

Efficacy of the multimodal strategy for Hand Hygiene compliance: an integrative review

Eficácia da estratégia multimodal para adesão à Higiene das Mãos: revisão integrativa
Eficacia de la estrategia multimodal en la adhesión a la Higiene de las Manos: revisión integradora

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ABSTRACT

Objective: Evaluate, from the literature, the effectiveness of the implementation of the multimodal strategy for health professionals compliance with Hand Hygiene and its sustainability over time. **Method:** Integrative review, with a view to answering the following question: "Is the implementation of the multimodal strategy effective in health professionals compliance with Hand Hygiene and can it be sustained over time?". The MEDLINE, SCOPUS, LILACS and CINAHL databases were used to retrieve the primary articles. **Results:** Twenty-five studies were analyzed. Among the components of the multimodal strategy, three need to be better worked: health education, feedback from practices and management involvement. Although it needs to focus more on its five elements, interventions based on the multimodal strategy have favored HH compliance and its long-term sustainability. **Conclusion:** The strategy proved to be effective for HH compliance, especially when all integrating components are adequately addressed. **Descriptors:** Hand Hygiene; Cross Infection; Personnel Health; Patient Safety; Health Knowledge, Attitudes, Practice.

RESUMO

Objetivo: Avaliar, a partir da literatura, a eficácia da implementação da estratégia multimodal para adesão dos profissionais de saúde à Higiene das Mãos e sua sustentabilidade ao longo do tempo. **Método:** Revisão integrativa, com vistas a responder a seguinte questão: "A implementação da estratégia multimodal é eficaz na adesão dos profissionais de saúde à Higiene das Mãos e pode ser sustentada ao longo do tempo?". Utilizaram-se as bases de dados MEDLINE, SCOPUS, LILACS e CINAHL para recuperar os artigos primários. **Resultados:** Foram analisados 25 estudos. Dentre os componentes da estratégia multimodal, três precisam ser melhor trabalhados: educação em saúde, *feedback* de práticas e envolvimento da gestão. Embora necessite maior enfoque dos seus cinco elementos, as intervenções baseadas na estratégia multimodal favoreceram a adesão à HM e sua sustentabilidade em longo prazo. **Conclusão:** A estratégia se mostrou eficaz para adesão à HM, em especial, quando todos componentes integradores são adequadamente contemplados. **Descritores:** Higiene das Mãos; Infecção Hospitalar; Pessoal de Saúde; Segurança do Paciente; Conhecimentos, Atitudes e Prática em Saúde.

RESUMEN

Objetivo: Evaluar, a partir de la literatura, la eficacia de la implementación de la estrategia multimodal en la adhesión de los profesionales de salud a la Higiene de las Manos y su sostenibilidad a lo largo del tiempo. **Método:** Revisión integradora, para responder a la siguiente pregunta: "¿La implementación de la estrategia multimodal es eficaz en la adhesión de los profesionales de la salud a la Higiene de las Manos y puede ser sostenida a lo largo del tiempo?" Se utilizaron las bases de datos MEDLINE, SCOPUS, LILACS y CINAHL para recuperar los artículos primarios. **Resultados:** Se analizaron 25 estudios. Entre los componentes de la estrategia multimodal, tres necesitan ser mejor trabajados: educación en salud, *feedback* de prácticas e involucramiento de la gestión. Aunque necesite un mayor enfoque de sus cinco elementos, las intervenciones basadas en la estrategia multimodal favorecieron la adhesión a la HM y su sostenibilidad a largo plazo. **Conclusión:** La estrategia se mostró eficaz en la adhesión a la HM, en particular cuando todos los componentes integradores están adecuadamente contemplados. **Descritores:** Higiene de las Manos; Infección Hospitalaria; Personal de Salud; Seguridad del Paciente; Conocimientos, Actitudes y Práctica en Salud.

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INTRODUCTION

Health Care-Related Infections (HCAI) represent a global challenge for patient safety. In recent years, greater concern has been expressed by health agencies and institutions to control and prevent the risk of such infections and at the same time to improve and ensure safe and quality care⁽¹⁻²⁾. Currently, they are considered a serious public health problem, as it affects millions of people, increasing morbidity and mortality, increasing antimicrobial resistance and excessive spending for health systems that could be preventable by basic precautionary measures, Hand Hygiene (HH)^(1,3).

Since 2005, the World Health Organization (WHO) has been adopting some strategies to be used in order to prevent the risks inherent to HCAI. In 2009, the multimodal strategy was recognized and disseminated internationally to improve compliance with HH practices, since hand washing is the simplest, most cost-effective and least costly measure to minimize the spread of pathogens and thus control and prevent the HCAI⁽¹⁻²⁾. The multimodal strategy prioritizes five key components that favor the change of practices and behaviors, namely: change in the system, which is related to the infrastructure of the institution; education and training of health professionals; evaluation and feedback of Hand Hygiene; reminders in the workplace and favorable institutional security environment⁽¹⁾.

Recent research has demonstrated the importance of promoting adequate HH technique compliance among health professionals in order to reduce the high rates of infections caused by multidrug resistant microorganisms⁽⁴⁻⁹⁾. However, low compliance with these practices remains a challenge for practitioners and health institutions, especially in developing countries, which may present an HCAI rate up to 20 times higher than in developed countries⁽¹⁰⁾.

