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Water Security Experiences and Water Intake Among Elementary Students at Low-Income Schools: A Cross-Sectional Study

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Abstract

Objective: To examine students' experiences of water security at school and how experiences relate to intake of water from different sources of water at school.

Design/Methods: In this cross-sectional study, 651 students in grades 3 to 5 in 12 low-income public elementary schools in the San Francisco area completed surveys about their daily intake of water from different sources of water at school, experiences of water security including safety, cleanliness, and taste of water at school, and their demographics. Multivariable linear regressions examined associations between students' water security experiences at school and reported intake from different sources of water at school.

Results: Approximately half of students were Latino (56.1%) and had overweight/obesity (50.4%). Most (74.5%) had some negative water security experience at school. Students drank from the school fountain or water bottle filling station a mean of 1.2 times/day (standard deviation [SD] = 1.4), sinks 0.2 times/day (SD = 0.7), tap water dispensers 0.2 times/day (SD = 0.6), and bottled water 0.5 times/day (SD = 1.0). In multivariable linear regression, students with more negative experiences of school water security drank less frequently from fountains (−0.5 times/day, *P* value < .001), but more frequently from tap water dispensers (0.1 times/day, *P* value = .040) and sinks (0.1 times/day, *P* value = .043), compared to students with no negative perceptions.

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Conclusions: On average, students had negative school water security experiences, which decreased their consumption of water from tap water sources. However, relationships between negative water security experiences and reported water intake appeared to be mitigated by water source. Schools should consider installing more appealing water sources to promote water intake.

Keywords

child; drinking; drinking water; schools; water quality

Drinking water, A zero-calorie beverage, in place of sugar-sweetened beverages can decrease intake of added sugars and calories and may help prevent obesity.[1–5] In addition, drinking an adequate amount of water is associated with positive health outcomes including fewer dental caries, better cognitive function, adequate hydration levels, and improved bowel and bladder function.[1] Despite this, 75% of school-aged children in the United States do not consume the recommended daily allowances for water,[6] resulting in an estimated plain water deficit of 900 to 1500 mL/day.[7]

Inadequate plain water intake and lower levels of hydration are more prevalent among lower income and ethnic minority populations.[8–10] Distrust and avoidance of tap water could contribute to these disparities in consumption of water. In the United States, 20% of African-Americans and 16% of Hispanics believe that their tap water is unsafe to drink, compared to 11% percent of Whites.[11] Water infrastructure failures may have contributed to distrust of tap water.[10,12] A recent nationwide study found increasing tap water avoidance in Black and Hispanic populations following the Flint Water Crisis.[10] In migrant populations, avoidance of tap water could stem from prior experiences living in countries with poor tap water quality.[13] In addition to leading to inadequate drinking water intake, low-income and minority populations who avoid tap water are also more likely to spend limited resources to purchase bottled water that often lacks fluoride that helps strengthen teeth and prevents dental caries.[14,15]

Negative perceptions of tap water safety have also been associated with increased consumption of sugar-sweetened beverages.[11,16] Children and young adults who drink no plain water consume twice as many calories from sugar-sweetened beverages as those who consume plain water.[17] Given that Black and Hispanic children and those from low income households consume more sugar-sweetened beverages, they could also disproportionately suffer from negative health issues associated with high consumption of such beverages such as obesity, diabetes, nonalcoholic fatty liver disease, abnormal cholesterol levels, and dental caries.[18–23]

As children spend much of their waking hours at school, the location is a fitting setting for promoting intake of water. Prior studies have found that increasing access to appealing drinking water sources and providing drinking vessels such as cups and reusable drinking water bottles and promoting water intake in school can increase student intake of water and decrease consumption of sugar-sweetened beverages.[4,24,25] In this study, we leverage data from Water First, a cluster randomized controlled trial that sought to examine how water access and promotion in schools affects students' intake of food and beverages, and obesity. We use cross-sectional data from this trial to examine how students' experiences of water security at school relate to their intake of water in the setting. While studies have explored the relationship between drinking water perceptions and water intake,[11,16,26] to our knowledge, no studies have examined how drinking water security experiences at school impact students' intake of water from different water sources. We hypothesized that students with more negative experiences of water security would consume less water overall and drink water less frequently from fountains and other taps, compared to students with more positive water security experiences.

