The Prevalence of Nosocomial Infections in Iranian Hospitals

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ABSTRACT

BACKGROUND AND OBJECTIVE: Nosocomial infections are one of the major health problems. As the length of stay in the hospital increases, the risk of mortality and morbidity increases, which ultimately increases the cost of treatment. Therefore, the present study was performed as a systematic review and meta-analysis to evaluate the prevalence of nosocomial infections in Iran.

METHODS: This systematic review and meta-analysis was performed in the range of the years 2001 – 2017. Articles related to the topic were assessed using Persian keywords "nosocomial infections", "hospital", and "Iran", and their English equivalent in descriptive and cross sectional studies by searching online databases of SID & Magiran, PubMed and Scopus, ScienceDirect and Google Scholar. Analytical and interventional studies were excluded from the study list.

FINDINGS: 578 articles had the preliminary inclusion criteria, and with the removal of 568 unrelated or low quality articles during secondary analyses, 10 articles were finally included in the process of meta-analysis. The overall prevalence of nosocomial infections in Iranian hospitals was 4.6% (CI-95%: 2.6–8.1). The highest prevalence of nosocomial infections was in Sanandaj with 15.6% (CI-95%: 10.22–82.1) and the lowest prevalence was in Urmia with 0.4% (CI-95%: 0.1–1.01).

CONCLUSION: The results of the study showed that nosocomial infection has a low prevalence in Iran, but more attention and control over nosocomial infections in Iranian hospitals is necessary to reach standard levels.

KEY WORDS: *Prevalence, Nosocomial Infections, Iran, Systematic Review, Meta-Analysis.*

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Introduction

The increase in the prevalence of emerging and re-emerging infectious diseases, the changes in disease patterns, the ever-increasing levels of microbial resistance and the need for medical services have led to an increase in the incidence of nosocomial infections (1). The prevalence of nosocomial infections has been one of the major health problems, and as the length of stay in the hospital increases, the risk of mortality and morbidity increases, which ultimately increases the cost of treatment (2). According to World Health Organization, they are unrelated to the original illness that brings patients to the hospital and neither present nor incubating as at the time of admission. In fact, nosocomial infections, otherwise known as hospital-acquired infections, are those infections acquired in hospital or healthcare service unit that first appear 48 h or more after hospital admission (1, 2). The patient had no such infection at the time of admission to the hospital and he/she initially referred to the hospital because of another disease or problem (2).

These infections may occur in different sections of the hospital, including Department of Pediatrics, Intensive Care Unit, and Burns Unit and factors such as the use of vascular catheters, long-term hospitalization, and the transfer of patients from other sections to the intensive care unit may cause or increase nosocomial infections. These infections are difficult to treat, and they sometimes lead to death (2 – 4). According to the WHO, approximately 15% of the patients admitted to the hospital suffer from this infection (4). In a world health organization (WHO) cooperative study (55 hospitals in 14 countries from four regions [Europe, Eastern Mediterranean, Southeast Asia and West Pacific Region]), about 8.7% of hospitalized patients had nosocomial infections. More than 1.4 million people all over the world suffer from the complications of this type of disease. These studies report that the highest frequency of nosocomial infections is from the hospitals in the Eastern Mediterranean and Southeast Asia with a percentage of 11.8% and 10%, respectively, while the prevalence is 7.7% for the European regions and 9% for the West Pacific Region (5, 6).

The most commonly reported nosocomial infections are surgical wound infections, urinary tract infections and respiratory infections, and most of the involved sections are surgical care units and orthopedic care units (7). The incidence of nosocomial infections in Europe is reported to be 1.6 to 13.2% (8 – 10). The incidence of nosocomial infections in the pediatric intensive care unit is 2.5%. The most commonly reported infections are bacterial (68%), candidal (9%), and viral (22%) (8 – 13). In a meta-analysis in the years 1997 – 2012, the prevalence of nosocomial infections was reported to be 30.4% (14). Among studies in Iran, Shojaei et al. (15) reported a prevalence of 0.8% in Qom, Amini et al. (16) reported a prevalence of 10.7% in Tehran, and a prevalence of 0.7% was reported in Torbat Heydariyeh (17). Therefore, considering that various incidence rates have been reported in the studies performed in different regions of Iran, and since the total prevalence of nosocomial infections in Iran has not yet been clearly reported, and in order to contribute to the continuation of prevention programs, the present systematic review and meta-analysis was conducted to evaluate the prevalence of nosocomial infections in hospitals in Iran.

