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# Associations between Household Water Fluoridation Status and Plain Tap or Bottled Water Consumption

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## Abstract

**Introduction:** The benefits of community water fluoridation for preventing dental caries are attenuated if people do not consume tap water.

**Objectives:** We examined associations between household water fluoride content and consuming plain tap or bottled water among US youth.

**Methods:** We used National Health and Nutrition Examination Survey data for 2013 to 2016 for 5,193 youth aged 2 to 19 y. Fluoride content in youth's household tap water samples was measured electrometrically with ion-specific electrodes and designated low (<0.6 mg/L) or about optimal (0.6 to 1.2 mg/L). Plain tap and bottled water consumption was obtained from one 24-h dietary recall. We used binomial regression models to estimate adjusted prevalence ratios (APRs) and 95% CIs for consuming plain tap water (including tap only or both tap and bottled) and consuming only bottled water as related to household water fluoride content (low or about optimal) and sociodemographic characteristics.

**Results:** On a given day, 52.6% of youth consumed plain tap water (43.8% exclusively and 8.8% both tap and bottled) and 28%, only bottled water. Neither tap water (APR, 0.96; 95% CI, 0.84 to 1.10) nor only bottled water (APR, 1.03; 95% CI, 0.86 to 1.22) consumption was associated with household water fluoride content. Non-Hispanic Black youth and Hispanic youth were about 30% relatively less likely to consume tap water and 60% to 80% relatively more likely to consume only bottled water than non-Hispanic Whites. Low income, low parental education, and no past-year dental visit were associated with not consuming tap water.



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Author Contributions

M. Lin, contributed to conception, design, data acquisition, analysis, and interpretation, drafted and critically revised the manuscript; S.O. Griffin, contributed to conception, design, data analysis, and interpretation, drafted and critically revised the manuscript; S. Park, contributed to design and data interpretation, critically revised the manuscript; C. Li, contributed to data acquisition, analysis, and interpretation, critically revised the manuscript; V. Robison, contributed to conception and data interpretation, critically revised the manuscript; L. Espinoza, contributed to conception, design, and data interpretation, critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

**Conclusion:** Half of youth consumed plain tap water on a given day. Consuming plain tap water was not associated with community water fluoridation status. This study is the first to find that up to 50% of the population served by fluoridated water may not receive its full caries-preventive benefits due to not consuming plain tap water.

## Knowledge Transfer Statement:

Half of US youth consumed plain tap water on a given day. Consuming plain tap water was not associated with community water fluoridation status. This finding suggests that up to 50% of the population served by fluoridated water systems may not receive its full caries-preventive benefits due to not consuming plain tap water. Our findings add support for the need to identify and address barriers to tap water consumption and promote health benefits of fluoridation.

### Keywords

dental caries; primary prevention; drinking water; public health dentistry; health status disparities; oral health

## Introduction

Studies and recommendations by major health organizations (e.g., US Public Health Service, American Dental Association, and World Health Organization) confirm that community water fluoridation (CWF) is safe and the most cost-effective public health measure to prevent dental caries (Griffin et al. 2007; Community Preventive Services Task Force 2013; US Department of Health and Human Services Federal Panel on Community Water Fluoridation 2015; O'Connell et al. 2016; Ran et al. 2016; Centers for Disease Control and Prevention [CDC] 2020b). Nearly 90% of the US population is on public water systems, and 73% of this population receives fluoridated water (CDC 2020a).

Studies based on national data from 2007 to 2014 report that about half of US adults consume tap water and one-third consume bottled water (Brooks et al. 2017; Rosinger et al. 2018). No data exist on whether tap and bottled water consumption varies by CWF status. This information is important because the benefits of CWF on preventing caries would be attenuated with decreased tap water consumption. Steady increases in bottled water sales suggest that more people are choosing bottled over tap water (Rosinger et al. 2018). Studies indicate that the fluoride content in bottled water is generally much lower than the recommended level for caries prevention (US Department of Agriculture 2005; Victory et al. 2017).

