

## ANALYSIS OF HAND HYGIENE PRACTICES AMONG HEALTH CARE WORKERS FOR PREVENTION OF NOSOCOMIAL INFECTION: A SYSTEMATIC REVIEW

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### Abstract

**Background:** Hand hygiene has been regarded as the most efficient technique in nosocomial infections control.

**Aim:** This study aims to summarize and evaluate the impact of hand hygiene practices among health care workers for prevention of nosocomial infection.

**Methods:** A systematic search strategy was conducted across several electronic reference databases (PubMed, Cochrane Library, Google Scholar) and included articles published between 2019–2023. Duplicate publications, review articles, and incomplete articles were excluded.

**Results:** The databases search identified a total of 19.427 articles (Table 1). Of these, 120 articles passed the screening process, resulting in 20 articles for full-text assessment. Among them, 13 articles contain insufficient details regarding the focus of interest. Hence, we found 7 appropriate studies.

**Conclusion:** Our study found that hand hygiene practices is a preventive measure for NIs and it seems that hand rubbing appeared to be more effective than hand washing as a hand-hygiene strategy, albeit with evidence of low to moderate quality. This strategy promotes the use of hand-rubbing in intensive care units for improved clinical outcomes for patients and healthcare providers.

**Keywords:** Hand hygiene practice, Health care workers, Nosocomial infection

**INTRODUCTION**

Nosocomial infections (NIs), also known as healthcare-associated infections (HCAs), are infections that emerge in patients while they are receiving care in a hospital or other healthcare facility and were not present or incubating at the time of admission.<sup>1</sup> HCAs degrade care quality and are the most common adverse effect of healthcare worldwide. When healthcare providers come into close contact with patients, they may be impacted by HCAs or function as a vector/source of infection for HCAs.<sup>2</sup>

The global prevalence of NI is estimated to be 0.14 (95% CI, 0.12-0.15). The prevalence varies in different regions and countries, with rates ranging from 0.06% to 0.32%. Low-income countries have a higher prevalence of NI compared to high-income countries.<sup>3</sup>

Since Ignaz Philipp Semmelweis recognized its enormous influence on the lowering of the incidence of childbed fever<sup>4</sup>, hand hygiene has been regarded as the most efficient technique in HCAs control. To avoid pathogenic organism transfer from one patient to the next, vigorous handwashing for 40-60 seconds or the application of alcohol hand rub is recommended before and after each patient encounter. However, compliance is frequently unsatisfactory in most resource-constrained situations due to limited infrastructure, a heavy workload, and skin sensitivities to handwashing products.<sup>1</sup>

Here we aims to evaluate the impact of hand hygiene practices among health care workers on the impact of NI or other related factors of NI.

**Method**

**Search Strategy**

This study is a qualitative systematic review. The data is obtained through electronic database search in Medline (PubMed), Cochrane Library, and Google Scholar. The keywords used are “Hand hygiene practice” AND “Healthcare workers” AND “Nosocomial infection”. The selected articles are based on inclusion and exclusion criteria.

**Table 1.** Literature search strategy

Database	Keywords	Results
PubMed	“Hand hygiene practice” AND “Healthcare workers” AND “Nosocomial infection”	721
Cochrane Library	“Hand hygiene practice” AND “Healthcare workers” AND “Nosocomial infection”	6
Google Scholar	“Hand hygiene practice” AND “Healthcare workers” AND “Nosocomial infection”	18.700

**Eligibility Criteria**

All studies were assessed for eligibility. The inclusion criteria of the included studies were original articles (observational studies including cohort, case control, cross-sectional, experimental) published in the last 20 years between 2004 and 2023, full-text articles available, published in English, and studied the impact of hand hygiene practice on the incidence of nosocomial infections. The exclusion criteria of the studies are articles that are not indexed by Scopus, editorials, reviews, and articles that did not evaluate the focus of interest of this study. The research selection was carried out in three successive phases. The titles and abstracts of all search results were initially screened and evaluated for relevance. Second, complete access was gained to all potentially eligible studies. Finally, the systematic review included only those studies that met our inclusion criteria. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guideline is used for the selection.

