Educational actions on hand hygiene: A review integrative

https://doi.org/10.56238/sevened2024.002-016

Betina Nemetz[1], Fabiano da Costa Michielin[2], Elisiane de Oliveira Machado[3], Djulia Andriele Wachter[4], Julia Piccinini[5], Fabio Silva da Rosa[6], Ana Luísa Petersen Cogo[7], Renata de Araujo Meirelles Leite[8], Suimara Santos[9] and Maicon Daniel Chassot[10]

ABSTRACT

Introduction: Hand hygiene (HH) is a basic health strategy, with low cost and low complexity, being the effective technique to prevent the transmission and infection of pathogens. Since health education brings benefits to HH adherence, it is recommended to continue the actions to raise awareness among professionals and carry out continuing education, reaffirming the need to implement continuous strategies to obtain improvements. Objective: To analyze the scientific production on educational actions on hand hygiene used for the adherence of health professionals. Method: This is an Integrative Review of the literature guided by the guiding question: what are the in-service education strategies carried out on hand hygiene for health professionals and their respective results? The databases consulted were Latin American and Caribbean Health Literature (LILACS), Nursing Database (BDENF), Cumulative Index to Nursing and Allied (CINAHL), PUBMed and Scopus. The time frame comprised the period from January 2013 to December 2022. Theoretical articles, review studies, reports of experiences or abstracts of scientific events, dissertations and theses were excluded. Results: The final sample for analysis consisted of 42 articles, divided into four categories according to the type of educational strategy used: multimodal strategy, digital technology, expository presentation and playful strategy. Conclusion: Multimodal interventions promoted an increase in HH adherence, emphasizing the importance of using diverse approaches. Educational strategies that incorporate digital technology have demonstrated improvements in HH adherence, while emphasizing that technology should be seen as an integral part of a set of strategies to optimize MH adherence. Although the expository approaches have shown an improvement in adherence, the need to adapt strategies to each professional group is reinforced. Regarding the playful approach, there was an initial increase in adherence to HH, but regression occurred over time, highlighting the importance of prolonged interventions.

Keywords: Nursing, Hand hygiene, Health Education, Infection control.

[1] Orcid: https://orcid.org/000-0003-3918-7688
[2] Orcid: https://orcid.org/0000-0003-1731-0008
[3] Orcid: https://orcid.org/0009-0002-9227-1213
[4] Orcid: https://orcid.org/0000-0002-9127-3164
[5] Orcid: https://orcid.org/0000-0002-5880-5341
[6] Orcid: https://orcid.org/0000-0001-5608-714X
[7] Orcid: https://orcid.org/0000-0003-2168-7801
[8] Orcid: https://orcid.org/ 0000-0002-0777-8806
[9] Orcid: https://orcid.org/0000-0002-8739-4385
[10] Orcid: https://orcid.org/0000-0001-7017-6982

INTRODUCTION

Hand hygiene (HH) is a basic health strategy, with low cost and low complexity, being an effective technique to prevent the transmission and infection of pathogens (WHO, 2008). Education and training are recommended for effective infection prevention and control programs by the World Health Organization (WHO) (WHO, 2008). There are multiple possibilities for training that can be proposed so that there is better adherence to hand hygiene.

HAI are associated with long-term morbidity, prolonged hospital stays, increased resistance of microorganisms to antimicrobials, increased treatment costs, and burden on patients and staff (PAULA et al., 2020). According to the WHO, HAI prevention should be the priority for settings and institutions committed to making healthcare safe (WHO, 2016).

The WHO states that the rate of HAI can be reduced by up to 55% with proper hand hygiene (WHO, 2011). To contribute, it launched the Multimodal Strategy for Improving Hand Hygiene in 2005, which was last revised in 2009, with the ultimate goal of reducing the spread of infection and multidrug-resistant germs, as well as the number of patients acquiring a preventable HAI and thus preventing the waste of resources and saving lives (WHO, 2009). The strategy recommends the availability of the necessary equipment to perform HH, such as the use of washbasins/sinks, surgical toilets, soap and antiseptic dispensers, paper towel holders, trash cans for paper towel disposal, and water, soap and alcohol gel supplies. In addition, evaluation and feedback, reminders, and institutional security climate are recommended (WHO, 2009).

The WHO Multimodal Strategy Implementation Guide highlights five key elements to improve hand hygiene: system change, training/education, assessment and feedback, workplace reminders, and institutional safety climate. The system change aims to ensure the availability of adequate infrastructure, such as water, liquid soap and alcoholic preparations at patient care points. Training/education includes regularly training healthcare professionals on the importance of hand hygiene and correct procedures, using the "My 5 Moments for Hand Hygiene" approach. Assessment and feedback involve monitoring healthcare workers' hygiene practices, infrastructure, and knowledge, providing regular feedback to motivate them to adhere to hand hygiene. Workplace reminders use visual and auditory aids to alert and remind about the importance of hand hygiene. And the institutional safety climate promotes a culture of HH, prioritizing patient safety and encouraging the active participation of professionals to ensure the success of the strategy (WHO, 2009).

The didactic materials produced by the WHO brought greater awareness about the burden of HAIs, the concept of HH and its fundamental role in the prevention of nosocomial infections and the practice of the correct HH techniques (FREDJ et al., 2020; WU et al., 2018). This content can be disseminated in lectures disseminating the knowledge of HH, presenting the techniques of correct washing, also promoting discussion in groups (FREDJ et al., 2020; WU et al., 2018).

Although it is a simple and efficient practice, adherence to HH has been an arduous and complex task (SILVA et al., 2018). Observational studies have shown that adherence to this practice is below 50% among health professionals (VALIM et al., 2019). Since health education brings benefits to HH adherence, it is recommended to continue the actions to raise awareness among professionals and to carry out in-service education, reaffirming the need to implement continuous strategies to obtain improvements. In order to allow professionals to acquire knowledge, contributing to a safer practice for themselves and for the patient, it is necessary to propose training that emphasizes hand hygiene techniques, their indications, the five moments proposed by the WHO, as well as the indicated solutions and their effectiveness, encouraging the use of alcohol gel (PAN AMERICAN HEALTH ORGANIZATION, 2008; NATIONAL HEALTH SURVEILLANCE AGENCY, 2008).

METHODS

In order to guide the presentation of data aiming at transparency in academic production, we used throughout the research the recommendations of PRISMA (PAGE et al., 2020), which are: (1) Study design; (2) Identification of the problem; (3) Data collection; (4) Data evaluation; (5) Data Analysis; (6) Presentation and Interpretation of Results and (7) Ethical Aspects. The objective of this study was to analyze the scientific production on educational actions on hand hygiene used for the adherence of health professionals.

This is an Integrative Review (IR) of the literature, a methodology that groups results obtained from other studies on the same topic, with the objective of synthesizing and analyzing the data obtained, developing a more comprehensive explanation of the phenomenon studied (WHITTEMORE; KNAFL, 2005). There are five interconnected steps or phases, namely: Problem Identification, Literature Search, Data Evaluation, Data Analysis, and Presentation of Results (WHITTEMORE; KNAFL, 2005).

