

Prevalence of Nosocomial Infection in Different Wards of Ghaem Hospital, Mashhad

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Abstract

Background: The CDC defines a nosocomial infection as a localized or systemic condition caused by an adverse reaction to the presence of an infectious agent(s) or its toxin(s). It is an infection that occurs between 48 to 72 hours after admission of patients in the hospital or as soon after the hospital discharge and on the admission time, patients don't have this infection.

Objectives: This study aimed to characterize the prevalence of nosocomial infection in Ghaem hospital, Mashhad, Iran.

Methods: This retrospective study was conducted in all wards of the Ghaem hospital, Mashhad during the 1 year period (2013); the data were collected from the wards records and HIS system and analyzed by the SPSS software (version16).

Results: In the present study, of total 35979 hospitalized patients in different wards of the Ghaem hospital was reported 1.1% of nosocomial infection. In the meantime, overall, the most prevalent organism was *Acinetobacter baumannii* with a prevalence of 37.2% and the minimum was linked to the *Bacillus species* with a prevalence 0.3%. The highest and lowest prevalence of the nosocomial infection was in the ICU and CCU with 49.9% and 0.3%, respectively. In general, among all wards of the mentioned hospital, the most frequent nosocomial infection was pneumonia (47.4%) and the lowest belonged to CSF (2.3%).

Conclusions: In our study, the ICU ward was accounted for the highest rate of nosocomial infection, due to the critical importance of this ward. Preventive measures and surveillance system for reduction of nosocomial infections is needed.

Keywords: Nosocomial Infection, Hospital, Iran

1. Background

The CDC defines a nosocomial infection as a localized or systemic condition caused by an adverse reaction to the presence of an infectious agent(s) or its toxin(s) (1). It is an infection that occurs between 48 to 72 hours after admission of patients in hospital or as soon after hospital discharge and on the admission time, patients don't have this infection (2). More than a century the nosocomial infection is the most important cause of disability in hospitalized patients, which resulted in increased hospitalization, imposed double therapeutic costs on the health care / therapeutic systems and patients, occurrence of significant health risks, and even mortality (2, 3). Nosocomial infection often occurs in aged patients, individuals with immunodeficiency or with other underlying diseases, individuals under treatment with immune suppresser drugs, or in the patients with surgical operations (4), however, the control of this infection can be very costly (4). Due to the importance of the prevalence of the nosocomial infec-

tion in contagious and mortality of patients, also its therapeutic costs, nosocomial infection control is considered as a global priority, which is performed with the aim of reducing the mortality rate, health care costs, and hospitalized duration (5). The high rate of the nosocomial infection in a community reflecting lack of a comprehensive and targeted strategy in the prevention of nosocomial infection incidences and advanced health care systems (6). 5% - 10% of adults in industrialized countries acquire nosocomial infections; this appears to be less than the rate among children (5). The prevalence of a nosocomial infection is various in the World, between 5% in European countries and North America to 40% in Africa, Latina America, and Asia. According to the conducted assessment by WHO in 14 world countries, 8.7% of hospitalized patients suffer from nosocomial infection (7). Furthermore, according to the WHO reports in 2005, more than 4.4 million nosocomial infections occurred annually in the world (8). Nosocomial infection is caused by bacterial, viral and fungal pathogens, which most common pathogens

are: *Pseudomonas aeruginosa*, *E. coli*, *Mycobacteria*, *Candida*, *Aspergelosis*, *Fozarium*, *Trycosporum*, and *Malasizia*. All of the pathogens have a role in the increase of contagious and mortality of patients in hospitals (8). The most prevalent nosocomial infections based on the NISs (Nosocomial infection surveillance system) include: wound infection, bloodstream infection (BSI), Urinary tract infection (UTI), and respiratory infection (7). UTI is the most common nosocomial infection in the world (about 40% out of all nosocomial infections). The main risk factor for acquiring this infection is the presence of urinary catheters. The most etiological agents of this infection include: gram negative bacilli such as *E. coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* (7). The prevalence rate of nosocomial pneumonia is near 0-5% cases per 1,000 hospitalized patients. Pneumonia frequency has a direct relationship with mechanical ventilation time. The dominant etiological agents for this infection are: gram-negative bacilli such as *P. aeruginosa*, *K. pneumoniae*, *A. baumannii*, and *Staphylococcus*. Infection in the surgical site is the most common type of post-surgical infection, which includes 14% - 16% of nosocomial infections. Hospital epidemiological pattern and antibiotic susceptibility pattern of microbial agents regularly should be evaluated (3, 8). With considering the above facts and data, attention to the nosocomial infections becomes more important every day and health care system of countries is forced to find the better solutions for encounter these infections (8, 9).

