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REVIEW

Educating healthcare workers to optimal hand hygiene practices: addressing the need

E. Mathai · B. Allegranzi · W. H. Seto · M.-N. Chraïti ·
H. Sax · E. Larson · D. Pittet

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Abstract The education of healthcare workers is essential to improve practices and is an integral part of hand hygiene promotional strategies. According to the evidence reviewed here, healthcare worker education has a positive impact on improving hand hygiene and reducing healthcare-associated infection. Detailed practical guidance on steps for the organization of education programmes in healthcare facilities and teaching–learning strategies are provided using the World Health Organization (WHO) Guidelines for Hand Hygiene in Health Care as the basis for recommendations. Several key elements for a successful educational programme are also identified. A particular emphasis is placed on concepts included in the tools

developed by WHO for education, monitoring and performance feedback.

Keywords Healthcare workers · Hand hygiene · Healthcare-associated infection · WHO recommendations · Educational programmes · Behavioural change

Introduction

Hand hygiene is the single most effective measure to prevent the transmission of healthcare-associated pathogens. Several studies have shown that ensuring sustained compliance with this very simple task is a constant challenge for healthcare workers (HCWs), even in settings without any resource constraints. The attitudes and behaviour of different professional groups significantly affect hand hygiene compliance [1–6], and interventions to motivate behavioural changes are of critical importance in bringing about improvement. Appropriately, most successful hand hygiene promotional strategies in health care have been multimodal and focused primarily on activities that facilitate behavioural change [6–11]. A key factor is to ensure that HCWs have an adequate knowledge of the role their hands play in the spread of healthcare-associated infection (HCAI) during different patient care activities that can result in hand contamination. This awareness is necessary to help them understand their capacity to contribute to prevent HCAI through effective and sustained behaviour change (self-efficacy). Knowledge influences behaviour directly and is essential for the individual to be able to evaluate the extent of the threat and to understand that a given behaviour can counteract or increase that threat. Conversely, lack of knowledge about the need for hand hygiene, the appropriateness and efficacy of agents used as

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E. Mathai · B. Allegranzi · D. Pittet
First Global Patient Safety Challenge, World Health
Organization Patient Safety, Geneva, Switzerland

W. H. Seto
Department of Microbiology, Queen Mary Hospital, Hong Kong,
Hong Kong Special Administrative Region, China

M.-N. Chraïti · H. Sax · D. Pittet
Faculty of Medicine, Infection Control Programme, University
of Geneva Hospitals, Geneva, Switzerland

E. Larson
Columbia University School of Nursing and Joseph Mailman
School of Public Health, New York, NY, USA

D. Pittet (✉)
Infection Control Programme, University of Geneva Hospitals
and Faculty of Medicine, 4 Rue Gabrielle Perret-Gentil,
1211 Geneva 14, Switzerland
e-mail: didier.pittet@hcuge.ch

well as a lack of awareness of the very low adherence rates to hand hygiene protocols among HCWs can contribute to poor hand hygiene compliance [1].

Guidelines provide evidence-based information and influence HCW practices. However, the successful implementation of recommendations requires additional strategies, including educational interventions, to ensure that guidelines are translated into daily practice and become part of HCWs' core competencies [12]. Based on these considerations, the World Health Organization (WHO) recommends that education be an integral part of any strategy aimed at implementing its recently published Guidelines on Hand Hygiene in Health Care [13]. Other major organizations also recommend that education be used as a strategy for improving hand hygiene in health care [14, 15].

Education covers a broad range of activities and can be delivered through various channels, including curricula for medical and nursing students, continuing education organized during conferences and meetings of professional bodies and in-service sessions in healthcare facilities for existing and new staff. For the purpose of this review, any programme organized within a healthcare facility with the aim to improve knowledge and awareness on one or more aspects of hand hygiene, such as the need for this practice ("why"), indications ("when"), and techniques ("how"), is considered as an "education programme".

Review process

The focus of this review is on providing some practical suggestions and recommendations to develop such programmes using the WHO Guidelines on Hand Hygiene in Health Care as the core reference document. It also provides an overview of evidence related to the impact of education on hand hygiene, which will be of use for the local development of programmes. The overview is based on inferences drawn in systematic reviews and a few other relevant studies archived in PubMed between January 1966 and June 2009.