Starting in 2013 to 2014, the National Health and Nutrition Examination Survey (NHANES) measured fluoride content in household tap water samples for participants aged 0 to 19 y. This study is the first to examine plain tap and bottled water consumption among youth by CWF status.

# Methods

## Data Source and Study Population

We used data from NHANES for 2013 to 2016, a cross-sectional survey representative of the civilian, noninstitutionalized US population. Additional details on NHANES are described elsewhere (Johnson et al. 2014). NHANES protocols were approved by the National Center for Health Statistics Research Ethics Review Board (CDC 2014b). Consent for survey participation was obtained from participants aged ≥12 y. Parent or guardian permission was required for survey participants aged <18 y (CDC 2014b).

NHANES collected household tap water samples for participants aged 0 to 19 y (CDC 2016). Fluoride content in household tap water samples was measured electrometrically with ion-specific electrodes (CDC 2016).

NHANES conducted the 24-h dietary recall through in-person interviews in a mobile examination center. For children aged <12 y, data could be provided with assistance from a proxy (e.g., parent or guardian). Respondents were asked about the amount of plain water (tap or bottled) consumed during the last 24 h (CDC 2014a). Because NHANES collected data throughout the year, including weekdays and weekends, variables on water consumption averaged across the population are likely representative of any given day.

This study included youth aged 2 to 19 y. We excluded children aged <2 y because national data indicated that breast milk, formula, and milk were the most commonly consumed beverage among this age group (Grimes et al. 2017).

Among 7,302 participants aged 2 to 19 y, 6,826 (93.5%) had data on household tap water fluoride content; 6,359 (87.1%) participated in the 24-h dietary recall; and of those, 5,921 (93.1%) had data on plain water consumption. There were 5,776 participants with data on fluoride content and plain water consumption. We then excluded 1) 426 participants who reported their drinking water source from a well, rain cistern, or spring and were assumed to not be on public water systems and 2) 165 participants whose tap water fluoride content exceeded 1.2 mg/L, the recommended maximum level for caries prevention in 2013 and 2014 (US Department of Health and Human Services Federal Panel on Community Water Fluoridation 2015). We excluded persons receiving water with high fluoride content because there was an insufficient sample size to generate stable estimates according to the NHANES guidelines when these participants were analyzed as a separate group. After the exclusions, 5,193 participants remained in the study.

## Dependent Variables

We examined the prevalence of consuming plain tap water (including tap only or both tap and bottled) and the prevalence of consuming only bottled water from the 24-h dietary recall. As a secondary analysis, we examined the mean amount of tap and bottled water consumption.

### Independent Variables

Our main explanatory variable was fluoride content of household tap water. We classified the fluoride content as low (<0.6 mg/L; American Academy of Pediatric Dentistry 2018) or about optimal (0.6 to 1.2 mg/L).

We also included covariates for which disparities in oral health status or water consumption were reported: sex, age, race/ethnicity, US-born status, family income, parental education, and past-year dental visit (CDC 2013; Onufrak, Park, Sharkey, and Sherry et al. 2014; Rosinger et al. 2018; CDC 2019).

### Statistical Analysis

We calculated the prevalence of 1) plain tap water consumption (including tap only or both tap and bottled) and 2) only bottled water consumption, overall and stratified by independent variables. Significant associations were determined with chi-square tests in bivariable analyses. We used 2 binomial regression models to estimate adjusted prevalence ratios and 95% CIs for consuming any tap water and consuming bottled water only. Models included fluoride content status and all covariates.

We also examined whether findings regarding the association between water fluoride content and plain tap or bottled water consumption differed when we used quantity versus any consumption as the dependent variable. For this analysis, the dependent variables were mean amount of plain tap and bottled water consumption. We used a linear regression model that included the same covariates as those in the binomial regression models.

