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Authors
Patel, Anisha I
Bogart, Laura M
Klein, David J
et al.

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Middle School Student Attitudes about School Drinking Fountains and Water Intake

Anisha I. Patel, MD, MSPH[a], **Laura M. Bogart, PhD**[b,c], **David J. Klein, MS**[b], **Burt Cowgill, PhD**[d], **Kimberly E. Uyeda, MD, MPH**[e], **Jennifer Hawes-Dawson, BA**[f], and **Mark A. Schuster, MD, PhD**[b,c]

[a]Division of General Pediatrics, University of California, San Francisco, CA

[b]Division of General Pediatrics, Boston Children's Hospital Boston, Boston, MA

[c]Harvard School of Public Health, Boston, MA

[d]Department of Health Policy and Management, Fielding School of Public Health University of California, Los Angeles, Los Angeles, CA

[e]Student Health and Human Services, Los Angeles Unified School District, Los Angeles, CA

[f]RAND Corporation, Santa Monica, CA

Abstract

Objective—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=3,211) in 9 California middle schools completed surveys between 2009–2011. 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

Address correspondence to: Anisha I. Patel, MD, MSPH, MSHS, Assistant Professor, Division of General Pediatrics, University of California, San Francisco, 3333 California Street, Suite 245, Mailbox 0503, San Francisco, CA 94118, 415-476-9189 (phone), 415-476-6106 (fax), [patela@peds.ucsf.edu].

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school drinking fountains were related to intentions to drink water at school (*B*=0.41; p-value <0.001); intentions to drink water at school were also associated with overall water intake (*B*=0.20; p-value <0.001).

Conclusions and Relevance—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.

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.

Keywords

schools; nutrition; adolescents

INTRODUCTION

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 kilocalories 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,[3,4–5] and 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 liters per day for adolescent girls and 2.4 liters 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, non-caloric 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 also 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 U.S. 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/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 was 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 2009–2011.[8] Seventh grade students from the intervention and control schools were eligible to complete surveys at baseline prior to the implementation of SNaX at the intervention schools. Among 4,022 eligible students in these schools, 80% (n=3,211) 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 if 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 five 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. Based on these analyses, responses from the four remaining items were averaged to create a scale in which higher values indicated more positive attitudes toward drinking water (a= 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 two schools and tested the same regression models, results were consistent. Thus in this paper, we only present 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 (one bottle = 2 glasses)," "1 glass (one 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, Other which consisted of predominately Whites), eligibility for free and reduced price meals through the U.S. 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 (U.S.-born vs. foreign-born). Covariates for this study were selected based on their association with water intake patterns in previous studies.[14–16]

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, 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, Inc., Cary, North Carolina) 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 other than English at home (46% Spanish, 6% other) and 39% being foreign-born.

Descriptive and Bivariate Analyses

While 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. Males, students of other races/ethnicities, students who were not eligible for free/reduced price meals, and students not born in the U.S. 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. Males, students of other races/ethnicities, those speaking a language at home other than English, and children not born in the U.S. 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, males 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, males, 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 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 U.S. 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 due to the lack of appeal of drinking fountains and concerns about the safety of water from fountains.[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 (e.g., cups, reusable water bottles) that allow for more than a sip of water at a time.[23, 35] Providing non-fountain sources of drinking water (e.g., 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] As cost has been cited as a major barrier to installing non-fountain 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 non-fountain drinking water sources in a few high-traffic locations (cafeterias, physical activity spaces).

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 non-potable due to contaminants, schools can provide safe tap water through short-term (e.g., filtration or reverse osmosis of tap water) or long-term solutions (e.g. 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 within the 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 (e.g., 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 (e.g., 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 U.S. 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 U.S.; thus, results may not be generalizable to all communities. Another limitation is that there were two 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 two 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 non-experimental, we also cannot determine if 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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Table 1

Sociodemographic Characteristics of Middle School Students in Study Schools, Los Angeles, California[a]

Adolescent characteristics	N	%
Mean Age in Years (SD)	3,210	12.3 (0.7)
Sex	3,211	
Male	1,653	51.2
Female	1,558	48.8
Race/Ethnicity	3,197	
Latino	2,386	75.2
Black	339	10.3
Other	472	14.4
Eligible for Free and Reduced Lunch	2,235	89.4
Language Spoken at Home	3,049	
English	1,474	48.2
Spanish	1,398	46.1
Other	177	5.7
Born in the United States	1,916	60.5

[a]Sociodemographic characteristics are those of students who responded to surveys, not the entire population of students in schools

Table 2

The Association of Middle School Students' Attitudes about Drinking Fountains and Intentions to Drink Water at School by Covariates, Los Angeles, California[a]

