



# Unique characteristics of community-onset healthcare-associated bloodstream infections: a multi-centre prospective surveillance study of bloodstream infections in Japan

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## SUMMARY

**Background:** Analysis of bloodstream infections (BSIs) is valuable for their diagnosis, treatment and prevention. However, limited data are available in Japan.

**Aim:** To investigate the characteristics of patients with bacteraemia in Japan.

**Methods:** This study was conducted in five hospitals from October 2012 to September 2013. Clinical, demographic, microbiological and outcome data for all blood-culture-positive cases were analysed.

**Findings:** In total, 3206 cases of BSI were analysed: 551 community-onset healthcare-associated (CHA)-BSIs, 1891 hospital-acquired (HA)-BSIs and 764 community-acquired (CA)-BSIs. The seven- and 30-day mortality rates were higher in patients with CHA- and HA-BSIs than in patients with CA-BSIs. The odds ratios (ORs) for seven-day mortality were 2.56 [95% confidence interval (CI) 1.48–4.41] and 2.63 (95% CI 1.64–4.19) for CHA- and HA-BSIs, respectively. The ORs for 30-day mortality were 2.41 (95% CI 1.63–3.57) and 3.31 (95% CI 2.39–4.59) for CHA- and HA-BSIs, respectively. There were 499 cases (15.2%) of central-line-associated BSI and 163 cases (5.0%) of peripheral-line-associated BSI. Major

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pathogens included coagulase-negative staphylococci ( $N = 736$ , 23.0%), *Escherichia coli* ( $N = 581$ , 18.1%), *Staphylococcus aureus* ( $N = 294$ , 9.2%) and *Klebsiella pneumoniae* ( $N = 263$ , 8.2%). *E. coli* exhibited a higher 30-day mortality rate among patients with HA-BSIs (22.3%) compared with patients with CHA-BSIs (12.3%) and CA-BSIs (3.4%). *K. pneumoniae* exhibited higher 30-day mortality rates in patients with HA-BSIs (22.0%) and CHA-BSIs (22.7%) compared with patients with CA-BSIs (7.8%).

**Conclusion:** CHA- and HA-BSIs had higher mortality rates than CA-BSIs. The prognoses of *E. coli*- and *K. pneumoniae*-related BSIs differed according to the category of bacteraemia.

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## Introduction

Bloodstream infections (BSIs) pose a serious problem in clinical settings.<sup>1,2</sup> BSIs have high mortality rates and treatment is expensive. Previously, bacteraemia was classified as community-acquired (CA) or hospital-acquired (HA).<sup>3</sup> As the role of medical care in CA infection cannot be overlooked, some studies have divided CA infections into two groups depending on medical care involvement: CA- and CA healthcare-associated (CHA)-BSIs.<sup>4,5</sup> Previous studies found that CHA-BSIs and HA-BSIs were similar in terms of the underlying diseases, sources of infection, causative pathogens and prognoses, while others found that CHA-BSIs differed from both CA- and HA-BSIs in terms of causative pathogens and prognoses.<sup>4,6,7</sup> Thus, BSIs have different characteristics depending on the context of infection. No study has compared these three groups in hospitals in Japan, which is a country with a rapidly aging population. Furthermore, the mortality rates of BSIs differ according to the causative organism. This is crucial, but data are scarce. Therefore, this study aimed to investigate the characteristics of patients with bacteraemia in Japan, with a particular focus on investigating the distributions of causative pathogens and the prognoses of patients stratified by causative organism.

## Methods

### Study design and data collection

This was a multi-centre, prospective cohort study conducted at five teaching hospitals in Japan. One hospital was a cancer centre with 589 beds. The other four hospitals were acute care general hospitals with 800–1300 beds. Patient characteristics, medication, underlying diseases, comorbidities, sources of infection and microbiological data were obtained from the medical records of each hospital between October 2012 and September 2013. Outcomes measured included mortality at seven and 30 days following blood culture sampling; these were also obtained from medical records.

### Definitions

This study included patients with positive blood cultures. Those with positive cultures arising from blood taken within two days of admission or three or more days after admission were classified as cases of CA- and HA-BSIs, respectively. Cases of CA infection were categorized into two groups: CA- and CHA-BSIs. BSIs were classified as healthcare-associated

infections if at least one of the following criteria was met: (1) the patient had undergone home-based intravenous treatment, wound dressing, parenteral nutrition, home-based nursing care, haemodialysis or intravenous chemotherapy within the prior 30 days; (2) the patient had been hospitalized in an acute care facility for at least two days within the preceding 90 days; or (3) the patient had been admitted to a nursing home or long-term care facility within the preceding 90 days.

Each episode of BSI was counted for each patient. Repeated positive blood cultures were considered as one episode of infection if the same bacterium cultured from the initial positive blood culture was identified on subsequent blood culture specimens within 28 days. Positive blood cultures obtained >29 days after the last positive culture were counted as a new episode. If multiple other bacterial strains were isolated during the same period and caused the same infectious diseases, this was counted as a single episode. However, if bacterial strains were isolated at different times and were thought to cause a different disease process, these were counted as separate episodes.

Each episode of BSI was classified as a central-line-associated BSI (CLABSI), peripheral-line-associated BSI (PLABSI), contamination, bacteraemia from another focus (excluding CLABSI, PLABSI and contamination) or undetermined. CLABSI was defined in accordance with the National Healthcare Safety Network criteria for determining infection.<sup>8</sup> The criteria for PLABSI comprised reddening, pain, induration, or other symptoms clinically suggestive of infection at the insertion site, as well as the absence of infection of other organs. Contamination was defined as either one of the two sets of skin-resident bacteria listed in the National Healthcare Safety Network criteria for determining infection, plus the absence of catheter placement and the resolution of fever without antibiotic use. The outcome was recorded as unknown if a patient had discontinued follow-up because of transfer to another hospital or hospital discharge.

### Statistical analysis

All comparisons were unpaired. Categorical variables are expressed as frequency and percentage, and were compared using Fisher's exact test. Associations were assessed using odds ratios (OR) with corresponding 95% confidence intervals (CI). Comparisons were made using three  $2 \times 2$  tables (CA-BSIs vs CHA-BSIs, CA-BSIs vs HA-BSIs and CHA-BSIs vs HA-BSIs). All *P*-values are two-tailed, and  $P < 0.015$  (with Bonferroni's adjustment) was considered to indicate significance.

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