

Primary caregiver, agent transmitting infections associated to health care: literature review

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ABSTRACT

Introduction: Infections associated to health care represent a public health problem, increase costs in medical care, morbidity and mortality. Humans are already identified as risk factors; however, "the caregiver" has scarcely been studied, and he can be a reservoir and transmitter of one or several infections. **Objective:** investigate into the current scientific evidence related to common infections, risk factors, knowledge, practice, and aptitude of the caregiver and his relationship with the infections associated to health care. **Methodology:** Systematic review of literature carried out based on electronic data, namely, PubMed, BVS, Trip Database, Science Direct, Ebsco Host, and Google Scholar. Documents published from 2013 to 2018, in English, Portuguese, and Spanish, were assessed; the terms MESH and DeCs, "nosocomial infection", "epidemiology", "caregivers", and "patient care" were used. A PICO question was raised, the studies selected included meta-analysis, randomized and controlled clinical trials, systematic revisions, and qualitative studies. Exclusion criteria were comprised by studies that included caregivers at home and in intensive care units, both for adults and children. **Results and conclusions:** 419 articles were obtained; 15 of them met the inclusion criteria, which showed the type of infections that are most common, as well as risk factors, knowledge, practices, and aptitudes of the caregivers in the prevention of IAAS (health-care associated infections) (by its acronym in Spanish), concluding that there is little scientific evidence, and deficiencies in knowledge, programs, and interventions addressed to the caregiver to prevent IAAS.

Key Words: Nosocomial infection; caregivers; patient care (DeCS).

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INTRODUCTION

The IAAS, also known as nosocomial infections, are those that the patient can develop when receiving health care during his stay in a hospital, which can be extended to outpatient care, home care, or geriatric institutions ⁽¹⁾.

The appearance of an IAAS still the most common complication in hospitalized patients; its magnitude and impact implies an increase in morbidity and mortality, prolonging hospital stays, permanent disability, increase of the resistance to antimicrobial agents, and high economic and social cost for the health systems ^(2,3); additionally, they are considered as the most frequent first adverse event in intensive care units and they represent between 20 and 30% of all avoidable serious complications ⁽⁴⁾.

The general burden of the IAAS still high; the World Health Organization (WHO) identified that 7% of the patients in developed countries and 16% in developing countries have at least one infection in any moment during the hospitalization, with an estimated mortality rate of 10% ⁽⁵⁾.

Most common incidence and prevalence are the following: Infection of the urinary tract associated to the use of catheter, pneumonia associated to the use of the fan, infection of the surgical site, and infection of the bloodstream associated to the use of catheter, which can evolve to a dangerous extent and sometimes can be potentially life-threatening. This type of infection corresponds approximately to 80% of all infections ⁽⁶⁻⁸⁾.

Each year in the United States of America, the Centers for Disease Control and Prevention (CDC) estimates there are 1,7 million cases, which contribute to 98,000 deaths and a cost estimated around \$10,000 million dollars ⁽⁹⁾.

In Europe, in 2011, the prevalence, mainly in Germany, was of 5.1%, involving approximately 8,000.00 patients per year. Another prevalence survey applied in 2011 to 231,459 patients in 947 hospitals of European countries revealed that at any one time 5.7% of patients acquired an infection ⁽¹⁰⁾.

The nosocomial bacteraemia in several European countries affects one in every 20 hospitalized patients, corresponding to a yearly total of 4,1 million patients; from these, it is estimated that 37.000 patients die every year ⁽¹¹⁾.

A study regarding prevalence of IAAS carried out in Mexico in 2011, at the request of the Department of Health, reported a point prevalence of 21%, which is almost twice as high as the international standards, which range between 5 and 10% ⁽¹²⁾.

On average, each day, in Guanajuato more than four people become infected when they had received treatment in some health center or hospital; in 2018, 1602 cases were reported, of which 853 occurred in men and 749 in women. The following were identified as the causes: Poor hygiene in the medical instruments or facilities, the own illness of the patient, and lack of hygiene measures of the caregiver and visitors ⁽¹³⁾.