Methods

Study Design and Participants

Data were collected as part of Water First, a 5-year-long cluster-randomized controlled trial involving 26 low-income public elementary schools in the San Francisco Bay Area that examined how water access and promotion in schools affects students' food and beverage intake, and obesity. Schools were eligible if more than half of the student population received free/reduced-price meals through the National School Lunch Program (proxy for serving low-income students) and had at least 65 fourth grade students who were the target of classroom-based water education and promotion activities, and evaluation. Trained research staff recruited participants by presenting the Water First project to fourth grade classes and distributing study information and permission forms to students within the study schools. Details on the study design, recruitment, and protocol are described elsewhere.[27]

Data Collection Procedures

To examine the impact of the intervention on students' beverage intake and weight status, students in fourth grade or combination (third/fourth or fourth/fifth) classes completed self-reported survey questions about their beverage consumption habits, physical activity, screen time, and sociodemographic information at baseline, 7 months, and 15 months after the start of the study. Questions about students' experiences of drinking water security at school and at home were included on the 15-month follow-up survey only. School-level demographic data were obtained using data compiled by the California Department of Education.[28]

This cross-sectional study is based on data collected during the first 2 cohorts of the Water First study. In 2016 and 2017, a total of 774 students in these cohorts completed baseline surveys and height and weight measurements. Of these students, a total of 651 students completed the 15-month follow-up (2017 and 2018) assessments for a retention rate of 84%.

Parental permission and student assent were obtained for study participation. This study was approved by the Institutional Review Board at Stanford University and the Human Research Protection Program at the University of California, San Francisco.

Study Measures

Outcome Variable—Researchers used a modified version of the validated Beverage and Snack Questionnaire to assess reported frequency of tap water intake at school from different drinking water sources in the last week.[29] Tap water intake was assessed through the following questions: "When you were at school, how often did you drink tap water from a fountain or water bottle filling station in the past week?" "When you were at school, how often did you drink tap water from a sink or refrigerator door in the past week?" "When you were at school, how often did you drink tap water from a tap water dispenser in the past week?" Overall frequency of tap water consumed at school in the past week was determined by summing the responses into one variable.

Frequency of bottled water consumed in the past week at school was assessed by the following question: "When you were at school, how often did you drink bottled water in the past week?"

The response choices for all beverage intake questions were "Never," "1 per week," "2 to 4 per week," "5 to 6 per week," "1 per day," "2 to 3 per day," and "4+ per day."

Key Independent Variables—Researchers modified the validated Child Food Security Assessment to assess students' experiences of tap water security at school.[30] Students were asked if they experienced the following statements many times, 1 or 2 times, or never in the last year: "I don't drink the water from sinks or fountains at school because it is not safe to drink," "I don't drink the water from sinks or fountains at school because it looks dirty," "I don't drink the water from sinks or fountains at school because it tastes bad."

Possible responses were scored as 0 (none), 2 (1 or 2 times), or 4 (many times). The drinking water security at school experience score was calculated by summing the scores for the individual questions for a range of 0 to 12. Participants were rated as having no negative experience if their drinking water security score was 0. Participants were rated as having some negative experience if their drinking water security score was greater than 0 and less than or equal to 4. Participants were rated as having a more negative experience if their drinking water security score was greater than 4.

Control Variables—Students' self-reported sociodemographic variables included their race/ethnicity (American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, Black or African American, Latino, or Hispanic, Non-Hispanic White, and Mixed), age (7 years old, 8 years old, 9 years old, 10 years old, or 11 years old), and sex (male or female).