**Data Extraction and Parameter Measured**

All the authors extracted the data from the articles. The following datas are collected: Author, year of publication, country, study design, subjects studied for NI, sample size, healthcare worker (HCW) personnel, hand hygiene practice (hand wash or hand rub, and what type of soap are used), compliance rate among HCW, NI cases definition, and impact of hand hygiene practice on NI incidence or related parameters. All disagreements regarding the methodology, article retrieval, and statistical analysis were resolved by consensus among the authors.

**Results**

The databases search identified a total of 19.427articles (Table 1). Of these, 120 articles passed the screening process, resulting in 20 articles for full-text assessment. Among them, 13 articles contain insufficient details regarding the focus of interest. Hence, we found 7 appropriate studies (Figure 1). The summary of the main findings of the selected studies is presented in Table 2 and 3.

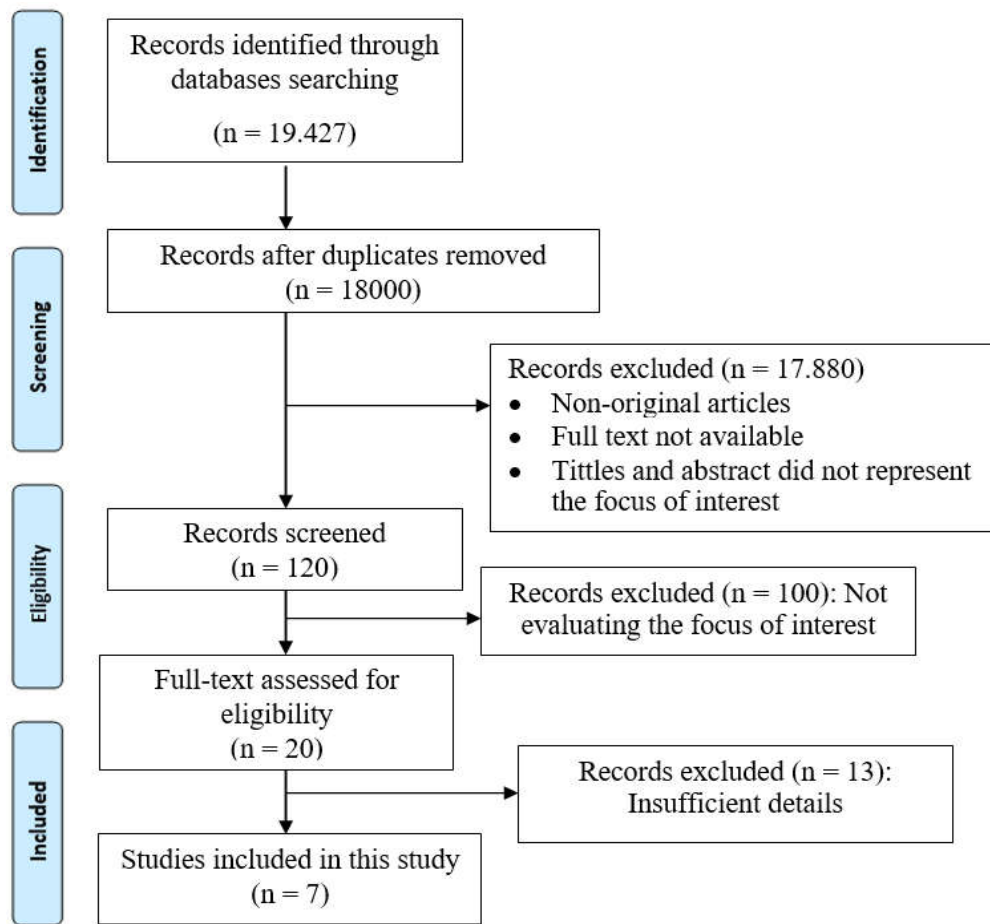


Figure 1. PRISMA flow diagram

Table 2. The characteristics of included studies

Author & Year of Publication	Country	Study design	Subject studied for NI	HCW personnel	Setting	Hand hygiene practice
Lam et al. 2004 <sup>5</sup>	Hong Kong	Observational	Infants <28 days old (N = NR)	Nurses & doctors	NICU	Water and antiseptic alcohol-based hand rub
Ng et al. 2004 <sup>6</sup>	Hong Kong	Observational	VLBW infants (N = 337)	Doctors, nurses and allied health workers	NICU	Coventional HW protocol: Chlorhexidine gluconate 4% New HR protocol: 1% chlorhexidine in isopropyl alcohol and ethyl alcohol
Rosenthal et al. 2005 <sup>7</sup>	Argentina	Cohort	Adults (N = NR)	Nurses & doctors	ICU	4% chlorhexidine handwash dispensers
Capretti et al. 2008 <sup>8</sup>	Italy	Cohort	VLBW infants (N = 165)	NR	NICU	Water and antimicrobial detergent (4% Chlorhexidine Gluconate) for at least 15 seconds
Souwene et al. 2009 <sup>9</sup>	France	Before-after trial design	Adults (N = 7)	Nurses & doctors	ICU	HW: 4% chlorhexidine gluconate or 4% povidone iodine HR: 45% isopropanol (2-propanol, 30% 1-propanol, and 0.2% mecetronium ethyl sulfate)
Martínez-Reséndez et al. 2014 <sup>10</sup>	Mexico	Cohort	Adults (N = 1007)	Nurses	ICU	Preintervention: soap/water bathing Intervention: bathing with Chlorhexidine-impregnated wipes Postintervention: soap/water bathing
Nasution et al. 2019 <sup>11</sup>	Indonesia	Experimental with pre-test and post-test design	Nurses (N = 16)	Nurses	Nurse's hand	handwashing with soap and hand rub.

