# Middle School Student Attitudes About School Drinking Fountains and Water Intake

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## Abstract

***Objective:*** To describe middle school student attitudes about school drinking fountains, investigate whether such attitudes are associated with intentions to drink water at school, and determine how intentions relate to overall water intake.

***Methods:*** Students (n = 3211) in 9 California middle schools completed surveys between 2009 and 2011. We used multivariate linear regression, adjusting for school sociodemographic characteristics, to examine how attitudes about fountains (5-point scale; higher scores indicating more positive attitudes) were associated with intentions to drink water at school and how intentions to drink water at school were related to overall water intake.

***Results:*** Mean age of students was 12.3 (SD = 0.7) years; 75% were Latino, 89% low income, and 39% foreign born. Fifty-two percent reported lower than recommended overall water intake (<3 glasses/day), and 30% reported that they were unlikely or extremely unlikely to drink water at school. Fifty-nine percent reported that school fountains were unclean, 48% that fountain water does not taste good, 33% that fountains could make them sick, 31% that it was not okay to drink from fountains, and 24% that fountain water is contaminated. In adjusted analyses, attitudes about school drinking fountains were related to intentions to drink water at school ($\beta = 0.41$; $P < .001$); intentions to drink water at school were also associated with overall water intake ($\beta = 0.20$; $P < .001$).

***Conclusions:*** Students have negative attitudes about school fountains. To increase overall water intake, it may be important to promote and improve drinking water sources not only at school but also at home and in other community environments.

**Keywords:** adolescents; hydration; nutrition; obesity prevention; schools

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## What's New

Although most schools provide water via fountains, little is known about student attitudes about fountains. In this study, middle school students had negative attitudes about fountains; such attitudes were associated with lower intentions to drink water at school.

Drinking water instead of sugar-sweetened beverages (SSBs) may be associated with a number of health benefits for children and adolescents. Cross-sectional data suggest that children and adolescents could reduce their caloric intake by 235 kcal per day if they drank water in place of 100% fruit juice and SSBs.[1] Several randomized controlled trials focused on reducing SSB intake among children and adolescents increased their intake of water,[2–8] decreased their intake of SSBs,[4,5] and reduced their prevalence of overweight and obesity[3–5] as well as dental caries.[9]

According to the 2011 Institute of Medicine's Dietary Reference Intakes, adequate intake levels for water in any form are 2.1 L per day for adolescent girls and 2.4 L per day for adolescent boys.[10] According to these cutoffs, nearly two-thirds of adolescents report low water intake (<3 glasses of water per day),[11] and a quarter do not drink any plain water.[12] Although tap water provides a low-cost, noncaloric beverage that is readily available in most settings, many youth do not drink tap water, with the majority opting for bottled water instead.[12–16] Tap water intake is lowest among Latino adolescents, a group that is at higher obesity risk than are white adolescents.[12,16]

Schools, where youth spend the majority of their time, offer a potential setting for increasing water intake. If students increase their water intake in schools, they can maintain a healthy weight, reduce dental caries, and improve their readiness to learn.[17–19] Studies suggest that students may begin their school day in a state of dehydration;[20] provision of water to students in schools may improve their cognitive function.[17–19]

Most US schools offer water via drinking fountains,[21–23] but qualitative studies suggest that students do not drink from fountains because they consider the fountains unclean or the water unpalatable or unsafe.[24,25] Although there are a few studies regarding student attitudes of

school drinking fountains,[24,25] there are no studies of Latino student attitudes of school fountains. In previous studies, mainly of adults, perceived health risks, taste preferences, and convenience have been cited as reasons why individuals may not drink tap water but opt for bottled water or other drinks instead.[26–28]

According to social-cognitive theories of behavior change, such as the theory of planned behavior, an individual's attitude toward a behavior in part influences his or her intention to perform the behavior, and that intention is in turn related to the behavior.[29] In order to inform school-based interventions to increase water intake, we sought to examine whether middle school student attitudes about school drinking fountains are associated with intentions to drink water at school. We then explored whether student intentions to drink water at school were associated with their overall daily water intake. Because adolescents who are Latino are more likely to drink SSBs[30] and be overweight and obese[31] than are adolescents who are white, we focused on middle school students in a predominantly Latino school district.