2. Objectives

This study aimed to characterize the prevalence of nosocomial infection in the Ghaem hospital, Mashhad, Iran.

3. Methods

This study is a retrospective/descriptive study, which was conducted in all wards of the Ghaem hospital, Mashhad during the 1 year period (2013). The Ghaem hospital is one of the biggest hospitals and strategic medical centers in the East of Iran, which is located in the Razavi Khorasan province with a capacity of 818 beds to accommodate patients of different ages from all over the East and North-East part of the country. All patients attending the hospital within 48 to 72 hours after admission were included in this study; the patients also included hospitalized individuals in different wards. Sampling method was done by the infection control team including; physicians and nurses that were trained in the field of hospital infections

and collected data including temperature chart, X-ray images, the results of various tests and consultation with colleagues in each ward. Clinical tests were done by ward physicians, and during this time, checking for symptoms was conducted by the nurses' colleagues. Then confirmed samples were selected by the control team and along with other information such as gender, ward, possibly underlying diseases, and length of hospitalization were recorded. To characterize the organism causing infection by applying standard methods, samples were transferred to the laboratory. In the laboratory, samples were cultured on the enriched and selective media such as blood agar, chocolate agar, Trypticase soy broth agar (TSB), eosin methyl blue, and so on. Then, after incubation for 24 hours, necessary examination including gram stain and morphological observation to identifying of the organisms was performed. Finally, the results of tests and types of organisms through HIS system were announced to the infection control team. In our study, at first, precision and validity of data was examined, and then the correct data were analyzed using the SPSS software (version 16) with the focus on 3 subjects: (types of bacteria, types of infection, and contaminated wards).

4. Results

In this study, from 35,979 hospitalized patients in different wards of hospital, 393 cases (1.1%) were reported of nosocomial infection. In regards to the results, the most frequent types of bacteria causing nosocomial infections were including *A. baumannii*, *K. pneumoniae*, *E. coli*, *S. epidermidis*, and *Enterococcus*, respectively. The lowest prevalence includes: *Bacillus*, *Proteus*, *Enterobacter*, and *Pseudomonas* species (Table 1). The most prevalence of nosocomial infection was in the ICU and the minimum of this was in the CCU (Figure 1). In general, among all wards of the hospital, the most frequent nosocomial infections belonged to pneumonia (47.7%) and the lowest of this belonged to CSF (2.3%). In the ICU the highest and lowest prevalence of nosocomial infections were related to CSF and SSI (Surgical Site Infection) with 77.8% and 10%. In the internal ward the most and lowest infections were UTI (Urinary Tract Infection) (60.6%) and CSF (3%), respectively. In the Cardiac ward the highest and lowest infections were UTI (42.9%) and CSF (0), respectively. In the NICU ward the most and lowest infections were BSI (76.9%) and UTI/CSF (0), respectively. In the pediatric ward the most and lowest infections were the UTI and pneumonia/surgical wound infection with the prevalence of 53.8% and 0, respectively. The most cases of infections in the CCU were UTI with 100% frequency and other infections were 0. In the Gynecology ward, the most

and lowest infections were pneumonia (50%) and surgical wound infections/CSF (0), respectively. Pneumonia and CSF were the most and lowest nosocomial infections in the emergency ward with the prevalence of 54.2% and 0, respectively. Furthermore, in the Thorax ward the most and lowest rate of nosocomial infections were associated with pneumonia (62%) and BSI/CSF (0). Finally for the surgery ward, UTI (52.3%) was the highest and BSI/CSF (0) were the lowest prevalence. In the meantime, the most prevalent organism in all wards was related to *A. baumannii* with a 37.2% prevalence and lowest was linked to the *Bacillus species* with a prevalence of 0.3% (Figure 2). The *A. baumannii* was the most common with a prevalence of 46.9% in the ICU and a minimum frequency with a prevalence of 0 percent in the pediatric and CCU wards. In the cardiac ward, the most prevalent bacterium was *K. pneumoniae* with a prevalence 23%, and the minimum of this bacterium in the CCU and Gynecology wards with prevalence 0, also the most frequency of *E.coli* was in the CCU with a prevalence of 100% and minimum of it in the ICU and NICU with a prevalence of 4.6% and 7.1%, respectively. In this study, *S. epidermidis* also had the most rate in the NICU with 42.9% and the minimum of this bacterium was in internal, pediatric and CCU wards with a prevalence of 0 (Table 2).