In Brazil, the rates of compliance with registered HH remain below the recommended level, with an average of 50% compliance in the health institutions investigated⁽¹¹⁾. The reasons for low compliance have multifaceted characteristics, which are related from the physical structure and support existing in the institution, available material and human resources, to professional behavior, conditioned, among others, to the process of education⁽¹¹⁻¹²⁾.

In this context, the multimodal strategy has been encouraged by several health agencies worldwide as a complete tool to achieve satisfactory results, since only the educational training does not guarantee the continuous improvement of HH practice⁽⁸⁾. Accordingly, the active participation of the heads and managers of the institutions was also highlighted, since the valuation of the change to maintain the favorable security environment can be considered effective for the change and maintenance of the indexes of improvement of HH compliance throughout the time^(9,13).

It is emphasized that efficacy in the context of health can be defined as the promotion of services widely available to all who can benefit, through scientific knowledge, to avoid both underutilization and excessive use of technologies⁽¹⁴⁾. Thus, the multimodal strategy is considered effective when, after its implementation in health institutions, it increases the HH compliance by health professionals and remains sustained over time⁽¹⁻³⁾.

OBJECTIVE

This study aims to evaluate, from the literature, the effectiveness of the implementation of the multimodal strategy for health professionals compliance with Hand Hygiene and its sustainability over time.

METHOD

It is an integrative review of the literature, which proposes the synthesis of the results of previous studies on the same subject⁽¹⁵⁾. The integrative reviews have been highlighted in the area of Nursing in the last decade and this is due to its broad potential on specific subjects, which allows the nurses who are in clinical practice to perform nursing care based on scientific evidence⁽¹⁶⁾.

For the development of the same, six phases were covered: 1- selection of the hypothesis or question of research; 2 - search strategy (establishment of inclusion and exclusion criteria, database and selection of studies); 3 - categorization of studies (extraction, organization and summarization of data); 4- evaluation of studies included in the review; 5- interpretation of results and 6- synthesis of knowledge⁽¹⁵⁾.

To guide the study, the research question was elaborated following the PICO strategy (Participant, Intervention, Comparison and Outcomes)⁽¹⁷⁾: "Is the implementation of the multimodal strategy effective in health professionals compliance with Hand Hygiene and can it be sustained over time?"

Inclusion criteria were original scientific articles using a quantitative approach that used an intervention to improve HH compliance, using a standardized and validated WHO observation form to calculate HH compliance index, which considers the opportunity for HH and the action performed. It should be noted that articles published in English, Spanish or Portuguese were included in the period from 2009 to 2017. This period of time is justified by the year of dissemination of said strategy by WHO, which was in 2009.

Publications such as theses and dissertations, studies in which the method was not clearly and adequately described, carried out only with students and did not include at least two key components of the WHO multimodal strategy or were not available in full were excluded from the review. Data collection occurred between May and October 2017.

The primary studies were searched in the following databases: Medical Literature Analysis and Retrieval System Online (MEDLINE), Latin American and Caribbean Literature in Health Sciences (LILACS), Current Nursing and Allied Health Literature (CINAHL) and SCOPUS. In order to ensure a careful search, the controlled descriptors (Health Science Descriptors (DeCS), Medical Subject Headings (MeSH) and CINAHL Headings were defined, and not controlled (keywords). The DeCS used were: *higiene das mãos* and *pessoal de saúde*, MeSH: hand hygiene and health personnel, and CINAHL Headings: handwashing and health personnel, and the keywords: *adesão/compliance*, *intervenção/intervention*, *programa de avaliação/program evaluation* and *estratégia multimodal/multimodal strategy*. The use of the Boolean operator (AND) allowed access to articles with intersections between descriptors and keywords, and the terms were combined in different ways, according to each database, to ensure wide and adequate search. Chart 1 shows the search mechanism used in each database and the number of articles retrieved.

Chart 1 – Search engine and number of texts retrieved in different databases, 2017.

Databases (Total)	Crossover – Descriptors	Articles obtained
MEDLINE (11)	hand hygiene AND health personnel	9
	hand hygiene AND compliance	-
	hand hygiene AND intervention	-
	hand hygiene AND program evaluation	-
	hand hygiene AND multimodal strategies	2
SCOPUS (12)	hand hygiene AND health personnel	11
	hand hygiene AND compliance	-
	hand hygiene AND intervention	-
	hand hygiene AND program evaluation	-
	hand hygiene AND multimodal strategies	1
LILACS (02)	<i>higiene das mãos AND pessoal de saúde</i>	2
	<i>higiene das mãos AND adesão</i>	-
	<i>higiene das mãos AND intervenção</i>	-
	<i>higiene das mãos AND programa de avaliação</i>	-
	<i>higiene das mãos AND estratégia multimodal</i>	-
CINAHL (00)	handwashing AND health personnel	-
	handwashing AND compliance	-
	handwashing AND intervention	-
	handwashing AND program evaluation	-
	handwashing AND multimodal strategies	-
Total		25

9,109 publications were found and 25 articles were eligible in order to compose the sample of the present study (Figure 1).