All estimates were generated with the 1-d dietary sample weights. We used SAS-callable SUDAAN version 11 to account for the complex sample design and weights of the NHANES. Reported findings are significant at $P < 0.05$.

## Results

Our study sample included 5,193 youth. On a given day, 52.6% consumed plain tap water (43.8% exclusively and 8.8% both tap and bottled); 28%, bottled water only; and 19.4% did not consume either tap or bottled water. Almost half the study population (45.4%) lived in households with fluoridated water (Table 1).

Consuming any plain tap water or consuming only bottled water was not significantly associated with fluoride content status in the bivariate or adjusted analysis: the adjusted prevalence ratio was 0.96 (95% CI, 0.84 to 1.10) for any tap water and 1.03 (95% CI, 0.86 to 1.22) for bottled only (Tables 2 and 3).

Multivariable analyses indicated that non-Hispanic Black youth and Hispanic youth were about 30% relatively less likely to consume tap water when compared with non-Hispanic White youth. Youth from low-income families, with low parental education, and without past-year dental visit were 10% to 20% relatively less likely to consume tap water than their counterparts. Consuming bottled water only was 60% to 80% relatively more prevalent among youth who were non-Hispanic Black, Hispanic, or non-Hispanic Asian

than non-Hispanic White. The associations between consuming bottled water only and low family income and low parental education were no longer statistically significant in the multivariable model, although the direction of the associations remained.

Results from the linear regression model with mean plain tap or bottled water amount consumed were similar to those from the binomial regressions based on prevalence. The amount of plain tap water and the amount of bottled water were not significantly associated with fluoride content status in the bivariate or multivariable analysis (results not shown).

## Discussion

Overall, we found that at least 50% of youth consumed plain tap water on a given day, and the lowest prevalence (38%) was among non-Hispanic Black youth, Hispanic youth, and youth with low-parental education. It is important to remember that this estimate is a lower bound on fluoridated water consumption because it does not account for fluoridated tap water that is used to prepare other beverages or food. Even at this level of tap water consumption, fluoridation would still offer a positive return on investment. An economic evaluation based on the most recent US data on CWF cost found that, on average, CWF's return on investment was $20 (O'Connell et al. 2016). The value would be $7.6 to $10 at tap water uptake of 38% and 50%, respectively.

In our study, consuming tap water was not significantly associated with CWF status. This finding suggests that the health benefits of CWF might not incentivize youth to consume tap water. One reason could be lack of knowledge regarding the importance of oral health and/or the benefits of fluoridation. One study based on 2009 data found that half of US adults could correctly identify the purpose of CWF (Mork and Griffin 2015). Given that parents' oral health literacy may be associated with their children's oral health knowledge (Dudovitz et al. 2020), youth could also be unaware of their household water fluoridation status. Alternatively, CWF may not be an important determinant in youth's or parents' decision to consume tap water.

Our study suggests that factors other than CWF status may influence tap water consumption among youth. Perceptions regarding tap water safety may be one factor. Previous studies found that about two-thirds of US adults and youth perceived their local tap water as safe to consume (Onufrak, Park, Sharkey, Merlo, et al. 2014; Onufrak, Park, Sharkey, and Sherry 2014; Family et al. 2019). Mistrust was higher among non-Hispanic Blacks, Hispanics, and those with low socioeconomic status as compared with their counterparts of non-Hispanic Whites and those with higher socioeconomic status (Onufrak, Park, Sharkey, Merlo, et al. 2014; Onufrak, Park, Sharkey, and Sherry 2014; Pierce et al. 2019). Alternatively, non-Hispanic Black and Hispanic populations were more likely to consume bottled water than the non-Hispanic White population (Rosinger et al. 2018). Distrust regarding the safety of tap water, especially among minorities and the disadvantaged, could not be determined in our study. However, a growing body of case reports in various communities—such as Mebane, North Carolina; southern Texas; San Joaquin Valley, California; Washington, DC; and Flint, Michigan (Wilson et al. 2008; Balazs et al. 2011; Brown et al. 2011; Johnston et al. 2016; Sadler et al. 2017)—suggests that minorities and people in disadvantaged