Overview of studies on impact

Educational interventions are universally accepted as an integral part of programmes aimed at improving HCW practices. Although identifying and implementing strategies capable of inducing behavioural change is very challenging and complex, many studies published in the last 25 years have demonstrated that an improvement in compliance with hand hygiene practices can be achieved [13]. Several areas of research discussed below indicate that

educational programmes can contribute significantly and thus reduce HCAI.

Interventions for improving hand hygiene compliance are often based on a multimodal strategy with education as a key component and, therefore, it is difficult to define the relative effectiveness of each strategy component [16]. However, reviews addressing improvements in practice in healthcare settings suggest that education, reminder systems and audit and performance feedback are likely to have at least some impact on behaviour [17–19].

A systematic review published in 2001 [20] identified 11 studies with educational interventions to improve hand-washing. Although not all reported behavioural change, and improvement was demonstrated only over the short term in others, hand hygiene compliance improvement was greater using educational approaches than interventions aimed at sinks and soap. Sustainability was improved by strategically placed reminders and performance feedback [20]. Multifaceted approaches which combine several aspects of education, such as training, written material, reminders and continued feedback of performance, can have an even better and more sustained effect on hand-washing compliance.

Two systematic reviews have been published recently on interventions for the prevention of HCAI: one on behavioural strategies [21] and the other specifically on educational strategies [22]. In the former, educational activities were included in 28 of 33 studies. All studies had at least two interventions, thus making it difficult to judge the contribution of education alone. Four studies judged as being of high quality by the authors all had education as a component and showed significant reductions in HCAI or colonization rates. Improvement in hand hygiene compliance was not consistent across these studies.

The review of educational interventions to reduce HCAI included 26 studies [22], with several emphasizing the need to include a hand hygiene component. Eighteen studies provided information on hand hygiene compliance. Different educational methods were used, including didactic sessions, posters and practical demonstrations. The duration of the interventions varied significantly from 1 day to years, and additional activities other than education were also included in some studies. Twenty studies were conducted in intensive care units, and the remaining in either single wards, on a hospital-wide basis or in long-term care facilities. All but five (21/26; 81%) observed a substantial reduction in HCAI. Only three studies reported sustainability over 1 year, and all found sustainable low infection rates after the intervention. Cost effectiveness was reported in a very limited number of studies, mostly based on cost estimates associated with infections prevented. Although the data are not directly comparable, most studies report that an educational intervention could be extremely cost

effective. Some studies conducted in countries with limited resources showed encouraging results similar to those observed in developed countries.

Several additional studies using education as a key element of the intervention have been published since those included in these systematic reviews [23–32]. Similar to previous studies, different educational strategies were used, often more than one, and some had also other integrated interventions. The entire hospital staff was targeted in several studies [23, 24, 26, 27]. In general, the educational intervention led to improvements in knowledge and hand hygiene compliance, and HCAI reduction was also achieved in most reported studies [23, 27, 30–32]. A case-control study [27] compared hospitals combining the use of alcohol-based handrubs with educational activities and posters (intervention) to others with only alcohol-based handrubs available (control). Improvement in hand hygiene compliance was significantly higher in the intervention hospitals compared to the control hospitals. In another report where education was implemented following a government directive [23], there was a significant reduction in methicillin-resistant *Staphylococcus aureus* (MRSA) rates. However, there was no significant change in hand hygiene compliance or alcohol-based handrub consumption. Unfortunately, data are insufficient to understand the degree of sustainability from these reports; at least one study reported a lack of sustainability at 3 months [28].

Education has been successfully used to improve hand hygiene in healthcare settings other than hospitals and in the community [33–36]. Therefore, the impact of education on hand hygiene compliance is substantial, at least in the short term. For long-term effects, measures such as reminders, audit and feedback are beneficial [37–40].

The studies used different content and delivery strategies for implementing education and various assessment methods. Training sessions were conducted using regular presentations, posters, e-learning, reflective discussion, videos, self-learning modules, practical demonstrations, feedback from assessment, or combinations of different methods. Information is lacking, however, on the rationale for choosing a particular approach, the teaching–learning methodologies used, the content covered, the mechanisms and individuals involved in delivery, and the learners' profiles as well as details of the methods for assessing knowledge improvement. All these different factors have an impact on outcome.

