

Ann Ig 2016; 28: 441-449 doi:10.7416/ai.2016.2126

Healthcare Associated Infections: educational intervention by “Adult Learning” in an Italian teaching hospital

A. Rinaldi¹, A. Marani¹, M. Montesano², S. Berdini², M.C. Petruccioli², F. Di Ninno¹, R. Orioli¹, F. Ferretti¹, G. Tarsitani³, C. Napoli³, A. De Luca², G.B. Orsi¹

Key words: healthcare associated infection, prevention, education, adult learning

Parole chiave: infezioni correlate all'assistenza, prevenzione, educazione, andragogia

Abstract

Background. An educational intervention for HAI prevention based on a combination of training, motivation and subsequent application in the current clinical practice in an Italian teaching hospital.

Methods. In 2015-2016 a pilot mandatory training on HAI targeted to HCWs was organized in the 450 bed teaching hospital Sant'Andrea in Rome. By adopting the “Impact/control matrix” prioritization tool, the relative level of impact (risk in causing or favoring HAI) and control (possibility for HCWs to prevent HAI) attributed by the participants to the issues associated to HAI during their working groups was evaluated.

Results. Overall, 34 physicians, 43 nurses and 15 non clinical professionals participated actively in seven courses, identifying 58 different issues related to HAI, which were reported 128 times. Results showed frequently that, within the same type of issue, HCW referred various levels of impact (risk in causing or favoring HAI) and personal control (possibility for HCW to prevent HAI). Overall staff shortage was the most reported problem by HCW in our hospital. Also hand washing was regarded as a main problem, but HCW expressed the feeling that individuals could act more successfully on this issue (high or medium control). Results showed that staff frequently did not know how to handle correctly visitors, similarly many colleagues expressed some difficulty in communicating information to patients and relatives on HAI. Surprisingly, “antimicrobial therapy” and “excessive invasive procedures” were not particularly highlighted by the personnel. HCW expressed satisfaction for the course approach.

Conclusions. The study showed an overall good level of knowledge regarding the importance and principles of infection control in our teaching hospital HCW. However personnel perceived a variability in the impact of many issues on HAI and even more on the personal possibility to control their effect. In order to improve HCW compliance with HAI prevention programs, the “Adult Learning” model seems to be very useful.

¹Department of Public Health and Infectious Diseases, “Sapienza” University of Rome, Italy

²Health Direction, Azienda Ospedaliero Universitaria Sant'Andrea, “Sapienza” University of Rome, Italy

³Department of Medical-Surgical Sciences and Translational Medicine, “Sapienza” University of Rome, Italy

Introduction

Healthcare acquired infections (HAI) are an important cause of morbidity and mortality in hospitals, where about 5-10% of patients are affected, determining high associated mortality (1, 2) and adding costs (3, 4).

Strategies of prevention and control have been stated and shared by many national and international organization as World Health Organization (WHO), Centers for Diseases Control and Prevention (CDC) and European Centers for Diseases Control (ECDC) and all consider healthcare workers (HCW) training in infection control a milestone to improve patient safety (5-8).

In healthcare settings, ongoing education is required for several reasons. First, all healthcare providers need to participate in ongoing education to remain abreast of the scientific innovations in the field of infection control. Secondly, technologic innovation demands learning new skills. Third, regulatory bodies – both national and international - now require that workers receive ongoing training in a variety of areas, depending on their job duties (9).

In order to improve HCW clinical practice we often need to change behaviours. This is an extremely difficult task, and it is often assumed that providing information on a topic will lead to knowledge gain and practice improvement (10, 11). However, this assumption is flawed, with many studies demonstrating that, although knowledge can be achieved via provision of training, it does not usually result in sustaining behavioural changes (12). To improve HCW compliance with prevention practices, infection control teams should learn from behavioural sciences, since the degree of knowledge (microbiological and epidemiological) about transmission precautions does not necessarily predict appropriate behaviour. Therefore, education must be conducted in order to modify appropriately the practices.

