how concerned are you about topical fluoride for your children?

Not at all concerned Extremely concerned

0 1 2 3 4 5 6 7 8 9 10

On a scale of 0 to 10 with "0" being "not at all concerned" and "10" being "extremely concerned", how concerned are you about topical fluoride for your child?

Not at all concerned Extremely concerned

0 1 2 3 4 5 6 7 8 9 10

Regarding topical fluoride in general for your children, which statement below best describes you?

- I always say no
- Most of the time I say no
- Sometimes I say no
- I say yes, but I have thought about saying no
- I always say yes

Regarding topical fluoride in general for your child, which statement below best describes you?

- I always say no
- Most of the time I say no
- Sometimes I say no
- I say yes, but I have thought about saying no
- I always say yes

I say no or have thought about saying no to topical fluoride because one or more of my children don't like getting it.

- Agree
- Disagree

I say no or have thought about saying no to topical fluoride because my child doesn't like getting it.

- Agree
- Disagree

I say no or have thought about saying no to topical fluoride because there was an out-of-pocket cost.

- Agree
- Disagree

If it were free or completely covered by insurance, would you still say no or think about saying no to topical fluoride?

- Yes
- No

Do you make choices about topical fluoride differently for each child?

- Yes
- No

The next questions are about the youngest child in your household.

Please tell us the age of your youngest child again: _____ years

What is your relationship to this child?

- Mother
 Father
 Other: _____

What is your child's gender?

- Boy
 Girl

What is your child's race? Please select all that apply:

- American Indian or Alaska Native
 Asian
 Black or African American
 Native Hawaiian or other Pacific Islander
 White
 Other: _____

Is your child of Hispanic, Latino, or Spanish origin?

- Yes
 No

What type of dental insurance does your child have?

- Private insurance
 Medicaid, public assistance
 My child does not have dental insurance
 Other: _____

Does your child currently need or use medicine prescribed by a doctor (other than vitamins)?

- Yes
 No

Caregivers have different thoughts about topical fluoride for their children. For each statement below, indicate how much you agree or disagree.

Please base your responses on your youngest child.

I think topical fluoride prevents cavities for my child.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

If my child's teeth are brushed regularly, they do not need topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

If my child has a healthy diet, they do not need topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

If my child goes to the dentist regularly, they do not need topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

If my child gets fluoride from drinking water, they do not need topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

If my child gets fluoride from toothpaste, they do not need topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I think getting topical fluoride too often is bad for my child.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I think my child's teeth can be healthy without topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I think my child needs topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I think topical fluoride is unhealthy for my child.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I trust that my child's dentist will give me a choice to say no to topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I think there is enough proof that topical fluoride is safe for my child.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I think topical fluoride has more benefits than risks for my child.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I think topical fluoride is harmless for my child.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

I trust what my child's dentist says about topical fluoride.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

Caregivers may have concerns about topical fluoride. Some of these concerns are listed below. These may or may not apply to you. For each statement, please indicate your degree of concern.

As a reminder, please base your responses on your youngest child.

I am concerned about topical fluoride because my child already gets too much.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned about topical fluoride because my child might swallow it.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned about topical fluoride because it is not natural.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned topical fluoride may cause my child unknown harm in the future.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned topical fluoride may cause learning problems for my child.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned topical fluoride may cause my child to have autism.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned that topical fluoride is mostly a way for my child's dentist to make money.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned about topical fluoride because I do not know how it works.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned about topical fluoride because I am not given enough information about it.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned topical fluoride may cause my child to get cancer.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned topical fluoride may build up in my child's body.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned topical fluoride may make my child's teeth look bad.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned that I am not being told the whole truth about topical fluoride.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned that I will feel pressured at my child's dentist to say yes to topical fluoride.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned topical fluoride may hurt my child's IQ.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned about topical fluoride because some research says it is not safe.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned about topical fluoride because some doctors do not approve of it.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

I am concerned about topical fluoride because I have friends or family who are opposed to it.

- Extremely concerned
- Somewhat concerned
- Slightly concerned
- Not at all concerned

Now we have some additional background questions about your youngest child.

Has your child ever had a cavity?

- Yes
 No

How likely is your child to get a cavity?

- Extremely likely
 Likely
 Unlikely
 Extremely unlikely

How bad would it be for your child to get a cavity?

- Extremely bad
 Somewhat bad
 Not that bad

What do you think about your child getting fluoride in their drinking water?

- Strongly oppose
 Somewhat oppose
 Somewhat favor
 Strongly favor

What do you think about your child using fluoride toothpaste?

- Strongly oppose
 Somewhat oppose
 Somewhat favor
 Strongly favor

Where do you get information about topical fluoride for your child? Please check all that apply:

- Parenting-focused web sites
 Science or health-focused web sites
 Social networking sites and message boards (e.g., Facebook)
 Other parents (not family)
 Family members
 My child's medical doctor
 My child's dentist
 Other health providers
 Other sources: _____
 I have not sought out information about topical fluoride.

The next questions are about your views on parenting. For each statement, please indicate how much you agree or disagree.

Children are likely to grow up happy and healthy without much intervention from their parents.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

Parents should adjust their parenting style to the individual needs of their children.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

Finding the best educational opportunities for children is important as early as preschool.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

If parents have the adequate time, resources, and knowledge, they can ensure their child's success.