Methods

In this systematic review and meta-analysis, we searched articles published in national and international journals about the prevalence of nosocomial infections in Iranian hospitals, and online databases of SID & Magiran, PubMed, Scopus, and ScienceDirect and the Google Scholar search engine using Persian keywords "nosocomial infections", "hospital", and "Iran", their English equivalent and possible combinations. The search process in Persian databases was based on Persian keywords, while their English equivalents were used in English databases, and they were used in Google Scholar search engine both in Persian and in English. The "AND" and "OR" functions were used in order to provide more comprehensive access to all articles. Therefore, the OR function was used to evaluate the common names for a disorder, like "Nosocomial infections OR Hospital Infections", or "Hospital OR Hospital Administration", and the AND function was used between keywords, like "Nosocomial infections AND Hospital" by matching words in MeSH browser. In order to evaluate the inclusion criteria and to assess the quality of articles, all articles related to the prevalence of nosocomial infections in Iranian hospitals were collected and all the articles whose title included nosocomial infections or hospital were selected and included in the initial list of articles.

After hiding the specifications of the articles, including the name of the journal and the name of the author, the full text of the articles was provided to the browsers. Two browsers independently reviewed each article and if the article was rejected, the reason for rejection was mentioned. In case of disagreement between two browsers, the third browser judged the

article. Since the word "Iran" might not have been mentioned in the title, in the second review, all the articles were evaluated based on the studies carried out in Iran by reviewing the title and abstract. Then, in subsequent evaluations, the articles on the relationship between nosocomial infections and the risk factors and the effects of different factors on these infections, as well as analytical and interventional studies were excluded from the list and only descriptive and cross-sectional studies that mentioned the prevalence were selected. The STROBE checklist was used to assess the quality of the studies.

In the final review, 10 articles entered the meta-analysis stage, all of which were prepared based on schematic representation of PRISMA (Fig 1). Then, a checklist of the data from the selected articles, including the name of the researcher, the title of the article, the year and place of the study, the sample size and the prevalence of nosocomial infection was prepared for the 10 reviewed articles (Table 1).
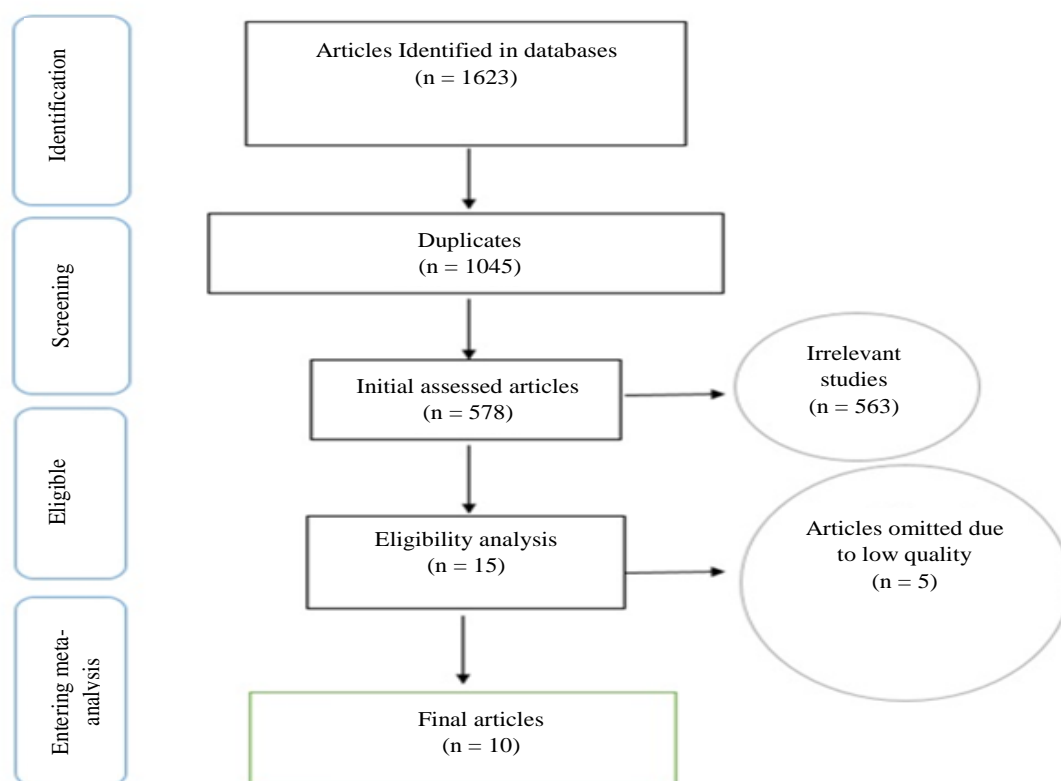

