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IMPACT OF MULTIMODAL DISSEMINATION STRATEGIES ON HEALTHCARE WORKERS' COMPLIANCE WITH INFECTION PREVENTION AND CONTROL RECOMMENDATIONS: A SYSTEMATIC REVIEW

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Abstract

Background: Healthcare-associated infections (HAIs) remain a major challenge worldwide, and healthcare workers' (HCWs) adherence to infection prevention and control (IPC) recommendations is critical to reducing their incidence. Hand hygiene compliance and vaccination uptake are recognized as key preventive measures, yet sustaining improvements in these behaviors remains difficult. Objective: This systematic review aimed to evaluate the impact of dissemination and multimodal interventions on HCWs' compliance with infection prevention and control recommendations for respiratory infectious diseases. Methods: The review was conducted in accordance with the PRISMA 2009 guidelines. A comprehensive search of Cochrane, Embase, and Medline databases was performed to identify randomized controlled trials (RCTs) published between 2010 and 2015. Studies assessing interventions designed to improve HCWs' adherence to hand hygiene, vaccination uptake, or other IPC practices were eligible. Data were extracted independently by multiple reviewers and synthesized narratively due to heterogeneity in study designs and outcomes. Results: A total of six RCTs involving more than 54,000 HCWs were included. Interventions examined included the WHO multimodal hand hygiene strategy, distribution of educational materials, audit and feedback, vaccination campaigns, and workplace reminders. Educational interventions were common across studies, often combined with non-educational strategies such as feedback or infrastructure provision. Multimodal approaches demonstrated superior effectiveness compared with single interventions, with improvements in hand hygiene compliance ranging from 16% to 22% and significant increases in vaccination uptake. However, the evidence for direct reductions in infection incidence and MRSA colonization was less consistent. Conclusion: Multimodal dissemination strategies that integrate education, feedback, and organizational support are more effective than single interventions in improving

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HCWs' compliance with IPC measures. While these interventions increase adherence to recommended practices, further research is needed to assess their long-term sustainability, cost-effectiveness, and direct impact on reducing HAIs in diverse healthcare settings.

Keywords: Healthcare-Associated Infections, Hand Hygiene Compliance, Infection Prevention, Healthcare Workers, Vaccination Uptake, Systematic Review.

INTRODUCTION

Healthcare-associated infections (HAIs) is one of the most pressing challenges in modern healthcare, contributing to patient morbidity, mortality, and financial burden worldwide. Among the various infection prevention measures, adherence to effective hand hygiene practices has been recognized as the single most important strategy for reducing the transmission of infectious agents in healthcare settings. Robust evidence demonstrates that improving hand hygiene compliance not only lowers the incidence of endemic infections but also curtails outbreaks and mitigates the spread of antibiotic-resistant organisms. In this context, alcohol-based hand rubs have become a cornerstone of infection prevention programs, as they are highly effective, less time-consuming, and better tolerated by healthcare workers compared to traditional handwashing with soap and water (1-4).

Programs that promote good hand hygiene have been shown to reduce the prevalence of infections linked to healthcare in hospitals (1,2). Adherence to proper hand hygiene has been shown to reduce not just the rates of endemic infection but also the frequency of outbreaks and the rise of antibiotic-resistant organisms (1). The application of antiseptic hand rub with an alcohol basis is one of the key elements of these hand hygiene programs. It is faster, less time-consuming, and less likely to irritate hands than plain hand washing with soap and water or detergent to eradicate harmful bacteria (3).

Healthcare workers (HCWs) fail to adequately appreciate the need of hand hygiene, despite it being a basic activity. Studies have shown that up to 40% of people do not practice hand hygiene (4). Numerous factors, including the type of healthcare professional, the department, and the degree of contamination risk, are linked to low compliance (5).

While several prior studies have demonstrated the effectiveness of interventions aimed at raising hand hygiene compliance, none have resulted in a long-lasting improvement (4,6). The Centers for Disease Control and Prevention released guidelines on hand hygiene in healthcare settings in 2002 in an effort to address some of these issues. These guidelines encouraged the use of alcohol-based solutions and the adoption of multimodal and multidisciplinary approaches to increase hand hygiene compliance (7). The Alliance for Patient Safety was approved by the WHO in 2004. The WHO views good hand hygiene as the primary measure in halting the spread of disease agents in hospital environments (8).

The necessity for multimodal interventions was emphasized in the recommendations, which included important components including health staff education and motivation, the use of hydroalcoholic preparations, the use of compliance indicators, and the dedication

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of all health managers. These days, the WHO suggests a multimodal approach to improving hand hygiene that involves institutional safety environments, system reform, training and education, evaluation and feedback, and workplace reminders (9).