## METHODS

### STUDY DESIGN AND PARTICIPANTS

Participants were students taking part in a randomized controlled trial of Students for Nutrition and eXercise (SNaX), an obesity prevention intervention delivered to students in 9 middle schools in Los Angeles, California, from 2009 to 2011.[8] Seventh grade students from the intervention and control schools were eligible to complete surveys at baseline before the implementation of SNaX at the intervention schools. Among 4022 eligible students in these schools, 80% (n = 3211) completed baseline surveys. The most common reasons why students did not complete surveys were parental refusal and student absences, including those related to school field trips. Parents provided consent for their child's participation; students provided assent. The RAND institutional review board, the Boston Children's Hospital institutional review board, and the Committee for External Research Review at the Los Angeles Unified School District approved the study.

### PREDICTOR AND OUTCOME VARIABLES

In order to test our hypotheses, informed by social-cognitive theories of behavior change, we first examined whether student attitudes about school drinking fountains were related to their intentions to drink water at school. We then assessed if intentions to drink water at school were associated with overall daily water intake among students. We developed these outcome and predictor variables based on previous qualitative studies of drinking water access we conducted in California schools and cognitive interviews that we conducted with 10 middle school students in the Los Angeles region.[24,32] (Cognitive interviewing is a technique used to decrease response error for surveys in which we asked students to reflect on their understanding of survey questions and their thought processes for answering questions in a particular way.)

To examine attitudes about drinking fountains at school, students were asked whether they "strongly agreed," "agreed," "neither agreed nor disagreed," "disagreed," or "strongly disagreed" with the following statements: "It is fine for me to drink water from fountains at my school," "The water that comes out of the fountains at my school could make me sick," "The drinking fountains at my school typically have dirt, gum, paper, or other trash in them," "The water that comes out of the fountains at my school tastes good," and "The water that comes out of the fountains at my school contains unhealthy chemicals like lead." For these 5 drinking fountain attitude items, we conducted exploratory factor analyses. Using a factor loading cut off of 0.60,[33] we retained all items except the item, "The drinking fountains at my school typically have dirt, gum, paper, or other trash in them," which had a factor loading of 0.53. On the basis of these analyses, responses from the 4 remaining items were averaged to create a scale in which higher values indicated more positive attitudes toward drinking water ($\alpha = 0.70$).

To assess student intentions to drink water at school, we asked students to report, "How likely is it that you will drink water the next day you are at school?" Response options included "extremely likely," "likely," "neither," "unlikely," or "extremely unlikely." The wording of this question was slightly different for the first pair of schools: "How likely is it that you will drink tap water or water from a drinking fountain the next day you are in school?" When we conducted sensitivity analyses in which we dropped the first 2 schools and tested the same regression models, results were consistent. Thus, here we present only the findings from the complete set of schools.

To examine daily water intake, we asked students to estimate their daily water intake: "Yesterday, how many glasses of water did you drink? Include tap water (from a sink or fountain) or bottled water like Aquafina. Do not include flavored sweetened water." Response options for this question included "4 or more glasses," "3 glasses," "2 glasses (1 bottle = 2 glasses)," "1 glass (1 cup = 1 glass)," "less than 1 glass (for example, a sip or a few sips from a fountain)," and "I did not drink water yesterday." Students were also asked whether they were at school on the day before the survey; analyses for the water intake outcome variable were restricted to students who answered "yes." Surveys were not administered on Mondays so that students would report daily water intake for a school day.