The institutions that provide health services require the presence of a caregiver who has to be with the patient, his contribution is irreplaceable due to the ties of kinship between them, since the caregiver assumes the responsibility to take care of basic needs, decision making, and he becomes the person in charge of the ill-patient ^(14,15).

The appearance of one IAAS results from the interaction between an infectious agent and a susceptible host. In this interaction there is an element known as chain of infection comprised by the infectious agent, reservoir, way out, transmission mode, way in, and susceptible host, and here, the caregiver is identified as a reservoir and transmission agent for being part of the hospital environment ⁽⁶⁾.

Many studies have focused in the research of each of the elements of the chain of infection that causes an IAAS, but very few studies have focused on the participation of the caregiver as factor of prevention and potential reservoir, able to host or carry some agent that can be transmitted to the ill person during the care, despite the fact that the caregiver carries multiple activities in the hospital that range from emotional support to cleaning, medication, and handling of invasive and non-invasive devices ⁽¹⁷⁾.

According to the Royal Spanish Academy, taking care of an individual is "an act that one provides oneself when oneself acquires autonomy", but it is also a reciprocal action that tends to be given to any person, who temporarily or permanently requires help to satisfy his basic necessities ⁽²⁰⁾. The caregiver is "that non-professional person who on a daily basis is in charge of the basic and psychosocial necessities of the ill person or that supervises him in his everyday life", and in most cases, he lives in the same home, and is always available to satisfy the demands of the ill person without receiving any payment for his role ^(14,15).

Several sociological studies show the amount that informal caregivers currently represent. In the North American population, it has been estimated that 19,2% (52 million people) takes care of ill adult people. In Canada, 9,6% of the population (3 million people) helps individuals affected by some kind of chronic illness ⁽¹⁸⁾.

The National Survey on Occupation and Employment (ENOE by its acronym in Spanish), in the third quarter of 2016 registered 286 thousand caregivers of dependent people in Mexico. This data revealed that this role is mainly taken by women, since 97 out of 100 caregivers are women; moreover, 38 out of 100 work in health centers and 62 in private homes. In average, they work 38.5 hours per week and earn 24.3 pesos per hour worked.

The objective was to carry out a systematic revision on the existing scientific evidence in order to find out the behavior of the caregiver and his relationship with IAAS, to identify how the caregiver can be the cause of an infection, when he is participating in the care.

METHODOLOGY

This study was a systematic review performed following the elements of the PRISMA Statement. Searches in electronic databases, published from 2013 to 2018, such as PubMed, BVS, Trip Database, Science Direct, Ebsco Host, and Google Scholar were carried out, elected because their impact on the health sector.

The following search strategies were used: The first search was in PubMed using the following search algorithm: ("Cross Infection/diagnosis" [Mesh] OR "Cross Infection/epidemiology" [Mesh] OR "Cross Infection/etiology" OR "Cross Infection/organization and administration" [Mesh] OR "Cross Infection/transmission" [Mesh]) AND ((Clinical Trial [ptyp] OR Review [ptyp] OR Meta-Analysis [ptyp] OR Practice Guideline [ptyp] OR systematic [sb]) AND ("loattrfree full text" [sb] AND "loattrfull text" [sb]) AND "2013/04/17" [Pdat]: "2018/04/15" [Pdat] AND "humans" [MeSH Terms] AND (English [lang] OR Portuguese [lang] OR Spanish [lang]) AND ("female" [MeSH Terms] OR "male" [MeSH Terms]) AND ("adult" [MeSH Terms] OR "adult" [MeSH Terms: noexp] OR "aged" [MeSH Terms])); the second search was in virtual health library with DeCs terms and Boolean operators: "cross

infection" AND caregiver; the third search with DeCs terms and Boolean operators: Trip Database "cross infection" AND caregiver; and Science direct: "nosocomial infection" AND caregiver, additionally in Google Scholar with DeCs terms.