In the formulation of the guiding question of the study, the acronym PCC was used to help establish the keywords and clarify the need for information (RETHLEFSEN et al., 2020). The study population (P) health professionals, the concept (C) hand hygiene, and the context (C) in-service education.

Thus, the guiding question proposed was: "What are the in-service education strategies carried out on hand hygiene for health professionals and their respective results?".

Data were collected by reading the selected articles in full using the databases chosen for their scientific criticality for the indexing of journals and relevance to the health area: Latin American and Caribbean Health Literature (LILACS), Nursing Database (BDENF), *Cumulative Index to Nursing and Allied* (CINAHL), PUBMed and Scopus.

The proposed eligibility criteria are original articles that answer the guiding question, without language restrictions, available in the form of full text and online. The time frame was from January 2013 to December 2022, as it aims to search for articles that express the theme in a more up-to-date way in scientific production. Theoretical articles, review analyses, reports of experiences or abstracts of scientific events, dissertations, theses, and articles that did not involve the nursing team were excluded.

The searches were performed by crossing the following Health Sciences Descriptors (DeCS) and *Medical Subject Heading* (MeSh): Hand *Disinfection*, Hand *Hygiene*, Continuing Education, *Continuing*, Health Personnel/*Military Health* and Infection Control/*Hospital Infection Control Program,* as shown in Table 1. The Boolean terms and operators AND and OR were used in the crossings , as shown in Chart 2.

Table 1 - Presentation of descriptors and definitions according to the Health Sciences Descriptors of the Virtual Health Library (DECS, 2022). Porto Alegre, 2023.

DESCRIBER/MeSH	**DEFINITION**
Hand *Disinfection*	The act of washing hands with water or other liquid, with or without soap or other detergent, for the purpose of destroying infectious microorganisms.
Higiene de Mão / *Hand Hygiene*	Practices involved in preventing the transmission of diseases through the hands.
Educação Continuada/*Education, Continuing*	Educational programs designed to inform individuals about recent advancements in their particular field of interest. They do not lead to any advanced conventional position.
Personnel/*Military Health*	Individuals working in the provision of health services, either as individual physicians or employees of health institutions and programs, whether trained or untrained health professionals,
	subject or not to public regulation.
Infection Control/*Hospital Infection Control Program*	Disease surveillance programs, usually within health care facilities, designed to investigate, prevent, and control the spread of infections and their causative microorganisms.

Source: Health Sciences Descriptors of the Virtual Health Library - 2022. Porto Alegre, 2023.

Chart 2 - Search strategy. Porto Alegre, 2023.

Database	Intersection
LILACS	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Educação Continuada”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Pessoal de Saúde”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Educação Continuada”*) AND* (“Controle de Infecção”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Pessoal de Saúde”) *AND* (“Controle de Infecção”)
BDENF	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Educação Continuada”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Pessoal de Saúde”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Educação Continuada”*)*
	AND (“Controle de Infecção”)
	(“Desinfecção das mãos”) *AND* (“Higiene de Mãos”) *AND* (“Pessoal de Saúde”) *AND* (“Controle de Infecção”)
CINAHL	(“Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* (“Education,Continuing”)
	(“Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* (“Health Personnel”)
	(“Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* (“Education,Continuing”) *AND* (“Infection Control”)

	(“Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* (“Health Personnel”) *AND* (“Infection Control”)
PUBMed	(“Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* “Education,Continuing”)
	(“Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* (“Health Personnel”)
	(“Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* (“Education,Continuing”) *AND* (“Infection Control”)
	(‘’Hand Disinfection”) *AND* (“Hand Hygiene”) *AND* (“Health Personnel”) *AND* (“Infection Control”)
Scopus	“Hand Disinfection” *AND* “Hand Hygiene” *AND* “Education,Continuing”
	“Hand Disinfection” *AND* “Hand Hygiene” *AND* “Health Personnel”
	“Hand Disinfection” *AND* “Hand Hygiene” *AND* “Education,Continuing” *AND* “Infection Control”
	“Hand Disinfection” *AND* “Hand Hygiene” *AND* “Health Personnel” *AND* “Infection Control”

Source: Virtual Health Library (VHL) - 2022.

First, the abstracts of the articles identified in the searches were read. After the first selection, the articles were read in full to verify the possibility of answering the guiding question. The data extracted from the articles were recorded using a structured instrument allowing the synthesis of the main findings of the searches, highlighting article number, author, year of publication, title of the article, objectives, method/methodology, educational intervention, main results, conclusions and limitations.

For data analysis, the information was ordered, coded, categorized, and summarized. The data found were compared item by item, and similar data were categorized and grouped and again compared to prepare for the analysis and synthesis process.

For the presentation and synthesis of knowledge, the data were formatted in a table, allowing the reader to verify the conclusions of the Integrative Review from the readings and thus contribute to a new understanding of the phenomenon.

The present study respects Law No. 9.610/98 - Copyright Law (BRASIL, 1998), mentioning the proper authors and their authenticity of thoughts, ideas, definitions and concepts according to the Brazilian Association of Technical Standards (ABNT, 2011). The guidelines of the National Research Ethics Commission (CONEP) are also respected.

PRESENTATION AND ANALYSIS OF RESULTS

The results of the analysis carried out among the primary studies selected for this integrative review are presented below, using tables and graphs, with the purpose of improving the analysis and discussion of the data.

The electronic search resulted in 2,280 potentially relevant studies from the databases (LILACS= 139, BDENF= 79, CINAHL= 380, PubMed= 1,003 and Scopus = 679). After removing duplicates, the titles and abstracts of 1,382 studies were reviewed and ineligible studies were excluded. Of the 147 records selected for full reading, applying the exclusion criteria, 42 articles remained, which were included in the final integrative review. A flowchart showing the search and selection process is presented in Figure 1.