It should be noted that, in total, 166 articles selected for complete reading were excluded, of which 88 were excluded because they did not include at least two of the components of the multimodal strategy; 35 articles because they were not studies with the pre-established design; 15 articles because they did not present the adherence index to pre and/or post-intervention HH; 14 articles because they are unavailable in full even after searching for switching service; 6 articles for being carried out in Primary Care; 5 because they were carried out only with students from the Health area and 3 because they were from another language, other than English, Portuguese or Spanish.

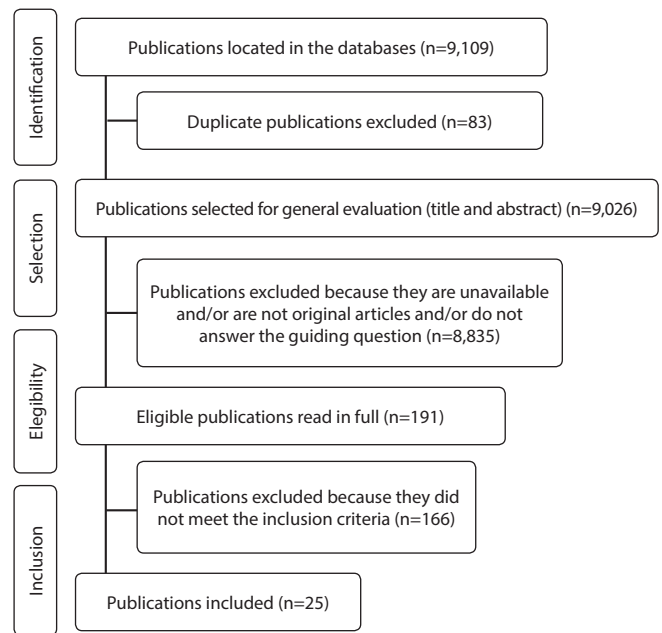


Figure 1 – Flowchart for identifying and selecting publications according to the PRISMA Statement

In the selection of articles, a careful reading of the title and the abstract was carried out, in order to verify the adequacy with the guiding question and, later, a complete reading of the manuscripts for certification of the inclusion and exclusion criteria established, being analysis of the articles performed in a descriptive way.

25 reviews were carried out that were strictly linked to the research object. The selection and analysis of the studies were conducted by two researchers, independently, in order to avoid biases in the screening of articles and in the inferences of the results.

RESULTS

Based on the inclusion criteria, the final sample consisted of 25 articles. The main information extracted from the original article for this study is presented in Chart 2.

The study participants were composed of nursing staff, physicians and other health professionals, who predominantly worked in the adult Intensive Care Unit (ICU), medical clinic, emergency departments, pediatric clinic and surgical clinic.

Chart 2 - Synopsis of key information from the 25 primary studies included in the integrative review, Brazil, 2018

Author, Year and Country	Outlining	Components of the multimodal strategy	Main actions developed	Post-intervention index and opportunities (n)	Post-intervention evaluation time	Post-intervention index and opportunities (n)	P value
Mathai, A. S. et al. ⁽¹⁸⁾ 2011 India	Quasi-experimental	1. System change. 2. Education/ Training. 4. Reminders in the workplace.	1. Alcohol gel-based solutions and dispensers increase. 2. Four lectures with slides over 5M for HH lasting 1 hour each, for 8 weeks. 4. Posters in the corridors and next to each patient.	25.95% n= 1,001	Immediately after intervention	57.36% n= 1,026	<0.001

To be continued

Chart 2

Author, Year and Country	Outlining	Components of the multimodal strategy	Main actions developed	Post-intervention index and opportunities (n)	Post-intervention evaluation time	Post-intervention index and opportunities (n)	P value
Borges. L. F. A. et al. ⁽¹⁹⁾ 2012 Brazil	Quasi-experimental	1. System change. 3. Evaluation and Feedback. 4. Reminders in the workplace.	1. Alcohol gel-based solutions. 3. Meetings to provide feedback to HH and HCAI rate, twice per industry. 4. Colorful posters about HH importance.	21% n= 119	Immediately after intervention	24.80% n= 117	0.68
Mestre, G. et al. ⁽²⁰⁾ 2012 Spain	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions. 2. Theoretical-practical workshops to encourage compliance and correct HH technique. 3. Creation of an HH monitoring team, workplace evaluators, with bimonthly feedback and control of alcohol use in gel. 4. Posters at the most popular places. 5. Management commitment and nursing direction.	57% n= NA	Immediately after intervention and after 1 year	2010: 78% n= 4,095 2011: 84% n= 761	<0.001
Mazi, W. et al. ⁽²¹⁾ 2013 Saudi Arabia	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 5. Institutional Security Environment.	1. Alcohol gel-based solutions and chlorhexidine. 2. Practical lectures and workshops on the 5M of HH, active methodology and products for HH, for 3 weeks. 3. Quarterly reports were sent to the team leaders and the hospital director. 5. Involvement of management and team leaders to implement strategies.	Phase I ICU: 39%; Neo. ICU 88%; Burns Unit: 70%; Kidney Un.: 43% n= 409	Phase II April/ May 2010 Phase III October 2010 Phase IV March 2011	Phase II ICU at: 57%; Neo. ICU: 90%; Burns: 85%; Kidney: 71% n=406 Phase III ICU at: 53%; Neo. ICU 90%; Burns: 78%; Kidney: 36% n=620 Phase IV ICU at: 81%; Neo. ICU: 68%; Burns: 53%; Kidney: 54% n= 540	Adult ICU <0.05 Neonatal ICU and Burns Unit dropped over the course of 15 months.
Schmitz, K. et al. ⁽²²⁾ 2014 Ethiopia	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace.	1. Non-water-soluble soap and antiseptics, individually distributed. 2. Training on the importance of HH with "Hand Hygiene Champions" methodology for 6 weeks. 3. Monitoring and weekly feedback to workers. 4. HH posters throughout the hospital.	2.10% n= 1,000	Immediately after intervention	12.70% n= 1,000	<0.001
Restrepo, A.V. et al. ⁽²³⁾ 2014 Colombia	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions. 2. Training on the 5M to HH. Meetings on the importance of HH by using audiovisual aids and handing out HH brochures. 3. Immediate feedback to workers after observation. 4. 5M posters for HH in all rooms, and correct HH technique above dispensers and washbasins. 5. Continuous action plan with coordinators and directors to follow up the strategy.	82% n= 1,279	Immediately after intervention	89% n= 1,962	0.007

