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Original article

## Limited School Drinking Water Access for Youth

Erica L. Kenney, Sc.D.<sup>a,\*</sup>, Steven L. Gortmaker, Ph.D.<sup>a</sup>, Juliana F. W. Cohen, Sc.D.<sup>b,c</sup>,  
 Eric B. Rimm, Sc.D.<sup>b,d,e</sup>, and Angie L. Cradock, Sc.D.<sup>a</sup>

<sup>a</sup> Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, Massachusetts

<sup>b</sup> Department of Nutrition, Harvard T.H. Chan School of Public Health, Boston, Massachusetts

<sup>c</sup> Department of Health Sciences, Merrimack College, North Andover, Massachusetts

<sup>d</sup> Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, Massachusetts

<sup>e</sup> Department of Medicine, Channing Division of Network Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts

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### ABSTRACT

**Purpose:** Providing children and youth with safe, adequate drinking water access during school is essential for health. This study used objectively measured data to investigate the extent to which schools provide drinking water access that meets state and federal policies.

**Methods:** We visited 59 middle and high schools in Massachusetts during spring 2012. Trained research assistants documented the type, location, and working condition of all water access points throughout each school building using a standard protocol. School food service directors (FSDs) completed surveys reporting water access in cafeterias. We evaluated school compliance with state plumbing codes and federal regulations and compared FSD self-reports of water access with direct observation; data were analyzed in 2014.

**Results:** On average, each school had 1.5 (standard deviation: .6) water sources per 75 students; 82% (standard deviation: 20) were functioning and fewer (70%) were both clean and functioning. Less than half of the schools met the federal Healthy Hunger-Free Kids Act requirement for free water access during lunch; 18 schools (31%) provided bottled water for purchase but no free water. Slightly over half (59%) met the Massachusetts state plumbing code. FSDs overestimated free drinking water access compared to direct observation (96% FSD reported vs. 48% observed, kappa = .07, p = .17).

**Conclusions:** School drinking water access may be limited. In this study, many schools did not meet state or federal policies for minimum student drinking water access. School administrative staff may not accurately report water access. Public health action is needed to increase school drinking water access.

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### IMPLICATIONS AND CONTRIBUTION

Adolescents' water consumption is lower than recommended. In a sample of Massachusetts middle and high schools, about half did not meet federal and state minimum drinking water access policies. Direct observation may improve assessments of drinking water access and could be integrated into routine school food service monitoring protocols.

Access to safe, clean drinking water is essential for health [1,2]. Adequate water intake helps to maintain proper body hydration. In turn, hydration status is associated with proper

circulatory and metabolic function [1,2]; emerging evidence suggests that poor hydration is associated with poorer cognitive function [3–7], mood [6,7], and well-being [8]. Increasing water consumption may be an effective strategy for reducing intake of sugar-sweetened beverages and subsequently reducing risk of obesity and dental caries [2,9–12]. However, national studies suggest that children and adolescents, in particular, do not drink adequate amounts of water as defined by the Institutes of Medicine [13,14], and that over half of children and adolescents are not adequately hydrated at any

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**Disclaimer:** This work is solely the responsibility of the authors and does not represent official views of the CDC.

\* Address correspondence to: Erica L. Kenney, Sc.D., Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, 677 Huntington Avenue, Boston, MA 02115.

E-mail address: [ekenney@hsph.harvard.edu](mailto:ekenney@hsph.harvard.edu) (E.L. Kenney).

given time, with significant disparities in hydration status by gender and race/ethnicity [15].

Most American children and youth spend much of their time—on average 6.6 hours per day for about 180 days per year [16]—in public school settings. It is crucial, therefore, that schools provide students with access to safe, free, clean drinking water during the day. School water access is determined by policies at several levels of influence. Individual states set plumbing codes that specify the minimum number of water sources per a given number of students and can also specify the types of water sources allowed [17]; codes requiring a higher minimum of sources have been associated with higher levels of student-reported water access in schools [18]. Although district- or school-level wellness policies could set requirements for water access, few of such policies have been found to do so [19]. At the federal level, the Healthy, Hunger-Free Kids Act of 2010 (HHFKA) requires schools participating in the National School Lunch Program to provide drinking water at no cost to students during lunch, in the places where they are served lunch [20]. This requirement went into effect during the 2011–2012 school year [21].