Figure 1 – Flowchart

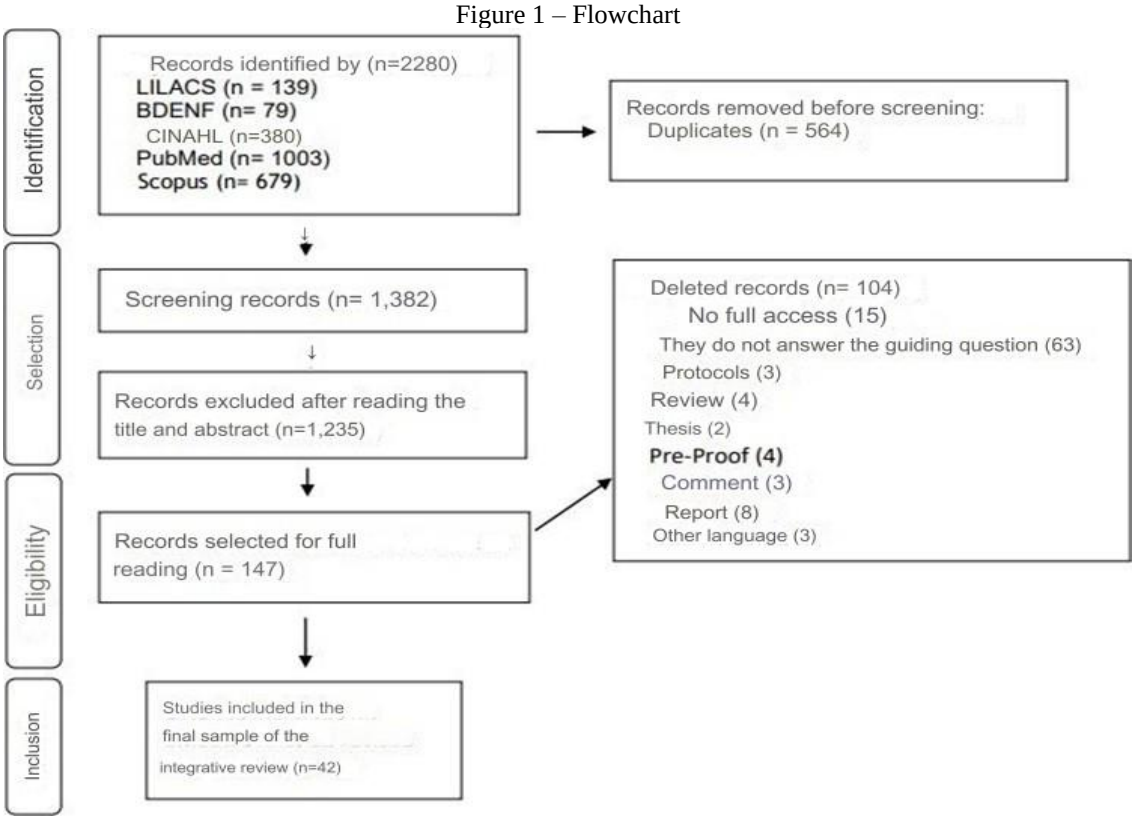

Figure 1. Study selection flowchart adapted from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2015). Porto Alegre, 2023.

The breakdown of the interventions and their respective authors are shown in Chart 3. Of the 42 articles included in this review, 30 (71.4%) articles discussed multimodal training strategies, 7 (16.6%) used digital technology as an intervention, 4 (9.6%) made an expository presentation, and 1 (2.4%) article used a playful strategy as an intervention. Regarding the year of publication, 2013 and 2018 stood out for representing six (14.3%) of the selected studies, respectively, followed by 2016, 2017 and 2018 with five (11.9%) studies in each year, 2014 with four (9.6%) studies, 2020, 2021 and 2022 with three (7.1%) studies in each year and 2015 with two studies (4.8%).

Table 3 - Categorization of educational strategies. Porto Alegre, 2023.

Educational strategy	**Author/Year**
Multimodal Intervention	Rodriguez et al, 2015
	van Dijk et al, 2019
	O'Donoghue et al, 2016
	Phan et al, 2018
	Sansam et al, 2016
	Mernelius et al, 2013
	Moro et al, 2016
	Baccolini et al, 2019
	Fariñas-Alvarez et al, 2017
	Allegranzi et al, 2013
	Ghazali et al, 2018
	Huis et al, 2013
	Yousef et al, 2020
	von Lengerke et al, 2019
	Farhoudi et al, 2016
	Restrepo et al, 2014
	Shen et al, 2017
	Santos et al, 2013
	Müller et al, 2021
	Oliveira et al, 2018
	Uneke et al, 2014

	Nobile et al, 2018
	Pimentel et al, 2019
	Watson et al, 2016
	Rees et al, 2013
	Kielar et al, 2021
	Suzuki et al, 2020
	Al-Maani et al, 2022
	Sopjani et al, 2017
	Berman et al, 2021
Playful Strategy	Neumark et al, 2022
Expository presentation	Sadeghi-Moghaddam et al, 2015
	Romero et al, 2019
	Scherer et al, 2017
Digital Technology	Kallam et al, 2018
	Abbas et al, 2020
	Stewardson et al, 2014
	Conway et al, 2014
	Higgins et al, 2013
	Eichel et al, 2022
	Kerbaj et al, 2017
	Hoang et al, 2018

Source: Prepared by the authors

The participants of the interventions were predominantly composed of the nursing team, who worked mostly in hospital environments. A description of the objectives and strategies of education can be found in Table 4.

Table 4 - Description of the objectives and education strategies of the studies in the sample. Porto Alegre, 2023.

Author/Year	Objectives	Educational strategy
Rodriguez et al, 2015	Estimating the effect of a Multimodal intervention in improvement of health professionals' adherence to HH in our UTIs, our landlady, the Buenos Aires.	Use of Reminders Supply of Educational material from Pocket, storyboard displaying the letter signed by the directors, photos of the Team & Results of direct observation.
van Dijk et al, 2019	Investigate the effects of Friendly competition in membership to HM as part of a Intervention program multimodal.	Direct observation with feedback and workshop Educational Optional.
O'Donoghue et al, 2016	To evaluate the efficacy in adherence to an intervention to improve MH awareness in a radiotherapy unit of a district hospital.	Educational lectures and provision of visual aids.
Phan et al, 2018	To determine adherence to MH after an educational program at an obstetric and gynecological center in a hospital in Vietnam.	Video, lecture, Discussion on small groups, role-playing with the use of ultraviolet (UV) light, practice and discussion of the Washing Technique Hands.
Sansam et al, 2016	Introducing HH for Healthcare Professionals Based in the WHO guideline for HAI reduction in Cambodia and evaluate their behavior patterns in hand hygiene.	Three sessions of Lectures and Practice of hand wash with UV light. After Provided poster on The five moments of the HM.
Mernelius et al, 2013	Improve compliance with hygiene	Lecture, workshop with group discussions, safety

	guidelines through the use of a multimodal and multidisciplinary hygiene intervention, and determine how long improved compliance is sustained.	briefings, strategic posters, training on the technique of HM with UV light and training for observers.
Moro et al, 2016	To report the effect of the campaign on HH adherence immediately after implementation, the level of adherence 7 years later, and to identify the factors associated with the observed improvement.	Training and education of health professionals, videos, participatory sessions, visual reminders in the workplace, monitoring and feedback of practices.
Baccolini et al, 2019	Assess the capacity, over time, of a multimodal intervention to improve compliance with hygiene precautions of health workers.	Education, training and performance feedback.
Fariñas-Alvarez et al, 2017	Implement a multifaceted hospital-wide HH intervention based on a WHO multimodal approach over the course of one year.	Bureaux theoretical-practical, observer training workshop, online course to improve HH, individual training sessions after direct observation and immediate feedback.
Allegranzi et al, 2013	To evaluate the effect of the WHO strategy to improve HH in five countries.	Intensive HM education and poster placement sessions.
Ghazali et al, 2018	Evaluate the duration and quality of HH before and after simulation-based training.	Annual presentation on HH, monthly reminder of WHO recommendations, training video and simulation with hand washing and use of UV light.
Huis et al, 2013	To test whether an innovative, theory-based	Education, warnings, feedback,