Sociodemographic covariates included student age in years, gender, race/ethnicity (African American, Latino/Hispanic, and other, which consisted predominately of whites), eligibility for free and reduced-price price meals through the US Department of Agriculture's National School Lunch Program (a proxy for low-income status), primary language spoken at home (English vs not English), and foreign-born status (US born vs foreign born). Covariates for this study were selected on the basis of their association with water intake patterns in previous studies.[14–16]

**Table 1.** Sociodemographic Characteristics of Middle School Students in Study Schools, Los Angeles, California*

| Characteristic | Value |
|---|---|
| Age, y, total no. of responses | 3210 |
| Mean age, y (SD) | 12.3 (0.7) |
| Sex, total no. of responses | 3211 |
| Male | 1653 (51.2%) |
| Female | 1558 (48.8%) |
| Race/ethnicity, total no. of responses | 3197 |
| Latino | 2386 (75.2%) |
| Black | 339 (10.3%) |
| Other | 472 (14.4%) |
| Eligible for free and reduced-price lunch | 2235 (89.4%) |
| Language spoken at home, total no. of responses | 3049 |
| English | 1474 (48.2%) |
| Spanish | 1398 (46.1%) |
| Other | 177 (5.7%) |
| Born in the United States | 1916 (60.5%) |

*Sociodemographic characteristics are those of students who responded to surveys, not entire population of students in schools.

### DATA ANALYSIS

We used descriptive statistics to summarize means and proportions for our main predictor and outcome variables. We used weighted least squares regression to examine the bivariate association of student attitudes about drinking fountains and our covariates with intentions to drink water at school. We also examined the bivariate association of student intentions to drink water at school and our covariates with overall water intake. We then used multivariate models, controlling for sociodemographic covariates, to examine the association of student attitudes about drinking fountains with intentions to drink water at school as well as the relationship between intentions to drink water at school and overall water intake. Values for outcome variables were not imputed; covariates were imputed only for multivariate models, using simple mean imputation. Before imputation, covariates were missing for 0.0% to 0.4% of records, except for primary language spoken at home and eligibility for free or reduced-price meals, which were missing for 5.0% and 21.9% of students, respectively; missing indicators were used for these variables in all multivariate analyses. Intentions to drink water at school were imputed only in the multivariate model predicting water intake, where it had been missing for 3.7% of records. All means, percentages, and regression results were weighted for nonresponse. We used SAS version 9.3 (SAS Institute, Cary, NC) for all analyses.

## RESULTS

### PARTICIPANT CHARACTERISTICS

Participant characteristics appear in Table 1. The mean age of students was 12.3 (SD = 0.7) years. Most were Latino (75%) or black (10%); others were white (5%), Asian/Pacific Islander (4%), Native American (<1%), or multiracial (5%). Most students were eligible for free and reduced-price meals (89%), with 52% speaking a language

**Table 2.** Association of Middle School Student Attitudes About Drinking Fountains and Intentions to Drink Water at School by Covariates, Los Angeles, California*

| | | Intention to Drink Water at School, %‡ | | | | | |
|---|---|---|---|---|---|---|---|
| Characteristic | N† | Extremely Unlikely | Unlikely | Neither | Likely | Extremely Likely | P§ |
| Total | 3086 | 10.6 | 19.2 | 17.2 | 36.9 | 16.1 | |
| Attitudes about drinking fountains, mean (SD) | 3082 | 2.30 (0.84) | 2.72 (0.76) | 2.82 (0.75) | 3.13 (0.76) | 3.12 (0.94) | <.001 |
| Age | | | | | | | .17 |
| 11–12 y | 2082 | 10.7 | 18.2 | 17.3 | 37.4 | 16.4 | |
| 13–15 y | 1003 | 10.5 | 21.2 | 17.3 | 35.7 | 15.3 | |
| Gender | | | | | | | <.001 |
| Male | 1597 | 9.6 | 15.4 | 17.1 | 39.0 | 19.0 | |
| Female | 1489 | 11.7 | 23.3 | 17.4 | 34.6 | 12.9 | |
| Race/ethnicity | | | | | | | .03 |
| Latino | 2293 | 9.7 | 19.9 | 17.9 | 38.5 | 14.1 | |
| Black | 325 | 14.5 | 18.9 | 18.3 | 31.5 | 17.1 | |
| Other | 454 | 12.5 | 16.3 | 13.5 | 31.7 | 26.1 | |
| Free and reduced-price lunch eligibility | | | | | | | .002 |
| No | 261 | 8.1 | 18.6 | 12.7 | 35.3 | 25.4 | |
| Yes | 2150 | 10.9 | 19.6 | 18.2 | 36.4 | 15.0 | |
| Language spoken at home | | | | | | | .22 |
| English | 1420 | 11.3 | 20.6 | 16.2 | 34.3 | 17.6 | |
| Spanish | 1345 | 9.8 | 18.0 | 17.9 | 40.2 | 14.1 | |
| Other | 172 | 8.3 | 16.8 | 18.6 | 36.1 | 20.2 | |
| US-born status | | | | | | | .007 |
| Foreign born | 1231 | 9.8 | 17.3 | 16.9 | 38.8 | 17.1 | |
| US born | 1847 | 11.1 | 20.5 | 17.4 | 35.6 | 15.4 | |