Inclusion criteria were: Studies of randomized clinical trials, systematic reviews, clinical practice guides, and qualitative studies published in English, Portuguese, and Spanish, which addressed nosocomial infections and their relationship with the caregiver of adult patients in hospitals.

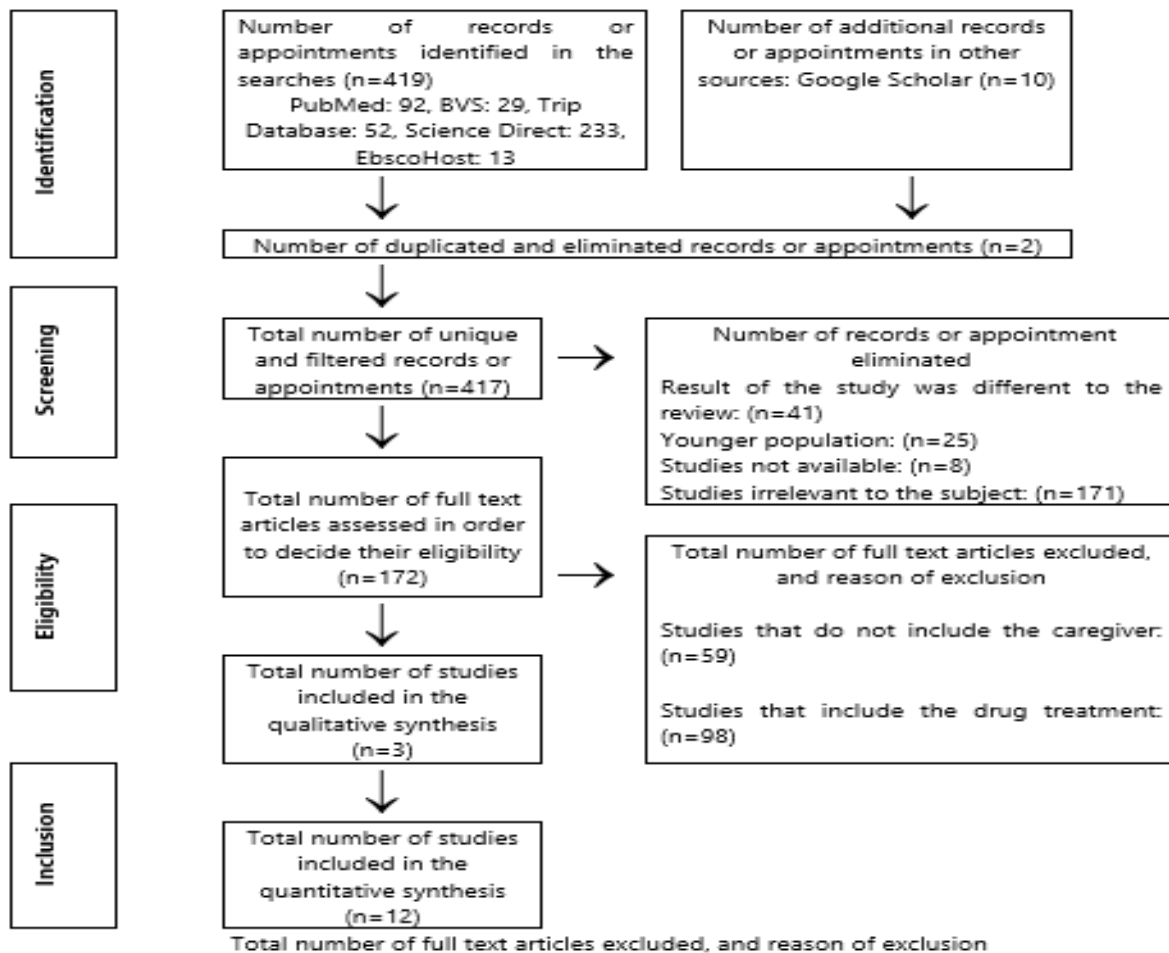
Exclusion criteria were patient caregivers at home and in intensive care units, both for adults and children.