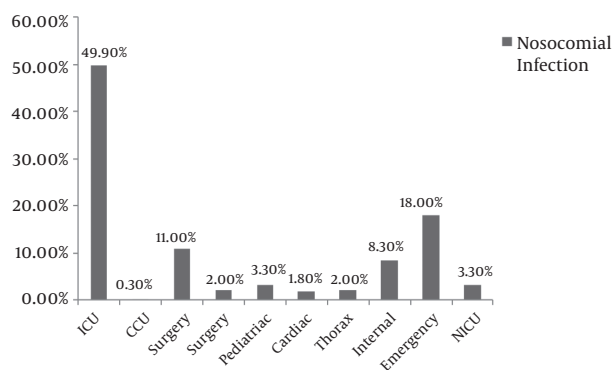


Figure 1. The Prevalence rate of Nosocomial Infection in Different Wards of Ghaem Hospital

5. Discussion

Nosocomial infection is one of the leading problems in the health system, therefore it is directly related to increased costs and hospitalization time. The prevalence rate of nosocomial infection in terms of geographic region, type of hospital, the patient, and the calculating method even in various regions of the country is different. According to the WHO report, the prevalence of the nosocomial infection in developed countries is below 5%, however, in

developing countries, this rate is different (6). In this study, the incidence of nosocomial infection is about 1.1%, which is not comparable to the global statistics in developing countries; a study conducted in Benin, in 2012, patients from the same ward were studied in the same day in each hospital for real estimation of nosocomial infection, and data showed that the prevalence rate of nosocomial infection was 19.1% (10). Other studies, especially from developing countries, reported the prevalence rate of 13.9% - 17.9% (11, 12). The prevalence rate of the nosocomial infection is comparable with European countries; the prevalence rates of the nosocomial infection in Norway (13), Italy (14), and France (15) was 5.1%, 5.4%, and 4.9%, respectively. Additionally, in Asian countries, such as the countries of Morocco (6), India (16), Thailand (17), Pakistan (18), and Saudi Arabia (19) is between 5% up to 60%. In some studies that were conducted in Iran, the prevalence rate of nosocomial infection was 4.1%, 0.6%, and 8.4%, respectively in Sari (20), Tehran (7), and Urmia (21), which the prevalence rate of the nosocomial infection was higher than the present study. Of course, these studies and our study cannot reflect the real prevalence of the nosocomial infection in Iran, because these have been carried out passively.

In this study among nosocomial infections, most infections were pneumonia with a prevalence of 47.7%, which correlate with other studies carried out in other areas of the world that showed the high prevalence of this infection (17-23). It appears that one of the reasons that causes this type of infection can be high density of patients in each ward or it is probably due to the use of a ventilator. Reports indicate that pneumonia increases 43.8% of the hospital costs compared with other nosocomial infections (24). In contrast to this study, in several studies in the countries of Morocco (6), Pakistan (18), and India (16) as well as some studies in Iran, Tehran (7), and Shiraz (25), the most prevalent nosocomial infection was reported as UTI (2, 3). In other studies, most cases of nosocomial infections were bacteremia with a prevalence of 52.4% (26), followed by wound infection with the prevalence of 49.1% and 24.3% (2, 27). It seems that many factors are involved in the diversity of nosocomial infections, which is a likely result from incomplete decontamination in wards, the use of shared devices and the infection site, length of stay in the hospitals, underlying immunocompromised disease, age of the patients, surgical procedure during hospital stay, and presence of invasive medical devices *in situ* (e.g., vascular catheters, urethral catheters, intubation of the respiratory tract) (28). In this study the most prevalent organism was *A. baumannii* with prevalence 37.2%, in accordance with our study Khashibai et al. reported *A. baumannii* as the high prevalent organism with prevalence 40.4% (22). As mentioned in results section, *A. baumannii* was