*All percentages are weighted for nonresponse to baseline survey.

†Among adolescents not missing outcome. Numbers may sum to less than 3086 due to missing data.

‡The wording of this question was slightly different for the first pair of schools: "How likely is it that you will *drink tap water or water from a drinking fountain* the next day you are in school?"

§Overall test for all categories of the characteristic predicting continuous intentions to drink tap water with weighted least squares regression.

other than English at home (46% Spanish, 6% other) and 39% being foreign born.

### Descriptive and Bivariate Analyses

Although a large proportion of students reported that they agreed or strongly agreed that drinking fountains are dirty (59%) or that water from drinking fountains does not taste good (48%), fewer students noted that it was not okay to drink from school fountains (31%), that drinking from fountains could make them sick (33%), and that the water from the fountains contained chemicals such as lead (24%); 80% reported at least one of these attitudes.

When asked about intentions to drink water at school, 30% of students said that they were unlikely or extremely unlikely to drink water from drinking fountains the next day at their school. In bivariate analyses, students with more positive attitudes about school water fountains had significantly greater intentions to drink water at school. Boys, students of other races/ethnicities, students who were not eligible for free/reduced-price meals, and students not born in the United States were significantly more likely to intend to drink water at school (Table 2).

With regard to overall daily intake of water, 16% of students said they drank <1 glass of water per day, and 53% said they drank <3 glasses of water per day. In bivariate analyses, greater intentions to drink water at school were significantly associated with greater overall water intake. Boys, students of other races/ethnicities, those speaking a language at home other than English, and children not born in the United States had significantly greater overall water intake (Table 3).

### Multivariate Analysis

In multivariate analyses controlling for sociodemographic covariates, positive attitudes about school drinking fountains remained associated with greater intentions to drink water at school. In the multivariate model, boys and students not eligible for free/reduced price meals continued to have greater intentions to drink water at school (Table 4). In adjusted analyses, controlling for covariates, greater intentions to drink water the next day at schools was associated with greater overall water intake. In these analyses, boys, students from other races/ethnicities, and those who spoke a language other than English at home reported greater overall water intake (Table 5).

## Discussion

This cross-sectional analysis is one of the few studies to examine how student attitudes about school drinking fountains are associated with intentions to drink water at school and how such intentions to drink water at school are related to overall water intake. In our study, negative attitudes about school drinking fountains were associated with lower

**Table 3.** Association of Middle School Student Intentions to Drink Water at School and Overall Water Intake by Covariates, Los Angeles, California*

