

Getting Back on Tap

The Policy Context and Cost of Ensuring Access to Low-Cost Drinking Water in Massachusetts Schools

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Background: Adequate water intake may have important health benefits for schoolchildren. Layers of federal, state, and local policy are relevant to provision of water within schools. Recently passed state and federal laws require free drinking-water access for students during mealtimes.

Purpose: To review Massachusetts local district wellness policies related to water access, provide estimates of costs for three water-provision strategies, and discuss implications for policy relevant to adequate drinking-water access.

Methods: Legal research was conducted using the LexisNexis legal database and government websites. Local wellness policies were double-coded using existing research tools. Costs of three water-delivery options were estimated using a 10-year school-district perspective.

Results: Prior to 2010, most Massachusetts public school district wellness policies (92%–94%) did not address access to free drinking water. Ten-year costs per school for providing water during mealtimes to students, including dispenser unit, installation, water testing, water, cups, and labor, range between \$12,544 and \$27,922 (depending on water-delivery option) assuming the average Massachusetts school enrollment. Water-provision strategies relying on tap water are more economical than bottled water in the long term.

Conclusions: Policy recommendations and cost considerations deserve attention at the local, state, and federal levels. Recommendations are discussed to ensure access to safe, free drinking water for all students. (Am J Prev Med 2012;43(3S2):S95–S101) © 2012 American Journal of Preventive Medicine

Background

Nearly 49 million students enroll in elementary and secondary public school programs in the U.S.¹ Adequate water intake may have health benefits for students and, potentially, an impact on obesity by providing a calorie-free source of hydration. Although multiple layers of policy are relevant to provision of water within schools, little is known about the effectiveness, impact, or implementation cost of various policy approaches to address water access and consumption. This article reviews the framework of federal, state, and local policy that historically has shaped school drinking-water access, infrastructure, and quality in Mas-

sachusetts schools; provides estimates of the costs of different water-provision strategies; and discusses implications for policy.

Water and Child Health

Despite its critical importance, research on water and its relationship to overall child health is limited. National estimates suggest that children and adolescents aged 4–19 years consume less than the recommended adequate intake of water,² despite the potential for cognitive and physical benefits including prevention of dehydration³ and dental caries (with consumption of fluoridated water).⁴ Water, when consumed in place of sugar-sweetened beverages, juice, and milk, is associated with reduced caloric intake.^{3,5} School-based intervention studies to promote water access and consumption show water-consumption promotion is feasible in school settings,^{6–10} and increased water consumption alone⁷ or accompanied by decreased sugary drink consumption is associated with lower obesity risk.¹¹ However, in some cities, contamination in school drinking water has restricted access to plumbed drinking water.^{12–14} Enabling

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Table 1. Key recent policy and programmatic activities influencing school water access in Massachusetts

1988	Federal LCCA signed into law establishing a remedial action program requiring states to establish a program to address lead in school drinking water
	MassDEP Lead in Schools Initiative begins
	The Consumer Product Safety Commission recalls lead-contaminated water-cooler units nationwide
	Massachusetts Department of Public Health conducts random water-quality sampling of elementary schools
	Boston Public Schools conducts districtwide water-quality testing
1996	The LCCA's remedial action program struck down by a federal court on constitutional grounds rendering it unenforceable against the states
2001	MA Healthy Schools Council, a state interagency task force, established
2003	Drinking water included in the MA Healthy Schools Council's "Checklist Concerning Environmental Health & Safety in Schools"
2004	MSBA created by statute
2005	MSBA publishes first Needs Survey Report rating school building conditions
	MassDEP Lead in Schools Initiative requests school districts conduct water-quality testing and report results
2006	Local school wellness policies required by law for schools participating in the National School Lunch Program
2010	MSBA publishes follow-up Needs Survey Report rating school building conditions
	MassDEP requests school districts test for lead and copper and report results
	Healthy Hunger Free Kids Act requires water be made available at no cost to students in food service areas (effective for the 2011–2012 school year)
2011	MA School Nutrition Bill requires water provision at no cost to students throughout the school day (effective date August, 2012)

MassDEP, Massachusetts Department of Environmental Protection; LCCA, Lead Contamination and Control Act; MA, Massachusetts; MSBA, Massachusetts School Building Authority

all children to receive the potential health and cognitive benefits of adequate, safe drinking water is a critical issue for decision makers.