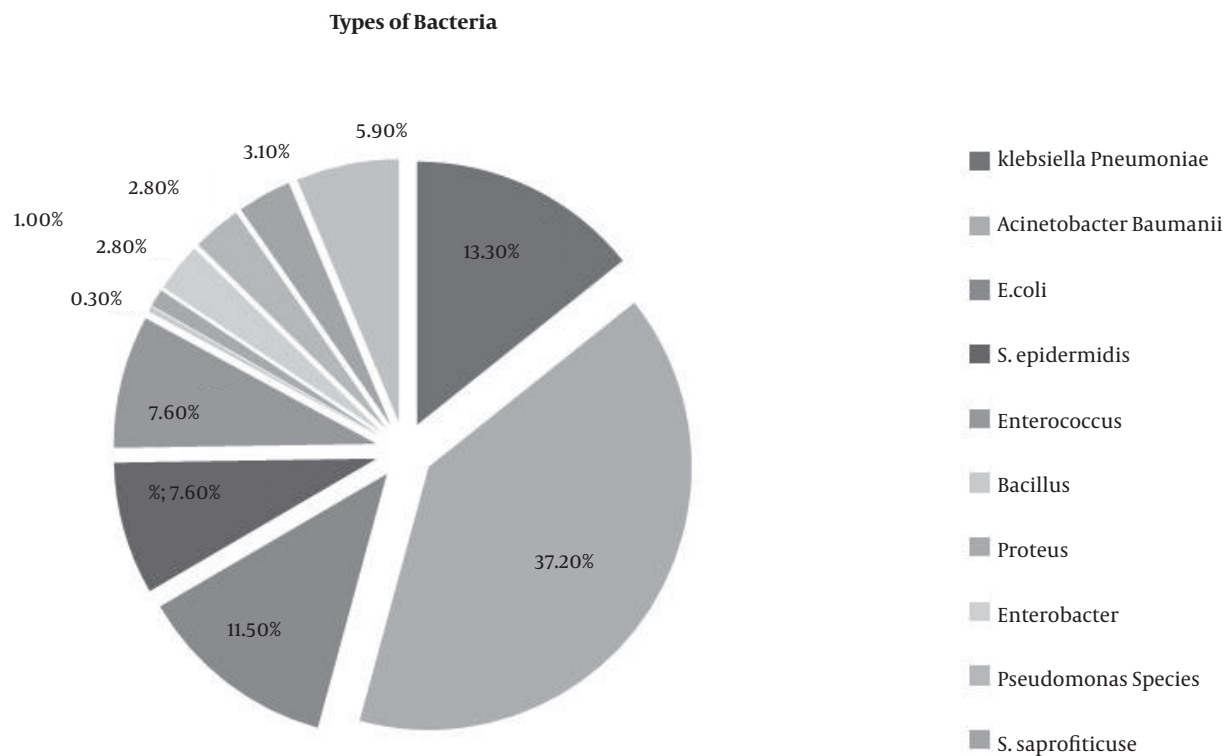


Figure 2. The Prevalence Rate of Bacteria in Different Wards of Ghaem Hospital

the highest frequent organism with a prevalence of 46.9% in the ICU, also, Neeta P Pradhan and et al. reported that the respiratory infections in their study were most repeatedly related with isolates of *Acinetobacter* which had often multidrug-resistance profile (22). But in a study conducted in Morocco, the most prevalent organism was *S. aureus* (10). Edrinc and et al. reported the most isolated organism was *E.coli* (3). In another study performed in Tehran of Iran, the most frequency was related to *E.coli* and other studies in different regions of our country (Iran) such as Shiraz (25), Urmia (21), Sari (29) and Tehran (7), the highest rate of organism was associated to *P. aeruginosa*. Several studies have reported *S. aureus* MRSA as a major cause of nosocomial infection in European countries (30). In our study, the highest rate of the nosocomial infection was in the ICU with a prevalence of 49.9% and followed by the Emergency ward with a prevalence of 18% and the lowest rate was in CCU, Cardiac, and Pediatric, Gynecology wards with the prevalence rates of 0.3%, 1.8%, and 2%, respectively. Similar to our study, Razine et al. reported that the most prevalent nosocomial infection was in the ICU with a prevalence rate of 34.5% (6). Furthermore, other studies like that reported the same, for example, Gosling et al. from Tan-