Researchers used a modified version of the validated Physical Activity Questionnaire for Older Children and Adolescents to assess physical activity in the past week.[31] Physical activity in the past week was assessed by asking the students to select which statement described their level of physical activity in the last 7 days: "All or most of my free time was spent doing things that involve little physical effort that made me breathe hard or sweat," "I sometimes (1−2 times last week) did physical things in my free time," "I often (3−4 times last week) did physical things in my free time," "I quite often (5−6 times last week) did physical things in my free time," or "I very often (7 or more times last week) did physical things in my free time."

Screen time was measured by asking the participants how much time they spent doing the following activities: playing video or computer games, watching movies or programs on TV or computer, and doing other things on the computer or phone, like searching google/

internet, Facebook/Twitter, emailing, texting, etc. The response choices for all screen time questions were "None at all yesterday," "Less than 1 hour yesterday," "1 or more hours but less than 2 hours yesterday," "2 or more hours but less than 3 hours yesterday," "3 or more hours but less than 4 hours yesterday," "4 or more hours but less than 5 hours yesterday," or "5 or more hours yesterday."

Trained research staff measured students' height and weight using calibrated scales and stadiometers as outlined in the National Health and Nutrition Examination Survey Anthropometry Procedures Manual.[32] Height and weight measurements were converted to body mass index-for-age-and-sex z-scores and percentiles using growth charts produced by the Centers for Disease Control and Prevention.[33] Participants were classified as Normal weight (fifth to 85th percentile for age), Underweight (<fifth percentile for age), Overweight (85th−94th percentile for age), or Obese (95th percentile for age or greater) based on Centers for Disease Control and Prevention growth charts.[33]

Analysis

Data analysis was conducted in Stata/SE 15.1 (Stata-Corp, College Station, Tex). We used the prior literature and range checks and examined variable distributions to establish appropriate cut-points for measures of water security experiences and reported water intake. Categories for the water security experiences score (no negative, some negative, more negative) were based on the distribution of responses. Descriptive analyses were used to report the means and proportions of outcomes, predictors and covariates (students' age, sex, race/ethnicity, physical activity, screen time, weight status, and intervention status). Regression models with bootstrapping were used to assess the unadjusted association of reported daily water intake at school and water security experiences and covariates of interest. Multivariable linear regression models including covariates were used to assess the adjusted association of student's daily intake of water from school water sources and their water security experiences at school. Bootstrapping was used to accommodate non-normally distributed outcomes and enabled reporting of outcomes on an interpretable scale (eg, intake per day). A P value less than .05 was considered statistically significant.

Results

Descriptive Statistics

Students' sociodemographic characteristics, reported water intake patterns, and school drinking water security experiences appear in Table 1. The sample was 51.8% male. Students' mean age was 10.6 years (standard deviation [SD] = 0.3). Overall, 56.1% of students were Mexican American or Latino, 17.2% were Asian or Pacific Islander, 15.4% were 2 or more races or American Indian, 8.0% were White, and 3.4% were Black/African American. Half (50.4%) of students were either overweight or obese. Overall, 74.5% of students had a negative experience of water security at school in the past year, with an increase over time (69.9% in year one and 77.7% in year 2; $P = .028$). On average, students drank from the fountain or water bottle filling station at school 1.2 times per day (SD = 1.4), the sink 0.2 times per day (SD = 0.7), tap water dispenser 0.2 times per day (SD = 0.6), and bottled water 0.5 times per day (SD = 1.0).

Unadjusted Association of Water Intake at School and School Drinking Water Security Experience

In unadjusted analyses, students with negative school water security experiences drank water from fountains fewer times per day compared to students with no negative experiences of tap water security at school (more negative 0.9 [SD = 1.2] vs no negative 1.5 [SD = 1.6], $P < .001$; some negative 1.2 [SD = 1.4] vs no negative 0.9 [SD = 1.2], $P = .048$; Table 2). Students with some negative experiences of tap water security at school drank from school tap water dispensers more times per day compared to students with no negative experience (0.2 [SD = 0.7] vs 0.1 [SD = 0.4], $P = .042$). Students with more negative school water security experiences drank water from all tap water sources fewer times per day than those with more favorable experiences (1.3 [SD = 1.8] vs 1.8 [SD = 1.7], $P = .003$). Frequency of daily intake from all school tap water sources was lower among females and older students but higher among those from Latino backgrounds, who primarily spoke Spanish or some other language at home, and among those with a higher body mass index z-score (Table 2).