Federal and Massachusetts State School Water Policies

School districts are subject to federal, state, and local laws and also have authority to adopt policies. Table 1 outlines important school water-access policy milestones for Massachusetts. School water quality emerged as a federal issue in 1988 with the Lead Contamination and Control Act (LCCA).¹⁵ The LCCA ordered a nationwide recall of lead-contaminated water cooler units in U.S. school buildings and had a “remedial action” provision requiring states to establish programs to address lead in school drinking water.¹⁵ Water-quality testing in Boston and other Massachusetts schools found levels of lead above the allowable thresholds for health.¹⁶ However, a 1996 legal challenge determined the LCCAs remedial action program to be unenforceable against the states, and states were no longer required by federal law to establish programs to monitor the presence of lead in school drinking water.¹⁷

More recently, drinking water in schools has been addressed as a federal school nutrition issue. Under the

Federal Child Nutrition and WIC Reauthorization Act of 2004, local school agencies participating in the federally funded National School Lunch Program (NSLP) were required to have a local school wellness policy including nutrition guidelines selected by the local educational agency in place by the first day of the 2006–2007 school year.¹⁸ Districts could elect, but were not required, to address water access in these policies. When the legislation was reauthorized in 2010, schools were required to make drinking water freely available during lunch and snack programs at no cost to students beginning with the 2011–2012 school year.^{19,20} Water was to be available in meal-service areas and could be provided via drinking fountains or other water sources where children could fill cups or bottles.

Massachusetts legislation and regulatory initiatives also influence school water access and quality (Table 1). In 2010, the Massachusetts state legislature required public schools to make plain, potable water available to students, free of charge, during the day, beginning with the 2012–2013 school year.²¹ The Massachusetts Uniform State Plumbing Code requires a minimum of one drinking fountain per 75 students in primary and secondary

educational facilities²² and that only potable water shall be accessible to plumbing fixtures supplying drinking water.²³ Although the plumbing code states that plumbing systems shall be maintained in accordance with state regulations,²⁴ local building inspectors are required to inspect only during construction, alteration, or repairs requiring a permit.²⁵ As a result, no uniform enforcement system is in place to ensure that school plumbing systems are maintained in proper working order.

School water-quality assessment and monitoring in Massachusetts is coordinated by the Massachusetts Department of Environmental Protection (MassDEP).²⁶ MassDEP periodically requests water testing and instructs schools with water-quality issues to notify parents, shut off contaminated sources, and provide bottled water from an approved supplier until water-quality concerns are addressed. Installation of point-of-use filtration devices to filter contaminants is not a practical option because, under Massachusetts law, installation of such devices triggers laws applicable to public water suppliers including water-distributor licensing, instituting testing protocols, and other regulatory provisions.²⁷ Schools on wells are regulated as public water suppliers and cannot use bottled water to comply with water-quality laws unless they obtain temporary approval in order to avoid health risks.²⁸

Massachusetts School Building Infrastructure and Water-Quality Status

Massachusetts was home to 1757 school buildings in 2010.²⁹ Seventy-seven percent of Massachusetts school children attended school in buildings built before 1980,²⁹ 6 years prior to the 1986 national ban on the use of lead plumbing materials. During a 2009–2010 school year assessment of school plumbing systems, the Massachusetts School Building Authority (MSBA) indicated that 6% of school buildings needed major plumbing-system repairs, and 1% full system replacement (unpublished data, MSBA, 2010, on file with the authors). Thus a fraction (7%) of public school buildings may lack sufficient drinking-water infrastructure. However, local information regarding whether school-district policies have addressed access to drinking water alone or in response to quality concerns is lacking.

Methods

Legal Research Methods

Legal research was conducted using the LexisNexis legal database and Massachusetts (e.g., MassDEP, MSBA) and federal government (e.g., Environmental Protection Agency) websites. Additional information about school building infrastructure and water quality was obtained through requests to government officials via phone and electronic (e-mail) correspondence.

Local School Wellness Policy Assessment

Although local school wellness policies are nonbinding, they provided insight into Massachusetts' local drinking-water policy adoption prior to the new federal and state water requirements. According to the MA Department of Early and Secondary Education (MA DESE) website (profiles.doe.mass.edu/), 391 public school districts were operating in the 2008–2009 school year. Researchers requested copies of local school wellness policies from school administrators or district food-service directors and assessed local school wellness policies covering 307 school districts. Fifteen additional districts confirmed that their district did not have an existing policy. The overall district response rate was 82%. Responding districts enrolled 91% of students in Massachusetts.

