Availability of Drinking Water in US Public School Cafeterias

Nancy E. Hood, PhD; Lindsey Turner, PhD; Natalie Colabianchi, PhD; Frank J. Chaloupka, PhD; Lloyd D. Johnston, PhD

ABSTRACT

This study examined the availability of free drinking water during lunchtime in US public schools, as required by federal legislation beginning in the 2011-2012 school year. Data were collected by mail-back surveys in nationally representative samples of US public elementary, middle, and high schools from 2009-2010 to 2011-2012. Overall, 86.4%, 87.4%, and 89.4% of students attended elementary, middle, and high schools, respectively, that met the drinking water requirement. Most students attended schools with existing cafeteria drinking fountains and about one fourth attended schools with water dispensers. In middle and high schools, respondents were asked to indicate whether drinking fountains were clean, and whether they were aware of any water-quality problems at the school. The vast majority of middle and high school students (92.6% and 90.4%, respectively) attended schools where the respondent perceived drinking fountains to be clean or very clean. Approximately one in four middle and high school students attended a school where the survey respondent indicated that there were water-quality issues affecting drinking fountains. Although most schools have implemented the requirement to provide free drinking water at lunchtime, additional work is needed to promote implementation at all schools. School nutrition staff at the district and school levels can play an important role in ensuring that schools implement the drinking water requirement, as well as promote education and behavior-change strategies to increase student consumption of water at school.

DESCRIPTIVE STATISTICS

In addition, consumption of SSBs is a contributor to dental caries, but this risk can be moderated by consumption of fluoridated tap water. Key health disparities are evident: lower-socioeconomic status children drink more sugary beverages and also have a higher incidence of dental caries. This might be due to lower consumption of fluoridated tap water among certain populations, as female, white, and higher-educated adolescents have higher rates of drinking tap water. Although fewer Mexican-American children consume fluoridated tap water than do white children, they drink more bottled water, and some Latino families give their children bottled water exclusively rather than tap water, which can contribute to reduced exposure to fluoride and poorer dental health.

Because of the potential positive impact of water consumption on health and cognitive outcomes, increasing attention has focused on the availability of drinking water in schools. Schools participating in the federally funded National School Lunch Program were required by the US Department of Agriculture to provide students with access to free potable drinking water during lunch by the 2011-2012 school year. The current study examined strategies for provision of drinking water during lunchtime at public schools in the United States during 2011-2012, and changes from the 2 previous school years. In addition, analyses examined school characteristics associated with meeting the new requirement, perceived cleanliness of drinking fountains, and respondent awareness of water-quality problems at school.

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METHODS

Study Design
This study utilizes 3 years of data (school years 2009-2010 to 2011-2012) from the Bridging the Gap study. Each year, data were collected from schools in three nationally representative samples in the contiguous United States. As described in detail elsewhere,22 public elementary schools were selected within school districts, with probability proportionate to size to obtain a sample that was nationally representative of 3rd-grade students. As described in earlier reports,23 middle and high school data were gathered from samples of schools selected with probability proportionate to size, which were designed to obtain samples representative of 8th-, 10th-, and 12th-grade students. This study was approved by the Institutional Review Board at the University of Illinois at Chicago and deemed exempt by the Institutional Review Board at the University of Michigan.

Surveys (with a modest monetary incentive) were mailed to principals each spring with follow-up calls and additional mailings to encourage participation. During the study period, 1,518 elementary, 651 middle, and 762 high schools participated for a total of 2,931 unique schools with 3,870 observations. Mean response rate was 58.4% for elementary schools and for middle and high schools was 71% without replacement and 87% with replacement. The main survey was to be completed by school administrators and a second module was instructed to be completed by school foodservice personnel.

Measures
In the early years of the Bridging the Gap study, the school administrator surveys were pilot tested with convenience samples of elementary, middle, and high school administrators (n=6), which revealed no problems with comprehension or face validity of survey items. Items used in the current analyses regarding drinking fountain availability, perceived cleanliness, and awareness of water-quality issues were added beginning in the 2009-2010 survey year. These items were developed by a multidisciplinary team of researchers and educators with extensive experience in health survey research; however, they were not pilot tested. The question about compliance with the federal drinking water requirement (added in 2011-2012) was based directly on language in the legislation and therefore has face validity.