Figure 1. The entrance steps of systematic review and meta-analysis (PRISMA)

Table 1. Specifications of the included articles (15–24)

Author	Pub. year	Region	Age	Sample size	Prevalence	Quality assessment
Shojaei(15)	2015	Qom	42±23	12668	0.8	High
Amini(16)	2009	Tehran	66.4±20.3	691	10.7	medium
Darvishpoor (17)	2016	Torbat-Heydariyeh	41.1±25.8	91	0.7	high
Ghorbanalizadhegan(18)	2006	Tehran	53±19.2	6817	4.1	high
Akbari (19)	2012	Urmia	55±10	101	0.4	high
Hajibaqeri (20)	2005	Sanandaj	57.04±17.6	160	15.6	medium
Shakib (21)	2014	Sanandaj	–	750	10.3	medium
Barak (22)	2011	Tehran	–	1795	3.9	high
Ghorbanalizadhegan(23)	2008	Tehran	52±18.5	155	3.2	high
Heydarpour (24)	2017	Kermanshah	65.2±11.8	6000	2.3	medium

Statistical analysis: In each study, the prevalence of nosocomial infections in Iranian hospitals was obtained. The heterogeneity among the studies was evaluated using the I^2 index, and considering its results ($I^2 = 98\%$) and the heterogeneity among the included studies, random effects model was used to combine the results of studies. Data were analyzed using Comprehensive Meta-Analysis software (version 3). The probability of bias in the publication of results, which is used to evaluate publication bias and not publishing non-significant articles, was analyzed by funnel plot and its significance was evaluated by Egger's test, and $p<0.05$ was considered significant (Fig 2, funnel plot). Accordingly, the publication bias was not statistically significant ($p = 0.271$), and the studied articles did not have publication bias.
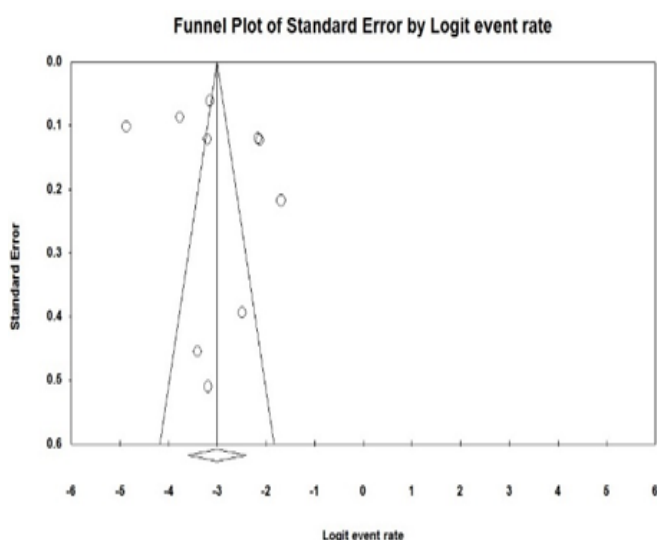

Figure 2. (Funnel plot) The results of the prevalence of nosocomial infections in Iranian hospitals

Results

According to the review of articles published in national and international journals, 34 articles were found in SID & Magiran databases, 402 articles in PubMed, 689 articles in ScienceDirect, 136 articles in Scopus, and 362 articles in Google Scholar search engine, and overall, 1623 articles were found. Then, by omission of 1045 duplicate articles that were identified through review and comparison in EndNote software, 578 articles were obtained. Then, 563 articles unrelated to the topic of the study were omitted and in secondary analyses, five articles were omitted due to the low quality of the articles. Finally, ten articles entered the process of meta-analysis (Fig 1). The total number of participants in the study was 29228, and the total