The paper describes the results of a pilot study of an educational intervention for HAI prevention based on a combination of training, motivation and subsequent application in the current clinical practice in an Italian teaching hospital.

Methods

The study was carried in the 450-bed teaching hospital Sant'Andrea in Rome, a tertiary referral centre with 37 clinical units and approximately 24,000 inpatient discharges per year.

During the previous nine years, point prevalence surveys enrolling a total of 2,840 patients were carried out (13). Also from 2012 a routine surveillance by alert organisms was implemented.

In 2015, a pilot mandatory training on HAI targeted to HCWs was organized and repeated in 2016. The training with an adult learning approach focused to change behaviours, beliefs and habits concerning traditional hospital hygiene issues. To achieve this goal, participatory techniques, group discussions and procedure demonstrations were adopted. This course was part of continuous medical education for the hospital HCWs. There were seven training editions, targeted to the wards (Gastroenterology, Nephrology, Immuno-Rheumatology, Internal Medicine, Emergency Medicine, Neurosurgery, Vascular surgery, Haematology, Oncology) that reported the highest HAI frequency according to alert organisms surveillance. The training course was divided in two day sessions (5 hours each).

First session

Following a general lecture on HAI, using prevalence surveys and routine surveillance by alert organisms data, the personnel received a specific epidemiological information on HAI (e.g. rates, aetiology, antimicrobial resistance, risk factors, outcomes) in their

wards. Also, principal infection control procedures (e.g. hand hygiene, contact precautions, insulation) routinely adopted in the hospital were analyzed. HCWs were divided in working groups and asked to identify the principal causes for HAI in their wards and to propose precise actions to prevent them. HCW working groups were encouraged to adopt a four step problem solving model (Mental Research Institute) (14): a) clear problem definition; b) analysis of preceding attempted solutions; c) clear definition of new solutions; d) a program of solutions to be implemented.

First, HCW working groups highlighted all principal causes and problems related to HAIs in their wards; secondly, the participants were asked to evaluate their level of possible intervention on the issue (control level). In order to carry out correctly this analysis, every group adopted a prioritization tool called ‘Impact/control matrix’ (figure 1) (15). This instrument illustrates, for each single issue, the control level (from low to high) on one axis and the related impact (from left to right) on the other axis. HCWs were encouraged to identify problems that could have a high, medium, or low impact on HAI prevention and determine the amount of control they had over them.

Second session

Following problem solving steps 3 and 4, participants focused one important issue related to HAI control and designed an action strategy to implement intervention.

According to the ‘Impact/control matrix’, all issues with “Low Control” level were excluded from the possible final solution proposals. On the contrary, all issues with “Medium Control” or “High Control” level were included in the prevention strategy. The final prevention strategy was carried out considering the SMART model (Specific, Measurable, Achievable, Relevant, Time based) method (16). Finally, the HCWs presented their solutions with a final discussion in a plenary session.

In order to evaluate influence on HCW clinical practice and overall satisfaction, at the end of the training sessions a questionnaire was administered. Satisfaction degree assessment was performed by identifying 5 levels based on a score from 1 to 5. Five levels were labeled as “full satisfied” (score: 4 or 5) versus the other rates of satisfaction (score: 0, 1, 2).

We also included direct observation of participants in their ward to monitor their compliance with correct infection control practices.