To be continued

Chart 2

Author, Year and Country	Outlining	Components of the multimodal strategy	Main actions developed	Post-intervention index and opportunities (n)	Post-intervention evaluation time	Post-intervention index and opportunities (n)	P value
Mahfouz, A. A. et al. ⁽²⁴⁾ 2014 Saudi Arabia	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions at the entrance of the rooms and above each bed. 2. Continuous meetings on patient safety, HCAI, 5M for HH and correct HH techniques, through videos and slides. Each training session lasted 2 to 3 hours. 3. Evaluation and Feedback passed on monthly to management and employees. 4. Distribution of posters by the hospital. 5. Involvement of leaders in training offered.	57,90% n= 1,182	After 1 year	84.90% n= 2,212	0.001
Leblebicioglu, H. et al. ⁽¹³⁾ 2015 Turkey	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions at the ICU entrances and at the nursing posts. The sinks were stocked with water, antiseptic soap and paper towels continuously. 2. 30-minute education sessions were held in each shift, with monthly duration, every two months and every six months, depending on the sector. 3. Monthly report sent to ICU with HH membership rate. 4. HH posters and reminders at various hospital sites. 5. Hospital administrators agreed and committed to the study.	29% n= 2,825	Immediately after intervention and up to 6 years later	45.50% 3 months after: 43.40% 2 nd year: 45.50% 3 rd year: 48.70% 4 th year: 73.30% 6 th year: 91% n= 19,320 (in the course of 6 years)	<0.0001
Chen, J. K. et al. ⁽²⁵⁾ 2016 Taiwan	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Change in the infrastructure and supply of alcohol gel. 2. Training of directors and department leaders to offer lectures, workshops and videos on the importance of membership and the impact of HH in the reduction of HCAI for 3 months. 3. Monthly feedback on HH and later annual membership. 4. Posters about the 5M for HH at the infirmary entrances. 5. Director of the hospital supported the intervention and stressed the importance of hand hygiene.	56.70% n= 1,760	Immediately after intervention and after 4 years	2010 69.44% n=5.472 2015 83,40% n= NA	<0.05
Sakihama, T. et al. ⁽²⁶⁾ 2016 Japan	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions at the entrance of the wards. 2. Regular seminars and lectures on HH. 3. Feedback from HH rate to CCIH (<i>Comissões de Controle de Infecção Hospitalar</i> - Hospital Infection Control Commissions) and participating clinics. 4. Posters for all participating clinics. 5. Only Hospital A had a management commitment.	General Index: 18% Hosp A: 11.50% Hosp B: 24.70% Hosp C: 18.90% n= 2,679	Hospital A and B after 2 months and hospital C after 3 months of intervention	General Index: 32,70% Hosp A: 39,90% Hosp B: 30% Hosp C: 26.50% n= 2,982	General Index <0.001 Hospital A had a higher compliance rate (+29%).

To be continued

Chart 2

Author, Year and Country	Outlining	Components of the multimodal strategy	Main actions developed	Post-intervention index and opportunities (n)	Post-intervention evaluation time	Post-intervention index and opportunities (n)	P value
Patel, B. et al. ⁽²⁷⁾ 2016 South Africa	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions and paper towel. 2. Trained professionals conducted HH's 5M educational presentation to the team at least once a week for 3 months. 3. Monthly feedback and performance charts for use in group educational sessions. 4. 5M posters for HH above the sinks. 5. Creating a continuous culture of improvement and behavior change.	Before contact with patient: 34% After contact with patient: 47% n= NA	After 1 year	Before contact with patient: 76% After contact with patient: 82% n= NA	<0.05
Trannin, K. P.P. et al. ⁽²⁸⁾ 2016 Brazil	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace.	1. Individual alcohol gel-based solutions. 2. Film about the importance of HH for 1 week. 3. Presentation of data collected on HH rates. 4. Sectors posters and colorful brooches as a reminder.	28.60% n= 2,304	After 1 month	38.90% n= 2,757	<0.0001
Mu, X. et al. ⁽²⁹⁾ 2016 China	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace.	1. Exchange of conventional faucets for faucets with sensors, alcohol-based gel solutions and paper towels. 2. Two HH education conferences and video presentations on appropriate HH techniques. 3. Every quarter, a final report on HH's membership in the consumption of products was sent to the hospital director and heads of units for 17 months. 4. Posters with correct HH technique at all clinics, above washbasins.	37.78% n= 1,266	Immediately after intervention	75.90% n= 26,586 (in the course of 17 months)	<0.001
O'Donoghue, et al. ⁽³⁰⁾ 2016 China	Quasi-experimental	1. System change. 2. Education/ Training. 4. Reminders in the workplace.	1. Alcohol gel-based solutions next to each place where the tests were performed. 2. Training and updates of 15 minutes on the benefits of HH and correct use of alcohol gel, performed three times at the beginning of the implementation and repeated 1 month later. 4. Pamphlets and posters as reminders.	28.90% n= 214	After 2 weeks	51.40% n= 243	< 0.01