HCW: Healthcare workers; HW: Hand wash; HR: Hand rub; ICU: Intensive care unit; NICU: Neonatal intensive care unit; NR: Not reported; VLBW: Very low birth weight

**Table 3.** The impact of hand hygiene practices on the incidence of nosocomial infections

Author & Year of Publication	Hand hygiene compliance (%)	NI cases definition	Impact of hand hygiene practice on NI incidence or related parameters
Lam et al. 2004 <sup>5</sup>	Before intervention: 40% After intervention: 53%	BSI, pneumonia, necrotizing enterocolitis, and central nervous system infections.	Decreased HAIs from 11.3 to 6.2 per 1000 patient-days (p = 0.14)
Ng et al. 2004 <sup>6</sup>	NR	NR	After the introduction of the HR regimen, the incidence of late-onset systemic infection decreased 2.8-fold. Likewise, the incidence of Gram-positive, Gram-negative, and fungal infections decreased by a factor of 2.5, 2.6, and 7 respectively. Incidence of NEC decreased significantly (p 0.0001) in the HR group. The incidence of MRSA septicaemia decreased substantially during the second 36-month period, according to subgroup analysis (p = 0.048).
Rosenthal et al. 2005 <sup>7</sup>	Before intervention is 23.1% (268/1160) After intervention: 64.5% (2056/3187) (RR, 2.79; 95% CI: 2.46-3.17; P, .0001)	VAP, Laboratory-confirmed, catheter-associated BSI, clinically suspected CABSIs, Symptomatic CAUTI	NI in both ICUs decreased from 47.55 per 1000 patient-days (104/2187) to 27.93 per 1000 patient days (207/ 7409) RR, 0.59; 95% CI: 0.46-0.74, P <0.0001).
Capretti et al. 2008 <sup>8</sup>	NR	Infections occurring within 72 h of birth: clinical signs, CRP> 2 mg/dL, and positive cultures were	Significant reduction in NI incidence after implementation of standardized handwashing protocol (p = 0.015)
Souwene et al. 2009 <sup>9</sup>	Before intervention: 51% After intervention: 60%	NR	No significant reduction in MRSA colonization/infection (P = 0.30)
Martínez-Reséndez et al. 2014 <sup>10</sup>	NR	VAP, CAUTI	The combined intervention lowered global and specific infection rates, including VAP related with <i>A baumannii</i> and CAUTI associated with <i>Candida spp.</i> (p<0.05)
Nasution et al. 2019 <sup>11</sup>	NR	Not applicable	There were no statistically significant differences between handwashing and hand rubbing in diminishing the total bacterial colony on the hands (p = 0.088). The average reduction in total colony by handwashing is 59.5%, and by hand rubbing it is 47.2%.