communities are more vulnerable to and disproportionately affected by issues related to poor water quality. Factors contributing to the implicated sociodemographic disparities in access to safe drinking water can reflect a composite burden of various factors, such as natural ecologic characteristics, built environment and water infrastructure, community sociodemographic characteristics, community planning policies, and governance practices (Wilson et al. 2008; VanDerslice 2011; Balazs and Ray 2014; Sanders and Slade 2018; Ruckart et al. 2019). It is unfortunate that racial/ethnic minorities and lower-income persons who have higher distrust of their water quality would likely benefit the most from the caries-preventive benefits of fluoridated water, because they typically have higher caries risk and lower access to dental care (CDC 2019; Lin et al. 2019).

Given fluoridation's positive return on investment and that its benefits are readily available to all members of the community with fluoridated water, ensuring the safety of tap water and educating the public about its safety could extend the caries-preventive benefits of fluoridated water to those groups who could most benefit.

This study is subject to limitations. First, water consumption was self-reported. However, the NHANES dietary recall methodology was designed to enhance recall and lessen measurement error (Ahluwalia et al. 2016). Results from the 24-h recall over the weighted population is considered a reasonably accurate estimation of the mean usual intake of the population because its data collection throughout the year adjusts for the effects of random errors, including day-to-day variability, although misreporting or other systematic bias may exist (Ahluwalia et al. 2016). The NHANES dietary recall has incorporated the US Department of Agriculture's Automated Multiple-Pass Method since 2002. This method is a computer-assisted interview system with standardized probes and a 5-step multiple-pass process, and it is designed to minimize misreporting and enhance complete and accurate data collection (Ahluwalia et al. 2016).

Second, plain tap water consumption is a conservative estimate of total tap water consumption. NHANES does not collect information on consumption of tap water used in prepared beverages and foods. One study found that plain water consumption accounted for about half of total beverage consumption (including plain water) among US children (Vieux et al. 2019). Thus, consumption of fluoridated tap water was underestimated in this study.

Third, the percentage of the population on public water systems with fluoridated water in this study (45.4%) is notably lower than the 73% reported by the CDC, which was estimated from the Water Fluoridation Reporting System (CDC 2020a). We do not believe that this influenced the relationships between water fluoride content and plain tap water consumption in our analysis. The lower water fluoridation coverage reported in this study is likely due to 3 factors. First, we excluded youth receiving water with fluoride content >1.2 mg/L. Including them would have slightly increased the estimated coverage to 46.8%. Second, geographic variation in water fluoridation coverage (e.g., state coverage varied from 11.3% to 100%; CDC 2020a) may not be fully captured in the NHANES sampling frame and thus not be representative of the United States. Each NHANES 2-y cycle samples about 15 counties from approximately 3,000 US counties.

Finally, the water sample in NHANES was collected directly from the tap (i.e., not reported by the water system). Water filtration can remove fluoride if it uses reverse osmosis, ion exchange, or distillation systems (CDC 2020b). Although an estimated 40% of US households use water filtration systems (US Environmental Protection Agency 2015), there is limited information on the use of each type of system. Analysis of a convenience sample of parents in Salt Lake City, Utah, indicated that 30% of their children drank only filtered water and 10% used water filtration systems that removed most to all fluoride (Hobson et al. 2007). Use of systems that filter fluoride out of water would further decrease the percentage of the population consuming fluoridated public water who actually receive the benefits of fluoride.

In conclusion, just over half of youth consumed plain tap water on a given day. Consuming tap water was not significantly associated with CWF status. This study is the first to find that up to 50% of the population served by fluoridated water may not receive its full caries-preventive benefits due to not consuming tap water. Our findings support the need to identify and address barriers to tap water consumption and promote the health benefits of fluoridation.