	strategy would be more effective in increasing nurses' HH compliance rates than a state-of-the-art strategy based on the literature.	guidance for appropriate products and facilities, and interventions based on social influence and leadership.
Yousef et al, 2020	To assess HH-related knowledge, attitude, and compliance rate following the implementation of a modified version of the WHO multimodal strategy.	Individual and practical training on HH, lectures and the placement of posters in strategic locations about the five moments of HH.
von Lengerke et al, 2019	Analyze data from the *PSYchological optimized hand hygiene promotion trial (*PSYGIENE) in adherence to MH.	Personalized interventions based on the psychological framework of behavior change of health professionals for HH adherence.
Farhoudi et al, 2016	To evaluate the effect of implementing the WHO multimodal MH improvement strategy among health professionals at a tertiary university hospital in a developing country.	Educational courses on infection prevention and control, provided an educational booklet, and educational sessions on MH with the practice of the five moments of MH.
Restrepo et al, 2014	To estimate the effectiveness of a multimodal strategy in improving HH in five wards of a tertiary care hospital in Medellín, Colombia (2008-2010).	Awareness-raising actions, audiovisual media and leaflets, posters on the importance of HH and a contest was held to encourage compliance with HH in the correct way.
Shen et al, 2017	Assess HH compliance and correctness before and after the implementation of a multimodal MH strategy.	HM training and education, reminders at strategic locations, and Direct observation with reward and punishment mechanism.

	improvement of HH launched by the WHO.	
Santos et al, 2013	To implement and evaluate the impact of a WHO-recommended educational intervention to improve adherence to HH in the endoscopy unit of a Brazilian tertiary hospital.	Training sessions, with demonstrations of appropriate techniques with the use of UV light, video with HH opportunities, visual posters and brochures with HH indications.
Müller et al, 2021	Continuous assessment of HH compliance and knowledge.	Educational workshop on the local production of alcohol-based antiseptics and the importance of HH, monitoring feedback, visual reminders and creating a safety climate, asking local staff for suggestions for improvement and patients for their personal opinion on HH.
Oliveira et al, 2018	Estimate the rate of adherence to HH before and after the implementation of a multimodal strategy.	Education, training, assessment, feedback, and reminders in the workplace.
Uneke et al, 2014	Promote the adoption of the WHO HH Guidelines to increase physician and nurse adherence to HH and improve patient safety.	Employee education and reminders in the workplace.
Nobile et al, 2018	Reduce the overall incidence of infections through multimodal programs and strategies, interactive training tools, and standardised compliance control methods.	The professionals created educational materials such as posters, flyers, videos and presentations about MH and the material was distributed monthly and used as a reminder to

		improve HH adherence.
Pimentel et al, 2019	Improve MH compliance in the perioperative setting while engaging anesthesia residents in quality improvement.	Electronic and laminated posters, reminder cards, a simulation-based HM workshop and direct observation with feedback.
Watson et al, 2016	To determine whether a multimodal strategy using the WHO methodology increases health workers' adherence to handwashing and awareness of the importance of good HH in the prevention of HAIs.	Educational materials, videos, surveys, demographic questionnaires, direct observation, immediate feedback under UV light and posters.
Rees et al, 2013	Determine whether a multimodal intervention program for HH could increase and maintain HH compliance rates in the organization.	Online education program on the importance and technique of HH, direct observation with monthly feedback, reminders and support from multiprofessional leadership.
Kielar et al, 2021	To evaluate the usefulness of the educational program entitled *"Clean Care is a Safer Care"* as a tool to increase compliance with HH principles.	Training seminars and posters placed in strategic locations.
Suzuki et al, 2020	To assess the effect of an interventional initiative in terms of changes in the consumption of alcohol-based antiseptic products and the MH Self-Assessment Framework score.	MH training sessions, e-learning with training and educational video with hospital staff as actors, filmed in the real hospital environment to improve understanding.
Al-Maani et al, 2022	Assess the impact of the project national models of HH in the	Involvement of the leadership as a model of HM,

	immediate and long-term adherence of health professionals to HH practices.	posting of HM messages with photographs of model leaders, weekly selection of personnel as role models, and conducting education and training in HM.
Sopjani et al, 2017	Evaluate the impact of the WHO multimodal HH campaign training tool on all public hospitals and the University Clinical Centre of Kosovo.	Training of health professionals with theoretical classes, video and practical hand washing with antimicrobial soap and rubbing with alcohol solutions.
Berman et al, 2021	Apply the *Systems template Engineering Initiative for Patient Safety* (SEIPS) to increase the effectiveness and sustainability of WHO guidelines on HH in health systems.	Educational trainings on MH, placement of posters and TV's with educational messages about HH in strategic locations.
Neumark et al, 2022	To evaluate the feasibility, acceptability and effect of using clowns to improve HH among physicians and nurses.	Trained clowns performed theatrical activities that conveyed messages about HM.
Sadeghi-Moghaddam et al, 2015	To determine HH adherence using the WHO Global MH Observation Protocol, before and after control and its impact on HAI rates in a Neonatal Intensive Care Unit.	A nurse from the Hospital Infection Control Commission (CCIH), through a lecture, provided education on HH.
Romero et al, 2019	To evaluate the effects of a HH education program on the adherence of health professionals in an ICU.	Weekly educational sessions on the incidence of HAIs, the importance of HH and how to perform HH.

Scherer et al, 2017	Identify the rate of adherence to the HH of the professionals and to compare the rates of adherence to HH before and after the training campaign carried out by the CCIH in an Adult Intensive Care Unit of a private hospital in the city of Porto Alegre/RS.	Training Demonstration of hand washing and delivery of printed material.
Kallam et al, 2018	Implement a MH quality improvement intervention in a neonatal intensive care unit of Ridge Regional Hospital, a large referral hospital in Accra, Ghana.	Narrated PowerPoint presentation and placement of visual reminders about the importance of HH.
Abbas et al, 2020	To assess the effectiveness of a short web-based module covering health education on preventive practices against the COVID-19 pandemic, including HH measures and respiratory etiquette among health workers.	E-health education on the importance of complying with appropriate HH standards in reducing COVID-19 transmission.
Stewardson et al, 2014	To assess the impact of self-directed use of SureWash on healthcare workers' MH technique and to assess the diagnostic capability of the device.	Video measurement technological device and immediate feedback to teach hand washing technique.
Conway et al, 2014	To study an automated group monitoring and feedback system that was implemented from January 2012 to March 2013 in a	Electronic system that monitors the use of disinfectant and soap to calculate MH events.

