A Survey of the Prevalence of Infections Present among Inpatients in a Tertiary Care Hospital in 2023

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Abstract: *Objective*: To explore the current infection rate among inpatients in a tertiary hospital in 2023, to understand the infection situation in the hospital, and to provide a reliable basis for carrying out further hospital infection prevention and control and other work. *Methods*: Inpatients of a tertiary hospital on a certain date in 2023 were selected, and the survey data were extracted with the Apricot Grove real-time monitoring system using a combination of questionnaires and medical record data. *Results*: The infection rate was 12.63%, of which the hospital infection rate was 2.25% and the community infection rate was 10.38%. Lower respiratory tract infections accounted for 77.28% of the community infections, and lower respiratory tract infections accounted for 73.44% of the cases of hospital infections, with a total of 44 strains of pathogens isolated from hospital infections, and a total of 218 strains of pathogens isolated from community infections. The total application rate of antimicrobial drugs was 31.67%, the proportion of prophylactic drugs in the whole hospital was 9.66%, the proportion of therapeutic drugs was 90.33%, and the rate of bacterial culture delivery was 39.18%. *Conclusion*: The infection rate survey truly reflects the dynamics of infection in this hospital, makes clearer the key departments and key links of hospital infection prevention and control, further provides the basis for targeted infection control, and improves the knowledge and execution of hospital infection prevention and control by medical staff.

Keywords: Hospital-acquired infections; Presenteeism; Infection control

1. Introduction

Nosocomial infections refer to infections suffered by patients in hospitals, including those that occur during hospitalization and those that occur after discharge from hospitals, but do not occur before admission to hospitals or those that are already in a latent state at the time of admission to hospitals, and infections transmitted by medical staff in hospitals are also hospital-acquired infections. From a broad perspective, the main body of hospital infections includes inpatients, medical staff, outpatient and emergency patients, visitors

and family members of patients, and so on, who suffer from infectious diseases in the environment of the hospital are hospital infections [1]. The rate of inpatient infections is an important indicator to reflect the situation of hospital infections. It is one of the most important indicators to measure the quality of hospital infection management, monitoring and judging the level of hospital infection control in clinical departments [2]. Currently, the inpatient infection rate in China's healthcare institutions is on the high side, and the situation of hospital infection is grim [3]. The population of inpatients in healthcare institutions is generally of advanced age and low immune function, which brings great challenges to the prevention and control of nosocomial infections [4]. In recent years, due to the wide application of various antimicrobial drugs, bacterial drug resistance has become an increasingly serious problem. Therefore, the development of effective preventive and control measures and the improvement of the level of infection incidence in hospitalized patients are of great significance in improving the quality of healthcare and reducing the rate of nosocomial infections. To understand the current situation of inpatient infections and related risk factors in a tertiary hospital, to find the problems in prevention and control and to put forward targeted countermeasures, a survey and analysis of the inpatients from 0:00 to 24:00 on 30th November 2023 was conducted, and the results are reported as follows.

2. Information and methodology

2.1. General information

Patients hospitalized in a tertiary hospital from 0:00 to 24:00 on 30 November 2023 were selected, and the survey data were extracted using the Apricot Grove real-time monitoring system by combining questionnaires and medical record information, which included basic information about the patient, type of infection, site of infection, infectious pathogens, use of antimicrobials, and other relevant information.

2.2. Methodology

The hospital infection full-time and part-time managers set up several clinical investigation teams. In each team, the team leader is the department director, the investigator contains at least three people, with two part-time sensory control physicians and full-time sensory control physicians. The investigations were conducted three to five days before the day and the inpatient hospitalized patients had two check-ups on a day. This data is combined with the case data and the Apricot Grove real-time monitoring system to improve the patient's infection information. After reporting or confirming the infection-related diagnosis, the hospital infection specialist verifies the infection diagnosis, and then there are different opinions with the investigation team to discuss the decision. The Apricot Grove real-time monitoring system extracts all the relevant data of the patients on the 24 hours of the day of the investigation.

2.3. Evaluation criteria for diagnosis of hospital-acquired infections

The investigators were diagnosing and confirming the basic information of the hospitalized patients, the type of infection, the site of infection, the infectious pathogens, and the use of antimicrobial drugs in the Apricot Grove real-time monitoring system according to the relevant infection diagnostic criteria in the Diagnostic Criteria for Hospital Infections (Trial) issued by the General Office of the National Health and Wellness Commission, as well as the requirements of the Code of Practice for Clinical Microbiology Laboratory Management in Healthcare Institutions, and so on.

2.4 Statistical methods

SPSS 21.0 statistical software was used to process the data, and the measurement information was expressed as

"Mean ± SD" and t-test were used. The measurement information was expressed as a percentage (%) and an x^2 test was used. The difference was considered statistically significant at $P < 0.05$.

3. Results

3.1. Presenteeism survey

During the survey period, the whole hospital (including the North Hospital) surveyed 2,842 people, with a survey rate of 100 percent. There were 359 people with current infections, with a current rate of 12.63 percent, of whom 64 were infected in hospitals, with a rate of 2.25 percent, and 295 were infected in the community, with a rate of 10.38 percent. The detailed data are shown in **Table 1**.