Because primary healthcare centers are changing significantly and implementing more sophisticated and invasive procedures than in the past—in fact, hospital stays are getting shorter and healthcare is increasingly provided in homes—hand hygiene is crucial in these settings. The risk of contracting and spreading illnesses linked to receiving medical care outside of a hospital is increased by all of these variables (10). Nevertheless, there is insufficient scientific proof that hand hygiene practices are followed in this context, despite the fact that formal documentation supporting the advocacy of hand hygiene procedures in primary care is rising (11,12).

In order to evaluate the impact of dissemination interventions on healthcare professionals' compliance with control and prevention recommendations for infectious illnesses at work, we evaluated the recent literature in this study.

METHOD

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 guidelines (13). A structured search strategy was applied to three major databases—Cochrane Library, Embase, and Medline—to identify eligible studies published between 2010 and 2015. Reference lists of included articles and relevant systematic reviews were also screened to ensure completeness.

Eligibility Criteria

We included randomized controlled trials (RCTs) that evaluated the impact of dissemination or intervention strategies on healthcare workers' (HCWs) compliance with infection prevention and control (IPC) recommendations in the workplace. Eligible studies were required to report outcomes related to hand hygiene compliance (HHC), vaccination uptake, or other IPC adherence measures. Non-randomized studies, reviews, and studies without relevant outcomes were excluded.

Study Selection

Two reviewers independently screened titles and abstracts for relevance. Full texts of potentially eligible studies were then retrieved and assessed against inclusion criteria. Discrepancies were resolved through discussion, and when necessary, by consultation with a third reviewer. A PRISMA flow diagram (Figure 1) summarizes the selection process.

Data Extraction

Data were extracted independently by all review authors using a standardized and piloted form. Extracted variables included: study reference, country/setting, study design, participant characteristics, intervention description, comparator, funding source, and

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primary outcomes. The corresponding author cross-checked all entries to ensure accuracy and consistency.

Data Synthesis

The findings were synthesized qualitatively, as heterogeneity in interventions and outcome measures prevented formal meta-analysis. Results were summarized narratively with a focus on the type of interventions implemented (WHO multimodal hand hygiene strategy, educational programs, audit and feedback, vaccination campaigns) and their effectiveness in improving compliance with IPC recommendations among HCWs.