To be continued

Chart 2

Author, Year and Country	Outlining	Components of the multimodal strategy	Main actions developed	Post-intervention index and opportunities (n)	Post-intervention evaluation time	Post-intervention index and opportunities (n)	P value
Farhoudi, F. et al. ⁽⁴⁾ 2016 Iran	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions next to all bedding and paper towel supply. 2. 2-part training course. In the first part use the Power Point slides for a period of 2 hours, followed by 2 hours to fill out observation forms. In the second part, enrollment in educational courses on HCAI control and prevention, twice a year. 3. Observation feedback to workers. 4. Posters and billboards on HCAI prevention and control. Promotional messages and correct techniques were displayed on the charts and exchanged monthly. 5. The project has become a hospital priority.	29.80% n= 255	After 1 year	71% n= 193	<0.001
Arntz, P. R. H. et al. ⁽⁵⁾ 2016 Holland	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace.	1. Alcohol gel-based solutions. 2. Education about 5M for HH and the relevance of HCAI prevention, with daily training, for 3 weeks. 3. Daily feedback during the second and third intervention period. 4. Distribution of posters in the infirmaries and screen rest in computers illustrating the importance of HH.	18.20% n= 407	During 3 weeks	1 st sem.: 40.50% 2 nd sem.: 49.50% 3 rd sem.: 45.70% n= 600	<0.001
Moghnieh, R. et al. ⁽³¹⁾ 2017 Lebanon	Experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback.	1. Alcohol gel-based solutions above the beds of all participating sectors. 2. Lecture about 5M for HH was initially introduced for all three groups. 3. With the incentive group a weekly audit was performed with the payment of an extra 1 hour for the best performance. For the feedback group, individual and group feedback was reviewed weekly, recalling the importance of HH for HCAI prevention.	Control group: 16% Incentive group: 21% Feedback group: 23% n= NA	During 21 weeks	Control group: 20%; Incentive group: 8 s: 60%; 14 s: 77%; 21 s: 34%; Feedback group: 8 s: 43%; 14 s: 51%; 21 s: 48% n = NA	Control group irrelevant. Incentive and feedback group <0.001. After discontinuation of interventions, the incentive group fell to 34% and the feedback group reached 48% (<0.0001).
Pfäfflin, F. et al. ⁽³²⁾ 2017 Ethiopia	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace.	1. Alcohol gel-based solutions on the walls and pocket flasks. 2. Workshop and lectures on cultural aspects and scientific evidence of HH and HCAI in neonatology, during four days. 3. Feedback of initial results for hospital management and for participants. Offer premium to the sector that achieved the highest compliance. 4. Posters emphasizing the importance of HH in strategic places of greater circulation.	1.40% n= 2,888	After 6 weeks	11.70% n= 2,865	<0.001

To be continued

Chart 2

Author, Year and Country	Outlining	Components of the multimodal strategy	Main actions developed	Post-intervention index and opportunities (n)	Post-intervention evaluation time	Post-intervention index and opportunities (n)	P value
Fariñas-Alvarez, C. et al. ⁽⁷⁾ 2017 Spain	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace 5. Institutional Security Environment.	1. Alcohol gel dispensers with tracking date of product placement. 2. Face-to-face sessions with 2-hour workshops with theoretical and practical content and online distance training. 3. Individual feedback reinforcing positive attitudes. 4. Posters about the importance of HH in the sectors. 5. The improvement of HH was considered a priority in hospital safety and quality policies.	54.50% n= NA	Immediately after intervention; after 2 months and after 6 months	March: 69.90% May: 44.80% September: 69.40% n= NA	< 0.001
Santosaningih, D. et al. ⁽³³⁾ 2017 Indonesia	Experimental	1. System change. 2. Education/ Training. 4. Reminders in the workplace.	1. Alcohol gel-based solutions next to each bed and door. 2. There were three different educational programs: active presentations; paper template training; and combination of both, for 8 weeks. 4. Posters presenting HH procedures in workplaces.	Pediatrics: 24.10% Medical Clinic: 5.20% Surgery: 18.90% Without intervention: Gynec-obst: 10.10% n= NA	Immediately after intervention	Pediatrics: 43.70% Medical Clinic: 18,50% Surgery: 24,90% Without intervention: Gynec-obst: 20,50% n= NA	Medical Clinic and surgery <0.01 and gynec-obst and Pediatrics <0.001.
Visan, F. A. et al. ⁽⁸⁾ 2017 Qatar	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Installations of washbasin and dispensers alcohol gel, chlorhexidine and quaternary ammonium compound in the corridors and change of taps for hand sensors. 2. Behavior change model conceptualized by Heath, Change & Heath to motivate HH for 25 months. 3. Monthly feedback to the team. Certificates and positive reinforcements for the first three professionals who hand sanitized. 4. Available 5M HH posters on top of washbasins. 5. The hospital administration supported and provided the necessary subsidies.	September to December 2011: 60.78% n= NA	During 4 years	2012: 77.38% 2013: 91.82% 2014: 93.96% 2015: 95.54% n= NA	Increased by more than 30% by the end of December 2015.
Pereira, E. B. S. et al. ⁽³⁴⁾ 2017 Brazil	Quasi-experimental	1. System change. 2. Education/ Training. 4. Reminders in the workplace.	1. Alcohol gel-based solutions. 2. Video about the correct technique for HH and its importance, for one week. 4. Posters were placed in strategic positions at the unit and leaflets on HH techniques and HH 5M.	Nur.: 48.70% Nursing assist.: 53.62% Doctors: 59.22% Physiotherapists: 81.48% n= 1,070	After 3 months	Nurs.: 54.91% Nursing assist.: 46.30% Doctors: 67,46% Physiotherapists: 79.59% n= 1,227	0.066