Adjusted Association of Water Intake at School and School Drinking Water Security Experience

In adjusted analyses, students with more negative experiences of water security at school drank from water fountains fewer times per day compared to students with no negative experiences (−0.5 [confidence interval {CI}: −0.8, −0.3], $P < .001$; Table 3). Students with some negative experience of water security at school drank water more frequently from sinks (0.1 [CI: 0.004, 0.3], $P = .043$) and tap water dispensers (0.1 [CI: 0.005, 0.2], $P = .040$) when compared to students with no negative water security experiences. Female students drank water less frequently from school fountains and tap water sources overall. Students of Asian or Pacific Islander backgrounds drank bottled water more frequently at school when compared to their white peers (0.3 [CI: 0.05, 0.6], $P = .019$). Older students drank less frequently from fountains (−0.4 [CI: −0.07, −0.1], $P = .006$), tap water dispensers (−0.1 [CI: −0.03, −0.008], $P = .038$), and all tap water sources (−0.6 [CI: −1.0, −0.2], $P = .002$) as compared to younger students (Table 3).

Discussion

This cross-sectional analysis of data from a cluster randomized controlled trial of a water promotion and access intervention in low-income elementary schools is the first to evaluate how students' experiences of water security at school is associated with their intake of water from various water sources at school. Students who had negative water security experiences at their school drank from water fountains less frequently than students who had no negative experiences of water security. Moreover, we also observed that students with more negative water security experiences drank from sinks and tap water dispensers more frequently than students without such experiences.

We found that approximately 3 in 4 students had negative experiences of water security at school, with increases over time as seen in previous studies.[10,15] These findings are similar to a 2014 study of low-income middle schools in the Los Angeles area in which 80% of students had some negative perception of tap water at school.[26] Overall, the frequency of reported water intake at school among students was low, with water fountains or water bottle filling stations being the most frequently used source of drinking water. On average, students drank from the fountain or water bottle filling station at school 1.2 times per day. Previous studies have reported low water intake among children and adolescents.[34] Since students spend a large amount of their waking hours in schools and adequate intake of water is associated with positive health effects, such as better cognitive function, schools offer an important setting for increasing water intake among children.[1]

We found that bottled water was the second most frequently consumed source of water in schools. Given that most elementary schools, including the ones in this study, do not make bottled water available at no cost in schools, students who drank bottled water in study schools likely brought it from home. This is concerning for several reasons. First, bottled water is more costly than tap water; families who buy bottled water rather than drinking tap water or filtered water are incurring extra expenses diverting funds from other necessities.[7] Second, single use bottled water has an environmental impact.[7] Third, most bottled water on the market does not contain fluoride which can help prevent dental caries.[14] We also found that Asian or Pacific Islander students were more likely to consume bottled water in school compared to their peers. Testing of tap water quality in schools and publicizing safety of tap water for students, staff, and families, as was a focus in the Water First intervention, could be an avenue for countering negative water security experiences and could help decrease reported bottled water intake.

Students who had more negative school water security experiences drank from fountains 0.5 fewer times per day than students without these experiences. Students with more negative water security experiences were also more likely to drink from tap water dispensers and sinks compared to students with no negative perception of tap water. While the increase in frequency of consumption from dispensers and sinks was low daily, when extrapolated to consumption in the past week or year, these amounts could be clinically significant. Given such findings, increasing the availability of non-fountain tap water sources in schools might be an avenue for increasing water intake and promoting water security at school. Other measures, such as providing cups or reusable water bottles so students can drink larger quantities of water or allowing more time to drink water during breaks, recess, and lunch could also encourage greater water intake at school.

