

potential associated with increasing rates of antimicrobial resistance, which justifies strict monitoring. As expected, β -lactam agents suffered the most reduction in their susceptibility rates. Furthermore, marked reductions were also observed for CIP, AK, CN, STX, and PMB (Figure 1).

In conclusion, special attention must be focused on the widespread resistance of KPC producers, which has important repercussions in Brazilian hospitals. However, little is known about the resistance (in particular, to polymyxin B) among *Enterobacter cloacae* complex isolates. Although this study did not include molecular characterization and emerging genotypes, measures of infection control and prevention of spreading are mandatory for this pathogen, especially when worrisome resistance (eg, to polymyxins) is detected.

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Legionnaires' Disease and Use of Water Dispensers With an Ultraviolet Sterilizer

To the Editor—Legionnaires' disease (LD) is mainly transmitted by inhalation of infectious aerosol, while aspiration of contaminated water is another possible mode of transmission.^{1–3} We report 3 LD cases with *Legionella pneumophila* (*Lp*) isolated in water samples from water dispensers with an ultraviolet (UV) sterilizer and a filter.

Legionnaires' disease is a notifiable infectious disease in Hong Kong. The Centre for Health Protection conducts epidemiological investigations for all cases and carries out environmental investigations according to local protocols. Water samples for *Legionella* culture and *Legionella* sequence-based typing of *Lp* isolates from human and water samples are performed as required.

Patient 1 was a 59-year-old bed-bound male patient with malignant brain tumor. He had been staying in hospital A for management of his malignancy since mid-December 2015. He presented with oxygen desaturation on June 8, 2016. On June 11, 2016, his tracheal aspirate was positive for *Lp* (non-serogroup 1) DNA but was negative for *Legionella* by culture.

The room where he stayed in the hospital had a water dispenser with a UV sterilizer and a filter, and a shower. He did not drink water from the water dispenser, but his helper used unboiled cold water from the water dispenser and the shower to perform sponge bathing and face washing for him. A cold-water sample from the water dispenser was positive for *Lp* (non-serogroup 1) at 0.4 colony-forming units (CFU)/mL. In addition, 2 hot-water samples from the shower were positive for *Lp* (non-serogroup 1) at 3.1 and 32.0 CFU/mL, respectively (Table 1). *Legionella pneumophila* isolates from the 3 water samples were all sequence type 583 (ST583), which is very rare in Hong Kong. Only 5 of the 7 alleles were amplifiable from this patient's tracheal aspirate, and they were identical to the corresponding alleles for ST583. The exact source of infection was undetermined because water samples from different sites were positive with the same sequence type.

Patient 2 was a 90-year-old female with multiple medical illnesses who was admitted to hospital B on March 14, 2017, for intestinal obstruction; surgery was performed on March 17. She developed shortness of breath on March 23 and was transferred to another hospital for management on April 11.

TABLE 1. Environmental Water Samples Positive for *Legionella pneumophila* Associated With 3 Cases of Legionnaires' Disease, Hong Kong

Sampling Site	<i>Legionella pneumophila</i>		<i>Legionella</i> Sequence-Based Typing Result
	Type	CFU/mL	
Patient 1			
Cold water from water dispenser in patient's room (preflush)	<i>Lp</i> non-1	0.4	ST583
Hot shower water in patient's room (preflush)	<i>Lp</i> non-1	3.1	ST583
Hot shower water in patient's room (postflush)	<i>Lp</i> -1	7.5	Not done
	<i>Lp</i> non-1	32.0	ST583
Patient 2			
Cold water from water dispenser in patient's room (preflush)	<i>Lp</i> -1	1.6	Not done
Cold water from water dispenser in patient's room (postflush)	<i>Lp</i> -1	0.1	Not done
Cold tap water in patient's room (post flush)	<i>Lp</i> -1	0.5	Not done
	<i>Lp</i> non-1	3.6	Not done
Cold shower water in patient's room (postflush)	<i>Lp</i> -1	0.2	Not done
	<i>Lp</i> non-1	0.1	Not done
Cold tap water in patient's room (preflush)	<i>Lp</i> non-1	5.6	Not done
Cold shower water in patient's room (preflush)	<i>Lp</i> non-1	0.1	Not done
Hot shower water in patient's room (preflush)	<i>Lp</i> non-1	0.1	Not done
Patient 3			
Cold water from a water dispenser in the pantry located on a floor where the patient had stayed (preflush)	<i>Lp</i> -1	0.2	ST1

NOTE. *Lp* non-1, *Legionella pneumophila* (non-serogroup 1); ST, sequence type; *Lp*-1, *Legionella pneumophila* serogroup 1.

On April 12, her urine was positive for *Lp*-1 antigen. Endotracheal aspirates on April 12 and 13 were negative for *Legionella* by culture and polymerase chain reaction.

The room she stayed before LD onset had a water dispenser with a UV sterilizer with a filter, a water tap, and a shower. She reported that she drank unboiled cold water from the water dispenser and that she had used the shower for bathing. Furthermore, 2 cold-water samples from the water dispenser were positive for *Lp*-1 at 0.1 and 1.6 CFU/mL, respectively. No molecular typing was done because of the negative clinical samples and the source of infection remained undetermined.