Compliance with Federal Requirements. In 2011-2012 only, in the module to be completed by foodservice personnel, respondents were asked which of the following strategies, if any, their school used to meet the requirement to provide free, potable drinking water for students during lunchtime: existing drinking fountains in cafeteria; installed new drinking fountains in cafeteria; water dispenser/pitcher and cups (in the food line); water dispenser/pitcher and cups (elsewhere in the cafeteria); water dispenser/pitcher but no cups (students bring water bottles); free, potable drinking water is not available in the cafeteria; and other (please describe). Responses involving water dispenser/pitchers were combined for analyses. Open-ended descriptions of “other” strategies were categorized and coded as meeting the requirements or not.

Other Drinking Fountain Measures. During all 3 years of data collection, in a survey section separate from the compliance question, respondents (administrators) were asked to report whether students had access to drinking fountains during the school day. The current analyses used a sub-item on drinking fountains specifically in the lunchroom. In middle and high schools, respondents were also asked about perceived drinking fountain cleanliness (“Generally, how clean are the drinking fountains at your school?”) and awareness of water-quality issues (“To what extent do you have problems with water quality in your school’s drinking fountains?”). In middle and high schools, respondents also reported whether their school had a written policy about availability of free drinking water.

School Characteristics. School characteristics were obtained from public-use files from the National Center for Education Statistics24 and from demographic questions on the study surveys. These characteristics were used as covariates in regression models and included school type (elementary, middle, high); US Census region (South, Northeast, Midwest, West); urbanicity (urban, suburban, or rural); student enrollment (smallest tertile vs upper two tertiles, for each school type); percentage of students eligible for free or reduced-price lunch (<15% vs ≥15%); and student race/ethnicity (≥66% white non-Latino, >50% black non-Latino, >50% Latino, or other).

Data Analysis
Strategies used to meet the drinking water requirement were compared by school type using χ² tests. Logistic regression analyses were used to identify school characteristics associated with meeting the drinking water requirement for each school type. For middle and high schools, school characteristics associated with perceived cleanliness of drinking fountains and awareness of water-quality problems were also examined. Changes over time in drinking fountain availability, perceived cleanliness, and awareness of water-quality problems were assessed using generalized estimating equations with binomial distribution and logit link. Generalized estimating equations account for the lack of independence of observations due to multiple observations for some schools.25 Analyses used normalized weights to account for selection probability and nonresponse bias. Weights also incorporated the number of students at each school; therefore, prevalence estimates are interpreted as the proportion of students within a given school rather than the proportion of schools. Analyses were conducted using the Statistical Analysis Software (version 9.2, 2010, SAS Institute, Inc).

RESULTS AND DISCUSSION

Strategies Used to Meet the Federal Drinking Water Requirement

A majority of students attended schools that met the federal drinking water requirement with existing drinking fountains in the cafeteria, with no differences by school type (Table 1). High school students were more likely to attend schools that had installed new fountains, but the number of schools was small (Table 1). Refrigerated fountains for plumbed drinking water are the lowest-cost solution over 10 years, even considering the initial investment in the first year.26 They also...
likely require less staff time to maintain than nonplumbed water dispensers, and they minimize waste from disposable cups. Although many schools rely on water fountains, fountains might not be very effective at encouraging water consumption. The elementary students might need permission to get up, and in all grades the water is not on the table with the meal and students must make a special trip and might have to wait in line to get water. In terms of practicality, drinking fountains might not sufficiently meet the need for access to water during meals.

About one fourth of students attended schools that had met the drinking water requirement with water dispensers. “Other” strategies were most common in elementary schools and included drinking fountains near the cafeteria (n=53), drinking fountains elsewhere in the school (n=28), free bottled water (n=13), cups provided for drinking fountains (n=7), and other strategies (n=19), such as students being permitted to bring or purchase water. Of these responses, only free bottled water clearly met the federal requirement for drinking water to be available in the cafeteria. Including schools that provided bottled water, 86.4%, 87.4%, and 89.4% of students attended elementary, middle, and high schools, respectively, that reported meeting the drinking water requirement; there was no difference by school type (Table 1).