Policies were double-coded independently by two trained research assistants using the 2008–2009 Bridging the Gap School District Wellness Policy Coding Tool, version 2.^{30,31} When policies referenced other guidelines (e.g., implementation guidelines), the original guidelines were obtained and incorporated. Coding discrepancies were resolved by a third coder. Data were obtained from the MA DESE (2008–2009 school year), including student enrollment by district and by grade, and proportions of students eligible for free or reduced-price meal programs.

Cost Assessment of Water Provision

Cost information associated with providing water to students during mealtimes in Massachusetts was gathered using methods based on prior studies³² and adapted for the U.S. setting. Costs were estimated using the perspective of the school or school district for installation of three water-delivery options: commercial bottled water cooler, tap-water dispensers (including both refrigerated and nonrefrigerated options), and plumbed drinking fountains (including both a wall-mounted water bottle filler and a water fountain). Life-cycle analysis, which assesses the initial costs, operating costs, and maintenance costs over the life cycle of a project,³³ was conducted for a 10-year period for a school with 520 students, the average school enrollment in Massachusetts.³⁴ Expert opinion from advocacy groups, content-area experts, local food-service directors, and other city health and education departments informed identification, quantification, and valuation of costs.³⁵ Assumptions regarding water consumption and numbers of water stations needed were based on expert opinion, and costs were calculated based on both a 4-ounce and an 8-ounce/meal consumption level.

Monetary values were obtained for Massachusetts, where available, or based on national or local municipal data. Specific sources are listed in Table 2. No additional costs were added to account for trash disposal of water cups. Scenarios for provision of water via water fountain do not account for the relatively lower efficiency of water delivery.⁴¹ All costs are in 2010 U.S. dollars, and are discounted according to federal guidelines.⁴⁰

Results

Local School Wellness Policy Assessment

In the 2008–2009 school year, 92% of Massachusetts public school districts with elementary school levels and 94% of districts with middle and high-school levels did not address access to free drinking water throughout the school day in their local school wellness policy. These

Table 2. Cost analysis for providing water access during lunch and afterschool snack in a Massachusetts public school with no existing plumbed drinking fountains in meal-service areas, 2010

	Commercial bottled water dispenser	Tap-water dispensers		Plumbed drinking water	
	Bottled water cooler (5-gallon reservoir)	Refrigerated beverage dispenser (three 5-gallon reservoirs)	Nonrefrigerated beverage dispenser (5-gallon reservoir)	Wall-mounted water bottle filler	Refrigerated water fountain
Servings per dispenser	640	1,920	640	N/A	N/A
Average MA public school enrollment during lunch and afterschool snack ^{a,34}	624	624	624	624	624
Dispensers needed	3	1	3	3	3
Water costs (\$) ^b					
Water per student per meal (oz) ³⁶	4	4	4	4	4
Water (\$/gal) ^{a,37}	0.41	0.013	0.013	0.013	0.013
Water, per year	1,439	46	46	46	46
Infrastructure costs (\$) ^b					
Dispenser unit, each ^{a,c}	N/A	1,955	117	963	963
Dispenser installation, each ^a	N/A	1,500	N/A	2,000	2,000
Infrastructure total, 10 years	N/A	3,455	699	8,889	8,889
Other costs (\$) ^b					
Cups, per year ^a	1,123	1,123	1,123	1,123	N/A
Labor, per year ^{a,38}	481	525	525	124	124
Electricity, per year ^{c,39}	30	140	N/A	N/A	150
Water testing, per 5 years	N/A	258	258	398	398
Total cost (\$) ^b					
Year 1 ^d	3,073	5,546	2,301	10,579	9,606
Average cost, Years 2–10 ^{c,e}	2,761	1,673	1,582	1,201	326
Total cost over 10 years ^f	27,922	20,601	16,538	21,386	12,544

^aResearchers estimated costs, labor, and enrollment in afterschool programs based on communication with Boston Public Schools staff and expert opinion.

^bAll costs are in 2010 dollars. Prices have been adjusted to 2010 dollars using the Consumer Price Index, U.S. Bureau of Labor Statistics. Costs after Year 1 have been discounted using real treasury 10-year interest rates for 2010 (2.2%).⁴⁰

^cResearchers estimated costs, energy usage, and replacement rates based on costs and specifications from the following companies: Citisco Foodservice Equipment; Global Tap; Crystal Mountain Coolers; Grindmaster Cecilware; and Hasley Taylor.

