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## Major Article

## Infection prevention and control in outpatient settings in China—structure, resources, and basic practices

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## Key Words:

Structure  
Resources  
Basic infection prevention and control practices  
Outpatient settings

**Background:** More than 7 billion visits are made by patients to ambulatory services every year in mainland China. Healthcare-associated infections are becoming a new source of illness for outpatients. Little is known about infection prevention, control structure, resources available, and basic practices in outpatient settings.

**Methods:** In 2014, we conducted a multisite survey. Five provinces were invited to participate based on geographic dispersion. Self-assessment questionnaires regarding the structure, infrastructure, apparatus and materials, and basic activities of infection prevention and control were issued to 25 hospitals and 5 community health centers in each province. A weight was assigned to each question according to its importance.

**Results:** Overall, 146 of 150 facilities (97.3%) participated in this study. The average survey score was 77.6 (95% confidence interval 75.7–79.5) and varied significantly between the different gross domestic product areas ( $P < .01$ ), but scores were not significantly different between the 5 facility types ( $P = .07$ ). The main lapse of infrastructure was in providing hand hygiene equipment (43.4%) and masks (38.7%) for patients in the waiting areas and main entrances.

**Conclusion:** In a sample of ambulatory facilities in 5 provinces in China, infection prevention and control was practiced consistently, although there were lapses in some areas.

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## BACKGROUND

Healthcare-associated infections are a major problem in healthcare settings, affecting millions of patients worldwide every year, especially in developing countries where there is an estimated prevalence of 15.5 episodes per 100 patients.<sup>1,2</sup> Over the last several years, healthcare delivery has shifted toward the outpatient setting. In the United States, there was a more than 50% increase in the number of Medicare-certified ambulatory surgical centers between 2001 and 2008, and these facilities performed more than 6 million procedures in 2007.<sup>3</sup> A similar situation has occurred in mainland China. According to data published by the government, there were 7.7 billion outpatient visits nationally in 2015—an increase from 2.2 billion visits to outpatient settings and emergency departments in 2005.<sup>4,5</sup> Due to ineffective booking systems and the visiting habits of patients

in China, outpatient settings are always overcrowded. Many outpatient visitors have infectious diseases, with 1 study showing that between 10.7% and 13.0% of outpatient visits were associated with influenza-like illness.<sup>6,7</sup>

Despite this shift in the use of healthcare facilities, attention to infection prevention and control in the outpatient setting is lacking, as evidenced by increased outbreaks of healthcare-associated infections resulting from lapses in infection prevention and control in outpatient settings.<sup>8,9</sup> A recent (2013) outbreak of hepatitis C virus infection in Dandong, Liaoning, China, highlighted this issue, having resulted in the infection of 82.5% (99/120) of patients receiving treatment for varicose veins in 1 outpatient setting.<sup>10</sup>

Compared with inpatient acute care settings, outpatient settings have traditionally lacked the infrastructure and resources to support infection prevention and control.<sup>11</sup> Several guidelines with minimum expectations for infection prevention and control in outpatient settings have been developed and published by many countries and regions, including Hong Kong.<sup>12,13</sup> These guidelines require all healthcare settings, regardless of the level of care provided, to make infection prevention a priority. Studies have revealed the status of basic infection prevention and control in ambulatory

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settings in developed countries, with 67.7% of ambulatory surgical centers experiencing at least 1 lapse in infection prevention and control.<sup>3</sup> However, few studies describe the resources for and basic practices of infection prevention and control in outpatient settings in developing countries, with even less data describing differences between economic areas. The objective of this study was to describe the available structure of and resources for basic infection prevention and control as well as infection prevention and control practices conducted in outpatient settings in China. Another objective was to describe differences in different economic areas and facility types in China.

## METHODS

### Self-assessment questionnaire

A self-assessment questionnaire was developed by infection prevention and control specialists at the West China Hospital, Sichuan University (Fu Qiao, Zhiyong Zong, and Weijia Yin) in June 2014. Six hospitals, including 3 tertiary hospitals, 1 secondary hospital, 1 specialized hospital, and 1 private hospital in Sichuan, Jiangsu, Fujian, Jiangxi, and Hubei Provinces, were invited to participate as pilots. The research team also consulted outpatient setting managers for advice. Following the pilot survey, the questionnaire was revised according to the received recommendations. The final version was then validated by the research team. Briefly, the questionnaire consisted of 3 sections on infection prevention and control structure, infrastructure and materials, and basic infection prevention and control actions, with a total of 22 questions. Four questions were about the prevention and control team, link nurse system, work plan, and policies for environmental surface cleaning. The second section used 7 questions to survey the equipment available for hand hygiene and personal protection. In the third section, several basic infection prevention and control actions were surveyed, including the observation of hand hygiene, environmental surface cleaning, auditing, training, and the surveillance of healthcare-associated infections.