| Characteristic | N† | Overall Water Intake, % | | | | | P‡ |
|---|---|---|---|---|---|---|---|
| | | Less Than 1 Glass | 1 to <2 Glasses | 2 to <3 Glasses | 3 to < 4 Glasses | 4 or More Glasses | |
| Total | 2873 | 16.3 | 13.9 | 22.9 | 18.5 | 28.5 | |
| Intention to drink water at school, mean (SD)§ | 2767 | 2.92 (1.18) | 3.04 (1.17) | 3.31 (1.23) | 3.46 (1.16) | 3.52 (1.29) | <.001 |
| Age | | | | | | | .57 |
| 11–12 y | 1949 | 16.2 | 13.5 | 23.8 | 19.5 | 27.0 | |
| 13–15 y | 924 | 16.5 | 14.7 | 21.0 | 16.4 | 31.5 | |
| Gender | | | | | | | <.001 |
| Male | 1477 | 13.2 | 13.1 | 22.1 | 19.1 | 32.6 | |
| Female | 1396 | 19.5 | 14.7 | 23.8 | 17.8 | 24.2 | |
| Race/ethnicity | | | | | | | <.001 |
| Latino | 2131 | 16.4 | 14.6 | 23.1 | 19.4 | 26.6 | |
| Black | 298 | 21.5 | 11.3 | 23.2 | 14.3 | 29.8 | |
| Other | 431 | 11.9 | 12.2 | 22.3 | 17.4 | 36.3 | |
| Free and reduced-price lunch eligibility | | | | | | | .15 |
| No | 250 | 13.3 | 13.5 | 21.8 | 22.8 | 28.6 | |
| Yes | 1986 | 16.4 | 13.8 | 23.8 | 17.7 | 28.3 | |
| Language spoken at home | | | | | | | <.001 |
| English | 1316 | 19.4 | 14.3 | 22.4 | 17.4 | 26.6 | |
| Spanish | 1253 | 14.0 | 13.9 | 23.7 | 19.6 | 28.7 | |
| Other | 160 | 10.7 | 10.1 | 17.4 | 18.6 | 43.2 | |
| US-born status | | | | | | | .007 |
| Foreign born | 1146 | 15.8 | 13.0 | 20.0 | 20.0 | 31.3 | |
| US born | 1721 | 16.4 | 14.5 | 24.9 | 17.6 | 26.7 | |

*All percentages are weighted.

†Among adolescents not missing the outcome and who reported being present being at school the previous day. Numbers may sum to less than 2873 due to missing data.

‡Overall test for all categories of the characteristic predicting continuous water intake with weighted least squares regression.

§The wording of this question was slightly different for the first pair of schools: "How likely is it that you will *drink tap water or water from a drinking fountain* the next day you are in school?"

**Table 4.** Association of Attitudes About School Drinking Fountains and Student Intentions to Drink Water at School*

| Adolescent Characteristic | Intention to Drink Water Next School Day (n = 3086) | |
|---|---|---|
| | β | P |
| Positive attitudes about school drinking fountains | 0.41 | <.001 |
| Female | −0.19 | <.001 |
| Age | −0.03 | .42 |
| Black (referent = Latino) | 0.03 | .73 |
| Other race/ethnicity (referent = Latino) | 0.11 | .11 |
| Speak English at home | 0.00 | .98 |
| US born | 0.03 | .47 |
| Eligibility for free and reduced lunch | −0.25 | .004 |

*Multivariable linear regression analysis weighted for nonresponse and controlled for all variables listed in the table, as well as study school sites and missing dummy indicators for eligibility of free/reduced lunch and language spoken at home.

intentions to drink water at school; lower intentions to drink water at school were associated with lower overall water intake among students.

In this study we found that a majority of adolescents reported low water intake. This finding is consistent with previous studies.[11,34] Because adolescents spend a large proportion of their waking hours in school, this setting may play an important role in increasing adolescent water intake. Currently, most US schools offer tap water to students via drinking fountains.[22,23] Studies, including the present one, suggest that students do not drink water from fountains because of the lack of appeal of drinking fountains and concerns about the safety of the water.[24,25] Moreover, students may not drink from fountains because the fountains may be too few in number, may be unavailable in key school locations, or may not be accompanied by vessels (eg, cups, reusable water bottles) that allow for more than a sip of water at a time.[23,35] Providing nonfountain sources of drinking water (eg, fountains or water stations with reusable water bottle fillers, water dispensers with cups) may increase water intake among students[2,3,6–8] and in some cases may reduce overweight/obesity.[3] Because cost has been cited as a major barrier to installing nonfountain water sources,[23,24] schools may also want to consider lower-cost strategies such as retrofitting existing drinking fountains to include bottle filler attachments or installing nonfountain drinking water sources in a few high-traffic locations (cafeterias, physical activity spaces).