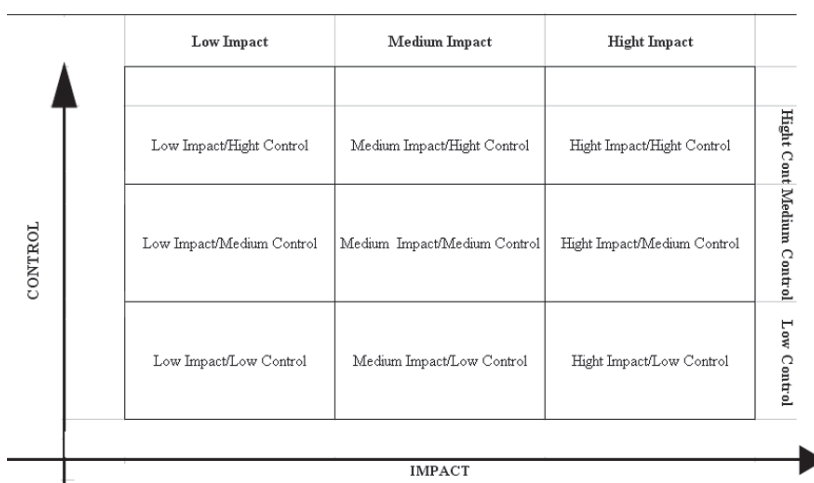


Figure 1 - “Impact/control matrix” prioritization tool

Furthermore, the principal results of the courses were reported by participants during infection control team meetings, in order to verify the feasibility of the proposed solutions.

Results

During 2015-2016, 92 out of 147 invited HCWs (62.6%) attended seven course editions. Overall, 34 physicians, 43 nurses and 15 non clinical professionals (technical personnel, pharmacists) participated actively in the courses (Table 1).

Overall, during the two years experience, course participants identified 58 different issues related to HAI, which were reported 128 times. In consideration of their key components, these issues were classified in three large categories: a) *behavioural*, when HCW activity was directly responsible for the infection; b) *organizational*, for all situations in which the hospital work organization was involved; c) *structural*, when the hospital building and the environment was related to the infection. By adopting the “Impact/control matrix” prioritization tool, the relative level of impact (risk in causing or favoring HAI) and control (possibility for HCWs to prevent HAIs) attributed by the participants to the issues associated with HAI during their working groups was evaluated. Table 2 shows the distribution of the 15 most

frequent issues (reported in at least two different course editions) as they were perceived by HCWs and the ranking of the issues was discussed with the trainers during the plenary session.

Overall, the results showed that HCWs perceived a variability in the impact of many issues on HAI and even more on the personal possibility to control their effect. Frequently, the same issue was described as having a high or medium impact, but, more often, the perceived control level was even wider.

Although with distinction between general personnel and HAI dedicated personnel, overall a staff shortage was the most reported problem by the course participants in our hospital. In both cases it was reported as an issue with high impact on HAI burden but with low possibility of intervention for the personnel (low control). Also hand washing was regarded as a main problem, but the HCWs expressed the feeling that individuals could act more successfully (high or medium control). However, in some cases, the staff underlined the lack of hand washing facilities. Other two aspects that were reported frequently were “relatives’ visit” and “wound medication”.

Surprisingly, among behavioural category “antimicrobial therapy” and “excessive invasive procedures” importance in HAI, pathogens and antimicrobial issues were not particularly highlighted by the personnel. Overall, structural issues were not frequently reported.

Table 1. HCW distribution in the seven training course editions

	2015			2016				Total Participants/ Invited HCW
	I edition	II edition	III edition	I edition	II edition	III edition	IV edition	
Physicians	2	5	2	8	4	10	3	34/61
Nurses	9	4	3	2	9	8	8	43/67
Non clinical personnel	-	-	8	-	5	1	1	15/19
TOTAL	11	9	13	10	18	19	12	92/147

Table 2 - Distribution of most frequently reported issues by prioritization through the impact/control matrix

Category*	Issue	High impact/ High control	High impact/ Medium control	High impact/ Low control	Medium impact/ High control	Medium impact/ Medium control	Medium impact/ Low control
1	Hand washing	++	+++++	+++		+	+
1	Wound medication	++	+++	+	++		
1	Antimicrobial therapy	+	+	+		+	
1	Protocols non compliance	++	+			++	
1	Invasive procedures excess	++					
2	Personnel shortage		+	+++++++			+
2	HAI dedicated personnel	+		+++++			+
2	Relatives' visits		+++		+	+++++	+
2	Information on HAI to patients and relatives	+	++	+	+	++	
2	Patient infected on admission			+++++			+
2	Lack of training on HAI	+	+	++			
2	Controlling visitors		+	+	+	+	
3	Environmental decontamination	+		+			
3	Patients' crowding		++				
3	Waste management	+				+	