Data collected included basic information about the hospital, its outpatient settings, and infection prevention and control procedures in outpatient settings. Three general categories of infection prevention and control were assessed in outpatient settings: the infection prevention and control structure, the infrastructure and equipment available for infection prevention and control, and basic infection prevention and control activities, covering essentials such as the observation of hand hygiene, audit of cleaning and/or disinfection compliance, infection prevention and control training, and management of occupational exposure. Gross domestic product (GDP) per capita was retrieved from the national data released by the National Bureau of Statistics of China (<http://data.stats.gov.cn>),

which were converted to U.S. dollars by Wikipedia,<sup>14</sup> and regional total expenditure on health in China for 2014 was obtained from the Ministry of Health of China.<sup>15</sup>

### Study design

Five provinces—Liaoning, Sichuan, Guangxi, Hunan, and Shanghai—were selected based on geographic dispersion. Each province was asked to select 30 facilities to participate in the survey. Ten tertiary hospitals, 5 secondary hospitals, 5 specialized hospitals, 5 private hospitals and 5 community health centers were required from each participating province, to establish the status of infection prevention and control between different types of healthcare facilities.

Participating facilities were asked to complete the survey between September 1, 2014, and October 15, 2014. The infection prevention and control practitioners of the facilities were required to answer the questionnaire.

### Data analysis

Data were entered into an EpiData 3.1 database, and analysis was conducted using SPSS version 23 software (IBM, Armonk, NY). A weight was assigned to each question according to its importance. Zero was given to the questions not answered, and a score was obtained for each hospital. The highest score for 1 hospital was 100. Differences between groups were tested using chi-square or Fisher's exact tests for categorical variables. Quantitative variables were evaluated using Student's *t* test or one-way analysis of variance. All *P* values presented were 2-sided, and significance was set at *P* < .05.

## RESULTS

### Participation

Guangxi, Hunan, Liaoning, Shanghai, and Sichuan Provinces, located in south, central, north, east, and west China, respectively, were selected to participate to represent geographic dispersion. GDP per capita differed between the provinces in 2014; expenditure on healthcare also differed widely between them (Table 1). There were 4,999 hospitals and 3,332 community health centers in the 5 provinces.<sup>4</sup> A total of 146 of the 150 selected facilities (97.3%) participated in the study, including 50 tertiary hospitals (34.2%), 24 secondary hospitals (16.4%), 25 community health centers (17.1%), 24 specialized hospitals (16.4%), and 23 private hospitals (15.8%). In total, 2.9% (146/4,999) of hospitals and 0.8% (25/3,332) of community health centers were surveyed. The number of outpatient visitors ranged from 300 to 3,409,700 (from 142 of the facilities'

**Table 1**  
Basic information about the surveyed provinces

	Sichuan	Hunan	Shanghai	Guangxi	Liaoning	Total	National
GDP per capita (US\$)	5707	6536	15812	5367	10612		7575
Expenditure on health per capita (U.S.\$) (%)	375.4 (6.58)	352.9 (5.4)	903.0 (5.71)	310.9 (5.79)	493.0 (4.65)		420.3 (5.55)
Number of healthcare facilities	80,114	62,646	5,016	34,440	35,243	217,459	983,528
Number of hospitals	1942	1172	338	527	1020	4999	27587
Surveyed hospitals, <i>n</i> (%)	25 (1.3)	25 (2.1)	22 (6.5)	24 (4.6)	25 (2.5)	121 (2.4)	121 (0.4)
Number of community hospitals	937	674	302	277	1142	3332	34321
Surveyed community hospital, <i>n</i> (%)	5 (0.5)	5 (0.7)	5 (1.7)	5 (1.8)	5 (0.4)	25 (0.8)	25 (0.07)
Visitors per nurse per day (Mean [95% CI])	43.3 (15.4-71.2)	78.8 (11.4-146.2)	142.6 (84.6-200.7)	49.3 (32.6-66.1)	36.3 (21.0-50.9)	67.4 (49.3-85.5)	

CI, confidence interval; GDP, gross domestic product.

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