



Parents' attitudes towards topical fluoride and vaccines for children: Are these distinct or overlapping phenomena?

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ABSTRACT

Despite attention paid to parental refusal of child vaccines, the phenomenon of topical fluoride refusal is poorly understood. We examine the extent to which parent attitudes and Internet use regarding topical fluoride treatment and vaccines may overlap and, in turn, uniquely or distinctly correlate with fluoride and vaccine refusal for the child. In 2017, we analyzed data collected from 2011 to 12 for 361 children from three Washington state dental clinics. The instrument included analogous measures of topical fluoride and vaccine safety concerns, perceived severity of preventable cavities/disease, and Internet use for fluoride/vaccine information; and measures of non-fluoridated toothpaste use, attitudes towards dental x-rays and amalgam and composite fillings. We assessed dental chart-based topical fluoride refusal occurring in 2009 or 2010 and parent-reported vaccine refusal. All analogous fluoride and vaccine items were substantively correlated. However, in a series of adjusted models, none of these items were significantly associated with fluoride refusal. Multiple fluoride and vaccine items were associated with vaccine refusal in unadjusted models; but only vaccine safety concerns, perceived severity of a preventable cavity, and Internet use for vaccine information remained significant in adjusted models. Although there is concordance between the two refusal behaviors as well as analogous attitudes and Internet use, these findings challenge the idea that fluoride refusal should be addressed with interventions focusing on vaccine refusal. Further research is required on the factors underlying refusal of preventive dental care.

1. Introduction

Vaccine-preventable disease outbreaks in the US and internationally have led to increased attention towards understanding and addressing vaccine hesitancy among parents. Parental determinants of vaccine hesitancy for their children include concerns about vaccine safety (including fear of adverse events), anticipated feelings of regret or guilt if the child contracts a vaccine-preventable disease or suffers from an adverse event, and using the Internet to search for information (Dubé et al., 2013; Salmon et al., 2015).

Do parents' vaccine attitudes indicate similar attitudes and refusal of other types of preventive care, including preventive dental care? Numerous studies have identified how health attitudes, norms, and behaviors cluster and constitute individualistic and collective health lifestyles (Abel, 1991; Cockerham, 2005; Slater and Flora, 1991), yet little attention has been paid to how vaccination attitudes and refusal

potentially cluster with other health domains. Such clustering may reflect more latent orientations towards treatments viewed as more “natural” and thus safer; or even broader dimensions of parenting, including “intensive parenting” practices that heavily emphasize managing a child's potential health and developmental risks (Reich, 2016).

Recent evidence indicates that vaccine refusal correlates with topical fluoride treatment, a type of preventive dental care regularly provided at a dental office and also offered at medical clinics (Chi, 2014). However, the extent to which refusal of these two types of preventive care reflect common attitudes and behaviors is unclear.

The present study contributes to this knowledge gap via a two-step analysis of topical fluoride and vaccination attitudes, behaviors, and refusal. First, we examine the extent of convergence between parent attitudes and behaviors regarding topical fluoride treatment and child vaccines. Specifically, we assess three parallel factors regarding vaccination and fluoride: (1) concern about safety and risks, (2) perceived

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severity if the child were to develop a disease or cavity that could have been respectively prevented by vaccination or fluoride—based on constructs of the Health Belief Model (Strecher and Rosenstock, 1997) and Extended Parallel Process Model (Askelson et al., 2015)—and (3) Internet use to obtain information about each preventive treatment (Seymour et al., 2015). To further elucidate whether vaccine and/or fluoride attitudes reflect more underlying beliefs about medical and dental treatments, we also examine how these three domains correlate with attitudes about three other dental procedures (x-rays, amalgam and composite fillings) and use of fluoride toothpaste.

Second, we consider to what extent these abovementioned fluoride- and vaccine-specific attitudes and behaviors correlate with both refusal behaviors. Empirically testing these parental attitudes' and behaviors' relative associations with topical fluoride and vaccine refusal for children allows us to evaluate the degree to which these two refusal behaviors reflect common or unique attitudes and behaviors. The answers to these questions will provide important insight on how to address refusal behaviors in clinical settings.

2. Methods

2.1. Study sample

Our data come from a case control study of parental refusal of topical fluoride for their children, conducted in 2011–12 among patients and their parents from three dental clinics in Washington state. Specific details regarding data collection and questionnaire have been previously reported (Chi, 2014), but briefly, those surveyed included parents whose child was seen for a dental checkup in one of the three study clinics in 2009 or 2010 ($N = 1024$). An English-language pre-tested survey was administered to parents who refused topical fluoride for their child (based on information from the child's dental records) and those who did not. Cases and controls were matched 1:1 on topical fluoride status, clinic, age, and gender. Surveys were mailed to parents with a \$2 incentive included. Additional phone and repeat mailing attempts were made to collect data from non-responsive parents. The University of British Columbia and University of Washington research ethics boards reviewed and approved this study.