1*: behavioural; 2: organizational; 3: structural

Table 3 - HCW course satisfaction and opinions distribution

	2015			2016			
	I edition	II edition	III edition	I edition	II edition	III edition	IV edition
How do you evaluate the importance of the subject debated in consideration of your professional needs?	4.6	4.3	4	4.3	4.6	4.3	4.8
How do you evaluate the course training quality?	4.5	3.8	4.3	4.3	4.6	4.6	4.9
Were the course topics suitable for your level?	4.6	3.8	4.2	4.5	4.6	4.5	5
Do you believe that the course arguments have been developed?	4.7	4	4.5	4.6	4.5	4.6	5
How do you evaluate the adopted teaching methodology by respect to the programmed topics?	4.8	4	4.5	4.6	4.6	4.5	5

With regard to the training satisfaction, >80% participants answered the questionnaire. The HCW course satisfaction and the opinions distribution are reported in Table 3.

Discussion

HAIs have become an important public health issue worldwide, including Italy (17-20), causing serious outbreaks (21) and an emergence in antimicrobial resistance (22). Therefore HCW education is considered a milestone in any infection control strategy (5-7).

Adult teaching models (active learning) allow the learner to explore topics of interest, and to review their views and the evidence at their own pace (23). Each time an individual revisits a topic and explores the issues, he will be questioning his beliefs, and this may eventually lead to a change of views and a decision to change his practice (12).

The approach of the educational program described in this paper starts from the assumption that HCW clinical practice is the result of a complex combination of knowledge, skills and attitudes.

Knowledge can be taught formally in the classroom, and informally on the job. Skills are practical tasks, ranging from very simple procedures to complex investigative techniques. Training and development in healthcare has historically focused on development of knowledge and competency in skill delivery, and this includes mandatory infection control training. Whilst these aspects of training and development are important, there is much literature demonstrating that these alone are not sufficient to ensure staff practice in an evidence-based manner. The key aspect, that is often overlooked, is the importance of attitudes in influencing clinical practice behaviour. Attitudes are a product of individual beliefs, professional and personal life experiences. These are unique to each individual, and cannot be taught or assessed. Staff must believe that change is necessary in order to make changes in everyday practice (24).

Although the study was carried out only in one center, as the training course lasted about two years and 92 HCWs were selected from nine wards, we are confident that the results are fairly representative of our working context.

We found an overall good level of knowledge regarding the importance and principles of infection control. The HCWs highlighted over 50 issues related to HAI and showed a high active participation in the working groups. Thanks to working groups, participants with different professional roles shared their experiences, knowledge and concerns about HAI control in their ward. Furthermore, by using the “impact/control matrix” prioritization tool, participants focused on the principal causes of HAIs and indicated which of them they perceived as under their control and which not.

The main finding was that various important issues (i.e. hand washing, antimicrobial therapy, etc) were considered by the HCWs as having a varying impact in determining HAIs. Similarly the sensation of control over specific issues was frequently perceived differently (Table 2). Unfortunately, it was not possible to stratify these results for staff category, because it was a team work.

As expected, “HAI dedicated personnel shortage” and “hand hygiene” were referred frequently as important issues practically in all course editions.

The courses revealed that ward staff frequently did not know how to handle correctly visitors, similarly many colleagues expressed some difficulty in communicating information to patients and relatives on HAI. In our opinion this result underlines the need to improve hospital internal communication, but also may be influenced by a “defensive medicine” attitude.

Surprisingly, among the behavioural categories, “antimicrobial therapy” and “excessive invasive procedures” were not frequently reported as overall structural issues.

Course evaluation demonstrated that participants were fully satisfied by this approach (Table 3).

However, this study may present some limitations. First, the course evaluation needs to be improved in order to verify

more precisely the adult learning model effectiveness in order to modify clinical staff’s attitudes and subsequent behavioural change. Second, since the pilot study has been realized in a single hospital, evaluation should be extended as a multicenter study.