	community hospital.	
Higgins et al, 2013	Determine if utilizing the SureWash informatics device would improve HH compliance and technique in an acute health care setting	Use of the SureWash computer device, posters with MH techniques and random audits to verify MH.
Eichel et al, 2022	Compare virtual reality (VR) technology with a conventional lecture in terms of user acceptance and relatively similar clinical outcomes to HM.	VR brings three situations that must be solved with tasks related to the theme of HH. Is Alarm sounded if an indication has been missed. After the scenarios are completed, the application directly evaluates the situations and gives feedback. The conventional lecture brings the correct technique, indications for MH and practical cases similar to those of the VR scenario.
Kerbaj et al, 2017	Evaluate the influence of text message feedback on the HM compliance of our healthcare professionals.	Sent 2 types of text messages, congratulatory messages or encouragement messages after one year of professionals being monitored by a radio frequency identification system.
Hoang et al, 2018	Standardize the duration of HH between visitors and professionals, using a real-time video that demonstrates hand postures and the duration of hand washing.	The sensor detects the movement of anyone passing in front of the sink and a video is played reminding them to remove their jewelry from their wrist and represent the WHO's "Six Postures" for hand washing.

Source: Prepared by the authors

DISCUSSION

The studies in this integrative review converge to verify the effectiveness of different health education strategies in improving hand hygiene in health professionals. The interventions proposed by the studies were analyzed from the perspective of subcategories, with the multimodal approach being the predominant one. This approach was developed by the WHO and combines several interventions and measures to promote sustainable behaviour change in relation to HH (WHO, 2009).

Dos 30 artigos da categoria de intervenção multimodal, verificou-se que apenas 16 abordaram todos os cinco componentes da estratégia proposta pela OMS (RODRIGUEZ et al., 2015; SANSAM et al., 2016; MERNELIUS et al., 2013; MORO et al., 2016; FARIÑAS-ALVAREZ et al., 2017; ALLEGRANZI et al., 2013; GHAZALI et al., 2018; HUIS et al., 2013; YOUSEF et al., 2020; FARHOUDI et al., 2016; RESTREPO et al., 2014; SHEN et al., 2017; MULLER et al., 2021; NOBILE et al., 2018; KIELAR et al., 2021 AND SUZUKI et al., 2020). However, the education/training element was present in all studies.

Among the educational and training strategies used, lectures and theoretical classes stand out, which were applied in 10 of the 30 studies (RODRIGUEZ et al., 2015; VAN DIJK et al., 2019; O'DONOGHUE et al., 2016; SANSAM et al., 2016; MERNELIUS et al., 2013; BACCOLINI et al., 2019; FARIÑAS-ALVAREZ et al., 2017; GHAZALI et al., 2018; SOPJANI et al., 2017, PHAN et al., 2018).

Training with the use of fluorescent gel and UV light was used in 5 studies (PHAN et al., 2018; MERNELIUS et al., 2013; GHAZALI et al., 2018; SANTOS et al., 2013; WATSON et al., 2016), while group discussions on hand hygiene adherence were employed in 4 studies (PHAN et al., 2018; HUIS et al., 2013; VON LENGERKE et al., 2019; NOBILE et al., 2018). Other approaches included educational workshops (VAN DIJK et al., 2019, MERNELIUS et al., 2013; FARIÑAS-ALVAREZ et al., 2017; MULLER et al., 2021; PIMENTEL et al., 2019), online education programs (HUIS et al., 2013; REES et al., 2013), training seminars (KIELAR et al., 2021) and the use of audiovisual media and leaflets (RESTREPO et al., 2014; UNEKE et al., 2014; SUZUKI et al., 2020). However, some articles (MORO et al., 2016; ALLEGRANZI et al., 2013; YOUSEF et al., 2020; FARHOUDI al., 2016; SHEN et al., 2017; OLIVEIRA et al., 2018; AL-MAANI et al., 2022; BERMAN et al., 2021) did not provide detailed information on the education intervention within the multimodal strategy, limiting themselves to mentioning that they carried out the training and education of health professionals, without going into detail about the specific strategies adopted.

The implementation of educational training through lectures and theoretical classes, used in the multimodal strategy, proved to be highly effective in increasing adherence to hand hygiene (PHAN et al., 2018; MERNELIUS et al., 2013; BACCOLINI et al., 2019) and the significant

increase in the level of knowledge of health professionals (SOPJANI et al., 2017; PHAN et al., 2018).

According to the conclusions of Samsam et al. (2016), the implementation of lectures, posters and the availability of alcohol gel was effective during the first year of application, however, after the two-year period, a reduction in the average adherence to hand hygiene was observed (SANSAM et al., 2016). This points to the need for a continuous and adaptive approach in the promotion of HH among healthcare professionals in order to achieve and maintain a high and uniform level of adherence.

The study conducted by O'Donoghue et al. (2016), although it demonstrated a significant improvement in adherence to hand hygiene among health assistants and radiologists, through lectures and provision of visual aids, drew attention to the fact that nurses did not achieve a significant increase in adherence (O'DONOGHUE et al., 2016). Although adherence increased significantly after the intervention, only half of the hand hygiene opportunities were performed, suggesting the need for repeated interventions to maintain hand hygiene adherence.

The understanding of the correct use of alcohol-based antiseptic products and the training of health professionals in relation to the WHO's multimodal strategy, through workshops, have demonstrated a positive impact on the commitment and knowledge of these professionals (MULLER et al., 2021). However, to ensure long-term efficacy, additional evaluations need to be carried out (MULLER et al., 2021). Another project, which adopts a bottom-up approach, bringing the active participation of professionals through communicative and interactive methods resulted in significant improvements in handwashing techniques over a 12-month period (NOBILE, et al., 2018). This emphasizes the relevance of engaging professionals in improvements, prioritizing collaboration and knowledge exchange to create joint solutions.

The PSYGIENE study examined the impact of behavioural change-based training sessions for the improvement of MH compared to interventions not adapted to behavioural change techniques. Tailored interventions resulted in a significant decrease in infections by multidrug-resistant organisms, indicating that personalized approaches are more effective in promoting HH adherence. This success was driven by factors related to habits, action planning, self-efficacy, action control, and perceptions of the social environment (VON LENGERKE et al., 2019).

Participants were instructed to apply a fluorescent dye-based cleaning detection gel to their hands, exposing them to UV light to reveal the scope of the gel. They then went about their usual hand-washing routine, and then again exposed their hands to UV light, highlighting areas that might not have been properly sanitized. This activity has been shown to be effective in promoting proper hand hygiene practices within the education part of a multimodal strategy (PHAN et al., 2018; MERLENIUS et al., 2013; GHAZALI et al., 2018; SANTOS et al., 2013; WATSON et al., 2016).

A single study used the friendly competition approach to improve adherence to MH, with monitoring, feedback, e-learning, and staff training. The results indicated a significant increase in adherence throughout the program (VAN DJIK et al., 2019). However, the study mentioned challenges, including difficulty in separating the effects of usual activities from the specific interventions in the study, due to organizations' freedom of choice. Also highlighted was the long interval between feedback reports, possibly limiting the impact. Future research is recommended to evaluate the long-term effects of this approach and the use of competition as a tool to promote adherence to hand hygiene (VAN DJIK et al., 2019).