School Characteristics Associated with Strategies
Few school characteristics were associated with meeting the drinking water requirement by any specific strategy (Table 2). Based on preliminary analyses, region was dichotomized as South vs all other US Census regions. In multivariate regression models controlling for all covariates, schools in the South were more likely to meet the requirement than were schools in all other regions. This is consistent with other nationally representative research showing that school districts in the South have made faster progress in developing nutrition-related school wellness policies, and that they have stronger policies than do districts in other regions of the United States. Regional disparity emerged across all school types, suggesting that it is robust, and potentially worth additional exploration about the factors associated with increased implementation of the standards in the South. Two other demographic disparities emerged: at the elementary school level, rural schools were more likely to meet the requirements and at the high school level, larger schools were more likely to meet the requirements. These differences are intriguing, and although the current data cannot provide answers as to the reasons for this pattern of results, one possibility pertains to the age of school facilities. Urban schools tend to have an older functional age and to have inadequacies in at least one aspect of their facilities. A study of >12,000 school and workplace drinking water sources found considerably higher rates of lead contamination from equipment >20 years old as compared with newer equipment. Therefore, without upgraded drinking water equipment, older schools, such as those in urban areas, might be likely to have problems with drinking water safety, leading to the discontinuation of drinking fountain access. The current findings suggest that some schools might need additional support or resources to meet the drinking water requirement, such as consultation with environmental health specialists or additional financial resources to renovate facilities.

Drinking Fountain Availability, Perceived Cleanliness, and Water-Quality Concerns
For a majority (>96%) of students across all grades, drinking fountains were available at least somewhere in the school.
The proportions of elementary students in schools with drinking fountains in the cafeteria increased significantly in 2011-2012 compared with 2009-2010 (Table 3), as did the proportions of middle and high school students in schools with written policies about free drinking water. This suggests that the new requirement might have increased the availability of drinking water in schools. However, an alternative explanation is that, because of the federal requirement, principals have become more aware of drinking fountain locations in their schools. Yet another possibility is that the requirement increased the impact of social desirability bias in respondents’ answers to questions about drinking fountains, even though this question was located in a separate part of the survey than the item about strategies for implementation of the federal drinking water requirement.

Drinking fountain cleanliness and water quality are issues that potentially impact the availability of drinking water at schools. The US Environmental Protection Agency recommends that school drinking fountains be cleaned daily. However, in four large California school districts, stakeholders reported that a majority of school drinking fountains were unpalatable in appearance or water quality, which deterred use. The vast majority of middle and high school students (92.6% and 90.4%, respectively) attended schools where the respondent perceived drinking fountains to be “clean” or “very clean” (data not shown in the Tables); however, it might be reasonable to expect that at schools following the US Environmental Protection Agency’s recommendations the fountains would be “very clean,” which was the case for only approximately half of the schools reporting here (Table 3). Subsequent analyses examining the school characteristics associated with perceived cleanliness compared “very clean” with other categories. Again, several regional differences emerged. Respondents at middle schools in the Northeast and West were less likely to perceive fountains to be very clean than were those in the South (adjusted odds ratio=0.55; 95% CI 0.34 to 0.89 and adjusted odds ratio=0.64; 95% CI 0.42 to 0.98), and respondents at high schools in the West were less likely to perceive fountains to be very clean than were those in the South (adjusted odds ratio=0.64; 95% CI 0.42 to 0.98). These regional disparities also indicate directions for technical assistance efforts to improve access to drinking water from sanitary facilities.

Water quality is a potential concern for both drinking fountains and water dispensers; most schools use public water systems and are therefore not required to test water.