To be continued

Chart 2 (concluded)

Author, Year and Country	Outlining	Components of the multimodal strategy	Main actions developed	Post-intervention index and opportunities (n)	Post-intervention evaluation time	Post-intervention index and opportunities (n)	P value
Shen, L. et al. ⁽³⁵⁾ 2017 China	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Pocket alcohol gel-based solutions, washbasins with paper towels, automatic taps and liquid soap dispensing sensor. 2. HH 5M instruction video and its correct technique and importance. 3. Periodic feedback to management, department heads, industry nurses and some workers. 4. Posters about correct HH techniques near washbasins. Colorful 5M posters in all nurses. Computer screen reminders and knowledge contest. 5. CCIH department management commitment to the study. quality control through rewards and punishments.	66.27% n= 1,675	Immediately after intervention	80.53% n= 3,369	<0.001
Kuwaiti, A. A. ⁽³⁶⁾ 2017 Saudi Arabia	Quasi-experimental	1. System change. 2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace. 5. Institutional Security Environment.	1. Alcohol gel-based solutions and increased dispensers and washbasins. 2. Slide training on the 5M for HH. Installation of screen saver on computers to display the 5M and education of companions, for 12 months. 3. Performance feedback to professionals and regular audits. 4. Posters above the washbasins. 5. Holding meetings with the hospital administration and the team to obtain compliance.	50.17% n= NA	During 2 years	2015: 66.08% 2016: 71.75% n= NA	<0.05
Musu, M. et al. ⁽³⁷⁾ 2017 Italy	Quasi-experimental	2. Education/ Training. 3. Evaluation and Feedback. 4. Reminders in the workplace.	2. Brief review of the literature, followed by practical demonstrations, illustrative videos and discussions about HH, lasting 7 to 10 months. 3. Performance feedback through monthly meetings with professionals. 4. Posters and brochures affixed to ICU and waiting room.	Total: 47% n= 918	Immediately after intervention	Total: 89.40% n= 2,414	<0.001

Note: NA – Not Available; P value: demonstrates whether the intervention was statistically significant to improve HH compliance after the implementation of the multimodal strategy. P - significant value < or equal 0.05.

It was observed that the five components of the multimodal strategy were not included in 52% of the studies. System change was in twenty-four studies (96%); education/training in twenty-four (96%); evaluation and feedback in twenty-one (84%); workplace reminders in twenty-three (92%) and institutional security environment in thirteen publications (52%). It is noteworthy that only twelve studies used all the elements of this strategy, which represents, therefore, 48% of the studies included in the present sample.

With regard to the actions developed regarding the element change in the system, the availability of gel alcohol was present in the majority of studies that used this component, followed by increase of gel alcohol dispensers, paper towel, chlorhexidine, faucet with automatic sensor and washbasins. The most used educational and training strategies were lectures/courses addressing the theme of the five HH moments of the WHO, form

of pathogen transmission and prevention and control of HCAI (23/25), followed by workshops (11/25). The preferred methodologies were theoretical presentations, using didactic resources such as slides, videos and films, practical demonstration and dialogue on the theme. The active methodology was cited in a study⁽²¹⁾, but did not present detailed information about its development.

The evaluation and feedback occurred through individually (02/20) or collective (11/20) meetings with the workers. In some studies weekly or monthly or quarterly reports were sent to department heads and/or hospital management (07/20). In all searches that had the reminder component in the workplace, educational posters were the preferred choice. Regarding research that explicitly made use of the institutional safety environment component, only three studies^(7,23,27) clearly stated that managers and managers committed to follow up on the implementation of the multimodal strategy after the study.

Regarding the time of evaluation, this occurred immediately after the intervention (8/25), immediately and/or in a period equal to or less than six months (8/25), for one year (5/25), for two years (1/25) for four years (2/25) and for six years (1/25).