Several reports, especially the earlier ones, are based on small sample sizes restricted to specialized areas within the hospital, such as intensive care units. Data on long-term compliance are insufficient in almost all reports. Practices sometimes differ between professional groups and during different work shifts [41]. It is recognized that physicians are usually more resistant to hand hygiene-related

behavioural change [1, 7, 42, 43] and less prone to attend educational sessions than other HCW categories, but educational strategies specifically addressing these aspects have not been reported in published studies. Hence, further efforts are required to develop and validate different educational tools, to evaluate their effectiveness to induce and sustain the required change among different professional categories, and to test their applicability and reproducibility in different types of healthcare facilities. Furthermore, data are required to estimate the resources needed for educational interventions and their cost effectiveness to enable appropriate planning and long-term sustainability.

Key factors for the success of a programme

Conventionally, education is delivered through traditional didactic sessions that aim at developing competency through improved knowledge and skills [44], with the assumption that compliance with best practices will follow. More recently, methods mimicking contextual conditions and stimulating reflective thinking, such as interactive e-learning, videos of real-life situations, experiential learning and participatory sessions, have been developed and are increasingly used. These facilitate better perceptions of the problems and adoption of the proposed solutions by HCWs, although there is no evidence so far as to which method may be the more effective. Considering the variability of resources available, cultural background and the extent to which hand hygiene is practised in facilities across the world, educational programmes need to be tailored to meet local needs. From the scanty evidence available, it has been possible to determine some of the essential features of an effective education programme (Table 1).

HCW behaviour is influenced by peers and superiors. Role modelling behaviour by senior staff and those in authority are identified as critical for promoting adherence to safe practices [3, 13, 45, 46]. Such behaviour adds to the knowledge gained in education and confirms that hand hygiene is an institutional priority. Statistical modelling on relevant components of hand hygiene behaviour among nurses found peer pressure from senior physicians and administrators and role modelling to be important contributors to the intention to perform hand hygiene [3]. A lack of role models is also identified as one of the risk factors for sustained behaviour change [13].

Recommendations for organizing an education programme

Although data on the impact of education as an intervention and on the appropriate approaches for this intervention

Table 1 Key features for the success of an educational programme

Feature	Conceptual description	Reference
Continuity	Education must be ongoing; several studies show that knowledge improvement is not sustainable in the absence of a continuous reinforcement of messages	[20, 28, 62]
Perception surveys	Understanding healthcare workers' perception of the importance of healthcare-associated infection and hand hygiene and how their performance in a specific facility can help to develop locally relevant educational interventions	[4, 48–50, 65, 66]
Monitoring and feedback of local practices	Reporting results of local hand hygiene compliance can help raise awareness of the need for practice and knowledge improvement	[37–40]
Use of practical educational tools	Prepackaged hand hygiene educational tools facilitate implementation and standardization of educational messages	[13, 67, 68]
Commitment from healthcare facility administration	Education should be a high priority among the objectives of the institution	[69]
Role modelling by senior staff	Role model behaviour from senior staff complements education and motivates practice	[3, 13, 45, 46]
Availability of infrastructure	All essential supplies and equipment required to practise the measures recommended through education should be permanently available	[63–70]
Use of a multimodal strategy	Integrating training with other strategy components (e.g., reminders, performance feedback) is essential to consolidate educational messages	[5, 21, 25, 27, 62–64]
Teaching–learning method	Several teaching approaches are likely to be effective Printed educational materials alone have small beneficial effects on professional practice	[21, 22, 62] [71]

are scanty, education is well accepted as a method for providing information with the aim of changing behaviour. The WHO Guidelines on Hand Hygiene in Health Care describe steps, based on available evidence and expert opinion, that are critical in organizing a successful educational programme to implement the guidelines [13]. These are summarized below.