Conclusions

The study showed an overall good level of knowledge regarding the importance and principles of infection control in the HCWs of our teaching hospital. However, personnel perceived a variability in the impact of many issues on HAI and even more on the personal possibility to control their effect. Frequently, the same issue was described as having a high or medium impact, but, more often, the perceived control level was even wider.

In order to improve HCW compliance with HAI prevention programs, adult learning model seems to be very useful.

Riassunto

Intervento di educazione mediante “Adult Learning” sulle infezioni correlate all’assistenza in un ospedale universitario italiano

Introduzione. Un intervento educativo sulle infezioni correlate all’assistenza (ICA) basato su training, approccio motivazionale e conseguente applicazione nelle attività cliniche è stato condotto in un ospedale universitario italiano.

Metodi. Nel 2015-2016 un corso di formazione obbligatorio sulle ICA è stato organizzato nell’ospedale universitario Sant’Andrea di Roma. Adottando come strumento una “matrice impatto del rischio/controllo” è stato valutato il livello relativo di impatto (rischio nel determinare ICA) e controllo (possibilità per il sanitario di prevenire le ICA) attribuito dai corsisti ai problemi correlati alle ICA.

Risultati. In totale hanno partecipato ai sette corsi 34 medici, 43 infermieri e 15 unità di personale tecnico, che hanno identificato 58 differenti problemi correlate alle ICA che sono stati riportati 128 volte. I risultati hanno frequentemente evidenziato, all’interno dello stesso fattore di rischio, come i sanitari rilevassero livelli d’impatto diversi (rischio di determinare o favorire le ICA) e pos-

sibilità di controllo (capacità per il sanitario di prevenire le ICA). In generale la carenza di personale è risultato il problema riportato più spesso. Inoltre il lavaggio delle mani è emerso come un problema principale, ma i sanitari hanno espresso il convincimento che la volontà e motivazione dei singoli potesse risolvere la questione (livello di controllo alto e medio). I risultati hanno evidenziato spesso come i sanitari non sapessero come gestire correttamente i visitatori, e molti colleghi hanno espresso alcune difficoltà nel comunicare le informazioni ai pazienti ed ai parenti sulle ICA. Sorprendentemente, “terapia antimicrobica” ed “eccesso di procedure invasive” non sono state rilevate frequentemente tra i problemi correlati alle ICA. I partecipanti al corso hanno espresso un elevato soddisfacimento per l’approccio del corso.

Conclusioni. In generale lo studio ha evidenziato un buon livello di conoscenza da parte dei sanitari riguardo l’importanza ed i principi di controllo delle infezioni nel nostro ospedale universitario. Comunque il personale ha riferito un giudizio variabile sull’impatto di diversi fattori di rischio segnalati ed anche sulle possibilità di controllarli e ridurli da parte del personale. Al fine di migliorare l’adesione dei sanitari ai programmi di prevenzione delle ICA, il modello di corso “Adult Learning” è apparso molto utile.