Table 2. Summary of logistic regression analyses examining school characteristics associated with meeting federal drinking water requirements in nationally representative samples of US public schools, 2011-2012 school year

<table>
<thead>
<tr>
<th></th>
<th>Elementary Schools (n=540)</th>
<th>Middle Schools (n=309)</th>
<th>High Schools (n=351)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Other</td>
<td>0.48 0.26-0.88</td>
<td>0.16 0.06-0.48</td>
<td>0.31 0.12-0.81</td>
</tr>
<tr>
<td><strong>School size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>0.62 0.74 0.048</td>
<td>0.74 0.42-1.68</td>
<td>0.07 0.42-1.68</td>
</tr>
<tr>
<td>Medium/large</td>
<td>0.84 0.42-1.68</td>
<td>0.87 0.38-2.00</td>
<td>2.20 1.01-4.80</td>
</tr>
<tr>
<td><strong>Urbanicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Suburban</td>
<td>1.38 0.75-2.55</td>
<td>1.12 0.46-2.70</td>
<td>0.47 0.18-1.19</td>
</tr>
<tr>
<td>Rural</td>
<td>6.76 2.08-21.95</td>
<td>1.33 0.43-4.11</td>
<td>0.68 0.21-2.16</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥66% White non-Latino</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>&gt;50% Black</td>
<td>0.85 0.31-2.31</td>
<td>0.32 0.08-1.25</td>
<td>0.39 0.11-1.45</td>
</tr>
<tr>
<td>&gt;50% Latino</td>
<td>1.76 0.79-3.89</td>
<td>0.64 0.24-1.71</td>
<td>0.26 0.09-0.73</td>
</tr>
<tr>
<td>Other</td>
<td>1.69 0.85-3.36</td>
<td>1.83 0.61-5.47</td>
<td>0.57 0.22-1.53</td>
</tr>
<tr>
<td><strong>Students eligible for free/reduced-priced meals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;15%</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>≥15%</td>
<td>2.05 0.99-4.24</td>
<td>0.83 0.24-2.89</td>
<td>0.69 0.17-2.92</td>
</tr>
</tbody>
</table>

*aAOR=adjusted odds ratio.
*bType III P value.
*cBased on tertiles of student enrollment calculated by school type (ie, elementary, middle, high).
quality for elevated bacteria or lead levels, although the US Environmental Protection Agency recommends lead testing for schools. As noted here, plumbing and other infrastructure components, particularly in old school buildings, could contaminate water. About one quarter of middle and high school students attended schools where the respondent expressed at least “a little” concern about drinking fountain water quality (Table 3). However, this question is subjective and might be biased due to inaccurate or incomplete knowledge. For example, some administrators might be unaware of water-quality issues, such as elevated lead levels, and therefore these data are more reflective of the respondents' awareness of water quality than actual objectively measured water quality. Although no school characteristics were significantly associated with awareness of water-quality problems (Table 3), it is possible that older facilities could be more prone to elevated lead levels. Unfortunately, the current data did not include measures of the age of the school facility, but technical assistance efforts in schools with water-quality problems—and, perhaps, in older buildings in particular—might require alternative solutions, such as the use of water dispensers or pitchers, rather than relying on fountains. Although the maintenance of drinking fountains, including ensuring cleanliness and water quality, typically falls under the responsibility of school facilities management personnel and/or school administrators, school nutrition staff can assist in maintaining clean, safe water sources by collaborating with environmental health professionals and other school staff on these issues.

Although most schools met the drinking water requirement, the mere provision of free drinking water might not necessarily increase students' water consumption. In an observational study in California, only 4% of students consumed free drinking water at lunch. Most school-based interventions shown to increase student water consumption have provided reusable water bottles to students and/or included at least minimal educational activities in addition to water provision. However, students' use of water bottles decreases quickly over time and students report using bottles for other beverages, such as SSBs. Bottles also require regular cleaning to avoid bacterial contamination. School nutrition staff can play an important role in maximizing the impact of widely available free drinking water in schools by conducting individual- and/or school-level interventions to promote water consumption.