The use of visual media, such as educational videos, posters, and reminders, has been shown to be effective in maintaining HH compliance based on the WHO 5 HH moments (FARIÑAS-ALVAREZ et al., 2017; KIELAR et al., 2021; RODRIGUEZ et al., 2015; RESTREPO et al., 2014; UNEKE et al., 2014; SUZUKI and al., 2020, PIMENTEL et al., 2019, REES et al., 2013). By adapting these visual resources to the culture and hospital environment, the increase in alcohol gel consumption after the intervention was evidenced (RESTREPO et al., 2014; SUZUKI et al., 2020; FARIÑAS-ALVAREZ et al., 2017).

In the study by Huis et al. (2013), two groups were compared: a control group received a standard strategy of education, warnings, and feedback to improve hand hygiene, while the experimental group received the same strategy, but with additions of interventions based on social influence and leadership, including specific activities for teams and leaders. Both groups showed improvements in hand hygiene compliance rates, but the experimental group, with the social and leadership interventions, achieved higher levels of long-term adherence. The team- and leadership-focused approach appears to hold promise for improving not only hand hygiene, but also other patient safety issues (HUIS et al., 2013).

It is worth mentioning that, although it does not go into detail about the education intervention used in the multimodal strategy, only one study reported the absence of a significant impact on HH adherence rates among health professionals through the use of the multimodal strategy (OLIVEIRA et al., 2018).

A playful approach, with the participation of clowns trained for theatrical and visual activities permeated by humor, focusing on the use of adornments and the relevance of hand hygiene, resulted in an increase in compliance with hygienic practices during the intervention period. However, it is worth noting that this rise did not reach statistical significance. Therefore, although the playful approach has shown some advances, its relevance has not been uniform across all sectors analyzed (NEUMARK et al., 2022).

Expository approaches have resulted in significant increases in adherence to hand hygiene (SADEGHI-MOGHADDAM et al., 2015; ROMERO et al., 2019; KALLAM et al., 2018). On the

other hand, the study by Scherer, et al. (2017), presented a training campaign that, although it had a positive impact on the adherence of nursing professionals, recorded a decline in the adherence of physical therapists, signaling the variable effectiveness of the approach between different groups (SCHERER et al., 2017).

Studies highlight the success of technology-enhanced educational interventions in consistently improving adherence to hand hygiene among health professionals. These innovative and technologically advanced approaches have the potential to play a significant role in preventing HAI and promoting safer environments for patients and professionals (ABBAS et al., 2020; STEWARDSON et al., 2014; HIGGINS et al., 2013; CONWAY et al., 2014; EICHEL et al., 2022; KERBAJ et al., 2017; HOANG et al., 2018). Beyond In addition, it is essential to carry out these interventions with a longer period of time to test the effectiveness of these approaches (HOANG et al., 2018; KERBAJ et al., 2017; STEWARDSON et al., 2014).

Despite the success of incorporating technology in improving technique and adherence to hand hygiene, Higgins et al. (2013) and Kerbaj et al. (2017) emphasize the importance of integrating technology into multimodal approaches, which combine diverse multifaceted activities to effectively enhance hand hygiene (HIGGINS et al., 2013; KERBAJ et al., 2017). This underscores the need to adopt a comprehensive approach, in which technology is one of the components of a set of strategies aimed at optimizing adherence to hand hygiene.

CONCLUSION

This integrative review reveals the diversity of approaches adopted with the aim of promoting adherence to appropriate hygienic practices. The predominance of the multimodal approach, developed by the WHO, demonstrates the importance of combining different strategies to achieve sustainable results. Despite the differences in the specific strategies adopted, it is evident that educational training and the direct engagement of health professionals are essential components for the success of interventions. Awareness, hands-on training, the use of visual aids such as UV light to show hygiene effectiveness, and active leadership are aspects highlighted in several studies as contributing to improved adherence to hand hygiene.

However, it is worth mentioning that the present review has limitations, including: the scarcity of details about the educational strategies employed in some of the studies analyzed, the presence of articles that are inaccessible in full, and the absence of studies in certain languages, as established by the inclusion criteria.

It is of utmost importance that future research explores how different educational approaches work in various settings, such as hospitals, clinics, and health centers, and how to adjust these strategies according to the local context and culture. Collaboration between healthcare professionals

from diverse fields is also essential to ensure the success of these strategies. Therefore, incorporating studies that look at the varying outcomes of different educational approaches according to context can provide valuable insights into the best way to promote hand hygiene adherence.

It is imperative that educational interventions aimed at improving hand hygiene among health care workers are implemented to contribute to the prevention of healthcare-associated infections. In addition, long-term evaluation and ongoing research are needed to better understand the effects of these interventions and further enhance HAI prevention strategies.

REFERENCES

1. ABBAS, K. et al. A web-based health education module and its impact on the preventive practices of health-care workers during the COVID-19 pandemic. Health Education Research, v. 35, n. 5, 353–361, ago. 2020. DOI:10.1093/her/cyaa034

2. ALLEGRANZI, B. et al. Global implementation of WHO's multimodal strategy for improvement of hand hygiene: a quasi-experimental study. The Lancet Infectious Diseases, v. 13, n. 10, 843–851, ago. 2013. DOI:10.1016/s1473-3099(13)70163-4

3. AL-MAANI, A. et al. "The impact of the hand hygiene role model project on improving healthcare workers' compliance: A quasi-experimental observational study." Journal of Infection and Public Health, v. 15, n. 3, p. 324-330, 2022. DOI: 10.1016/j.jiph.2022.01.017.

4. ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS (ABNT). Norma Brasileira ABNT NBR14724. 3 ed. Rio de Janeiro, 2011. Disponível em https://www.normasabnt.org/abnt-nbr-14724/. Acesso em: 26 dez. 2022.

5. BACCOLINI, V. et al. Effectiveness over time of a multimodal intervention to improve compliance with standard hygiene precautions in an intensive care unit of a large teaching hospital. Antimicrobial Resistance & Infection Control, v. 8, n. 92, mai. 2019. DOI: 10.1186/s13756-019-0544-0.

6. BERMAN, L. et al. "Utilizing the SEIPS model to guide hand hygiene interventions at a tertiary hospital in Ethiopia." PloS one, v. 16, n. 10, e0258662, out. 2021. DOI:10.1371/journal.pone.0258662

7. CONWAY, L. J. et al. Implementation and Impact of an Automated Group Monitoring and Feedback System to Promote Hand Hygiene Among Health Care Personnel. The Joint Commission Journal on Quality and Patient Safety, v. 40, n. 9, 408–417, 2014. DOI:10.1016/s1553-7250(14)40053-9.