We also found that female students were generally less likely to consume tap water overall and less likely to use school tap water sources such as fountains and tap water dispensers. This finding is consistent with other studies that also found lower overall reported water intake among female students.[26] We also found that student characteristics such as increasing age and racial demographics influenced the types of water students consumed at school. Older students were less likely to consume tap water from fountains and consumed less tap water overall. This is in contrast to another study that found that although older students had fewer intentions to drink water, they still consumed more water.[26] These divergent findings could be due to that study surveying a middle school aged cohort. We also found that students of Asian or Pacific Islander backgrounds drank more bottled water while in school. While other studies have noted higher consumption of bottled water among Black and Hispanic populations, to our knowledge, no other study has found an association of increased bottled water consumption while in school among Asian or Pacific Islander populations.[35,36] Given the disparities in water intake by gender, age, and racial background, a more tailored approach in addressing the particular concerns of those students might be warranted.

This study has many strengths including a large, ethnically diverse sample with a relatively high response rate. And it is the first study to examine how water security experiences in schools relate to students' intake of drinking water from different sources. Despite these strengths, this study has some limitations. First, this study was geographically limited to the San Francisco Bay Area and included school districts that were predominately of students from low-income and Latino backgrounds. Therefore, findings might not be generalizable to other locations or groups. While other studies have found that individuals from lower-income backgrounds are less likely to drink tap water, we do not have a measure of students' household income level in this study. This study also does not include consumption amounts. Thus, we cannot estimate the quantity of water being consumed by students in school. Last, as this study relies on self-reported water security experiences and beverage intake, social desirability bias is possible.

Conclusion

Frequency of reported water intake at school is low among students ranging from 0.2 to 1.2 times per day, depending on the drinking water source. Negative experiences of water security at school may contribute to low reported water intake at school. However, providing tap water dispensers or other appealing tap sources could mitigate the impact of negative experiences of water security on water intake. Given the observed variation in reported water intake from different tap water sources by gender, race/ethnicity, age, and weight status, a one-size fits all approach may not be successful in reducing inequities in water intake at school. Schools should consider designing drinking water access and promotion interventions that are tailored to students' perceptions, backgrounds, and culture.

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What's New

Children spend a majority of their waking hours at school, making the setting important for healthy hydration. This study is novel in its examination of how experiences of water security at school influence children's reported water intake from different sources of water at school.

Table 1.

Sociodemographic Characteristics, Water Intake Patterns, and Experiences of Drinking Water Security of Elementary School Students in Study Schools, San Francisco Bay Area, California 2017 to 2018

Student Characteristics	**n = 651, n (%)**
Mean age in years (SD)	10.6 (0.3)
Sex (%)	
Male	337 (51.8)
Female	314 (48.2)
Race/ethnicity (%)	
White	52 (8.0)
Asian or Pacific Islander(API)	112 (17.2)
Black	22 (3.4)
Latino	365 (56.1)
Other (American Indian/Two or more races)	100 (15.4)
Weight status (%)	
Underweight	17 (2.6)
Normal	306 (47.0)
Overweight	137 (21.0)
Obese	191 (29.4)
Mean BMI Z-score (SD)	0.89 (1.1)
Physical activity times/week (%)	
0 times	65 (10.0)
1–2 times	204 (31.3)
3–4 times	149 (22.9)
5–6 times	104 (16.0)
7 or more times	127 (19.5)
Mean screen time yesterday in hours (SD)	3.98 (3.4)
Intake of various types of water at school, mean times/day (SD)	
Fountain or water bottle filling station	1.17 (1.4)
Sink	0.22 (0.7)
Tap water dispenser	0.19 (0.6)
Bottled water	0.52 (1.0)
Experiences of drinking water security at school	
Mean experience score, range 0–12 (SD) *	4.45 (3.9)

SD indicates standard deviation; BMI, body mass index.

* The water security at school experience score was calculated by summing participant response to the following questions. Please say whether this happened to you many times, 1 to 2 times, or never in the last year (12 months): I don't drink the water from sinks or fountains at school because it is not safe to drink," "I don't drink the water from sinks or fountains at school because it looks dirty," and "I don't drink the water from sinks or fountains at school because it tastes bad." Possible responses were coded as none (0), 1 or 2 times (2), or many times (4). Range of score: 0 to 12.