Among the results of the data analysis, only three articles (12%) did not present statistically significant results (p value <0.05) to improve HH compliance after implementation of the multimodal strategy or showed a decrease in HH compliance over the evaluation time. The first of these studies carried out in Brazil⁽¹⁹⁾ used three of the five components of the multimodal strategy - change in the system, evaluation and feedback, and reminders in the workplace; the second was held in Saudi Arabia⁽²¹⁾, and in addition to the three previous components, also used education and training for three weeks. The third one was also developed in Brazil⁽³⁴⁾ and included only three elements - change in the system, reminders in the workplace, and education and training for only one week.

DISCUSSION

The increase in research related to this topic in the last five years, especially between the years 2016 and 2017, whose publications corresponded to more than 60% (17/25) of the studies included. This growth in scientific studies may be related to several factors, such as the serious negative impact of HCAI worldwide, priority to research aimed at prevention and control of HCAI, which also include the Brazilian Agenda of Priorities in Health Research, as it represents the fifth international goal of patient safety, as well as the encouragement given by WHO and other international and national agencies to the use of the multimodal strategy to improve HH compliance⁽³⁸⁻⁴⁰⁾.

It is important to note that, although the study showed that the multimodal strategy, when correctly implemented, is capable of increasing workers' HH compliance, it is explicit that, in many cases, post-intervention compliance rates - even if statistically significant of $p < 0.05$ - are below what is necessary and expected^(5,7,18-19,21-22,26,28,30-33).

According to the Global Human Development Index (HDI)⁽⁴¹⁾, approximately 85% (21/25) of the countries in which the studies included in this review occurred have a very high or high HDI^(4-5,7-8,13,19-21,23-31,34-37). With respect to the medium and low HDI countries (4/25)^(18,22,32-33), all had a pre-intervention HH compliance of less than 30%, and a post-intervention compliance of less than 50%, except a study⁽¹⁸⁾ (1/4) that reached 57% after the intervention. Some countries, such as Saudi Arabia^(21,24,36), Spain^(7,20) and Qatar⁽⁸⁾, already had a higher pre-intervention rate than those with lower HDI, such as Ethiopia^(22,32), Indonesia⁽³³⁾ and India⁽¹⁸⁾.

Also in this context, two studies carried out in Ethiopia^(22,32), a country with a low HDI, showed that pre-intervention HH compliance of 2.10% and 1.4% and even after educational implementation, post-intervention records remained at 12.70% and 11.70%, respectively. Similarly, a study conducted in Indonesia⁽³³⁾, an average HDI country, found that even after the implementation of a multimodal strategy, compliance rates in medical and surgical clinical practice remained at 18.5% and 24.9%, respectively, and a study conducted in Brazil⁽¹⁹⁾, although classified as a high HDI country, also deserves to be highlighted, with 24.8% HH compliance even after applying these strategies.

A study⁽³⁹⁾ that evaluated the implementation of the multimodal strategy in five countries with different classifications of economic development verified a more significant improvement in HH in low- and middle-income countries than in high-income countries, probably because in places where basic knowledge and physical resources are scarce, the contribution of the multimodal strategy can provide immediate and substantial progress, albeit far from what has been advocated. Even so, multicomponent intervention has proven viable and sustainable in all hospitals, including those with limited resources, and should be strongly encouraged.

It should also be noted that the study conducted in Brazil⁽¹⁹⁾ did not achieve a significant compliance rate, possibly due to the fact that it did not use the element of the education/training program, a key element to change practices and behaviors, besides presenting limitations related to the number of registered opportunities (pre-intervention 119 and post-intervention 117), which hinders the understanding, interpretation and inference of the analyzed data.

A study in three hospitals in Japan⁽²⁶⁾ showed that although HH compliance increased with the implementation of the five components of the multimodal strategy, the hospital that maintained the managers' commitment during and after the intervention was the one that most assured an increase in the rate of with approximately 30% increase, while the other two hospitals showed an increase of only 5% and 7%, respectively.

It is in this overview that studies^(8, 21-22, 28, 30) have shown that the institutional safety environment, education and training of health professionals, and feedback evaluation are three key components for increasing HH compliance and are capable of sustaining compliance rates for periods of time, since they consider Permanent Education and vicarious learning as a means to obtain constant improvements. Thus, in order to ensure a continuous change of improvement in HH and sustainability of compliance rates, a multimodal approach is essential, in a combined, periodic and permanent manner^(3,39), which did not occur in the mentioned studies^(19,22,32-33).

WHO itself recommends that in order to achieve a successful and sustained improvement in HH, it is necessary to use several actions to address different institutional obstacles and behavioral barriers⁽²⁾. However, cultural changes do not occur quickly and spontaneously, they need to be permanent and always evaluated. The Brazilian *Política Nacional de Educação Permanente em Saúde* (PNEPS - freely translated as National Policy of Permanent Education in Health) considers health workers as the main agents of change, and the work environment is the ideal place to develop learning, enabling changes in professional practices⁽⁴²⁾.

According to Bandura⁽⁴³⁾, learning can be active or by observation, the latter being considered the main way to obtain knowledge, because it occurs by observing the behavior of other people and the experiences generated or obtained by them, called vicarious learning. In this sense, the importance of the social context for certain behaviors is evident, considering that encouragement for development comes from each subject, and that people reproduce behaviors or model themselves in some way according to others and the environment.