The identification and selection of articles was carried out independently by 2 reviewers (EBF and MRTF); the assessment was performed by a third reviewer (AAA); the articles were saved and the copies identified in several databases were saved in Mendeley, version 19.5.

RESULTS

From the 419 articles found in the literature search, 92 documents were located in PubMed; 29 in the virtual health library; 52 in Trip Database; 23 in Science Direct; 12 in

Figure 1. Flow diagram that summarizes the process to identify eligible studies.



Source: Own development

Table 1. Description of articles selected in this systematic review

Title, author, and country	Journal and year	Type of study	Methodology
Risk factors for infection associated to health care in hospitalized adults: Systematic review and meta-analysis	American Journal of Infection Control 2017	Systematic review and meta-analysis	Search in electronic databases: MEDLINE, Embase and LILACS; studies from 2009-2016 were included; 867 studies were obtained, and 65 met the review criteria and 18 were used.
Practices based on the evidence to increase hand hygiene compliance in healthcare centers: A comprehensive review	American Journal of Infection Control 2017	Systematic review	Search in electronic databases: MEDLINE, studies from 2002-2015 were included; 151 studies were obtained, 73 of which met review criteria.
Infections of the bloodstream in older patients	La virulencia 2016	Systematic review	Search in electronic databases: Pubmed up to September 2015
Risk factors for secondary nosocomial bacteremia to bacteriuria associated to urinary catheter: A systematic review	Urol Nurse 2015	Systematic review	Search in electronic databases: MEDLINE, Scopus, Cochrane, CINAHL, and the database about outbreaks with the help of a medical librarian, where studies from 1983-2012 were included; 5231 studies were obtained, 79 of which met review criteria and 7 were used.
An automated system of hand hygiene compliance is associated with a better monitoring of hand hygiene	American Journal of Infection Control 2017	Quasi/experimental	Retrospective cohort implementing a hand hygiene compliance automated control system
The increase in hand hygiene efficiency decreases the nosocomial infection markers and their cost after a hand hygiene automated monitoring system	American Journal of Infection Control 2014	Quasi/experimental	Installation of a wireless system to monitor hand hygiene, monitoring the dispensers and evaluating doctors, nurses, patients, caregivers, and other health professionals
Family caregivers in public tertiary care hospitals in Bangladesh: Risks and opportunities for infection control	American Journal of Infection Control 2014	Qualitative	A 48-hour monitoring in 3 public hospitals was carried out, and 12 interviews were carried out to family caregivers
Infections in the bloodstream in internal medicine	La virulencia 2016	Systematic review	Search in electronic databases: MEDLINE, Pubmed
Comment about: Family caregivers in tertiary care public hospitals in Bangladesh: Risks and opportunities for infection control	American Journal of Infection Control 2014	Letters to the editor	Comment to the article published
Hand hygiene of health personnel and of family caregivers in health facilities in Bangladesh: Results of the National Health Baseline Survey of Bangladesh	The Journal of Hospital Infection 2016	Descriptive/Observational	A baseline survey about hand hygiene was used. It was applied to 100 groups of rural and urban populations; hand hygiene infrastructure was examined in 875 health centers and the behavior in 100 health centers was monitored

