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# Introductory Chapter: Hospital-Acquired Infection and Legionnaires' Disease

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## 1. Introduction

According to the Institute of Medicine, hospital-acquired infection and the adverse event in hospitals are responsible for 44,000–98,000 deaths and account for \$17–29 billion in the healthcare cost in the USA alone [1, 2]. The care of the patient in the intensive care unit (ICU) is expensive and poses a significant economic burden on the healthcare [3, 4]. In the early part of the twentieth century, the intensive care units were taking care of patients with respiratory failure related to polio. With the advancement of technology and medicine, patients with multiple comorbidities are now being admitted in the ICU. A study by the World Health Organization (WHO) found that 51% of the patients in the ICU have infections [5]. The risk of infection among patients on a mechanical ventilation is 6- to 21-fold higher. Surprisingly, the risk of ICU-acquired infections among low- and middle-income countries was found to be 2–3 times higher than the ICU-acquired infections among ICU patients in developed countries [5, 6]. With the advent of invasive monitoring and therapeutic devices, the incidence and prevalence of the infection have increased, and we have seen a significant increase in antibiotic use and multidrug-resistant (MDR) infections [7]. Infectious conditions, sepsis, and septic shock continue to be responsible for significant morbidity and mortality [7]. Increased MDR infection has now become a global threat. Two million cases and 23,000 deaths each year are attributable to MDR infection in the USA alone, according to the Centers for Disease Control and Prevention (CDC) [8, 9]. In addition, inappropriate use of the antibiotics not only leads to increase in MDR but costs the healthcare \$27–42 billion annually [8–10]. The central line-associated bloodstream infection (CLABSI) and catheter-associated urinary tract infection (CAUTI) have also been associated with significant nosocomial infection [11]. With significant efforts from the regulatory agency as well as the healthcare organization and providers, a significant decrease in CLABSI and CAUTI has been seen [1, 12]. Education and antibiotic stewardship programs have been recommended by the CDC in 2014. In 2017, a survey by the National Healthcare Safety Network found that the number of hospitals with antibiotic stewardship program (ASP) has increased to 76.4%. Still 25% of the hospitals do not have ASP. As of September 2019, the ASP is required by the Centers for Medicare and Medicaid Services (CMS) as part of the patient care reimbursement. With this new regulatory requirement by the CMS, it is expected that the ASP in hospitals will reach close to 100% [13].

In this book, we will also be addressing Legionnaires' disease in detail. Legionnaires' disease is a bacterial infection caused by Gram-negative bacteria, usually found in freshwater [14]. It can lead to severe pneumonia which can be fatal

Country	City/state	Source	Cases	Mortality	Fatality rate
London, England [17]	Westminster	Via. water system	3	0	0
Belgium [18]	Evergem	Cooling towers	32	2	6.7%
USA [18]	Ohio, New Jersey, Michigan	Unknown? Flint Michigan water crisis	32	6	18.75%
USA [18]	Atlanta, Georgia (in Sheraton Hotel)	Water system	66	1	1.5%
USA [18]	Fletcher, North Carolina	Hot tub display	141	4	2.83
Canada [18]	Moncton, New Brunswick	Unknown	16	N/A	—
USA [18]	Batavia, Illinois		13	N/A	—

**Table 1.**  
*Selected Legionnaires' disease outbreak in 2019.*

(Legionnaires' disease), but milder and subclinical infection forms (Pontiac fever) do exist [14, 15]. This disease is much more common than we think. Approximately, 10,000 patients are hospitalized every year with Legionnaires' disease in the USA alone. Legionnaires' disease also creates a public health concern. It is usually transmitted by inhaling the mist or via the cooling and water system issues. There have been numerous Legionnaires' disease outbreaks over the decades, and the number seems to be increasing [16]. In the 1970s there were five outbreaks, in the 1980s seven, in the 1990s four, and in the 2000s ten. From 2010 to 2018, there were 23 outbreaks. In the year 2019 alone, there were seven outbreaks (shown in **Table 1**). These reported outbreaks represent just the tip of the iceberg, as not all of them are reported. Moreover, reports from the developing countries are almost nonexistent. The fatalities from Legionnaires' disease range from 0 to 75% [16]. The longevity, multiple invasive devices, increase in transplants, immunocompromised status, aging population, and increase in travels all pose a significant risk of increased outbreaks and high fatality rates. Research and education need to be done in this area. In this book, we will try to address the epidemiology, clinical and therapeutic as it pertains to disease as well as clinical scenario and treatment of Legionnaires' disease among immunocompromised host.

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