Despite these policies, water access in schools is by no means universal. Access varies by region and by the sociodemographic makeup of the student body [18], and providing adequate access to safe water can be challenging for schools with older infrastructure or limited access to safe tap water sources [19,22,23]. Although a recent, nationally representative survey of US public schools found that most public school students (more than 86%) attend schools that meet the HHFKA requirement for providing free water during lunch [24], this survey relied on reports from school principals, the validity of which is unclear. To assess whether public health action is needed to improve water access in schools and, thus, reduce the potential negative health impacts of inadequate water intake and hydration, there is a need for objectively measured data about the adequacy of water access in schools.

Our aim was to describe the state of drinking water access for youth using a direct observation protocol in a sample of public middle and high schools throughout Massachusetts. From these direct observations, we evaluated whether schools met the Massachusetts state plumbing codes as of spring 2012, as well as whether the schools met the HHFKA requirement for free water access during lunch. These two policies were the relevant drinking water access policies in place at the time for Massachusetts schools; although Massachusetts now has a state regulation specifying that free drinking water must be made available to students throughout the day (implemented in the 2012–2013 school year), this was not in place at the time of the study [19]. Similarly, although it is possible for local education agencies to issue district wellness policies that specify the provision of drinking water to students, very few Massachusetts districts (6%) had such policies in place [19]. Finally, to assess the validity of administrator-reported data about school water access, we compared our direct observations of water access in lunchroom areas to reports about water access in lunchroom areas from school FSDs.

## Methods

### *Sample and design*

This cross-sectional study uses information gathered from the baseline data collection of the Nutrition Opportunities to Understand Reforms Involving Student Health study, conducted

May–June 2012. School districts with both middle and high schools in Massachusetts were eligible to participate in the study; 113 districts were invited to participate, with a middle and high school randomly sampled within each district [25]. Of these, 31 districts (31%) agreed to participate in the water access assessment, with the primary reason for nonparticipation given being a lack of time on the part of the district FSDs, resulting in a final sample size of 59 school buildings for water access analysis (in two districts, the middle and high school shared the same building, whereas in a third district only a high school was visited). Each participating school was visited by research assistants on one day to complete a direct observation of drinking water availability at the school. Study procedures were approved by the Office of Human Research Administration at the Harvard T.H. Chan School of Public Health.

### *Measures*

For the on-site observations of water access, trained research assistants visited each participating school and used a standardized protocol to document school drinking water access. Research assistants walked through the entire school building to assess the presence of drinking water access points. Each time a drinking water access point was identified, the research assistant recorded the type (e.g., fountain, cooler, pitcher), functional status (able to draw water vs. not able to draw water from the source), and their perception of the cleanliness of the water source (coded as clean or dirty). Bathroom, classroom, and kitchen sinks were excluded unless cupholders or signage specifying the sink should be used for drinking were observed. Research assistants recorded the location of the water source, including the specific floor and closest room number (if applicable) and categorized the location type (i.e., hallway, cafeteria, gym, classroom, office, play space, outdoors, or other). Flow rate, operationalized as the time to the nearest second needed to draw nine fluid ounces from the water source, was measured using a stopwatch and cup. Water temperature was measured using a digital thermometer (Taylor; Model # 9847N) to the nearest 10th of a degree Fahrenheit. Research assistants were trained to take detailed qualitative notes about their perceptions of the water sources' appearance (e.g., whether the water source was rusty, had trash in the basin). In addition, research assistants documented each vending machine, school store, or other beverage sale access point where bottled water was sold, including cafeterias. In a separate study utilizing a similar protocol, inter-rater reliability for coding of water source type was excellent, with  $\kappa = .91$ ; inter-rater reliability was also high for coding of water source location, with  $\kappa = .83$ .

FSDs for each school district were asked to complete a survey online asking about water access at the selected middle and high schools. The survey was developed with input from expert fellow researchers and stakeholders and was meant to align with similar questions asked about water in the United States Department of Agriculture's (USDA) Special Nutrition Program Operations Study [26]. The survey asked FSDs to report on the school building's source of tap water (response options: public or municipal, site-operated well, no tap water available, or do not know) and the frequency of water quality testing at the school (response options: more than annually, annually, less than annually, or not tested). FSDs were also asked for both the participating middle and the high school, "Is free drinking water available to students where school meals are served?" and asked

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