^dCost of dispenser units, installation, water testing, water, cups, and labor

^eAverage yearly cost, excluding initial capital purchases. Includes cost of water, labor, electricity, cups, water testing every 5 years, and replacement of dispensers if needed.

^fAll capital costs plus yearly cost of water, labor, electricity, and cups; water testing every 5 years; and replacement of dispensers if needed.

MA, Massachusetts; N/A, not applicable

districts serve 96% of Massachusetts elementary, middle, and high school students. Three percent of elementary, middle, and high school students were enrolled in districts with strong policies mandating that free water always be available throughout the school day (Table 3). In that same school year, 5% of Massachusetts public school districts with elementary schools, 3% of districts with middle schools, and 2% of districts with high schools had strong policies that met the IOM standard prohibiting all beverages with added caloric sweeteners and/or banned all competitive foods and beverages on school campuses. Table 3 depicts the proportion of students enrolled in

districts in Massachusetts that have various categories of policies related to drinking water and vending machines by school level.

Water-Provision Costs

For a MA school of average enrollment without existing drinking-water infrastructure in the food-service area, first-year cost estimates to provide 4 ounces of water per student/day solely during mealtimes, depending on the water-delivery system selected, are between \$2,301 and \$10,579 (Table 2). Assuming children consume 4 ounces

Table 3. Percentage of students in Massachusetts school districts with wellness policies ($n=307$), 2008–2009 school year

Policy focus and strength	Elementary school students		Middle-school students		High-school students	
	All ($n=381,541$)	Eligible ($n=118,136$)	All ($n=193,723$)	Eligible ($n=58,846$)	All ($n=255,053$)	Eligible ($n=79,106$)
Access to free drinking water						
None	95	95	95	95	96	96
Weak ^a	2	3	2	3	2	2
Strong ^b	3	2	3	2	3	1
Regulation of vending machines						
None	34	27	34	27	36	29
Weak ^a	42	40	43	40	41	38
Strong ^b	24	33	24	33	23	33

Note: Eligible indicates those students who qualified for free or reduced-price lunch. Percentages may not add to 100 due to rounding error.
^aWeak policies included vague terms, suggestions, or recommendations, as well as those that required action, but noted exceptions for certain grade levels or certain times of day.⁴²

^bStrong policies were definitely required and specified an implementation plan or strategy. These include both strong policy language and complete restriction (e.g., ban on vending machines or competitive foods).⁴²

of water during mealtime and at snack, the 10-year costs for providing water to students, including dispenser unit, installation, water testing, water, cups, electricity, and labor are \$27,922 for commercial bottled water coolers, \$20,601 and \$16,538 for refrigerated and nonrefrigerated tap-water dispensers (respectively), and \$21,386 and \$12,544 for plumbed wall-mounted water bottle filler and refrigerated water fountain (respectively). Using the alternative assumption that school students each consume 8 ounces of water during meal and snack periods, 10-year costs would be \$40,996 for commercial bottled water coolers, \$21,015, and \$16,952 for refrigerated and nonrefrigerated tap-water dispensers, and \$21,800 and \$12,959 for plumbed wall-mounted water bottle filler and refrigerated water fountain (respectively). Statewide, between \$1.1 and \$1.3 million in local district expenditures in the first year will be needed if the 7% of Massachusetts schools classified by the MSBA as either in need of major plumbing-system repair or replacement were to implement capital plumbed drinking fountain improvements making drinking water available to students during lunch and snack times.

Discussion

Prior to the 2010 federal requirements for the provision of free drinking water to students during mealtimes,⁴² few Massachusetts local school district wellness policies addressed water provision. Between 4% and 5% of all Massachusetts students were enrolled in districts that were identified as having any policy provisions related to providing free drinking water to students. Nationally,

12%–13% of students were enrolled in districts that addressed availability of free drinking water.³¹ For many districts in Massachusetts, the original wellness policy drafting process was a missed opportunity to address water availability; relatively more attention was focused on access to competitive foods and beverages via vending.