Table 2.

Unadjusted Association of Elementary Students' Daily Water Intake From Various School Water Sources With Experiences of School Drinking Water Security and Student Characteristics, San Francisco Bay Area, California 2017 to 2018*

	Unadjusted Mean Times Per Day Students Drank Water From Various School Water Sources								
Characteristic	Fountain (SD)	*P* Value	Sink (SD)	*P* Value	Tap Water Dispenser (SD)	*P* Value	All Tap Water Sources† (SD)	*P* Value	Bottled Water (SD)	*P* Value
Negative experience of water security‡										
None (n = 166)	1.5 (1.6)		0.1 (0.5)		0.1 (0.4)		1.8 (1.7)		0.5 (1.0)	
Some (n = 226)	1.2 (1.3)	.048	0.3 (0.8)	.063	0.2 (0.7)	.042	1.7 (2.0)	.74	0.5 (1.0)	.82
More (n = 259)	0.9 (1.2)	<.001	0.2 (0.8)	.21	0.3 (0.7)	.13	1.3 (1.8)	.003	0.6 (1.1)	.37
Age (β, 95% CI)	−0.3 (−0.6,−0.03)	.031	−0.04 (−0.2, 0.1)	.65	−0.09 (−0.2, 0.03)	.16	−0.5 (−0.9, −0.05)	.027	0.05 (−0.2, 0.3)	.66
Sex										
Male	1.4 (1.5)		0.3 (0.8)		0.2 (0.7)		1.9 (2.1)		0.5 (1.1)	
Female	0.9 (1.2)	<.001	0.2 (0.6)	.21	0.2 (0.6)	.34	1.2 (1.5)	<.001	0.5 (0.9)	.75
Race and ethnicity										
White	1.0 (1.3)		0.1 (0.4)		0.1 (0.2)		1.2 (1.4)		0.3 (0.7)	
API	0.7 (1.2)	.20	0.2 (0.7)	.24	0.2 (0.8)	.066	1.2 (2.0)	.93	0.6 (1.1)	.016
Black	1.3 (1.2)	.38	0.2 (0.5)	.71	0.1 (0.3)	.42	1.6 (1.3)	.26	0.8 (1.3)	.13
Latino	1.4 (1.4)	.079	0.3 (0.8)	.048	0.2 (0.7)	.002	1.8 (1.9)	.004	0.5 (1.0)	.072
Other§	1.0 (1.4)	.91	0.1 (0.6)	.81	0.1 (0.4)	.39	1.2 (1.7)	.89	0.5 (1.0)	.12
Primary language spoken at home										
English	0.9 (1.2)		0.2 (0.6)		0.1 (0.5)		1.2 (1.6)		0.5 (1.0)	
Spanish	1.2 (1.4)	.031	0.2 (0.6)	.60	0.3 (0.8)	.12	1.7 (1.8)	.016	0.4 (0.8)	.36
English/Other	1.3 (1.5)	<.001	0.3 (0.8)	.051	0.2 (0.7)	.15	1.8 (1.9)	<.001	0.6 (1.1)	.37
BMI z-score (β, 95% CI)	0.1 (0.06, 0.2)	.001	0.02 (−0.03, 0.06)	.47	0.04 (−0.007, 0.09)	.094	0.2 (0.08, 0.3)	.001	0.02 (−0.05,0.1)	.59
Intervention group										
Control	1.0 (1.3)		0.2 (0.7)		0.1 (0.5)		1.3 (1.6)		0.5 (1.0)	
intervention	1.3 (1.5)	.001	0.3 (0.8)	.067	0.3 (0.8)	<.001	1.9 (2.0)	<.001	0.6 (1.1)	.43

SD indicates standard deviation; CI, confidence interval.

[*] Bootstrap linear regression used to assess the unadjusted association of daily water intake with covariates.

[†] All tap water sources at school include fountains, sinks, and dispensers.

[‡] Cut-offs were no negative experience: score=0, some negative experience: $2 \leq$ score ≤ 4, more negative experience: score ≥ 6.