Preparation for the intervention

- (1) Review recommendations and existing practices. Infection control professionals, knowledgeable in evidence-based recommendations and experienced in current practices in the institution, are key players in this first step. This review should highlight recommendations that are considered to be critically important for success in the healthcare facility. This will enable the education programme to prioritize and focus on practices that require modification, instead of covering all recommendations in a similar manner. These prioritized recommendations may require endorsement from the management and/or from the infection control committee.
 - (i) *Established practice*. A policy for the practice is already present or is already standard practice in the institution, such as washing hands that are visibly dirty or visibly soiled with blood or other body fluids.
 - (ii) *Non-established practice—easy implementation*. It is expected that HCWs will agree with the rationale for the recommendation and that required resources are available. Such recommendations could be easily implemented following conventional in-service educational programmes using lectures or posters, such as an intervention to improve hand antisepsis before inserting peripheral vascular catheters or other invasive devices.
 - (iii) *Non-established practice—difficult implementation (lack of resources)*. It is anticipated that implementation would be difficult, mainly because of the lack of resources, such as the need for alcohol-based handrub at the point of care, especially in areas of high workload and high-intensity patient care.
 - (iv) *Non-established practice—difficult implementation (HCW resistance)*. HCW resistance can be expected to be high for such interventions, for example, for hand antisepsis after glove removal, as HCWs may consider their hands to be clean, having been protected by gloves.
- (2) Categorize recommendations. During the review, recommendations can be organized under four categories based on existing practices and situations. Front-line senior nurses in the hospital usually have an accurate knowledge of actual practices on the wards [47].
 - (3) Address issues identified during the review before launching the education programme. Ensure good quality and sustainable supplies of all required items. If HCW resistance is anticipated, the reasons and factors leading to it should be identified. A focus

group consisting of HCWs from the relevant areas of care is a dependable method of gathering such information [48–50]. If necessary, this can be followed by a simple survey of the key concerns identified. Using the same methods, information on determinants of good hand hygiene practices can also be collected.

- (4) Measure indicators at baseline. HCW knowledge and perceptions should be measured at this time. It is also important to have indicators such as hand hygiene compliance rates and product consumption measured at baseline in order to monitor and evaluate the intervention. Tools to measure these indices are already available through WHO (<http://www.who.int/gpsc/en/>; accessed 14 May 2010).
- (5) Prepare the programme. Aims, objectives and the time schedule for developing the programme and implementing it throughout the hospital should be agreed upon and involve all key players.
- (6) Identify resources. Resources needed for the education programme in terms of staff, time and materials should be identified. The value of committed and effective teachers with insight in how humans learn cannot be overstated. Appointing an infection control link-HCW, preferably a senior member from the team in each hospital ward, and providing him/her with prior training in the intervention could prove to be useful [51]. In this way, he/she will then become a representative of the infection control team in the respective ward and can help identify the reasons for resistance to the recommendations, prepare wards for better acceptance of the intervention, facilitate training and promote good practice at the point of care.

The education programme

The objectives, content and structure of the programme need to be formulated to take into account local priorities and resources and to target all categories of HCWs and students. The programme should be tailored to suit the skills and requisite capacities of each target audience in the healthcare facility. The training package should contain not only educational content, but also strategies for teaching–learning and for assessing practice performance. The stated objectives should cover the three learning “domains” in Bloom’s taxonomy, i.e., affective, psychomotor and cognitive, to facilitate the acquisition of knowledge, skills and the right attitudes [52]. Information generated during the planning phase review and focus groups will be valuable in developing objectives to match the needs.

Table 2 Suggestions for the content of educational programmes to improve hand hygiene in healthcare facilities

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1. Burden of health care-associated infections (HCAI)
 - a. Mortality, morbidity, economic costs associated with HCAI
 2. Rationale for hand hygiene
 - a. Potential risks of transmission of microorganisms to patients
 - b. Potential risks of healthcare workers’ (HCW) colonization or infection by organisms acquired from the patient
 - c. Methods of reducing transmission through hands
 3. Indications for hand hygiene
 - a. Five moments for hand hygiene action and examples
 - b. Concept of patient zone and environmental surfaces in the vicinity of patients
 4. Techniques for hand hygiene
 - a. Handrubbing with alcohol-based handrub
 - b. Handwashing
 - c. Choice of hand hygiene agents
 5. Methods to maintain hand skin health
 - a. Skin care recommendations
 - b. Reporting adverse events
 6. Glove use
 - a. Indications and other recommendations regarding use
 - b. Hand hygiene: before and after
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Programme content should be based on the objectives and address the “why”, “when” and “how” aspects of hand hygiene and promote behaviour change. Table 2 provides a number of suggestions of topics to be included. Using a standardized model for hand hygiene, such as the “five moments”, will be an advantage in imparting knowledge on “when” [53]. Recommendations are available for “how” (http://www.who.int/gpsc/5may/Hand_Hygiene_Why_How_and_When_Brochure.pdf; accessed 14 May 2010), and there are several sources to explain “why” (<http://www.who.int/gpsc/5may/tools/en/index.html>; accessed 14 May 2010) [13]. It is also important to develop a communication channel to regularly remind HCWs (e.g., posters, e-mail, etc.).