zania (31) showed 40% of nosocomial infections in the ICU and another from Thailand (17) reported a 22.2% of nosocomial prevalence rate in the ICU. This might be due to sensitivity of the ICU, application of devices such as ventilator, suction, oxygen, intravenous catheters, and chips in this ward and prescribe the high rate of stronger antibiotics predisposes patients to nosocomial infections (16). Main risk factors including: central venous catheterization, urinary catheterization, mechanical ventilation, stress ulcer prophylaxis, and period length of ICU stay are involved in the susceptibility of patients admitted to the ICU to nosocomial infections, these infections in the ICU caused a statistically significant increase in the length of stay in the ICU, and increased health care costs imposed on patients (22). Different studies have an alleged increase in the ICU mortality rate in patients with nosocomial infections (32).

The main limitation of this study is that firstly, only patients were followed, which have been hospitalized, furthermore, after discharge, there was no report of these infections in these patients. Secondly, we studied bacterial nosocomial infections, and viruses, fungi, and parasites were not listed.

5.1. Conclusion

In regards to our study, the ICU ward was accounted for the highest rate of nosocomial infection, due to the critical importance of this ward, preventive measures, and surveillance system for reduction of nosocomial infection is needed.

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Footnotes

Authors' Contribution: Study concept and design, Jamal Falahi; drafting of manuscript, Azad Khaledi and Saeid Amel Jamehdar; critical revision of the manuscript for important intellectual content, Mohammad Yousef Alikhani and Kiarash Ghazvini; performance of laboratory tests, Mahboubeh Honarmand; performing of statistical tests, Ali Taghipour.

Conflicts of Interests: None declared.

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Table 1. The Prevalence Rate of Types of Bacteria in Different Wards of Ghaem Hospital

Type of Bacteria	Ward											Total
	ICU	Internal	Heart	NICU	Surjical	Pediateric	EMG	CCU	Women	Thorax	Other	
Acinetobacter												
Within ward, %	46.9	9.1	12.5	14.3	14.3	0	50.0	0	57.1	37.5	.0	37.2
K. pneumoniae												
Count	30	5	2	2	8	3	3	0	0	1	0	54
Within type of bacteria, %	55.6	9.3	3.7	3.7	14.8	5.6	5.6	0	0	1.9	0	100.0
Within ward, %	15.3	15.2	25.0	14.3	19.0	23.1	4.3	0	0	12.5	0	13.7
S. epidermis												
Count	12	0	1	6	3	0	7	0	1	0	0	30
Within type of bacteria, %	40.0	.0	3.3	20.0	10.0	0	23.3	0	3.3	0	0	100.0
Within ward, %	6.1	0	12.5	42.9	7.1	0	10.0	0	14.3	0	0	7.6
E. coli												
Count	9	8	2	1	10	3	9	1	1	1	0	45
Within type of bacteria, %	20.0	17.8	4.4	2.2	22.2	6.7	20.0	2.2	2.2	2.2	0	100.0
Within ward, %	4.6	24.2	25.0	7.1	23.8	23.1	12.9	100.0	14.3	12.5	0	11.5
Enterococcus												
Count	12	5	0	0	2	3	7	0	1	0	0	30
Within type of bacteria, %	40.0	16.7	0	0	6.7	10.0	23.3	0	3.3	0	0	100.0
Within ward, %	6.1	15.2	0	0	4.8	23.1	10.0	0	0	0	0	7.6
S. aureus												
Count	6	6	1	1	2	3	3	0	0	1	0	23
Within type of bacteria, %	26.1	26.1	4.3	4.3	8.7	13.0	13.0	0	0	4.3	.0	100.0
Within ward, %	3.1	18.2	12.5	7.1	4.8	23.1	4.3	0	0	12.5	.0	5.9
Pseudomonas												
Count	3	2	1	0	4	0	0	0	0	1	0	11
Within type of bacteria, %	27.3	18.2	9.1	0	36.4	0	0	0	0	9.1	0	100.0
Within ward, %	1.5	6.1	12.5	0	9.5	0	0	0	0	12.5	0	2.8
Enterobacter												
Count	4	1	0	1	2	1	1	0	0	0	1	11
Within type of bacteria, %	36.4	9.1	0	9.1	18.2	9.1	9.1	0	0	0	9.1	100.0
Within ward, %	2.0	3.0	0	7.1	4.8	7.7	1.4	0	0	0	100.0	2.8
Saprophyticus												
Count	7	2	0	0	1	0	2	0	0	0	0	12
Within type of bacteria	58.3	16.7	0	0	8.3	0	16.7	0	0	0	0	100.0
Within ward, %	3.6	6.1	0	0	2.4	0	2.9	0	0	0	0	3.1
Proteous												
Count	3	0	0	0	1	0	0	0	0	0	0	4
Within type of bacteria, %	75.0	0	0	0	25.0	0	0	0	0	0	0	100.0
Within ward	1.5	0	0	0	2.4	0	0	0	0	0	0	1.0
Bacillus												
Count	1	0	0	0	0	0	0	0	0	0	0	1
Within type of bacteria, %	100.0	0	0	0	0	0	0	0	0	0	0	100.0
Within ward, %	0.5	0	0	0	0	0	0	0	0	0	0	0.3
Candida												
Count	17	1	0	1	3	0	3	0	0	1	0	26
Within type of bacteria, %	65.4	3.8	0	3.8	11.5	0	11.5	0	0	3.8	0	100.0
Within ward, %	8.7	3.0	0	7.1	7.1	0	4.3	0	0	12.5	0	6.6
Total												
Count	196	33	8	14	42	13	70	1	7	8	1	393
Within type of bacteria, %	49.9	8.4	2.0	3.6	10.7	3.3	17.8	.3	1.8	2.0	0.3	100.0
Within ward, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2. The Prevalence Rate of Types of Infections in Different Wards of Ghaem Hospital