Beginning with the 2012–2013 school year, Massachusetts schools will be required to provide water during mealtimes *and* throughout the school day at no cost to students.²¹ Based on an estimated first-year cost of between \$2,301 and \$10,579 for 4 ounces of water provided during mealtimes alone, school districts must consider longer-term costs in developing strategies to meet these requirements. Although recent intervention studies suggest similar volumes of water consumption when water is provided during mealtimes or snack times in conjunction with education and promotion activities,^{36,43} 4 ounces of water per meal per student may be suboptimal for hydration and health benefits. Assuming students receive approximately one third of daily nutrition requirements in school via school meals programs, adequate consumption levels of plain drinking water during school could be 8–12 ounces per day² with accompanying higher cost.

Given the potential cost impact, as well as the health and cognitive benefits for children that accompany adequate access to safe drinking water, local, state, and federal leaders must consider several factors. First, availability of safe drinking water in school buildings will be necessary to implement federal and state drinking-water policies; second, oversight, sources of financial support, and technical assistance for local agencies will be needed

to ensure compliance. Reforms may be needed at the school district, state, and federal levels to ensure access to low-cost drinking water in school settings.

Implications for School Districts

Decisive action is needed in school districts with water-quality issues stemming from inadequate infrastructure. District drinking-water policies and local school wellness policies can be written to require remediation and repairs to bring school buildings into compliance with plumbing-code requirements and relevant state laws. Although bottled water may be necessary in the short term to protect the health and safety of children in buildings with water-quality concerns, it is not the preferred long-term approach. The analysis of water provision during mealtimes alone indicates that upfront and capital 1-year costs of bottled water are on par with tap-water dispensers. However, based on 10-year operational cost estimates, provisions that rely on safe, quality tap water, whether chilled or otherwise, have considerably lower cost. Case-study examples of school efforts to provide water to students are available at the Water in Schools website (www.waterinschools.org/).

Implications for State and Federal Policy

Massachusetts' relatively robust set of mandates for drinking-water access in schools could be strengthened by reforms to align water access in schools with the existing plumbing code, discourage the long-term use of bottled water, propose enforcement mechanisms, and provide for repairs. New regulations pertaining to drinking-water access in schools should support existing code requiring one plumbed drinking fountain per 75 students and ensure water-quality standards. One enforcement strategy is to incorporate drinking-water evaluation criteria in the school certification process.⁴⁴ Capital funding may be needed to reactivate plumbed drinking-water infrastructure potentially supported by policy actions prompting the state agency that allocates state funds for new school buildings and repairs to prioritize drinking-water infrastructure upgrades and repair.

Prior to 2010, federal policy largely was silent on the issue of drinking water in schools. Current federal school nutrition policy only addresses access to water in areas where meals, including lunch and snack, are served. Nationally, a policy shift is required to recognize access to safe drinking water throughout the school day as a core part of school nutrition as has been done in Massachusetts. Although passage of the LCCA in 1988 brought attention to school water quality and spurred testing, the LCCA's currently unenforceable remediation provisions could be revitalized if federal funding for plumbing infrastructure upgrades in school buildings is made available

and tied to compliance with the substantive portions of the law.

Limitations and Study Considerations

Estimates of costs of updating drinking-water infrastructure in Massachusetts are based on the best available evidence. There is limited comprehensive and detailed information on current drinking-water infrastructure and quality or other types of local school drinking-water policies in public schools throughout Massachusetts. Reporting of water-testing results is requested, but not mandated, by state authorities. Estimates of costs of water-delivery options in 2010 dollars are specific to Massachusetts and may fluctuate based on existing drinking-water infrastructure.

Additionally, scenarios for the provision of water via a water fountain without making a cup available do not account for lower efficiency of water delivery via a water fountain and may underestimate actual water cost. Estimates from a 1978 study suggest that water fountain users consume approximately 1.8 ounces per 3–6 second use time but that water wastage can be extensive.⁴¹ Providing cups at plumbed drinking-water fountains, currently not required by federal law, may improve efficiency and signal a water-delivery system that also can be used at a lower cost than bottled water throughout a school building.

Conclusion

Reforms at the school district, state, and federal levels will help ensure access to low-cost drinking water in school settings. Water-provision strategies that rely on safe, quality tap water have considerably lower long-run cost. Key state agencies with oversight of school building environments and public health must determine the scope of need and prioritize interventions within districts. Water quality and access could be included as part of school licensing and accreditation processes. State environmental-protection agencies might consider targeted water-quality testing, prioritizing older school buildings or those that have identified need. Ensuring safe, free drinking water in school buildings will be essential to the success of water-promotion activities.

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