[§] Other includes participants with American Indian ancestry or 2 or more races.

Table 3.

Adjusted Association of Elementary Students' Daily Water Intake From Various School Water Sources With Experiences of School Drinking Water Security and Student Characteristics, San Francisco Bay Area, California 2017 to 2018*

	Adjusted Mean Times Per Day Students Drank Water at School									
Characteristic	**Fountain (95% CI)**	***P* Value**	**Sink (95% CI)**	***P* Value**	**Tap Water Dispenser (95% CI)**	***P* Value**	**All Tap Water Sources† (95% CI)**	***P* Value**	**Bottled Water (95% CI)**	***P* Value**
Negative experience of water security‡										
None	Reference		Reference		Reference		Reference		Reference	
Some	−0.3 (−0.6, 0.003)	.052	0.1 (0.004, 0.3)	.043	0.1 (0.005, 0.2)	.040	−0.04 (−0.4, 0.3)	.85	−0.0005 (−0.2, 0.2)	.996
More	−0.5 (−0.8, −0.3)	<.001	0.1 (−0.02, 0.2)	.092	0.1 (−0.003, 0.2)	.058	−0.3 (−0.7,0.01)	.059	0.1 (−0.08, 0.3)	.25
Age (β, 95% CI)	−0.4 (−0.7, −0.1)	.006	−0.08 (−0.2, −0.09)	.38	−0.1 (−0.3, −0.008)	.038	−0.6 (−1.0,−0.2)	.002	−0.001 (−0.2, 0.2)	.99
Sex										
Male	Reference		Reference		Reference		Reference		Reference	
Female	−0.5 (−0.7, −0.2)	<.001	−0.04 (−0.2, −0.07)	.47	−0.04 (−0.1,0.06)	.43	−0.5 (−0.8, −0.3)	<.001	0.01 (−0.2, 0.2)	.90
Race and ethnicity										
White	Reference		Reference		Reference		Reference		Reference	
API	−0.3 (−0.8, 0.1)	.13	0.1 (−0.06, 0.3)	.20	0.1 (−0.04, 0.3)	.15	−0.09 (−0.6, 0.4)	.73	0.3 (0.05, 0.6)	.019
Black	0.4 (−0.2, 1.0)	.21	0.008 (−0.3, 0.3)	.95	−0.009 (−0.2, 0.2)	.92	0.4 (−0.3, 1.1)	.23	0.2 (−0.2, 0.7)	.36
Latino	0.2 (−0.2, 0.6)	.25	0.1 (−0.04, 0.3)	.15	0.07 (−0.02, 0.2)	.14	0.4 (0.02, 0.8)	.041	0.2 (−0.08, 0.4)	.19
Other§	−0.02 (−0.5, 0.4)	.93	0.02 (−0.2, 0.2)	.79	0.006 (−0.1, 0.1)	.91	0.01 (−0.5, 0.5)	.96	0.2 (−0.1, 0.5)	.21
BMI z score	0.09 (0.003, 0.2)	.043	0.02 (−0.03, 0.07)	.48	0.04 (−0.007, 0.08)	.10	0.1 (0.02, 0.3)	.022	0.03 (−0.05,0.1)	.51
Intervention group										
Control	Reference		Reference		Reference		Reference		Reference	
intervention	0.2 (0.03, 0.5)	.024	0.1 (−0.2, 0.2)	.11	0.2 (0.07, 0.3)	.001	0.5 (0.2, 0.8)	<.001	0.09 (−0.08, 0.3)	.30

CI indicates confidence interval.

*Multivariable bootstrapping linear regressions models with adjustment for student characteristics above along with student physical activity, screen time, and school intervention status were used to assess the association of daily water intake with school water security experience and student characteristics.

†All tap water sources at school include fountains, sinks, and dispensers.

[‡]Cut-offs were no negative experience: score=0, some negative experience: 2 ≤ score ≤ 4, more negative experience: score ≥ 6.

[§]Other includes participants with American Indian ancestry or 2 or more races.