**Table 5.** Association of Student Intentions to Drink Water at School and Overall Water Intake*

| Adolescent Characteristic | Glasses of Water Consumed Yesterday (n = 2873) | |
|---|---|---|
| | β | P |
| Intention to drink water the next day at school | 0.20 | <.001 |
| Female | −0.28 | <.001 |
| Age | 0.02 | .62 |
| Black (referent = Latino) | 0.21 | .06 |
| Other race/ethnicity (referent = Latino) | 0.39 | <.001 |
| Speak English at home | −0.28 | <.001 |
| US born | −0.05 | .41 |
| Eligibility for free and reduced lunch | −0.11 | .30 |

*Multivariable linear regression analysis weighted for nonresponse and controlled for all variables listed in the table, as well as study school sites and missing dummy indicators for eligibility of free/reduced lunch and language spoken at home.

In this study, we found that up to a third of students had concerns about the quality and safety of drinking water from fountains. Given such attitudes, altering the school environment to make free and appealing water more readily accessible may be insufficient to improve student water intake in schools. Testing drinking water in schools for contaminants and communicating water quality testing results to students, parents, teachers, and other school staff may help to counter student concerns regarding the safety of water from fountains. In cases when school drinking water is discovered to be nonpotable as a result of contaminants, schools can provide safe tap water through short-term (eg, filtration or reverse osmosis of tap water) or long-term solutions (eg, replacement of lead solder or plumbing).

Our study finding that student intentions to drink water at school were associated with greater overall water intake suggests that the school water environment may influence students' overall water intake. Because most water intake occurs at home, it may be important to increase student water intake at home as well as at school for a clinically significant impact on water intake.[12]

Pediatricians can help children, adolescents, and their families to shift their beverage intake from SSBs and 100% fruit juice to water. During well-child visits, pediatricians can advise youth and their parents to advocate for improved water access at school, to pack reusable water bottles for use at school, to model drinking water, and to ensure that the home beverage environment fosters healthy beverage habits (eg, by asking whether appealing drinking water is easily accessible at all times and suggesting limits on SSBs and 100% fruit juice intake).

In this study, we also found that students who were eligible for free and reduced-price meals (a proxy for low-household income) were less likely to intend to drink water at school. Given that the most common source of drinking water in schools is tap water from drinking fountains, low water intake at school may stem from concerns about tap water. Previous studies suggest that there are disparities in the type of water consumed, with children and adolescents from households of lower educational levels and African American and Latino youth being more likely to purchase bottled water than to drink tap water.[12,16] This is important because most single-use bottled water on the market is not fluoridated unless specified on packaging, can have an environmental impact if bottles are not recycled, and is more costly than tap water. When tap water supplies are safe, pediatric practitioners can play a key role in increasing consumption of tap water by asking families about the type of water they consume (eg, bottled vs tap

water) and educating them about the health and economic benefits of drinking tap water.

Although this is one of the few studies to explore student attitudes of drinking water in US school settings, the study has several limitations. The participant population consisted of students in a single school district with a predominately low-income, Latino population located in a temperate region of the United States; thus, results may not be generalizable to all communities.

Another limitation is that there were 2 versions of the question that measured intentions to drink water at school. In the first pair of schools we asked about intentions to drink tap water or water from a drinking fountain at school, but for the remaining study schools, we asked about intentions to drink water at school. Because these questions were worded differently, it is unclear how student interpretation of these 2 questions differed. In addition, although we examined how student attitudes about school drinking fountains are related to student intentions to drink water at school, we did not have a measure of actual water intake at school. Because this study is cross-sectional and nonexperimental, we also cannot determine whether student attitudes about drinking water at school are causally related to intentions to drink water at school, and whether such intentions are causally related to overall water intake.

## CONCLUSION

Water intake among middle school students is low, and negative attitudes about school drinking fountains may play a role in discouraging water intake at school. A first step toward improving water intake among students is to increase access to safe and appealing drinking water within school settings. In order to increase water intake overall, it may be important not only to increase access of safe drinking water in school settings but also to promote consumption of water in home and community settings through increased access of safe drinking water, decreased availability of SSBs, and promotion and marketing of safe tap water to students and families.

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