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**Table 1.**

Population Distribution, US Youth Aged 2 to 19 y: NHANES, 2013 to 2016.

| Characteristic | Sample Size | Weighted % (95% CI) |
|---|---|---|
| **Patterns of plain tap and bottled water consumption** | | |
| **Tap only** | 1,995 | 43.8 (38.7 to 48.9) |
| **Both tap and bottled** | 376 | 8.8 (7.3 to 10.6) |
| **Bottled only** | 1,693 | 28.0 (24.4 to 31.9) |
| **Neither tap nor bottled** | 1,129 | 19.4 (17.0 to 22.1) |
| **Fluoride content in household tap water, mg/L** | | |
| **<0.6** | 2,825 | 54.6 (43.4 to 65.4) |
| **0.6 to 1.2** | 2,368 | 45.4 (34.6 to 56.6) |
| **Sex** | | |
| **Male** | 2,588 | 50.0 (48.2 to 51.7) |
| **Female** | 2,605 | 50.0 (48.3 to 51.8) |
| **Age, y** | | |
| **2 to 5** | 1,190 | 21.2 (19.5 to 22.9) |
| **6 to 11** | 1,839 | 34.0 (31.7 to 36.4) |
| **12 to 15** | 1,129 | 22.8 (20.8 to 24.8) |
| **16 to 19** | 1,035 | 22.1 (19.8 to 24.5) |
| **Race/ethnicity** | | |
| **White, non-Hispanic** | 1,325 | 48.9 (40.7 to 57.2) |
| **Black, non-Hispanic** | 1,319 | 15.8 (11.6 to 21.0) |
| **Hispanic** | 1,739 | 24.7 (19.4 to 30.9) |
| **Asian, non-Hispanic** | 452 | 5.1 (3.7 to 7.0) |
| **Others** | 358 | 5.5 (4.6 to 6.7) |
| **US born** [a] | | |
| **Yes** | 4,811 | 94.8 (93.5 to 95.9) |
| **No** | 381 | 5.2 (4.1 to 6.5) |
| **Family income level** [b] | | |
| **Low income** | 2,921 | 48.4 (42.5 to 54.3) |
| **Higher income** | 1,893 | 51.6 (45.7 to 57.5) |
| **Parental education** [c] | | |
| **≤ High school graduate/GED** | 2,002 | 31.7 (26.9 to 36.8) |
| **> High school graduate/GED** | 3,108 | 68.3 (63.2 to 73.1) |
| **Past-year dental visit** [d] | | |
| **Yes** | 4,035 | 78.5 (76.4 to 80.4) |
| **No** | 1,145 | 21.5 (19.6 to 23.6) |

Limited to 5,193 youth with data on plain tap and bottled water consumption and household tap water fluoride content, excluding 583 youth with household water fluoride content exceeding 1.2 mg/L or with private wells, rain cistern, or springs as the primary source of drinking water.

GED, General Educational Development; NHANES, National Health and Nutrition Examination Survey.

[a]Born in 1 of the 50 US states or the District of Columbia. Missing data ($n$ = 1) not included in the proportion calculation.

[b]Defined as the percentage of family income relative to the federal poverty level (FPL): low income <200% FPL and higher income ≥200% FPL. Missing data ($n$ = 379) not included in the proportion calculation.

[c]Highest education level of the household reference person or spouse, whichever is higher. Missing data ($n$ = 83) not included in the proportion calculation.

[d]Missing data ($n$ = 13) not included in the proportion calculation.

