CONCISE COMMUNICATION

Hospital Water Management Programs for *Legionella* Prevention, Minnesota, 2017

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ABSTRACT Infection preventionists at Minnesota hospitals were surveyed to determine whether they had *Legionella* water management plans. Of 137 hospitals, 84 (61%) responded. Among them, 27% hospitals had a water management plan, 21% regularly sampled for *Legionella*, and 51% had knowledge of ASHRAE *Legionella* prevention standards. Significant changes are needed to protect patients from nosocomial infection.

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Legionnaires' disease is characterized by severe pneumonia and a nonproductive cough. *Legionella pneumophila* serogroup 1 is responsible for 99% of cases. Disease incidence has been rising in the United States, with 8,000–18,000 cases annually.[1,2] *Legionella* are ubiquitous in water, and they thrive in places of stasis (especially with a biofilm) and heat (35–46°C or 95–115°F) such as hot water tanks, cooling towers, whirlpools, and plumbing systems.[3] Inhalation of aerosolized water droplets containing *Legionella* is the most common exposure route. Outbreaks are associated with buildings that have complicated water storage and distribution systems including hotels, long-term care facilities, and hospitals.[3,4] The vulnerability of patients in hospitals increases the risk of severe disease.[5] *Legionella* are well suited to hospital water systems, and secondary disinfection with chlorine, monochloramine, or copper-silver ionization, plus monitoring this intervention through testing comprises one preventive measure. When a system is contaminated, control options include super-heating and flushing the system with or without shock chlorination, or use of point-of-use filters. Control of *Legionella* in cooling towers requires engineering expertise.

Effective facility water management includes plans to control *Legionella* growth to prevent infections. In 2015, the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) published standards (ASHRAE 188) for managing water to reduce *Legionella* growth.[6] The US Centers for Disease Control and Prevention developed a tool kit in June 2016 to provide practical ways to implement ASHRAE 188.[7] In June 2017, the Centers for Medicaid and Medicare Services (CMS) mandated that all Medicare-certified facilities have water management policies in place to reduce the growth and spread of *Legionella*.[8]

We surveyed Minnesota hospitals to determine whether they had *Legionella* water management plans in place to assess whether they could meet the new CMS requirement.

METHODS

We developed 18 forced-choice and open-ended questions with subparts regarding water systems, management plans (including testing) and *Legionella* prevention. After pilot testing and refinement, the survey was sent in April 2017 via e-mail to infection preventionists in all 137 acute-care, critical access acute-care, and long-term acute-care hospitals in Minnesota. Over 6 weeks, 3 reminder e-mails were sent, followed by telephone contact with nonrespondents. The survey could be completed online or verbally if requested. Recipients were directed to complete survey parts and/or to include others with more knowledge, such as engineering staff.

In addition to facility type, hospitals were categorized by location (ie, 7-county Minneapolis–St Paul metropolitan area or greater Minnesota), and size based on licensed bed count: large (>249 beds), medium (100–249 beds), or small (<100 beds).

Microsoft Excel and R statistical software packages were used to analyze the results. Pearson χ^2 tests on the relevant data were conducted, with the significance level set at $P < .05$.

RESULTS

Overall, 84 surveys were returned (61% response rate); 3 were incomplete and were excluded from analyses. Moreover, 36 of 57 acute-care facilities (63%), 44 of 78 critical access facilities (56%), and 1 of 2 long-term acute-care facilities (50%) responded. Furthermore, 15 of 23 metropolitan area hospitals (65%) and 66 of 114 greater Minnesota hospitals (58%) responded. Selected responses are listed in Table 1.

With multiple responses possible, the most commonly used devices to store and distribute water were the following: humidifiers (65%), cooling towers (44%), spa pools (40%), dialysis (28%), outdoor decorative fountains (23%), indoor fountains (11%), and irrigation equipment (69%).

Overall, 27% of hospitals had a water management program with significant differences noted by hospital type (50% of acute care hospitals, 9% of critical access hospitals; $P < .001$), location ($P = .03$), and size ($P < .001$) (Table 1). More facility water management programs covered nonpotable water (77%) than potable water (59%).

Only 7% of facilities measured pH at which cold and hot water are stored and at point of use with no differences by hospital type, location, or size (Table 1). More facilities measured the temperature at which cold and hot water are stored (46%) and at point of use (60%) with no differences by hospital type, location, or size (Table 1). Hot water temperature range at storage were reported as 109–145°F (35–46°C). All facilities were supplied by community drinking water sources. Fewer than 5 facilities used secondary disinfection (eg, reverse osmosis, ultraviolet light, or chlorine) of any system.