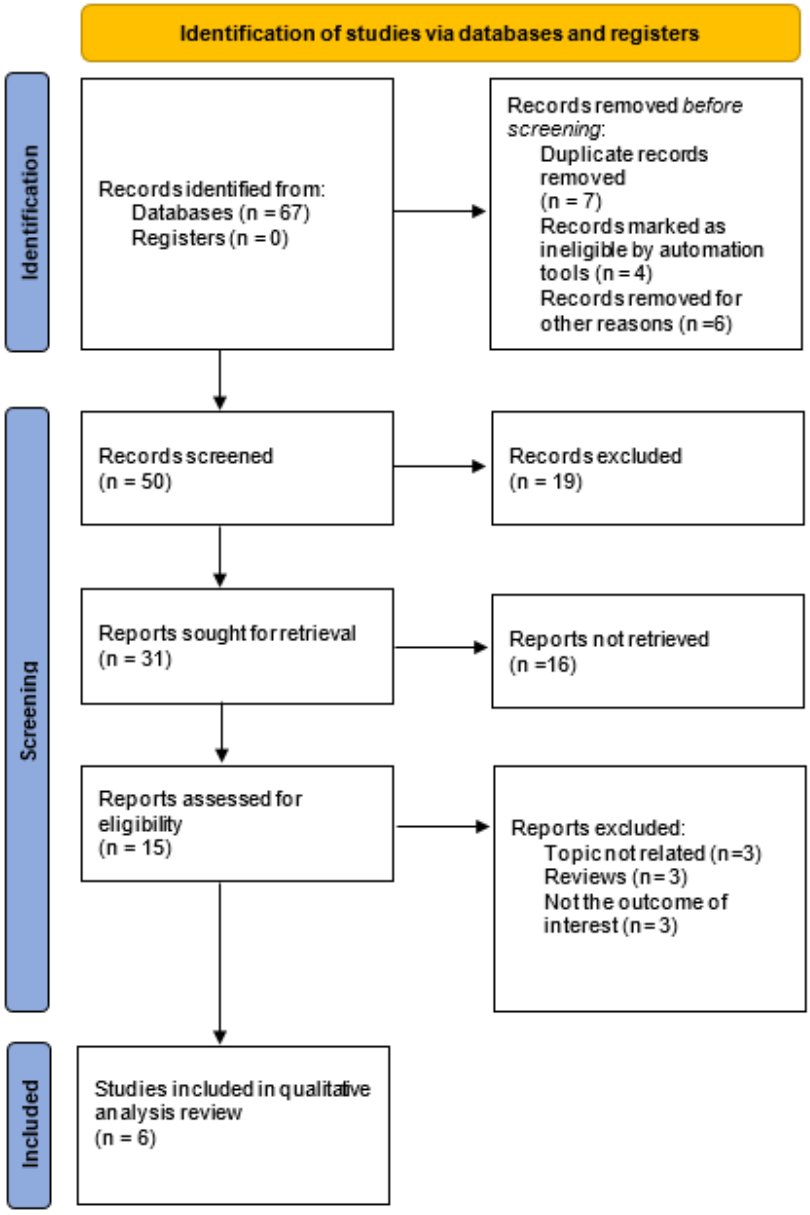

Fig 1: PRISMA consort chart of studies selection

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RESULTS

In this systematic review study, we included 6 RCTs (Fig 1) targeted Healthcare workers Compliance with the prevention protocols and hand hygiene. Interventions implemented were WHO multimodal strategy for improvement of hand hygiene, Meetings, Educational materials, and vaccine. The outcome of interest include; hand hygiene compliance (HHC) and vaccination uptake. The following infection control and prevention adherence outcomes—vaccination uptake, HHC, and knowledge of infection prevention and control—were evaluated for over 54393 healthcare professionals across all categories. One research just included the options for hand hygiene; it did not specify the number of healthcare professionals evaluated (14). Characteristics of the included studies were presented in (Table 1). The distribution of implementation techniques was based on educational interventions in five of the research (14–18). A modified version of the WHO multi-modal hand hygiene improvement strategy—which includes education, workplace reminders, observation and feedback, product and infrastructure provision for hand hygiene, and the development of a safety culture—was used in three studies that evaluated HHC (14–16,19). Two research (17,18) performed surveys and focus group sessions to personalize their distribution interventions. In one study (16), performance monitoring of healthcare delivery was used; in two other studies (14,16), audit and feedback were used. In one research, part of the intervention was making performance data publicly available (18). The incidence of gastrointestinal, cutaneous, and soft-tissue infections as well as urinary tract infections did not significantly decrease, according to the Yeung et al. research. These results were consistent with other research conducted in hospitals, which shown that the use of alcohol-based antiseptic hand rub reduced the frequency of infections (1,2,20). In a similar vein, a recent research conducted in long-term care facilities (21) shown that the use of antimicrobial soap significantly reduced the overall incidence of infection. Yeung et al. found that following hand hygiene intervention, the risk of infection decreased. The total incidence of infection was shown to have risen in the control group, mostly due to an increase in the incidence of urinary tract infections and septicemia (15).

DISCUSSION

The findings of this review reinforce the critical role of healthcare workers' adherence to infection prevention and control measures in reducing the burden of healthcare-associated infections. Consistent with previous studies, our analysis shows that higher levels of hand hygiene compliance are associated with significant reductions in infection incidence, highlighting the strong link between preventive behavior and patient outcomes. Evidence suggests that even modest improvements in adherence can translate into meaningful decreases in infection rates, while larger gains in compliance are correlated with substantial reductions in healthcare-associated morbidity and mortality. These results underscore the importance of sustained, structured interventions to foster long-term behavioral change among healthcare workers, moving beyond short-term compliance toward embedding infection control as a cornerstone of clinical practice

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Past research has shown that the incidence of infection decreases according to the level of hand hygiene adherence. For instance, it has been shown that when hand hygiene adherence rose 1.5 to 2.8 times, the incidence of healthcare-associated infections decreased by 40% to 45% (1,2,20). There was a reported 64% drop in the incidence of healthcare-associated infections when hand hygiene adherence improved by more than three times (22). Significant differences between the treatment and control groups in specific months were not clearly evident, despite a considerable and significant decrease in the treatment group's cumulative total incidence of infection (15). In order to promote flu vaccination, an active multicenter campaign that gave personal pleasure and took into consideration the profile of HCWs who were not vaccinated outperformed a scientifically correct information program, according to research conducted in France by Rothan et al. on senior health care workers. HCW participation in program execution is necessary to prevent top-down information from being rejected. More research is required to determine the program's long-term effectiveness (18). In the research by Mertz et al., the intervention group's rate of hand hygiene adherence was noticeably higher than that of the control group. The control group's rate of adherence increased from baseline, albeit the difference was not very significant. This could be because of a number of things, such as cross-contamination between groups, the Hawthorne effect, or the installation of alcohol-based hand rub dispensers throughout the hospital (14). Mertz et al. (14) used a cluster-randomized trial instead of randomly assigning health care workers (HCWs) in order to reduce the effects of contamination between the study groups. However, it is possible that information about the trial was disseminated to the control units, leading to contamination between the groups. Because HCWs in the control group knew they were being watched, they may have increased their adherence (23,24), an effect that is predicted to diminish over time (25).