8. COSTA, J. G. et al. Fatores impactantes na prática da higienização das mãos. Revista Científica de Enfermagem, v. 12, p. 278-291, 2022. DOI: 10.24276/rrecien2022.12.38.278-291.

9. EICHEL, V. M. et al. Is virtual reality suitable for hand hygiene training in health care workers? Evaluating an application for acceptability and effectiveness. Antimicrob Resist Infect Control, v.11, n. 91, 2022. https://doi.org/10.1186/s13756-022-01127-6

10. FARHOUDI, F. et al. Impact of WHO Hand Hygiene Improvement Program Implementation: A Quasi-Experimental Trial. BioMed Research International, 2016. DOI:10.1155/2016/7026169

11. FARIÑAS-ALVAREZ, C. et al. Estrategia multimodal para la mejora de la adherencia a la higiene de manos en un hospital universitario. Revista de Calidad Asistencial, v. 32, n. 1, 50–56, jun. 2017. DOI:10.1016/j.cali.2016.06.011

12. FREDJ, S. B. et al. Multimodal intervention program to improve hand hygiene compliance: effectiveness and challenges. Journal of the Egyptian Public Health Association, v. 95, n. 11, 2020. DOI: 10.1186/s42506-020-00039-w.

13. GHAZALI, A. D. et al. Impact of a simulation-based training in hand hygiene with alcohol-based hand rub in emergency departments. Infection Control & Hospital Epidemiology, v. 39, n. 11, 1347–1352, ago. 2018. DOI:10.1017/ice.2018.229

14. HIGGINS, A.; HANNAN, M. M. Improved hand hygiene technique and compliance in healthcare workers using gaming technology. Journal of Hospital Infection, v. 84, n. 1, 32–37, 2013. DOI:10.1016/j.jhin.2013.02.004

15. HOANG, D. et al. Video didactic at the point of care impacts hand hygiene compliance in the neonatal intensive care unit (NICU). Journal of Healthcare Risk Management, v. 37, n. 4, 9–15, 2018. DOI:10.1002/jhrm.21314

16. HUIS, A. et al. Impact of a team and leaders-directed strategy to improve nurses' adherence to hand hygiene guidelines: A cluster randomised trial. International Journal of Nursing Studies, v. 50, n 4, 464–474, ago. 2013. DOI:10.1016/j.ijnurstu.2012.08.004

17. KALLAM, B. et al. Implementation science in low-resource settings: using the interactive systems framework to improve hand hygiene in a tertiary hospital in Ghana. International Journal for Quality in Health Care, 2018. DOI:10.1093/intqhc/mzy111

18. KERBAJ, J. et al. Smartphone text message service to foster hand hygiene compliance in health care workers. American Journal of Infection Control, v. 45, n. 3, 234–239, 2017. DOI:10.1016/j.ajic.2016.10.018

19. MERNELIUS, S. et al. Compliance with hygiene guidelines: The effect of a multimodal hygiene intervention and validation of direct observations. American Journal of Infection Control, v. 41, n. 5, e45–e48, mai. 2013. DOI:10.1016/j.ajic.2012.09.008

20. MORO, M.L. et al. "Determinants of success and sustainability of the WHO multimodal hand hygiene promotion campaign, Italy, 2007-2008 and 2014." Euro surveillance: bulletin Europeen sur les maladies transmissibles, v. 22, n. 23, 30546, 2017. DOI:10.2807/1560-7917.ES.2017.22.23.30546

21. NEUMARK, Y. et al. "A feasibility study of the use of medical clowns as hand-hygiene promoters in hospitals." PloS one, v. 17, n. 12, e0279361, dez. 2022. DOI: 10.1371/journal.pone.0279361

22. NOBILE. et al. "Promotion of hand hygiene: the experience of the orthopaedic hospital Gaetano Pini-CTO, Milan, Italy." Annali di igiene : medicina preventiva e di comunita, v. 30, n. 3, 229-236, 2018. DOI:10.7416/ai.2018.2214

23. O'DONOGHUE, M. et al. A quasi-experimental study to determine the effects of a multifaceted educational intervention on hand hygiene compliance in a radiography unit. Antimicrobial Resistance & Infection Control, v. 5, n. 1, out. 2016. DOI:10.1186/s13756-016-0133-4

24. OLIVEIRA, A. C.; GAMA, C. S.; PAULA, A. O. Multimodal strategy to improve the adherence to hand hygiene and self-assessment of the institution for the promotion and practice of hand hygiene. Journal of Public Health, v. 40, n. 1, 163–168, 2017. DOI:10.1093/pubmed/fdx035

25. ORGANIZAÇÃO MUNDIAL DE SAÚDE (OMS). Guia para Implementação da Estratégia Multimodal da OMS para a Melhoria da Higiene das Mãos. Genebra, 2009. Disponível em: https://www.saude.df.gov.br/documents/37101/45849/2.5.1.pdf/0ab493d1-d864-070e-1ec3-adee857cc3ec?t=1650148037634. Acesso em: 15 maio 2023

26. ORGANIZAÇÃO PAN-AMERICANA DA SAÚDE; AGÊNCIA NACIONAL DE VIGILÂNCIA SANITÁRIA (ANVISA). Manual para observadores: estratégia multimodal da OMS para a melhoria da higienização das mãos. Anexo 17. 2008. Disponível em:

https://www.anvisa.gov.br/servicosaude/controle/higienizacao_oms/manual_para_observadores-miolo.pdf. Acesso em: 18 dez. 2022

27. PAGE, M.J. et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. Disponível em: https://www.equator-network.org/reporting-guidelines/prisma/.

28. PAULA, D. G. et al. Higiene das mãos em setores de alta complexidade como elemento integrador no combate do Sars-CoV-2. Revista Brasileira de Enfermagem, v. 73, n. 2, 2020. DOI: 10.1590/0034-7167-2020-0316

29. PHAN, H. T. et al. An educational intervention to improve hand hygiene compliance in Vietnam. BMC Infectious Diseases, v. 18, n. 1, mar. 2018. DOI:10.1186/s12879-018-3029-5

30. PIMENTEL, M. P. T. et al. Resident-Driven Quality Improvement Project in Perioperative Hand Hygiene. Journal of Patient Safety, v. 1, 2017. DOI:10.1097/pts.0000000000000282

31. RETHLEFSE, M.L. et al. PRISMA-S Group. PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews. Systematics Reviews, v. 26, 2020. DOI: 10.1186/s13643-020-01542-z.

32. ROMERO, D.M.P. et al. Efeitos da implementação de um programa de educação de higienização das mãos entre profissionais de uma UTI: análise de séries temporais interrompidas. Jornal Brasileiro de Pneumologia, v. 45, n. 5, 2019. DOI: 10.1590/1806-3713/e20180152.

33. SADEGHI-MOGHADDAM, P. et al. Does training improve compliance with hand hygiene and decrease infections in the neonatal intensive care unit? A prospective study. Journal of Neonatal-Perinatal Medicine, v 8, n 3, 221–225, mai. 2015. DOI:10.3233/npm-15915001

34. SCHERER, J de S. et al. Higienização das Mãos: Adesão dos Profissionais Antes e Após Programa de Capacitação. J. Health Sci, v. 19, n. 2, p. 171-178, abr. 2017.