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What do visitors know and how they feel about contact precautions?	The Journal of Hospital Infection 2018	Descriptive/Observational	The survey was applied using the conceptual framework of Initiative for System Engineering for the Safety of the Patient to visitors of hospitalized patients at random
Knowledge and attitude of the visitors to patients in contact isolation	American Journal of Infection Control 2014	Descriptive/Observational	The survey was applied in hospital units to 137 patients in contact isolation
Evaluation of the understanding and satisfaction of the patient and caregiver with the use of contact isolation	American Journal of Infection Control 2016	Descriptive/Observational	The survey was applied in hospital units to 500 patients in contact isolation
Identification of psychological determinants of hand washing: Results of two cross-sectional questionnaires in Haiti and Ethiopia	American Journal of Infection Control 2015	Descriptive/Observational	Personal interviews were applied to 1274 primary caregivers
Psychosocial factors in caregivers and risk of infection of the bloodstream in patients of a health institution of Medellín, 2014	CES Salud Pública 2015	Descriptive/Observational	One hundred seventy seven (177) caregivers were followed-up; additionally, the care given to 56 patients who have placed a catheter was assessed

Source: Own development

EbscoHost; and 10 articles in other sources consulted such as Google Scholar. After carrying out the critical review of the documents, a total of 15 articles were accepted (Fig. 1).

The type of study of the articles selected were: Systematic review (5), descriptive/observational (6), quasi-experimental (2), qualitative (1), letters to the editor (1). English was the language in 14 articles and Spanish in only one article. The origin of the articles were Colombia (1), Haiti and Ethiopia (1), Bangladesh (3), and the United States of America (10); the years of the articles vary from 2013 to 2018. This information is summarized in table 1.

The objective of this review was to perform a systematic review in the existing scientific evidence that indicated the behavior of the caregiver and his relationship with the IAAS; after the assessment of the documents, three relevant aspects stand out: a) Types of nosocomial infections; b) Risk factors of a IAAS; and c) Practices, knowledge, and attitude of the caregivers to prevent an IAAS.

Types of nosocomial infections

The types of most frequent infections included the bloodstream infections associated to the central line, infections of the urinary tract association to urinary catheter, infections in the surgical site, and pneumonia associated to the fan ⁽²¹⁾.

Risk factors of an IAAS

While there is no consensus about the risks, the following factors were identified as extrinsic factors to acquire an IAAS, namely, the placing and handling of the central venous catheter, period of hospitalization, catheterization and handling of the urinary catheter, aspiration of secretions, gastrostomy tube, and lack of application of specific measures techniques ⁽²²⁾.

Something that has not been studied in depth regarding the IAAS is what happens from the insertion of a devise through the appearance of an infection ⁽²³⁾.

Other factors are: Ignorance due to the improper use of the techniques, limited knowledge of basic infection control measures, lack of control policies, lack of healthcare personnel so the caregiver addresses this shortfall, the transmission of pathogens during the direct contact with the patient and the environment, since a patient could be an additional reservoir for the patient that is not infected ⁽²¹⁾.

Other risk factors are bedridden patient, presence of intravascular access or gastrostomy during admission, institutionalization, exposure to instruments and procedures, and urinary incontinence ⁽²⁴⁾; additionally, handling of permanent simultaneous devices such as the central venous catheter and the urinary catheter are closely related to the

appearance of an infection in the bloodstream ⁽²⁵⁾. Family, social, and economic environments as well as stress and schooling of the caregiver represent a very high risk to become triggers of an IAAS ⁽²⁶⁾.

Difficulties to access some materials such as soap and washing facilities, poor environmental hygiene around the ill person, inadequate conditions of the facilities, and lack of training regarding infection control are factors that predispose to the transmission of infections ⁽²⁷⁾.

Another factor that we found was that compliance of contact precautions from the health personnel affects to a large extent the compliance of the visitor, which is associated to a perception of low risk, thus, contact precautions are not performed ⁽²⁸⁾.

There is no standardized education method addressed to primary caregivers and visitors even though visitors seem to understand the purpose of the precaution measures around hospitalized patients, in addition to the fact that ignorance of the caregiver regarding the presence of a nosocomial infection in the patient prevails ⁽²⁹⁾.

Repeated or continuous exposure, improper hand hygiene, and lack of knowledge about transmission of infections underline the caregiver as risk factor and, in turn, determining, for the transmission of an IAAS ⁽³⁰⁾.

