



Major article

The prevalence of infections and patient risk factors in home health care: A systematic review

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Key Words:

Infectious disease
Infection rate
Increased risk
Home environment
Home infusion
Hospice

Background: Home health care (HHC) has been the fastest growing health care sector for the past 3 decades. The uncontrolled home environment, increased use of indwelling devices, and the complexity of illnesses among HHC patients lead to increased risk for infections.

Methods: A systematic review of studies evaluating infection prevalence and risk factors among adult patients who received HHC services was conducted and guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Literature was searched using Medline, PubMed, and the Cumulative Index to Nursing and Allied Health as well as hand searching. Two reviewers independently assessed study quality using validated quality assessment checklists.

Results: Twenty-five studies met the inclusion criteria and were reviewed. The infection rates and identified risk factors for infections varied dramatically between studies. In general, patients receiving home parental nutrition treatments had higher infection rates than patients receiving home infusion therapy. The identified risk factors were limited by small sample sizes and other methodologic flaws.

Conclusions: Establishing a surveillance system for HHC infections, identifying patients at high risk for infections, tailoring HHC and patient education based on patient living conditions, and facilitating communication between different health care facilities will enhance infection control in HHC settings. Future studies should use a nationally representative sample and multivariate analysis for the identification of risk factors for infections.

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Health care delivery systems in developed countries have undergone a dramatic change since the 1970s, with many acutely ill patients moving out of hospitals to their homes to reduce hospital and nursing home stays, improve patient outcomes, and subsequently cut health care costs.^{1,2} As a result, home health care (HHC), defined as “care provided by professionals to a person in his/her own home,”³ has become 1 of fastest growing health care sectors. In the United States, more than \$72.2 billion was spent on HHC during 2009 alone⁴ and approximately 12 million Americans, most (69%) older than age 65 years,⁵ received care from more than 33,000 home health care providers nationwide during 2010.⁴ The demand for HHC is expected to increase as the population continues to age, with an estimate that 20% of Americans will be older than age 65

years in 2030.⁶ The increase in HHC services is not a phenomenon unique to the United States. In other developed countries, HHC is also expanding due to a combination of demographic shifts, changes in the epidemiologic landscape of diseases, and advances in technological support.⁷

Receiving health care in the home has many advantages for patients. It provides them with necessary care and services in the comfort of their own home and maintains their dignity and independence. However, it also poses special challenges and health hazards, one of which is infection control. Although patients making use of home care are less acutely ill than patients in hospitals or long-term-care facilities, they are exposed to potential hazards that are not experienced by hospitalized patients or long-term facility residents. These hazards put HHC patients at high risk for infections. For example, although HHC is overseen by health professionals, much of the actual care is provided by the patients themselves, family members, or close friends who do not have formal training. Unlike hospitals or long-term-care facilities, the

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Conflicts of interest: None to report.

home environment is usually limited by space and lacks sufficient supplies or resources, a situation that poses unintentional sanitary hazards. In addition, the increasing use of indwelling devices in HHC can further expose patients to risk for infections.⁸

During the 1990s, 3 infection outbreaks that captured national attention were reported in patients receiving HHC, and all were related to indwelling catheters.⁹⁻¹¹ Since then, researchers have sporadically studied infection rates and risk factors in home care patients, focusing primarily on patients receiving home parental nutrition (HPN) treatment.¹²⁻¹⁶ Although individual studies aid in understanding, a systematic analysis provides a more complete picture of infections in home care settings, guiding clinical practices in HHC and identifying gaps in knowledge that need to be addressed in future research. A search of the literature revealed that no systematic review of infection in HHC settings has been published. To address the gap in knowledge, we conducted a systematic review to critically review and synthesize published evidence on infection prevalence and risk factors among adult patients who received HHC services and to evaluate the methodologic quality of these studies. The questions that guided our systemic review were, What are the infection rates among the HHC patients? and, What are the known risk factors for infections among patients receiving HHC services at home? The information presented in our systematic review is the critical first step for HHC professionals to develop guidelines to prevent and control infections in HHC.