Ward	Type of Infection					Total
	Pneumonia	UTI	Jarahi	BSI	CSF	
ICU						
Within ward, %	65.3	25.6	1.5	4.0	3.5	100.0
Within type of infection, %	68.8	37.5	10.0	22.9	77.8	49.9
Internal						
Count	3	20	3	6	1	33
Within ward, %	9.1	60.6	9.1	18.2	3.0	100.0
Within type of infection, %	1.6	14.7	10.0	17.1	11.1	8.3
Cardiac						
Count	2	3	1	1	0	7
Within ward, %	28.6	42.9	14.3	14.3	0	100.0
Within type of infection, %	1.1	2.2	3.3	2.9	0	1.8
NICU						
Count	3	0	0	10	0	13
Within ward, %	23.1	0	0	76.9	0	100.0
Within type of infection, %	1.6	0	0	28.6	0	3.3
Surgical						
Count	2	23	19	0	0	44
Within ward, %	4.5	52.3	43.2	0	0	100.0
Within type of infection, %	1.1	16.9	63.3	0	0	11.0
Pediatric						
Count	0	7	0	5	1	13
Within ward, %	0	53.8	0	38.5	7.7	100.0
Within type of infection, %	.0	5.1	0	14.3	11.1	3.3
Emergency						
Count	39	28	2	3	0	72
Within ward, %	54.2	38.9	2.8	4.2	0	100.0
Within type of infection, %	20.6	20.6	6.7	8.6	0	18.0
CCU						
Count	0	1	0	0	0	1
Within ward, %	0	100.0	0	0	0	100.0
Within type of infection, %	0	7	0	0	0	0.3
Gynecology						
Count	4	2	0	2	0	8
Within ward, %	50.0	25.0	0	25.0	0	100.0
Within type of infection, %	2.1	1.5	0	5.7	0	2.0
Thorax						
Count	5	1	2	0	0	8
Within ward, %	62.5	12.5	25.0	0	0	100.0
Within type of infection, %	2.6	0.7	6.7	0	0	2.0
Other						
Count	1	0	0	0	0	1
Within ward, %	100.0	0	0	0	0	100.0
Within type of infection, %	0.5	0	0	0	0	0.3
Total						
Within ward, %	47.4	34.1	7.5	8.8	2.3	100.0
Within type of infection, %	100.0	100.0	100.0	100.0	100.0	100.0