**Table 2.**

Prevalence of Consuming Plain Tap Water and APRs by Household Tap Water Fluoride Content and Sociodemographic Characteristics, US Youth Aged 2 to 19 y: NHANES, 2013 to 2016.

| Characteristic | Crude Prevalence of Consuming Plain Tap Water | | APR for Consuming Plain Tap Water (95% CI)[b] |
|---|---|---|---|
| | % (95% CI) | *P* Value[a] | |
| **Overall** | 52.6 (47.1 to 58.0) | | |
| **Fluoride content in household tap water, mg/L** | | 0.621 | |
| **<0.6** | 51.6 (44.3 to 58.9) | | 0.96 (0.84 to 1.10) |
| **0.6 to 1.2** | 53.8 (47.1 to 60.3) | | 1.00 |
| **Sex** | | 0.938 | |
| **Male** | 52.7 (47.2 to 58.0) | | 1.00 |
| **Female** | 52.5 (46.1 to 58.8) | | 1.01 (0.93 to 1.10) |
| **Age (years)** | | **0.029** | |
| **2 to 5** | 55.7 (47.7 to 63.4) | | 1.00 |
| **6 to 11** | 54.2 (47.9 to 60.3) | | 0.92 (0.84 to 1.02) |
| **12 to 15** | 53.5 (46.6 to 60.2) | | 0.92 (0.80 to 1.06) |
| **16 to 19** | 46.3 (40.7 to 51.9) | | **0.84 (0.74 to 0.96)** |
| **Race/ethnicity** | | **<0.001** | |
| **White, non-Hispanic** | 63.7 (58.1 to 69.0) | | 1.00 |
| **Black, non-Hispanic** | 37.8 (32.8 to 43.1) | | **0.68 (0.58 to 0.80)** |
| **Hispanic** | 37.8 (32.7 to 43.1) | | **0.71 (0.62 to 0.81)** |
| **Asian, non-Hispanic** | 57.2 (46.0 to 67.8) | | 1.00 (0.86 to 1.16) |
| **Others** | 57.9 (49.3 to 66.2) | | 1.00 (0.88 to 1.15) |
| **US born** [c] | | **0.044** | |
| **Yes** | 53.1 (47.6 to 58.6) | | 1.00 |
| **No** | 43.2 (33.8 to 53.1) | | 0.90 (0.73 to 1.09) |
| **Family income level** [d] | | **<0.001** | |
| **Low income** | 42.6 (36.9 to 48.6) | | **0.85 (0.77 to 0.94)** |
| **Higher income** | 62.6 (57.3 to 67.6) | | 1.00 |

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| Characteristic | Crude Prevalence of Consuming Plain Tap Water | | APR for Consuming Plain Tap Water (95% CI)[b] |
|---|---|---|---|
| | % (95% CI) | *P* Value[a] | |
| **Parental education** [e] | | | |
| **≤ High school graduate/GED** | 37.7 (33.1 to 42.5) | | **0.79 (0.71 to 0.88)** |
| **> High school graduate/GED** | 59.6 (54.1 to 64.9) | | 1.00 |
| **Past-year dental visit** | | **<0.001** | |
| **Yes** | 54.2 (48.6 to 59.8) | | 1.00 |
| **No** | 46.7 (41.1 to 52.4) | | **0.91 (0.84 to 0.99)** |

Limited to 5,193 youth with data on plain tap and bottled water consumption and household tap water fluoride content, excluding 583 youth with household water fluoride content exceeding 1.2 mg/L or with private wells, rain cistern, or springs as the primary source of drinking water.

APR, adjusted prevalence ratio; GED, General Educational Development; NHANES, National Health and Nutrition Examination Survey.

[a] *P* value from chi-square tests to assess differences in the prevalence across categories of characteristics.

[b] From a multivariable binomial regression model limited to those with data on all variables ($n = 4{,}760$). APRs in bold font indicate statistical significance ($P < 0.05$).

[c] Born in 1 of the 50 US states or the District of Columbia.

[d] Defined as the percentage of family income relative to the federal poverty level (FPL): low income <200% FPL and higher income ≥200% FPL.

[e] Highest education level of the household reference person or spouse, whichever is higher.