	N[b]	Intentions to Drink Water at School (%)[c]					p-value[d]
		Extremely unlikely	Unlikely	Neither	Likely	Extremely likely	
TOTAL	3,086	10.6	19.2	17.2	36.9	16.1	
Attitudes about Drinking Fountains Mean (SD)	3,082	2.30 (0.84)	2.72 (0.76)	2.82 (0.75)	3.13 (0.76)	3.12 (0.94)	<0.001
Age							
11–12	2,082	10.7	18.2	17.3	37.4	16.4	0.17
13–15	1,003	10.5	21.2	17.3	35.7	15.3	
Gender							
Male	1,597	9.6	15.4	17.1	39.0	19.0	<0.001
Female	1,489	11.7	23.3	17.4	34.6	12.9	
Race/Ethnicity							
Latino	2,293	9.7	19.9	17.9	38.5	14.1	0.03
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 Lunch Eligibility							
No	261	8.1	18.6	12.7	35.3	25.4	0.002
Yes	2,150	10.9	19.6	18.2	36.4	15.0	
Language Spoken at Home							
English	1,420	11.3	20.6	16.2	34.3	17.6	0.22
Spanish	1,345	9.8	18.0	17.9	40.2	14.1	
Other	172	8.3	16.8	18.6	36.1	20.2	
U.S.-Born Status							
Foreign-Born	1,231	9.8	17.3	16.9	38.8	17.1	0.007
U.S.-Born	1,847	11.1	20.5	17.4	35.6	15.4	

[a] All percentages are weighted for nonresponse to the baseline survey.

[b] Among adolescents not missing the outcome. Ns may add to less than 2,526 due to missing data.

[c]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?"

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

Table 3

The Association of Middle School Students' Intentions to Drink Water at School and Overall Water Intake by Covariates, Los Angeles, California[a]

	N[b]	Overall Water Intake (%)					p-value[c]
		Less than 1 glass	1 to <2 glasses	2 to < 3 glasses	3 to < 4 glasses	4 or more glasses	
TOTAL	2,873	16.3	13.9	22.9	18.5	28.5	
Intentions to Drink Water at School Mean (SD)[d]	2,767	2.92 (1.18)	3.04 (1.17)	3.31 (1.23)	3.46 (1.16)	3.52 (1.29)	<0.001
Age							
11–12	1,949	16.2	13.5	23.8	19.5	27.0	0.57
13–15	924	16.5	14.7	21.0	16.4	31.5	
Gender							
Male	1,477	13.2	13.1	22.1	19.1	32.6	<0.001
Female	1,396	19.5	14.7	23.8	17.8	24.2	
Race/Ethnicity							
Latino	2,131	16.4	14.6	23.1	19.4	26.6	<0.001
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 Lunch Eligibility							
No	250	13.3	13.5	21.8	22.8	28.6	0.15
Yes	1,986	16.4	13.8	23.8	17.7	28.3	
Language Spoken at Home							
English	1,316	19.4	14.3	22.4	17.4	26.6	<0.001
Spanish	1,253	14.0	13.9	23.7	19.6	28.7	
Other	160	10.7	10.1	17.4	18.6	43.2	
U.S.-Born Status							
Foreign-Born	1,146	15.8	13.0	20.0	20.0	31.3	0.007
U.S.-Born	1,721	16.4	14.5	24.9	17.6	26.7	

[a] All percentages are weighted.

[b] Among adolescents not missing the outcome and who reported being present being at school the previous day. Ns may add to less than 2,873 due to missing data.

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

[d] 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 Students' Intentions to Drink Water at School[a]

	Intentions to Drink Water Next School Day N=3086	
Adolescent Characteristics	**β**	**p-value**
Positive attitudes about school drinking fountains	0.41	<0.001
Female	−0.19	<0.001
Age	−0.03	0.42
Black (referent = Latino)	0.03	0.73
Other race/ethnicity (referent = Latino)	0.11	0.11
Speak English at home	0.00	0.98
U.S.- born	0.03	0.47
Eligibility for free and reduced lunch	−0.25	0.004

[a]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.

Table 5

Association of Students' Intentions to Drink Water at School and Overall Water Intake[a]

	Glasses of Water Consumed Yesterday N=2873	
Adolescent Characteristics	**β**	**p-value**
Intentions to drink water the next day at school	0.20	<0.001
Female	−0.28	<0.001
Age	0.02	0.62
Black (referent = Latino)	0.21	0.06
Other race/ethnicity (referent = Latino)	0.39	<0.001
Speak English at home	−0.28	<0.001
U.S.- born	−0.05	0.41
Eligibility for free and reduced lunch	−0.11	0.30

[a]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.