35. REES, S. et al. Success of a Multimodal Program to Improve Hand Hygiene Compliance. Journal of Nursing Care Quality, v. 28, n. 4, 312–318, 2013. DOI:10.1097/ncq.0b013e3182902404

36. Report on the Burden of Endemic Health Care-Associated Infection Worldwide, 2011. Disponível em: https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507_eng.pdf. Acesso em: 26 dez 2022.

37. RESTREPO, A. V. et al. Implementación de la estrategia “Atención Limpia es Atención Segura” en un hospital de tercer nivel en Medellín, Colombia. Revista Chilena de Infectología, v. 31, n. 3, 280–286, 2014. DOI:10.4067/s0716-10182014000300005

38. RODRIGUEZ, V. et al. A multimodal intervention to improve hand hygiene in ICUs in Buenos Aires, Argentina: a stepped wedge trial. International Journal for Quality in Health Care, v. 27, n. 5, 405–411, set. 2015. DOI:10.1093/intqhc/mzv065.

39. ROMERO, D. M. P. et al. Effects of the implementation of a hand hygiene education program among ICU professionals: an interrupted time-series analysis. Jornal Brasileiro de Pneumologia, v. 45, n. 5, jun. 2019. DOI:10.1590/1806-3713/e20180152

40. SANSAM, S. et al. “Assessment of hand hygiene compliance after hand hygiene education among health care workers in Cambodia.” Nagoya journal of medical science, vl. 78, n. 2, 151-62, 2016.

41. SANTOS, L. et al. Improving hand hygiene adherence in an endoscopy unit. Endoscopy, v. 45, n. 06, 421–425, 2013. DOI:10.1055/s-0032-1326284

42. Segurança do Paciente em Serviços de Saúde: Higienização das Mãos / Agência Nacional de Vigilância Sanitária. Brasília: ANVISA, 2009. Disponível em: https://www.anvisa.gov.br/servicosaude/manuais/paciente_hig_maos.pdf. Acesso em: 10 dez. 2022

43. Segurança do Paciente: Higienização das Mãos em Serviços de Saúde. Brasília, 2007. Disponível em: https://www.anvisa.gov.br/servicosaude/manuais/paciente_hig_maos.pdf. Acesso em: 25 maio 2023

44. SILVA, A. C. T. et al. Efetividade de ações educativas para adesão a meta de higienização das mãos em uma unidade clínica. Journal of Infection Control, v. 8, n. 4, p. 255-260, 2019. Disponível em: https://jic-abih.com.br/index.php/jic/article/view/278/pdf.

45. SILVA, B. R. et al. Monitoring hand hygiene adherence in an intensive care unit. Revista de Enfermagem UERJ, v. 26, 2018. DOI: 10.12957/reuerj.2018.33087.

46. SILVA, I. D. P. et al. Fatores relacionados à prática de higienização das mãos para o controle de infecções: uma revisão integrativa. Brazilian Journal of Health Review, v. 5, n. 3, p. 8323-8336, 2022. DOI: 10.34119/bjhrv5n2-300.

47. SILVA, P. S. et al. Prevenção e controle de infecções relacionadas à assistência à saúde: fatores extrínsecos ao paciente. HU Revista, v. 43, n. 3, p. 277–283, 2018. DOI: 10.34019/1982-8047.2017.v43.2739.

48. SOPJANI, I.; JAHN, P.; BEHRENS, J. Training as an Effective Tool to Increase the Knowledge About Hand Hygiene Actions. An Evaluation Study of Training Effectiveness in Kosovo. Medical Archives, v. 71, n. 1, 2017. DOI:10.5455/medarh.2017.71.16-19

49. STEWARDSON, A. J. et al. Efficacy of a New Educational Tool to Improve Handrubbing Technique amongst Healthcare Workers: A Controlled, Before-After Study. PLoS ONE, v. 9, n. 9, e105866, set. 2014 . DOI:10.1371/journal.pone.0105866

50. SUZUKI, Y. et al. The effect of a 5-year hand hygiene initiative based on the WHO multimodal hand hygiene improvement strategy: an interrupted time-series study. Antimicrobial Resistance & Infection Control, v. 9, n. 1, 2020. DOI:10.1186/s13756-020-00732-7

51. UNEKE, C. J. et al. Promotion of hand hygiene strengthening initiative in a Nigerian teaching hospital: implication for improved patient safety in low-income health facilities. The Brazilian Journal of Infectious Diseases, v. 18, n. 1, p. 21–27, 2014. DOI:10.1016/j.bjid.2013.04.006

52. VALIM, M.D. et al. Efficacy of the multimodal strategy for Hand Hygiene compliance: an integrative review. Revista Brasileira de Enfermagem, v. 72, n. 2, p. 552-565, 2019. DOI: 10.1590/0034- 7167-2018-0584.

53. VAN DIJK, M. D. et al. “A multimodal regional intervention strategy framed as friendly competition to improve hand hygiene compliance.” Infection control and hospital epidemiology, v. 40, n. 2, p.187-193, 2019. DOI:10.1017/ice.2018.261

54. VON LENGERKE, T. et al. Impact of psychologically tailored hand hygiene interventions on nosocomial infections with multidrug-resistant organisms: results of the cluster-randomized

controlled trial PSYGIENE. Antimicrobial Resistance & Infection Control, v. 8, n. 1, 2019. DOI:10.1186/s13756-019-0507-5

55. WATSON, J. A. Role of a multimodal educational strategy on health care workers' handwashing. American Journal of Infection Control, v. 44, n. 4, p. 400–404, 2016. DOI:10.1016/j.ajic.2015.10.030

56. WHITTEMORE, R.; KNAFL, K. The integrative review: updated methodology. Journal of Advanced Nursing, v. 52, n. 5, p. 546–553, 2005. DOI: 10.1111/j.1365-2648.2005.03621.x.

57. WORLD HEALTH ORGANIZATION. Health care without avoidable infections: The critical role of infection prevention and control, 2016. Disponível em: http://apps.who.int/iris/bitstream/10665/246235/1/WHO-HIS-SDS-2016.10-eng.pdf?u a=1. Acesso em: 26 dez 2022.

58. WU, K.S. et al. Identifying heterogeneity in the Hawthorne effect on hand hygiene observation: a cohort study of overtly and covertly observed results. BMC Infectious Diseases, v. 18, n. 1, 2018. DOI:10.1186/s12879-018-3292-5.

59. YOUSEF, R. H. A.; SALEM, M. R.; MAHMOUD, A. T. Impact of implementation of a modified World Health Organization multimodal hand hygiene strategy in a university teaching hospital. American Journal of Infection Control, v. 48, n. 3, p. 249–254, 2020. DOI:10.1016/j.ajic.2019.07.019