Additionally, hand rub dispensers were installed after the baseline assessment but before the intervention began, which may have increased adherence rates in both groups (26). Mertz et al. could not find a change in the rate of hospital-acquired MRSA colonization after screening patients every two weeks (14). Given the little variation in the rates of hand hygiene adherence between the groups, was not surprising. The results of Mertz et al. are consistent with studies indicating that a bigger relative increase in hand hygiene adherence is required to have an impact on the incidence of MRSA colonization, the higher the baseline hand hygiene adherence rate (27). Excluding suspected MRSA infection outbreaks and redefining hospital-acquired MRSA colonization as newly identified 5 or 10 days after admission instead of 3 days after admission did not alter the outcome of sensitivity analysis. According to a recently released review (28) most observational research indicated a relationship between higher hand cleanliness rates and a lower incidence of illnesses linked to healthcare. Furthermore, the majority of research were limited to certain hospital units or the intensive care unit. In a research by MacDonald et al. (29), there was a decrease in MRSA colonization instances but no improvement in hand hygiene adherence rates. According to research by MacDonald et al. (29) and Mertz et al. (14) there are several other factors at play and there is no clear correlation between the rates of adherence to hand hygiene and MRSA colonization

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rates. The introduction of alcohol handrub improved self-reported HHC, according to a prospective interventional study carried out in the United States; nonetheless, nosocomial infection rates remained unchanged (30). The care facilities were chosen for the Yeung group's clustered, RCT investigation using snowball sampling (15). Their participating facilities were a combination, with diverse sources of income, nurse staffing levels, and residents' impairment degrees (15). Their interventions, which included giving out alcohol handrub, providing reminder materials, and educating HCWs, were based on the WHO model (15). Their initial design did not include performance feedback, but due to a decline in HHC during the experiment, it was introduced midway through (15).

According to Martin et al.'s (19) results, a multimodal hand hygiene enhancement method raises HCWs HHC level by 21.6% when compared to the control group. These results aligned with those from many observational and experimental studies conducted without a control group, which demonstrate comparable levels of impact from educational interventions, with increases in HHC ranging from 18% to 41% (1,2). Recently, Erasmus et al. (31) discovered that the intervention increased HHC by 16.1% in a before-and-after study to examine the usability and indications for efficacy of using action plans among nurses in 2 hospital staff in order to improve hand hygiene. These findings are extremely similar to those reported by Martin et al (19).

Table 1: characteristics of included studies

Study	Study sample	Participants	Comparator	Study design	Interventions	Study	Out comes
Martin et al. (19)	170	Healthcare workers	Conventional activities	Cluster RCT	WHO multimodal strategy for improvement of hand hygiene	Spain Ministry of Health	HHC
Mertz et al. (14)		HCW in contact with patients	Conventional activities	Cluster RCT	WHO multimodal strategy for improvement of hand hygiene	National Service Foundation	HHC
Ho et al. (16)	810	Healthcare workers (HCW) in contact with patients	Conventional activities	Cluster RCT	WHO multimodal strategy for improvement of hand hygiene	Health Protection Centre	HHC
Yeung et al. (15)	188	HCW in contact with patients	Conventional activities	Cluster RCT	WHO multimodal strategy for improvement of hand hygiene	University laboratories	HHC

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Riphagen et al (17)	50,351	HCW in contact with patients	Conventional activities	RCT	Meetings, Educational materials, and vaccine	Organization for Health Development and Research	Vaccination uptake
Rothan et al. (18)	2874	HCW in contact with patients	Conventional activities	RCT	Meetings, Educational materials, and vaccine	None	Vaccination uptake

CONCLUSION

This systematic review demonstrates that multimodal dissemination strategies are more effective than single interventions in improving healthcare workers' adherence to infection prevention and control measures, particularly in hand hygiene compliance and vaccination uptake. Educational programs, when combined with complementary approaches such as audit and feedback, performance monitoring, and provision of alcohol-based hand rubs, consistently achieved higher levels of compliance compared to standard practices or single diffusion efforts.

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