BSI: Blood stream infection; CABSIs: catheter-associated blood-stream infection; CAUTI: Catheter-associated urinary tract infection; MRSA: Methicillin-resistant *Staphylococcus aureus*; NEC: Necrotizing enterocolitis; NI: Nosocomial infection; HAI: Healthcare associated infection; HR: Hand rub; HW: Hand wash; VAP: Ventilator-associated pneumonia

**Discussion**

Hand hygiene is one of the most critical infection control factors in a hospital setting. Healthcare personnel are frequently responsible for infection transmission from one patient to the next via contaminated hands.<sup>12</sup> Healthcare-associated infections are a significant burden on healthcare facilities. According to a recent meta-analysis, hospitals in the United States spend USD 9.8 billion per year to combat various types of hospital-acquired illnesses.<sup>13</sup> Reduced hand hygiene compliance is regarded as a global issue, and compliance varies between healthcare professions.<sup>12,14</sup>

Hand hygiene is characterized as the major measure that has been shown to be helpful in avoiding healthcare-associated illnesses and antibiotic resistance.<sup>15</sup> Hand washing with soap and water or with an alcohol-based hand rub is the most cost-effective public health strategy for preventing healthcare-associated infections.<sup>16</sup> The WHO established guidelines on hand hygiene techniques in 2009 in order to reduce the occurrence of hospital-associated illnesses. Despite the fact that hand washing is a simple procedure, some healthcare personnel are hesitant to follow the suggested hand hygiene procedures. A lack of proper knowledge, awareness, and attitude toward hand hygiene is associated with poor compliance of healthcare personnel in following recommended hand hygiene measures.<sup>12,17</sup>

According to the WHO, NIs afflict an estimated 1.4 million individuals worldwide at any given moment. There are numerous repercussions connected with healthcare-related infections, including prolonged hospitalization, incapacity, increased healthcare costs for patients and families, increased morbidity and death, and antibiotic resistance.<sup>12</sup> All of this adds to the financial burden on the health-care system. As a result, NIs are seen as a major public health risk for patients, healthcare staff, and the health-care system.<sup>18</sup>

In this study we found that hand hygiene practice, either hand washing or hand rubbing can decrease the incidence of NI or other related parameters, although hand rubbing is seems more superior than hand washing. However. Nasution et al. did not find any significant different among these two procedures.<sup>11</sup> The settings in which the majority of studies included in this systematic review is in intensive care units, where the patients are vulnerable to the occurrence of NIs.

This study have several limitations. First, we included only a few studies due to the scarcity of the available literatures that evaluate the impact of hand hygiene practices on the incidence of NIs or other parameter that represent it. Although many systematic review have been published regarding the compliancae or strategies to improve hand hygiene practices. Second, the majority of health care settings included was ICU and this is may be not represent the whole settings in health care settings. Third, given the ambiguity surrounding the randomization of research participants in included

studies, some variables may become crucial concerns. These disparities in baseline susceptibility to infection and response to hand-hygiene practices may account for some of the differences. In terms of the number of care contacts, some ICUs may not be similar; for example, neonatal ICUs are likely to have a higher rate of care contacts than adult ICUs. Similarly, surgical ICU patients may be more susceptible to infection than medical ICU patients. Hand hygiene frequency may potentially influence HCAI rates and the skin conditions of healthcare personnel. Only one of the included studies indicated significantly higher compliance with the hand-rub method, although it is unclear if the higher compliance with the hand-rub technique accounts for differences in effect estimates between the two strategies. Alcohol hand massages appear to be more gentle on the hands than soap and water hand cleaning. As a result, rather than being a result of use, this could be a motivator for compliance.

### Conclusion

According to our findings, hand hygiene is a preventive measures of NIs and it seems that hand-rub may be more effective than handwash strategies in terms of compliance. Improved compliance may be mediated by a variety of factors, one of which could be improved health workers' hand conditions as seen by lower likelihood of a skin reaction when using hand-rub procedures. This suspicion, however, demands additional investigation.

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