**Table 3.**

Prevalence of Consuming Plain Bottled Water Only and APRs by Household Tap Water Fluoride Content and Sociodemographic Characteristics, US Youth Aged 2 to 19 y: NHANES, 2013 to 2016.

| Characteristic | Crude Prevalence of Consuming Plain Bottled Water Only | | APR for Consuming Plain Bottled Water Only (95% CI)[b] |
|---|---|---|---|
| | % (95% CI) | *P* Value[a] | |
| **Overall** | 28.0 (24.4 to 31.9) | | |
| **Fluoride content in household tap water, mg/L** | | 0.647 | |
| **<0.6** | 28.6 (24.8 to 32.7) | | 1.03 (0.86 to 1.22) |
| **0.6 to 1.2** | 27.3 (22.3 to 33.0) | | 1.00 |
| **Sex** | | **0.049** | |
| **Male** | 26.0 (22.2 to 30.1) | | 1.00 |
| **Female** | 30.0 (25.6 to 34.8) | | 1.14 (0.98 to 1.32) |
| **Age, y** | | 0.061 | |
| **2 to 5** | 24.9 (19.7 to 30.9) | | 1.00 |
| **6 to 11** | 26.8 (23.1 to 30.8) | | 1.14 (0.91 to 1.43) |
| **12 to 15** | 28.3 (23.4 to 33.8) | | 1.19 (0.97 to 1.45) |
| **16 to 19** | 32.5 (27.3 to 38.2) | | **1.30 (1.08 to 1.57)** |
| **Race/ethnicity** | | **<0.001** | |
| **White, non-Hispanic** | 19.4 (15.7 to 23.6) | | 1.00 |
| **Black, non-Hispanic** | 35.0 (29.4 to 41.0) | | **1.63 (1.29 to 2.06)** |
| **Hispanic** | 40.2 (35.7 to 44.8) | | **1.80 (1.44 to 2.24)** |
| **Asian, non-Hispanic** | 36.2 (26.7 to 47.0) | | **1.64 (1.22 to 2.21)** |
| **Others** | 22.5 (17.6 to 28.3) | | 1.04 (0.79 to 1.37) |
| **US born** [c] | | **0.013** | |
| **Yes** | 27.5 (23.9 to 31.4) | | 1.00 |
| **No** | 37.6 (29.9 to 46.0) | | 1.06 (0.88 to 1.26) |
| **Family income level** [d] | | **<0.001** | |
| **Low income** | 33.4 (29.5 to 37.6) | | 1.15 (0.99 to 1.33) |
| **Higher income** | 22.5 (18.7 to 26.7) | | 1.00 |

| Characteristic | Crude Prevalence of Consuming Plain Bottled Water Only | | APR for Consuming Plain Bottled Water Only (95% CI)[b] |
|---|---|---|---|
| | % (95% CI) | *P* Value[a] | |
| **Parental education** [e] | | **<0.001** | |
| **≤ High school graduate/GED** | 36.1 (32.4 to 39.9) | | 1.13 (0.98 to 1.31) |
| **> High school graduate/GED** | 24.1 (20.3 to 28.3) | | 1.00 |
| **Past-year dental visit** | | 0.082 | |
| **Yes** | 27.3 (23.6 to 31.2) | | 1.00 |
| **No** | 30.7 (25.9 to 36.0) | | 1.06 (0.92 to 1.22) |

Limited to 5,193 youth with data on plain tap and bottled water consumption and household tap water fluoride content, excluding 583 youth with household water fluoride content exceeding 1.2 mg/L or with private wells, rain cistern, or springs as the primary source of drinking water.

APR, adjusted prevalence ratio; GED, General Educational Development; NHANES, National Health and Nutrition Examination Survey.

[a] *P* value from chi-square tests to assess differences in the prevalence across categories of characteristics.

[b] From a multivariable binomial regression model limited to those with data on all variables ($n = 4{,}760$). APRs in bold font indicate statistical significance ($P < 0.05$).

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