Table 1. Presenteeism survey 2023

Information	Data
Number of people surveyed	2842
Number of hospital-acquired infections	64
Number of infections in the community	295
Hospital infection rate (%)	2.25
Community infection rate (%)	10.38
Presenteeism rate (%)	12.63

3.2. Survey on the distribution of infection sites in the community

Among the community infections, 228 cases of lower respiratory tract infections accounted for 77.28% of the community infections, and detailed data on the site of infection are shown in **Table 2**.

Table 2. Distribution of sites of infection in the community of the hospital surveyed in 2023

Community infected case	Cases
Lower respiratory tract	228
Upper respiratory tract	6
Peritoneum (anatomy) compartment	1
Septicaemia abdominal tumor	3
Gastrointestinal tract infections	2
Pelvic tissue infection	15
Urinary tract	42
Skin infection	3
Soft tissue infection	2
Joints and joint capsules	1
Reproductive tract	1
Other infections of the male and female genital tract	1
Antibacterial drug use	1
Escalation of postoperative antimicrobial use	1
bacteremia	4
Other parts	5

3.3. Survey on the distribution of hospital infection sites

Among hospital-acquired infections, lower respiratory tract infections also took the first place, with a total of 47 cases, accounting for 73.44% of hospital-acquired infections. The distribution of hospital-acquired infections by site is shown in **Table 3**.

Table 3. Distribution of sites of hospital-acquired infections surveyed in this hospital in 2023

Hospital infected case	Cases
Lower respiratory tract	47
Upper respiratory tract	10
Ventilator-related	1
Ascitic fluid	1
Central nervous system, CNS	1
Pelvic tissue infection	3
Urinary tract	1
Skin infection	2
Soft tissue infection	1
Bacteremia	1
Other parts	7

3.4. Survey of the distribution of pathogens of infection in the community

A total of 218 pathogens were isolated from community infections, the top 6 being 49 strains of *Pseudomonas albicans*, 36 strains of *Klebsiella pneumoniae*, 22 strains of *Escherichia coli*, 13 strains of *Acinetobacter Baumannii*, and 12 strains of *Staphylococcus Aureus*, and 12 strains of *Pseudomonas Aeruginosa*. The distribution of pathogens of community infections is shown in **Table 4**.

Table 4. Survey of the distribution of pathogens of community infections in the hospital in 2023

Pseudomonas albicans	Klebsiella pnenmoniae	*Escherichia coli* (*E. coli*)	*Acinetobacter baumannii* (zoology)	Staphylococcus aureus	Pseudomonas aeruginosa	Other	Total
49	36	22	13	12	12	74	218

3.5. Survey on the distribution of pathogens of hospital infections

A total of 44 strains of pathogens were isolated from hospital infections and the top 5 were 6 strains of *Pseudomonas aeruginosa*, 5 strains of *Klebsiella pneumoniae*, 5 strains of *Pseudomonas albicans*, 4 strains of *Acinetobacter baumannii*, and 4 strains of *Corynebacterium striatum*. The distribution of hospital infection pathogens is shown in **Table 5**.

Table 5. Distribution of pathogens of hospital-acquired infections in the hospital surveyed in 2023

Pseudomonas aeruginosa	Klebsiella pnenmoniae	Pseudomonas albicans	*Acinetobacter baumannii* (zoology)	Corynebacterium striatum	Other	Total
6	5	5	4	4	20	44

3.6. Survey on the use of antimicrobial drugs

As shown in **Table 6**, the total application rate of antimicrobial drugs was 31.67%, the proportion of prophylactic use in the whole hospital was 9.66%, and the proportion of therapeutic use was 90.33%. Among all the cases of antibacterial drug use, 661 cases (73.44%) of antibacterial drugs were applied in the first combination, 224 cases (24.89%) of antibacterial drugs were applied in the second combination, 15 cases (1.67%) of antibacterial drugs were applied in the third combination, and 0 cases (0.00%) of antibacterial drugs were applied in the fourth combination and above (**Table 7**). Therapeutic drugs were sent for bacterial culture in 101 cases, with a bacterial culture delivery rate of 39.18%.

Table 6. Survey of antimicrobial application rate in the hospital in 2023

Number of antimicrobial drug users	Antimicrobial drug use rate (%)	Proportion of prophylactic use (%)	Proportion of therapeutic use (%)	Bacterial culture delivery rate (%)
900	31.67	9.66	90.33	39.30

Table 7. Survey of antimicrobial combination uses in the hospital in 2023

Application of antimicrobials in the first combination	Dichotomous application of antimicrobials	Triple application of antimicrobials	Quadruplex and above
661	224	15	0

4. Discussion

In recent years, hospital-acquired infections have become the focus of health care in China and one of the major public health problems facing hospitals. As the use of antimicrobial drugs becomes more and more common, the incidence of hospital infections also rises year by year [6]. According to statistics, 5,000–8,000 patients die each year due to bacterial drug resistance in China, and about 10,000 patients die each year due to hospital infections [7]. Therefore, effective prevention and control of hospital infections has become a hot issue in the current healthcare field.