Gender, schooling, practices, knowledge, and attitude of the caregivers to prevent nosocomial infections (IH by its acronym in Spanish)

With respect to sex, it was identified that between 60% and 70% of caregivers are women, with secondary education at least, and the rest with university education ⁽²⁹⁾; regarding the knowledge about patient isolation, caregivers understand that this is a preventive and protection measure against an IAAS, however, the use of personal protection equipment is low ^(28,31,32). Furthermore, lack of knowledge is associated to motivation, which is reflected in the poor behavior of the family caregiver for not following prevention rules ⁽²⁷⁾.

Regarding the care of family caregivers, they provided care 24 hours carrying out cleaning and psychological support activities; in total, they performed 2065 caring tasks, and 75% (1,544) involved direct contact with the patient. It was noted that they washed their hands with soap 4 times only ⁽³³⁾.

Isolation policies generate safety, satisfaction, and positive response, but reduce the contact time and direct examination from health workers, affecting the quality of the care; additionally, they generate more adverse events such as patient's depression and delirium. In this context, the generation and exploration of studies that investigate in depth the care provided is highlighted, in addition to generate strategies to improve the knowledge of the caregivers about the transmission of nosocomial infections and the reduction of the exposure to causative agents ⁽³²⁾.

A integrated review suggests five intervention categories to prevent a nosocomial infection: (1) Improve education

conscience (transfer of knowledge, mentoring assessment, and feedback); (2) facilities design and planning; (3) protocols and procedures at individual level; (4) programs at institutional level; and (5) multimodal interventions that involve final users, in addition to understand the interaction between caregivers, patients, and relatives³¹.

DISCUSSION

The review helped to described available evidence about IAAS and their association to the caregiver of hospitalized adults.

Although there are many risk factors that can cause an infection, studies, strategies, and policies have been addressed to hand washing; likewise, health personnel are in charge of meeting prevention measures; however, there is another important element during care, the caregiver, who supports with the care, and probable infection agent.

Isolation policies for patients that develop an generates safety, satisfaction, and positive answer of family caregivers, but reduce contact time and direct examination of health workers which affect the quality of care, and generate more adverse events such as depression and delirium of the patient. In this context, the generation and exploration of studies that investigate in depth the care they provide are emphasized, in addition to generate strategies to improve the knowledge of the caregivers about transmission of infections and reduction of exposure to causative agents ⁽³²⁾.

The review had some limitations. Firstly, we only included studies published in 4 databases, therefore, relevant articles published in other databases were not assessed; secondly, the meta-analysis evaluated emerged from descriptive/observational studies which are susceptible to bias; thirdly, there are very few studies that assess the correlation between the caregiver and the nosocomial infections or IAAS.

CONCLUSIONS

A large percentage of studies, strategies, and policies have been addressed to hand washing; likewise, health personnel are in charge of meeting prevention measures, however, there is another important element during care, the caregiver, who supports during care and that has not been studied as part of the chain of infection.

Most common IAAS are those that predominate at global level in practically all health institutions; in some of them, the caregiver may be a probable infection agent.

Unfortunately, risk factors are so diverse that programs to prevent IAAS shall be comprehensive and involve executives, administrators, health personnel, educational institutions, health personnel in training, patients, and informal caregivers. Tendency indicates that caregivers are people with such an education level who have the required comprehensive skills to participate in programs addressed to prevent the IAAS;

likewise, education strategies shall be redesigned.

It is suggested to raise awareness about prevention taking as a basis education, improvement of hospital facilities, protocols and individualized procedures, generation of institutional policies, and use of multimodality for caregivers and patients.

It is proposed to increase scientific production that studies the association between the caregiver and the IAAS in hospitals, in order to make clear if there is a relationship between these two variables, and to plan and implement strategies for prevention, control, and monitoring, locating the caregiver, visitor, and the patient himself as key players for the operationalization of them.

CONFLICT OF INTEREST

There is no conflict of interests among the authors.

FINANCING

No one.

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