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TABLE 1. Selected Responses Regarding *Legionella* Prevention

Facility Response	Metropolitan Area (n = 15), No. (%)	Greater Minnesota (n = 66), No. (%)	*P* Value	Small Hospital (n = 59), No. (%)	Medium-Sized Hospital (n = 9), No. (%)	Large Hospital (n = 13), No. (%)	*P* Value
Have a water management plan	8 (53)	14 (21)	.03	10 (17)	3 (33)	9 (69)	< .001
Measure pH at which water stored	3 (20)	3 (5)	NS	4 (7)	1 (11)	1 (8)	NS
Measure temperature at which water stored	8 (53)	29 (44)	NS	24 (41)	5 (56)	8 (62)	NS
Regularly sample water for *Legionella*	8 (53)	9 (14)	.003	7 (12)	3 (33)	7 (54)	.003
If sample, plan in place if *Legionella* detected	5 (63)	5 (56)	NS	2 (29)	2 (67)	6 (86)	NS
Knowledge of ASHRAE 188	15 (100)	26 (39)	< .001	22 (37)	7 (78)	12 (92)	< .001
Knowledge of CDC tool kit	14 (93)	21 (32)	< .001	18 (31)	6 (67)	11 (85)	< .001

NOTE. NS, not statistically significant.

Moreover, 21% of responding hospitals regularly sample water for *Legionella*, with differences noted by hospital location and size ($P < .01$) (Table 1). The most common reasons for not sampling were that the facility is just developing a management plan, that there have been no *Legionella* cases, or that water was received from the community water supply where testing is presumed to have occurred. The most common sites that are tested were cooling towers (59%) and "high risk" areas (29%). Most responding hospitals (82%) used a contractor for sample collection, which was most often performed quarterly (35%) or annually (24%). In addition, 14 facilities did testing at CDC Environmental *Legionella* Isolation Techniques Evaluation–certified laboratories.[9] In the event of detecting *Legionella*, 59% of respondents had a plan in place, and 90% noted that it was part of their water management program, with no significant difference found between type, location, and size of facility (Table 1).

Approximately half of facilities (51%) had knowledge of ASHRAE 188 (Table 1). Fewer (43%) knew of the CDC tool kit (Table 1). Of those who knew about ASHRAE 188, 56% had used it, and of those who knew about the tool kit, 46% had used it. 59% developed their water management program before AHRAE 188 was released, and 38% of respondents plan to modify their programs to meet the standard.

Among our survey respondents, 11 (50%) facilities with a water management program had a management program team with the facilities, infection control, and engineering departments being represented most often. Most facilities (59%) evaluate their water management programs, most frequently on an annual basis (77%). However, some facilities that evaluated their program annually or monthly also evaluated their water in response to an outbreak or when new standards are issued.

In addition, 37 facilities expressed interest in setting up a water management program; 20 did not. Several reasons were given for not wanting to establish one: it was thought not to be needed, lack of resources, waiting for a larger affiliated hospital to establish, lack of stagnant water, or the water department was doing its job. Most facilities (76%) expressed interest in having the health department provide assistance in setting up a program including providing access to ASHRAE 188 and the tool kit and providing education.

DISCUSSION

Our results suggest that hospitals need to do much more to prevent Legionnaires' disease and to control *Legionella* in their water management systems. Only 27% of facilities had a water management plan, and 20% stated no interest in developing one. Only 51% of responding hospitals had knowledge of ASHRAE 188, and fewer had knowledge of the CDC tool kit. Awareness was significantly related to type, location, and size of hospital. Awareness of guidelines did not translate to use. Most programs were developed before the ASHRAE 188 standard was published, but few facilities planned to modify their program to meet the new standard.

Fewer than 50% of respondents indicated that hot water temperature was measured at storage at their hospital, and at least some reported temperature lower than recommended by ASHRAE. Although the CDC recommends testing for *Legionella* be considered at least once a year, only ~20% reported sampling on a regular basis. Facilities in the metropolitan area, larger facilities, and acute-care facilities tended to do more sampling, suggesting that resources play a role in the performance of testing procedures.

Almost all facilities had a plan in place should *Legionella* be detected. Among facilities with water management programs, 50% had a management team in accordance with the CDC tool kit. Most facilities evaluated their water management program and did so annually.

Our results may not be generalizable to all hospitals or healthcare facilities. Not all hospitals responded to our survey, although most nonrespondents were small rural hospitals. Hospital water management plans may vary geographically dependent on prior experience, perceived risk, and available resources to develop a plan. Our survey occurred just prior to the CMS requirement, so responses are likely to be different now.

Facilities were very interested in setting up water management plans and overwhelmingly wanted the health department to make resources available to them. An estimated 20% of all

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Legionnaires' disease cases in the United States are definite or possible healthcare-associated cases, with a case fatality rate of 12%, so preventive actions are needed.[5] Significant water management changes need to occur soon to meet the new CMS requirements and to better protect patients from healthcare-associated *Legionella* infections.

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