In this context, feedback from practices as a Permanent Education strategy can be considered a necessary and very useful element to increase and maintain HH improvement rates, since

it allows identifying gaps and implementing actions directed at behavior change. When performed immediately and individually, it has influenced the performance of professionals by allowing the identification of barriers that interfere in the HH compliance and seek timely solutions, as well as to detect the types of opportunities and the reason for failures for HH, highlighting the protagonism of the subject, that is, the central role of the health professional in the process of learning^(20,30). However, collective feedback is also an important alternative, since it is in the collective exercise of the process of knowledge construction that one can favor learning and enable the transformation of praxis^(13,43-44).

This review evidenced that the studies that sustained compliance over time were supported by the management and involvement of the institution's leaders, as well as a multidimensional approach, such as the study carried out in Saudi Arabia⁽²⁴⁾, which increased HH compliance of 60.8% before the intervention to 84.9% after one year, involving the leaders during the training workshops and providing monthly feedback to the workers, ensuring their prominence.

In this sense, a study carried out in Turkey⁽¹³⁾ deserves special mention in maintaining the 91% rate of HH compliance after six years of the intervention period, with active participation of administrators during infection control meetings and education sessions with workers during all study follow-up. A similar survey, conducted in Taiwan⁽²⁵⁾, maintained HH compliance in 83.4% after four years of intervention, with effective participation of management in the actions carried out and monthly feedback to health workers.

An experimental study in Lebanon⁽³¹⁾ verified that the group that received weekly feedback individually and collectively was the one that achieved the highest rate of HH compliance after intervention, with a statistically significant result ($p < 0.001$). It is worth noting the study by Visan et al.⁽⁸⁾, who during the meetings to feedback the practices, also provided certificates to the three best professionals of the adherence, and together with the participation of management and active education, they sustained an index of 95.4% over four years.

It should be noted that the change in structure, represented mostly by the availability of alcohol gel and the supply of washbasins and paper towels, are no less important, since professionals need the means to perform HH, however, used alone, they are not able to change behaviors. The same thing happens with the component related to the distribution of reminders and posters at the health care site^(19,21,30,32,34).

In this element, it is worth mentioning the proposal made by Farhoudi et al.⁽⁴⁾, who chose to use colorful posters, in different sizes, similar to cartoons or comics that were changed monthly in order to attract the attention of health professionals. This strategy favored HH compliance, which was 29.8% to 71% after one year. Although the study did not provide information on how the cleanings were made, it is important to note that these should be cleanable and preserved, and the material should favor this technique, thus avoiding an effect contrary to the desired⁽⁴⁵⁾.

With regard to greater sustainability over time in HH compliance, interventions that presented educational actions that included the five components of the multimodal strategy maintained higher post-intervention compliance rates^(7,8,13,24-25,27,36). The self-sustaining average among these studies was 83%, and some factors, besides those related to infrastructure, can be considered as responsible

for such results, such as intervention time, which ranged from three months to one year or more, lectures and workshops used concomitantly by means of practical elucidations, immediate and/or weekly feedback, monthly reports to team leaders and managers, professional effort recognition, placards at strategic locations, screenshots on computers, and institution's commitment to security environment.

It should be emphasized that health education has been shown to be effective in rising and maintaining HH compliance rates, as long as it allows for a re-signification of behaviors and assimilation of relevant information. Thus, innovative methods must replace conservative behaviors, in order to recognize the health professional as an active subject of his work process and to question reasons for non-compliance that transcend the domain of the individual and pass through structural, organizational, educational and management components.

Study limitations

The limitations of this review consider that some included studies do not present in detail the strategies implemented, such as time of intervention and evaluation after intervention, whose analysis may present subjectivity and information gaps. However, all data from the included surveys were collected from the direct observation by means of a validated instrument recommended by the World Health Organization, which is considered the gold standard when it is desired to verify compliance⁽³⁷⁾, but which are subject to the Hawthorne effect.

Contributions for the sectors of Health and Nursing

The results of the present study are important because they portray the setting about the effectiveness of the implementation of the multimodal strategy to improve HH through the descriptive analysis of its contemplated elements and sustainability of results over time. This review brought together some of the strategic actions developed and used in different countries and institutions that have proven to be effective for HH compliance, which may help in the planning and implementation of health education in the context of the theme, since HH compliance is a global challenge, with serious negative repercussions for patient safety and the quality of health services offered.

CONCLUSION

The implementation of the multimodal strategy proved to be effective for improving HH compliance and sustainability over time, especially when all five components of the intervention were used in an appropriate, articulated and interdependent manner. The results suggest that the use of isolated elements, such as the change in infrastructure or distribution of educational posters or punctual health education is not enough to guarantee HH compliance. Likewise, important elements should be considered in the planning and execution of said strategy to increase HH and ensure its sustainability, such as the involvement and commitment of management with security actions, individual and/or collective feedback and the use of active and permanent methodologies

for health education. In this context, the achievement and dissemination of study results through multicomponent intervention is encouraged as a way to identify successful approaches, looking for possible implementation adequacy and continuous improvements in health care environments.

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