Of the 361 parents in the sample, 277 (76.7%) had complete (non-missing) information on all variables in this study. Item-specific missingness ranged from 0 to 7.4%. When such an overall level of missingness exists, complete case analysis is not recommended due to the potential for introducing bias and reducing statistical power (Schafer, 1999). Hence, we used the imputation by chained equations (ICE) method in Stata 13's multiple imputation (MI) module (StataCorp, College Station, Texas) to estimate plausible values for all missing values. ICE entails specifying a series of multivariable equations to estimate multiple plausible values for each missing value (White et al., 2011). This procedure leads to the creation of a series of m datasets, each of which contains the actual values for all complete/non-missing observations and an imputed value for each missing observation. Based on recommendations in the MI literature, we computed $m = 25$ different datasets to ensure adequate variability in plausible values (White et al., 2011). Stata computes all analyses separately on each of these 25 datasets of $n = 361$ cases and then aggregates the results based on Rubin's method into one final set of estimates (Schafer, 1999). Our MI-based results revealed the same pattern of findings and substantive conclusions as complete case analysis.

2.2. Measures

Topical fluoride and vaccine refusal were both binary variables (coded 1 = refusal, 0 = accepted), respectively based on chart records and parental self-report regarding ever refusing to have their child immunized. In the survey, caregivers were asked whether they had ever refused topical fluoride for the children in their care at a dental care

visit.

Perceived fluoride and vaccine side effects/safety were each based on the mean of two items. Fluoride concern items assessed how concerned the parent is that (1) her/his child might have a serious side effect from topical fluoride provided at the physician's or dentist's office and (2) the topical fluoride her/his child receives at the physician's or dentist's office might not be safe. Vaccine concern items analogously assessed how concerned the parental is that (1) her/his child might have a serious side effect from a shot and (2) childhood shots might not be safe. All four items were coded on a four-point scale from “not at all concerned” = 0 to “very concerned” = 3. The correlations for the fluoride-specific ($r = 0.74$) and vaccine-specific ($r = 0.77$) items respectively indicated a high degree of item consistency for each scale.

Perceived severity of potential disease consisted of two items asking the parent how bad it would be if the child got (1) a cavity preventable by fluoride and (2) one of the diseases that shots might have prevented. Both items were coded on a four-point scale from “horrible for my child” = 0 to “not that bad for my child” = 3.

Internet use for fluoride/vaccine information consisted of two binary measures (yes = 1; no = 0) respectively asking the responding parent if s/he uses the Internet to help decide whether her/his child gets topical fluoride and “shots.”

Disapproval of dental treatments consisted of four items: three asking parents how “OK” they are with dental x-rays, amalgam (“silver colored”) fillings, and composite (“tooth colored”) fillings for the child (each coded okay = 0; somewhat or not okay = 1), and fluoride toothpaste use by the child (coded as does use = 0 and does not use and [$n = 17$] “don't know” = 1).

Demographic covariates included parents' age, education, annual family income, and dental insurance status; child's sex, age (computed from date of birth and date survey was returned), race (white versus non-white), and Hispanic ethnicity; and clinic site.

2.3. Statistical analyses

Our analyses in 2017 proceeded in two steps. First, we computed bivariate correlations to determine the convergence between analogous fluoride- and vaccine-related variables for the abovementioned constructs. From a psychometric standpoint, this requires focusing on the magnitude of the correlations to determine substantive (versus statistical) significance. Furthermore, Stata user-created programs to compute correlations from MI data do not estimate p -values. Second, we examined the extent to which vaccine and fluoride-related and dental procedure variables were associated with refusal by estimating a series of Poisson regression models (with robust standard errors) that included demographic covariates, reporting prevalence ratios and 95% confidence intervals. These robust Poisson models produced results similar to those obtained using binary logistic regression models, but enabled reporting results as probabilities versus odds (Barros and Hirakata, 2003).

3. Results

Table 1 reports descriptive statistics for our study variables. Our sample was diverse with respect to demographic factors (e.g., socioeconomic status, parent and child age, race-ethnicity). Notably, 85.2% of parents reported having dental insurance.

Though 51.5% of parents refused fluoride, only 27.7% reported refusing vaccinations. Fluoride concerns about side effects/safety were significantly lower ($p < .05$) than those for vaccines. Parents reported significantly lower perceived severity if their child developed a fluoride-preventable cavity versus a vaccine-preventable disease.

Fewer parents reported Internet use for information on fluoride (16.9%) versus vaccines (21.8%). For dental treatments, only 26% reported not being okay with dental x-rays, with more parents averse to amalgam (65.3%) than composite (17.9%) fillings, and < 10% used

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