prevalence of nosocomial infections in Iranian hospitals was 4.6% (95% CI: 2.6–8.1). The highest prevalence of nosocomial infections was in Sanandaj with 15.6% (95% CI: 10.8 – 22.1) and the lowest prevalence was in Urmia with 0.4% (95% CI: 0.1 – 1.01) (Fig 3). In this figure, the black square is the prevalence rate, and the length of the line segment on which the square is located is the 95% confidence interval in each study, the lozenge mark shows the prevalence rate throughout the country for all articles.
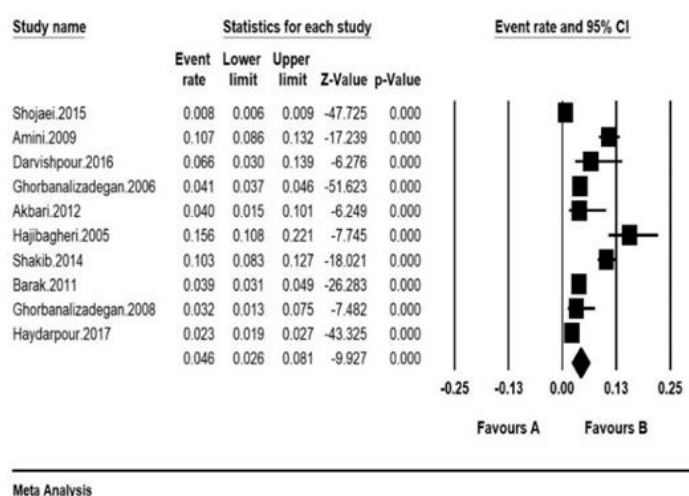

Meta Analysis

Figure 3. The prevalence of nosocomial infections in Iranian hospitals based on a randomized model in the range of the years 2001 – 2017

Discussion

Based on the analysis conducted in this study, the total prevalence of nosocomial infections in Iran and based on a structured review between the years 2001 – 2017 was reported to be 4.7%. In a meta-analysis in the years 1997–2012, the prevalence of nosocomial infections was reported to be 30.4%, which indicates the reduction of these infections in Iranian hospitals (14). What is obtained on the basis of meta-analysis is the outcome of all studies in Iran and can therefore provide healthcare policy-makers with a more precise and measurable prevalence. Despite the successes of the implementation of national nosocomial infections surveillance system in Iran, which according to the results of this study has a prevalence of 4.6% and is lower than other countries, there are still challenges in this regard, one of the most important challenges being the under-reporting of nosocomial infections. The recorded prevalence of nosocomial infections in many hospitals in Iran indicate lack of infection reporting in some cases. That's because according to internal and external evidence, the actual rate of nosocomial

infections in Iran is estimated to be between 8% and 10%, while according to the reports by the center for disease management, the prevalence of nosocomial infections based on the infection care system was 0.87 in Iran in 2008 (14–24). According to the World Health Organization (WHO), the prevalence of nosocomial infections in developed countries is between 5% and 10%, and it is more than 25% in developing countries (14–24). Different prevalence rates are reported in cross-sectional studies in different countries. The prevalence of nosocomial infections was 9.6% In India (25, 26), a prevalence of 7.4% was reported in Italy (27), and the prevalence of nosocomial infections in surgical sections was 3.7% in a systematic review conducted in Canada (28).

In various studies, urinary tract infection has been reported to be one of the most common nosocomial infections (28–30), while about 70% of nosocomial infections are caused by 7 specific bacterial pathogens, including gram-positive organisms of Staphylococcus Aureus, coagulase-positive Staphylococcus, Enterococcus and gram-positive organisms of Escherichia coli, Pseudomonas, Aeruginosa, Enterobacter and Klebsiella pneumoniae. Klebsiella pneumoniae and Escherichia coli are more common in Iran. While most fungal nosocomial infections are mild, they spread in the body and cause serious problems in patients with hematologic malignancies, AIDS, and chronic diseases such as diabetes (31, 32).

As a result, circumstances should first be provided to prevent the spread of nosocomial infections, and secondly, to provide accurate reports of the prevalence of nosocomial infections in hospitals in order to provide control measures based on accurate information. The strategies for controlling nosocomial infections include the prevention of these infections through the recruitment and use of specialists as infection control experts and the presence of a knowledgeable infection control physician by playing an active role in the infection control program, as well as improving the knowledge of the physicians and nurses about infection control. Such measures can largely improve the reporting of hospital infections, increase patient's defense and reduce the risk of being infected in the process of medical tasks or with medical equipment, improve the nutritional status of the patient, improve proper monitoring of the patient's skin and wounds, and take care of respiratory and other devices, like dialysis machine (25–32). Considering the increasing incidence of nosocomial infections and the prevalence reported in this study, as well as the increase in predisposing factors that cause nosocomial infections in hospitalized patients, more attention should be paid to this issue, and more knowledge should be gained through the training of patients and health-care systems. The results of the present study and the prevalence reported by the meta-analysis indicate a low prevalence in Iran that is close to developed countries, but the articles reviewed in this study reported a different prevalence in Iranian hospitals. Therefore, it is necessary to pay more attention to the management of nosocomial infections in order to reach lower levels and equal levels for all hospitals in Iran.

Acknowledgment

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