The main strength of this study is the use of timely data collected from large, nationally representative samples to assess early implementation of a new federal requirement to increase students’ access to drinking water. Results should be interpreted in the context of some limitations, however. Data are cross-sectional, which precludes a causal interpretation of reported associations. Some measures assessed compliance with federal legislation, which raises the possibility of social desirability bias. To minimize this, respondents were guaranteed confidentiality, but any survey data carries the risk of some desirability bias. The response rates were calculated based on standard definitions, but were low among elementary schools. The final analytic data weights were adjusted to account for school propensity to respond (based on predictive models using school demographic variables associated with response vs nonresponse status), but it is possible that nonresponse bias could have been an issue, particularly for schools where practices were not well aligned with national requirements. Coding all drinking fountains outside the cafeteria as not meeting the requirement was conservative; fountains immediately adjacent to the

### Table 3. Changes over time in administrator-reported availability of drinking water fountains, perceived fountain cleanliness, and awareness of water quality problems, in annual surveys of nationally representative samples of US public schools, 2009-2010 to 2011-2012 school years

<table>
<thead>
<tr>
<th></th>
<th>2009-2010</th>
<th>2010-2011</th>
<th>2011-2012</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td><strong>Elementary schools</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking fountains in cafeteria</td>
<td>435 (64.9)</td>
<td>351 (64.0)</td>
<td>384 (74.5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Middle schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking fountains in cafeteria</td>
<td>229 (68.3)</td>
<td>221 (70.4)</td>
<td>219 (69.8)</td>
<td>0.40</td>
</tr>
<tr>
<td>Written policy for availability of free drinking water</td>
<td>179 (53.4)</td>
<td>153 (49.5)</td>
<td>188 (63.4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Drinking fountains perceived as “very clean”</td>
<td>158 (48.1)</td>
<td>149 (47.6)</td>
<td>160 (51.1)</td>
<td>0.94</td>
</tr>
<tr>
<td>No awareness of water-quality problems in drinking fountains</td>
<td>242 (76.0)</td>
<td>206 (71.4)</td>
<td>211 (71.2)</td>
<td>0.23</td>
</tr>
<tr>
<td>High schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking fountains in cafeteria</td>
<td>238 (66.4)</td>
<td>230 (67.3)</td>
<td>252 (72.1)</td>
<td>0.07</td>
</tr>
<tr>
<td>Written policy for availability of free drinking water</td>
<td>164 (47.8)</td>
<td>168 (51.9)</td>
<td>202 (60.0)</td>
<td>0.004</td>
</tr>
<tr>
<td>Drinking fountains perceived as “very clean”</td>
<td>177 (48.7)</td>
<td>161 (46.0)</td>
<td>171 (49.5)</td>
<td>0.56</td>
</tr>
<tr>
<td>No awareness of water-quality problems in drinking fountains</td>
<td>247 (74.2)</td>
<td>233 (74.6)</td>
<td>237 (76.3)</td>
<td>0.70</td>
</tr>
</tbody>
</table>

- Percentages are weighted to indicate percentage of students within schools nationally.
- Significantly different from 2009-2010 estimate; P<0.05.
- Comparison category was not at all clean/somewhat clean/clean.
- Comparison category was a little/some/a lot of problems.
foodservice area that are accessible to all students during the lunch period could be sufficient, but this level of detail was not consistently available from open-ended responses. Finally, as noted, the specific survey items used here were not validated and the subjective nature of respondent-reported data limits the ability to draw conclusions about actual cleanliness of drinking fountains and water-quality issues.

CONCLUSIONS

Most schools reported meeting the new federal requirement to provide access to free drinking water for students during school lunches through drinking fountains in the cafeteria. Although drinking fountains are a sustainable and cost-effective strategy, some concerns about cleanliness and water quality were reported by survey respondents. Because the federal drinking water requirement is unfunded, schools might need additional resources to address these barriers to providing water at lunch. In this regard, there appear to be several opportunities for dietetics practitioners to improve practices in schools. First, at a district level, registered dietitian nutritionists can collaborate with school-level staff on individually appropriate strategies for each school to implement this requirement. In addition, although not all schools have a registered dietitian nutritionist onsite, school foodservice staff can play a role in promoting water consumption in the cafeteria. In many schools and school districts, dietetics practitioners are members of a health or wellness council and, in such a role, it is possible to advocate for feasible and sustainable strategies to provide drinking water. Finally, with regard to changing student behaviors, dietetics practitioners are credible messengers and are likely to be well positioned to promote water consumption through educational activities or other behavior-change strategies. Working in collaboration with school staff, such as administrators, nurses, and teachers, can be a particularly effective strategy to promote water consumption as part of creating a healthful school environment.

References


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