The results of this study showed that the rate of inpatient infections in the hospital was 12.63%, the rate of hospital infections was 2.25%, and the rate of community infections was 10.38% The rate of hospital infections was lower than that of 3.17% in the study of Chen Shili et al. and higher than that of 1.52% in the study of Che Yanhua et al. [5–6]. The study shows that the rate of infection on the day of the investigation in the hospital was still acceptable, but the focus should be on strengthening the various measures of infection control in the hospital. However, there is a need to focus on strengthening the infection control measures in the hospital and strengthening the risk assessment of key links and key areas so that corresponding measures can be taken to gradually reduce the rate of hospital-acquired infections.

In the results of this study, among community infections, lower respiratory tract infections were the highest, accounting for 77.28% of community infections, and among hospital infections, lower respiratory tract infections were also in the first place, accounting for 73.44% of the number of cases of hospital infections, which is basically in agreement with the results of the study by Zhang Haijin, which found that lower respiratory tract infections were in the first place [8]. Li Qiao et al. found that lower respiratory tract infections accounted for the highest percentage of hospital infections, which is consistent with the results of this study [9–10].

In the results of this study, a total of 218 pathogens were isolated from community infections, and the top 6 were 49 strains of *Pseudomonas albicans*, 36 strains of *Klebsiella pneumoniae*, 22 strains of *Escherichia coli*, 13 strains of *A. baumannii*, and 12 strains of each of *Staphylococcus aureus* and *Pseudomonas aeruginosa*,

and a total of 44 strains of pathogens were isolated from hospital infections, and the top 5 were 6 strains of *P. aeruginosa*, 5 strains of *Klebsiella pneumoniae*, 5 strains of *P. albicans*, 5 strains of *Pseudomonas aeruginosa*, 4 strains of *Acinetobacter baumannii*, and 4 strains of *Corynebacterium* stri*atum*. In the results of the study by Yang Jian Tax et al., the common pathogens in hospitals were *Acinetobacter baumannii*, *Klebsiella pneumoniae*, *Escherichia coli*, *Candida*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*, which were nearly the same, except for *Candida* [11]. This indicated that in infected patients, *Acinetobacter baumannii*, *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* were the most common. Chaohui Xu found that *Escherichia coli*, *Staphylococcus aureus*, *Acinetobacter baumannii*, and *Staphylococcus epidermidis* were in the top 4 of hospital infections, which is consistent with the results of this study [12].

In this study, the total application rate of antimicrobial drugs was 31.67%, the proportion of prophylactic use in the whole hospital was 9.66%, and the proportion of therapeutic use was 90.33%. Zhang Shengqin et al. found that the use rate of antimicrobial drugs among inpatients on the survey date 2017–2019 was 62.98%, 53.06%, and 49.0%, respectively, with therapeutic use being predominantly the main use of drugs, which is in line with the results of the present study, suggesting that antimicrobial drug medication use is reasonable [13]. Among all the cases using antimicrobial drugs, 661 cases (73.44%) of antimicrobial drugs were applied in the first combination, 224 cases (24.89%) of antimicrobial drugs were applied in the second combination, 15 cases (1.67%) of antimicrobial drugs were applied in the third combination, and 0 cases (0.00%) of antimicrobial drugs were applied in the fourth combination and above. Therapeutic drugs were sent for bacterial culture in 101 cases, with a bacterial culture delivery rate of 39.30%. In the results of the study by Jia Lu Xi et al., the average rate of use of antimicrobial drugs in traditional Chinese hospitals was 31.59%, with a bacterial culture delivery rate of 11.07%, and in Western hospitals, the average rate of use of antimicrobial drugs was 32.74%, with a bacterial culture delivery rate of 16.33% [14]. In the results of the study by Yang Su et al., the average rate of use of antimicrobial drugs daily was 32.85%, and the rate of bacterial culture delivery accounted for 47.99%, which is consistent with the results of this study [15]. The state has formulated an antimicrobial drug policy to strengthen the management of antimicrobial drug clinical application, ensure the safety of patients' medication, reduce the abuse of drugs, and slow down the emergence of drug-resistant bacteria, which is mentioned in the 2022 Notice of the General Office of the National Health Commission of the State Health Care Commission on the Issuance of 2022 National Healthcare Quality and Safety Improvement Targets. In 2022, the Circular of the Office of the National Health and Health Commission on the issuance of the National Medical Quality and Safety Improvement Targets mentions that the rate of pathogenetic delivery of antimicrobial drugs to hospitalized patients before their use should not be less than 50%, which is to regulate the clinical application of antimicrobial drugs and guarantee medical quality and safety. The level of pathogenicity of inpatients before the use of antimicrobial drugs should be gradually reduced.

To sum up, this survey of the current rate of infection truly reflects the dynamics of infection in the hospital, makes clearer the key departments and key links of hospital infection prevention and control, and further provides a basis for targeted infection control, and improves the knowledge and implementation of hospital infection prevention and control by medical staff.

Disclosure statement

The authors declare no conflict of interest.

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