METHODS

Our systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.¹⁷ PRISMA is a 27-item checklist that is used to improve the reporting of systematic reviews and meta-analyses and has been endorsed by major biomedical journals for publication of systematic reviews.¹⁸

A comprehensive search of the literature was conducted independently by 2 reviewers (JS and CM). Three electronic databases (Medline, PubMed, and Cumulative Index to Nursing and Allied Health Literature [CINAHL]) were used and the search terms included *home care*, *home health care*, *hospice*, and *home infusion* in various combinations with *infection*, *sepsis*, *pneumonia*, *infectious disease*, and *communicable diseases*. Hand searching of reference lists was also conducted to identify relevant citations.

The following inclusion criteria were used to identify relevant studies: original research that primarily examined the infection rates and/or identified risk factors of infections in adult patients receiving HHC services, written in English, and published through May 2013. Furthermore, patients in these studies must have been receiving health or supportive care, including hospice, infusion treatment, or total parenteral nutrition at home. Researchers could use either experimental or nonexperimental designs. The primary outcome measures for this review were infection rates and risk factors related to infections. This review was not limited to a specific type of infection given the dearth of studies on HHC related infections. Editorials, commentaries, studies with very small sample sizes (ie, <20), or studies that focused on infections among HHC workers or family members were excluded. We also excluded studies related to outbreaks because these can inflate the actual infection rates occurring in the HHC settings, and risk factors examined during the outbreak period usually focused on very specific factors such as 1 specific type of needleless device.⁹

The following data were extracted from each study by 2 researchers (JS and CM): research objectives, design, sample size, target population, infection type(s), infection rate, and identified

risk factors. Study quality was assessed by using 2 observational research checklists, respectively, 1 for studies only describing infection rates, the other for studies examining risk factors. Published by Agency of Healthcare Research and Quality, these 2 checklists were specifically designed for observational studies that examine incidence or prevalence, or identify risk factors of chronic diseases and have been well tested.¹⁹ The checklists do not yield a composite score like some quality assessment tools,²⁰ but summarize the major threats to the study's internal validity and external validity.¹⁹ To meet the needs for our systematic review, the original checklists, which contain a primary epidemiologic focus, were carefully reviewed and certain items that are not applicable in our systematic review such as subgroup definition, symptom severity and frequency of chronic diseases, and study follow-up, were removed. The modified checklists consisted of 4 main components: study description, interval validity, external validity, and overall writing. Using these modified checklists, we developed a list of strengths and weaknesses for each of the reviewed studies.

All included studies were reviewed by 2 of the authors (JS and CM). To ensure consistency, at the beginning of the review process each of the 2 reviewers independently assessed 2 studies and compared the results. Differences between the reviewers were discussed to ensure the same interpretation of criteria. Following the first process, the reviewers met for discussion after finishing every 3 studies and resolved all discrepancies.

RESULTS

Study selection

The Medline search yielded 440 articles, the PubMed search yielded 1,022 articles, whereas the CINAHL search yielded 378 articles. After removal of duplicates, titles and abstracts of 1,287 articles were screened. One thousand two hundred sixty-four articles were excluded for the following reasons: 1,239 did not include HHC patients or focused on outcomes not related to infections; 13 were not research studies; 3 had very small sample sizes (ie, <20); 6 focused on pediatric patients; and 3 were outbreak studies. Hand searching of reference lists of retrieved articles added 2 additional eligible articles for review. This resulted in 25 studies included in our systematic review (Fig 1).

Characteristics of studies

Table 1 describes the characteristics of the 25 reviewed studies. A majority (n = 13; 52%) was conducted in the United States. Nine studies (36%) were conducted in Canada and European countries, 1 study (4%) included both American and Canadian sites, 1 study (4%) was conducted in South Africa, and 1 was from Japan (4%). More than half of the reviewed studies (n = 14; 56%) focused on patients receiving HPN treatments, 4 (16%) focused on general HHC patients, 3 (12%) focused on home infusion patients, 3 (12%) on patients with indwelling devices (2 with urinary catheter only and 1 with both urinary catheter and intravenous device), and 1 (4%) on HHC patients with mechanical ventilators. Most studies (n = 17; 68%) were conducted in a single HHC site; 8 (32.0%) were multisite studies, including those which used national representative samples from the United States.^{21,22} Most researchers examined a single type of device-related infection such as intravenous (IV) line-associated infections (n = 19; 76%),^{12-16,21,23-36} urinary catheter-related infections (n = 4; 16%),^{25,26,31,37} or ventilator-associated pneumonia (n = 1; 4%)³⁸; only 3 (12%) studies^{22,39,40} described all types of infections in general HHC patients.

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