Teaching–learning strategies should aim at continuing and progressive education to address the different objectives and preferably include a variety of teaching–learning methods, including those that facilitate reflective thinking [54]. The following approaches are used:

- (1) Oral presentation: the trainer presents the topic by a traditional lecture accompanied by one or several other methods (e.g., interactive whiteboards, video).
- (2) Demonstration: the trainer shows how to perform a certain procedure and assists the trainee in its performance. Visual demonstration of the effectiveness of hand hygiene, for example, the use of a fluorescent dye [26], has a strong impact and will also help in the evaluation of the technique [55].

- (3) Interactive learning: based on his/her background (knowledge, acquired mastery of a given topic), the trainee builds up knowledge starting from a specific question and by establishing links. This can be facilitated through e-learning and has been successfully used to improve hand hygiene [32, 56]. This method offers considerable flexibility in time, space and selection of content and curricula and may be particularly useful if a large and varied HCW population has to be trained. Cognitive, emotional, behavioural and contextual perspectives as well as assessment and feedback can be built into the training module. Another advantage is that the content can be updated based on evolving knowledge, and the training material developed can be also used by other facilities. Good acceptability of this mode of training by HCWs has been reported [57]. One drawback is that basic computer skills and easy access to computers and the internet are required, which may represent a possible limitation in many facilities. Another limitation is that a considerable amount of time and expertise is required to develop effective e-learning modules, and these are dependent on financial resources available and administrative support [56], although the long-term benefits may outweigh these concerns.
- (4) Problem-solving approach: the trainee is asked to find the information needed to solve a problem and thus learn from information gathered.
- (5) Experiential learning: the trainee is stimulated to evaluate his/her personal experience in practical situations and to learn from this. These experiences can be significant influences in modifying behaviour, including hand hygiene [58].
- (6) Guideline summaries, leaflets, brochures or information sheets should be made also available to the HCW. The choice of appropriate learning methods to convey different aspects and a tight alignment between these can ensure that the programme caters to the needs of each trainee and help build competence. Some tools for educational intervention are available from: http://www.who.int/gpsc/5may/tools/training_education/en/index.html (accessed 14 May 2010). Successful application of other techniques for persuasion, such as the use of opinion leaders and participatory decision-making, has been reported in healthcare facilities [59, 60]. These interventions can be time-consuming and could be reserved for recommendations requiring attitude change, in particular in the case of HCW resistance. Further research is needed to assess their role for sustained institutional culture change.

Monitoring, evaluation and feedback

The overall functioning and impact of the programme and individual educational strategies must be regularly evaluated and the lessons learned used to strengthen and sustain the programme. Assessment of improvements in knowledge and the practices of individual HCWs is an important part of the education programme. Tools for data management are available from: http://www.who.int/gpsc/5may/Instructions_for_Data_Entry_and_Analysis.doc (accessed 14 May 2010). Feedback on practices with specific proposals for improvement is also a form of education [37]. HCAI rates or infection rates with specific multidrug-resistant bacteria can be used as outcome measures, and the results obtained should be compared with the baseline values to chart progress. However, these types of changes take time and may not be useful for evaluating the education programme in the short term. Feedback on the programme can be also sought from staff.

Conclusion

Although education alone is likely insufficient to effect sustained changes in staff hand hygiene practices, it is one component of any programme to improve hand hygiene in healthcare settings. Educational programmes must be adapted to local needs and resources and must be primarily focused on “why”, “when” and “how” and behavioural change. Guidelines and tools for most aspects of an educational programme to improve hand hygiene in healthcare facilities have been developed by WHO and other agencies [61]. The WHO guidelines and tools are available for wider use and can be accessed free of charge through <http://www.who.int/gpsc/> (accessed 14 May 2010). Once modified according to local requirements, they will help in promoting uniform standards of practice.

Given the paucity of data on various aspects of educational interventions in improving hand hygiene in health care, facilities worldwide should be encouraged to document their experiences, including details on all aspects of the intervention and its evaluation. While appreciating the critical role of a formal education programme in achieving better adherence to hand hygiene protocols, it is also important to emphasize that educational programmes alone are not sufficient to guarantee improvement [21, 27, 62, 63]. A multifaceted approach [5, 21, 25, 62–64], including interventions aimed at strengthening the facility infrastructure and supplies and those addressing cognitive, behavioural and administrative aspects, is fundamental to improving hand hygiene in health care.

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