References

1. European Centre for Disease Prevention and Control (ECDC). Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. Stockholm: ECDC, 2013.
2. Magill SS, Edwards JR, Bamberg W, et al. Multistate point-prevalence survey of health care-associated infections. *N Engl J Med* 2014; **370**: 1198-208.
3. Roberts RR, Douglas Scott R, et al. Costs attributable to healthcare-acquired infection in hospitalized adults and a comparison of economic methods. *Med Care* 2010; **48**(11): 1026-35.
4. Zimlichman E, Henderson D, Tamir O, et al. Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. *JAMA Intern Med* 2013; **173**(22): 2039-46.
5. World Health Organization (WHO). Patient Safety: WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge, Clean Care is Safer Care. Geneva, Switzerland: World Health Organization, 2009.
6. Siegel JD, Rhinehart E, Jackson M, Chiarello L and Healthcare Infection Practices Committee. Management of multidrug-resistant organisms in health care settings. *Am J Infect Control* 2007; **35**: S165-193.
7. Muto CA, Jernigan JA, Ostrowsky BE, et al. SHEA Guideline for preventing nosocomial transmission of multidrug-resistant strains of staphylococcus aureus and enterococcus. *Infect Control Hosp Epidemiol* 2003; **24**: 362-86.
8. Brusaferrero S, Arnoldo L, Cattani G, et al. Harmonizing and supporting infection control training in Europe. *J Hosp Infect* 2015; **89**(4): 351-6.
9. Hoffman KK, Clontz EP. Education of healthcare workers in the prevention of healthcare-associated infections. In: Mayhall CG, ed. *Hospital epidemiology and infection control*. 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2011: 1384-92.
10. D’Alessandro D, Agodi A, Auxilia F, et al. Prevention of healthcare associated infections: Medical and nursing students’ knowledge in Italy. *Nurse Educ Today* 2014; **34**: 191-5.
11. Montagna MT, Napoli C, Tafuri S, et al. Knowledge about tuberculosis among undergraduate health care students in 15 Italian universities: a cross-sectional study. *BMC Public Health* 2014; **14**: 970.
12. Cooper T. Putting educational theory into clinical practice. *J Hosp Infect* 2007; **65**(Suppl 2): 124-7.
13. Marani A, Napoli C, Berdini S, et al. Point prevalence surveys on healthcare acquired infections in medical and surgical wards of a teaching hospital in Rome. *Ann Ig* 2016; **28**: 274-81.
14. Watzlawick P, Weakland JH, Fish R. *Change: Principles of problem formulation and problem resolution*. New York: WW Norton, 1974.
15. Lachman-Doucet S. *How to Manage Issues Visually with an Impact/Control Matrix*. Projerra, Visual perspectives in project management and business analysis, 2016. Available from: <http://www.projerra.ca/how-to-manage-issues-visually-with-an-impactcontrol-matrix/> [Last accessed: 2016, September 19].
16. De Luca K, Spaletta E. *Praticare il tempo. Manuale operativo per ottimizzare la vita personale e professionale*. Roma: Sovera, 2011.
17. Orsi GB, Giuliano S, Franchi C, et al. Changed epidemiology of ICU acquired bloodstream infections over 12 years in an Italian teach-

- ing hospital. *Minerva Anestesiol* 2015; **81**(9): 980-8.
18. Orsi GB, Franchi C, Marrone R, Giordano A, Rocco M, Venditti M. Laboratory confirmed bloodstream infection aetiology in an intensive care unit: eight years study. *Ann Ig* 2012; **24**: 269-278.
 19. Napoli C, Fasano F, Iatta R, Barbuti G, Cuna T, Montagna MT. *Legionella* spp. and legionellosis in Southeastern Italy: disease epidemiology and environmental surveillance in community and health care facilities. *BMC Public Health* 2010; **10**: 660.
 20. Montagna MT, De Giglio O, Napoli C, et al. Invasive Fungal Infections in Patients with Hematologic Malignancies (Aurora Project): Lights and Shadows During 18-Months Surveillance. *Int J Mol Sci* 2012; **13**(1): 774-87.
 21. Orsi GB, Franchi C, Giordano A, et al. Multidrug resistant *Acinetobacter baumannii* in an Intensive Care Unit. *J Chemother* 2008; **20**: 219-24.
 22. Orsi GB, Ciorba V. Vancomycin-resistant enterococci healthcare infections. *Ann Ig* 2013; **25** (6): 485-492.
 23. Renkl A, Atkinson RK, Maier UH, Staley R. From example study to problem solving: Smooth transitions help learning. *J Exper Educ* 2002; **70**(4): 293-315.
 24. Farrington M. Infection control education: how to make an impact-tools for the job. *J Hosp Infect* 2007; **65**(Suppl 2): 128-32.

Corresponding author: GB Orsi, Dipartimento di Sanità Pubblica e Malattie Infettive, Sapienza Università di Roma, P.le Aldo Moro 5, 00185 Roma, Italy
e-mail: giovanni.orsi@uniroma1.it