Patient 3 was a 49-year-old female with hematological malignancy who was admitted to hospital C on August 12, 2017, for pneumonia and had intermittent fever after admission. She was discharged on September 11 and was admitted to another hospital on September 13. On August 29, her sputum was positive for *Lp*-1 DNA, and on September 13, her bronchoalveolar lavage culture was positive for *Lp*-1. She had stayed in multiple rooms located on different floors of hospital C. Cold drinking water was provided in pots supplied by the water dispenser in the pantry on that floor. The water dispenser was equipped with a UV sterilizer and a filter. The patient reported that she drank the pot water provided without boiling. A cold-water sample from the water dispenser in the pantry on one of the floors on which she had stayed was positive for *Lp*-1 (0.2 CFU/mL). The *Lp*-1 isolates from the patient and the water sample from the water dispenser were both ST1, the most prevalent environmental sequence type in Hong Kong. In this case, the patient's onset of LD was uncertain, and the source of infection was undetermined.

The use of water dispensers equipped with different types of water treatment devices has gained popularity. Ultraviolet light

has been reported as an effective means for disinfection against *Legionella* in water systems.⁴ In our cases, the UV sterilizers claimed to deliver a UV dosage of 30 mJ/cm² or more, which is greater than the reported dosage require to inactivate *Lp*.⁵ However, *Lp* was still recovered from cold-water samples from these water dispensers.

Failure to eradicate *Legionella* in water from these water dispensers can be multifactorial. The point-of-entry application of UV disinfection does not allow eradication of *Legionella* within the biofilms distal to the point of entry.⁶ Moreover, UV disinfection provides no residual protection and regrowth of *Legionella* in the biofilm layers of scale, and accumulated debris may allow recolonization.⁷

Immunosuppression is a well-established risk factor for LD.^{1,8} Studies have shown that bed bathing, use of nasogastric tube, and surgery are risk factors for nosocomial LD,^{2,3,9} and aspiration of contaminated water is a possible mode of transmission for *Legionella*.^{2,3} Our findings provide evidence that cold water from these water dispensers is not free from *Legionella*, but its association with LD could not be confirmed. However, it is prudent to advise immunocompromised patients, particularly those who are at high risk of aspiration, to avoid drinking cold water from these water dispensers without boiling. Moreover, hospitals should avoid installing these water dispensers in areas that serve a large number of immunocompromised patients.

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Incidence and Risk Factors of Postoperative Pneumonia in Abdominal Operations Patients at a Teaching Hospital in China

To the Editor—Postoperative pneumonia (POP) is defined as hospital-acquired or ventilator-associated pneumonia

in postsurgical patients; it is among the most common complications among postsurgical patients, leading to increased morbidity, length of hospital stay, and costs.^{1,2} Elucidating the risk factors for POP would help reduce the incidence of this complication; however, few studies have been published concerning POP with abdominal operations in Chinese hospitals.

To determine the incidence of, pathogens implicated in, and risk factors for POP in abdominal operations in China, we conducted a research in The Second Affiliated People's Hospital of Fujian University of Traditional Chinese Medicine, a tertiary-care teaching hospital in southeastern China. All patients who received abdominal operations between January 1, 2015, and December 31, 2015, in this hospital were included in the study. The demographic data and medical records including imaging, and laboratory tests were reviewed, and healthcare-associated infections were monitored as usual. Pneumonia was identified using the 2015 US Centers for Disease Control and Prevention (CDC) criteria for a pneumonia event.³

Among the 618 patients who received abdominal operations, 36 patients (5.83%) developed POP. The POP incidence rates differed among abdominal surgery types as follows: gastric, 11 of 56 (19.64%); hepatic, 4 of 27 (14.81%); colorectal, 16 of 127 (12.60%); biliary tract, 4 of 80 (5.00%); appendix, 1 of 156 (0.64%); and inguinal hernia surgery, 0 of 172 ($P < .001$). Lower respiratory tract specimens from 30 POP patients were sent to the microbiology laboratory for pathogen culture, and 12 samples were positive for bacterial growth. The following pathogens were isolated: *Klebsiella pneumoniae* (4 strains), *Pseudomonas aeruginosa* (2 strains), *Escherichia coli* (2 strains), *Staphylococcus aureus* (2 strains), and *Candida albicans* (2 strains).

To determine the risk factors for POP, univariate analysis and multivariable analysis (logistic regression analysis) were used. Patients who developed POP after abdominal operations were included in the POP group. For each POP patient, 2 controls were randomly selected from patients who did not acquire pneumonia before and after abdominal operations and did not develop other healthcare-associated infections during this hospitalization. As shown in Table 1, univariate analysis revealed that POP patients had higher rates of smoking, diabetes mellitus, chronic pulmonary disease, chronic cardiovascular disease; higher levels of serum creatinine; higher American Society of Anesthesiologists (ASA) scores; lower levels of serum albumin and hemoglobin; and longer durations of surgery than control patients. Multivariable analysis demonstrated that smoking and chronic cardiovascular disease were independent risk factors for POP.

The POP incidence has been reported to be between 0.78% and 40%, making it the third most common infection in patients after an operation, with a mortality rate between 30% and 40%.^{2,4} The present study shows that the incidence of POP is not considered low in patients undergoing abdominal