- Strongly agree
- Agree
- Disagree
- Strongly disagree

Now we have some questions about your views on various issues.

Did you get topical fluoride as a child?

- Yes
- No

Are you afraid of going to the dentist?

- Yes, very
- Yes, quite
- A little
- No

Overall, how hesitant about childhood vaccines do you consider yourself to be?

- Not at all hesitant
- Not too hesitant
- Somewhat hesitant
- Very hesitant

How worried are you about global warming?

- Very worried
- Somewhat worried
- Not very worried
- Not at all worried

In general, how would you describe your political views?

- Very conservative
- Conservative
- Moderate
- Liberal
- Very liberal

How important is religion in your life?

- Very important
- Somewhat important
- Not too important
- Not at all important

The next few questions are about COVID-19.

Have you received one or more doses of a COVID-19 vaccine?

- Yes
 - No
-

What are your plans for getting a COVID-19 vaccine?

- Get it as soon as I can
 - Wait and see how it's working
 - Get it only if required
 - Definitely not get it
-

If an FDA authorized vaccine for COVID-19 was available for children for free, how likely would you be to get your children vaccinated?

- Extremely likely
 - Likely
 - Unlikely
 - Extremely unlikely
-

If an FDA authorized vaccine for COVID-19 was available for children for free, how likely would you be to get your child vaccinated?

- Extremely likely
 - Likely
 - Unlikely
 - Extremely unlikely
-

On a scale of 0 to 10 with "0" being "not at all opposed" and "10" being "totally opposed", how opposed are you to a COVID-19 vaccine for yourself?

Not at all opposed Totally opposed

0 1 2 3 4 5 6 7 8 9 10

On a scale of 0 to 10 with "0" being "not at all opposed" and "10" being "totally opposed", how opposed are you to a COVID-19 vaccine for your children?

Not at all opposed Totally opposed

0 1 2 3 4 5 6 7 8 9 10

On a scale of 0 to 10 with "0" being "not at all opposed" and "10" being "totally opposed", how opposed are you to a COVID-19 vaccine for your child?

Not at all opposed Totally opposed

0 1 2 3 4 5 6 7 8 9 10

We have a few final background questions about you and your household.

In what U.S. state or territory do you currently live in?

- I do not live in a U.S. state or territory
 Alabama Alaska
 American Samoa Arizona
 Arkansas California
 Colorado Connecticut
 Delaware District of Columbia (D.C.)
 Florida Georgia
 Guam Hawaii Idaho
 Illinois Indiana Iowa
 Kansas Kentucky
 Louisiana Maine
 Maryland Massachusetts
 Michigan Minnesota
 Mississippi Missouri
 Montana Nebraska
 Nevada New Hampshire
 New Jersey New Mexico
 New York North Carolina
 North Dakota Northern Mariana Islands
 Ohio Oklahoma
 Oregon Pennsylvania
 Puerto Rico Rhode Island
 South Carolina South Dakota
 Tennessee Texas
 U.S. Virgin Islands Utah
 Vermont Virginia
 Washington West Virginia
 Wisconsin Wyoming

What is your zipcode?

What is your age in years?

What is your gender?

- Woman
 Man
 Non-binary or third gender
 Prefer to self-identify: _____

What is the highest degree or level of school you have completed?

- Less than high school diploma
 High school diploma or equivalent (e.g., GED)
 Some college or 2-year college degree
 4-year college degree
 More than 4-year degree

What is your race? Please select all that apply:

- American Indian or Alaska Native
 Asian
 Black or African American
 Native Hawaiian or other Pacific Islander
 White
 Other: _____

Do you consider yourself to be Hispanic, Latino, or of Spanish origin?

- Yes
 No

What is your annual household income?

- Less than \$15,000
 \$15,000 but less than \$25,000
 \$25,000 but less than \$50,000
 \$50,000 but less than \$75,000
 \$75,000 but less than \$100,000
 \$100,000 but less than \$150,000
 \$150,000 or more

Please respond to the following statement about the food eaten in your household in the past 12 months:

We worried whether our food would run out before we got money to buy more.

- Often true
 Sometimes true
 Never true
 Don't know

Please respond to the following statement about the food eaten in your household in the past 12 months:

The food we bought just didn't last and we didn't have money to get more.

- Often true
 Sometimes true
 Never true
 Don't know

What type of dental insurance do you have?

- Private insurance
 Medicaid, public assistance
 I do not have dental insurance
 Other: _____

When schools are running normally, is any child in your household homeschooled?

- Yes
 No
 Not applicable - I do not have school-aged children.

Is any child in your household eligible for free or reduced-cost breakfasts or lunches at school?

- Yes
 No
 Not applicable - I do not have school-aged children.

Thank you for taking our survey. We have a few final questions for you.

If you would like to take part in future research,
please enter your email address: _____

Your email address will not be linked to your survey
responses.

At the end of the study, would you like an emailed summary of what we have learned?

- Yes
 - No
-

At the end of the study, would you like to receive information about topical fluoride?

- Yes
 - No
-

Please enter your email address: _____

Your email address will not be linked to your survey
responses.

Is there anything else you would like to tell us?

After you submit the survey you will be taken to a new page to enter a drawing. Entry is optional.