American Journal of Infection Control 41 (2013) e45-e48

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Compliance with hygiene guidelines: The effect of a multimodal hygiene intervention and validation of direct observations

Sara Mernelius MS [a,*], Per-Olof Svensson RN, BSc [b], Gunhild Rensfeldt RN, BSc [b], Ewa Davidsson RN, BSc [c], Barbro Isaksson MD, PhD [c], Sture Löfgren MD, PhD [a], Andreas Matussek MD, PhD [a]

[a] Clinical Microbiology, Division of Medical Services, Jönköping, Sweden
[b] Unit for Health Care Hygiene, Jönköping, Sweden
[c] Department of Infection Control, University Hospital, Linköping, Sweden

Key Words:
Multidisciplinary
Adherence
Double appraisal
Multiappraisal
Self-reporting
Hand hygiene
Barrier precautions
Dress code

Background: Good compliance with hygiene guidelines is essential to prevent bacterial transmission and health care-associated infections. However, the compliance is usually <50%.

Methods: A multimodal and multidisciplinary hygiene intervention was launched once the baseline compliance was determined through direct observations in 4 departments of obstetrics and gynecology. Detailed evaluations of the compliance rates were performed at point of stability (at 80%) and follow-up (3 years after hygiene intervention). Validation of direct observations was performed using blinded double appraisal and multiappraisal.

Results: At baseline, the compliance with barrier precautions and the dress code at the 4 departments were 39% to 47% and 79% to 98%, respectively. Point of stability was reached approximately 1 year after the hygiene intervention was launched. The compliance with barrier precautions was significantly higher at follow-up compared with baseline in 3 departments. In the validation by double appraisal, 471 of 483 components were judged identical between observers. In the multiappraisal, 95% to 100% of the observers correctly judged the 7 components.

Conclusion: It is possible to improve compliance with hygiene guidelines, but, to ensure a long-lasting effect, a continuous focus on barrier precautions is required. Observation is a valid method to monitor compliance.

Copyright © 2013 by the Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.

Microbial transmission and health care-associated infections (HAIs) are major problems worldwide. To prevent this, good compliance with hygiene guidelines, and especially hand hygiene, is crucial.[1] Previous investigations estimate that the compliance with hand hygiene is usually <50%.[1] There are indications that a single intervention (education) has no sustained effect on compliance with hand hygiene.[2] However, a lasting improved compliance with hand hygiene could be achieved by a multimodal hygiene intervention.[1-4] Important parts of an intervention has proven to be performance feedback on compliance rates, support from hospital administration and senior staff members, as well as involving all of the members of the staff, and all professions.[5-8] There are, however, conflicting results regarding the long-lasting effect on compliance after educational programs.[4,9,10]

Direct observation is considered the gold standard for monitoring compliance with hygiene guidelines,[11,12] although the validity of direct observations seems scarcely studied. Furthermore, monitoring compliance by direct observations is considered labor intensive and expensive. Alternative methods, such as self-reporting by health care workers (HCWs) and registration of hand hygiene product usage, are therefore sometimes preferred.[13]

A problem when comparing compliance rates is the difference in protocols used. In this study, direct observation of compliance with hygiene guidelines was performed according to the Swedish protocol (Table 1).[14] Observations were initiated in 2006 and have thereafter become mandatory at all wards where patient care, treatment, or examinations are performed.

The main goals of this study are to improve the compliance with hygiene guidelines, by use of a multimodal and multidisciplinary

* Address correspondence to Sara Mernelius, MS, Clinical Microbiology, Division of Medical Services, Ryhov County Hospital, S-551 85 Jönköping, Sweden.
E-mail address: sara.mernelius@lj.se (S. Mernelius).

Supported in part by Futurum-the Academy for Healthcare, County Council, Jönköping and the Medical Research Council of Southeast Sweden.
Conflicts of interest: None to report.

0196-6553/$36.00 - Copyright © 2013 by the Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.ajic.2012.09.008

Table 1
Constituting components of barrier precautions and the dress code, the Swedish protocol

Barrier precautions*	Dress code†
B1. Hand disinfection before patient contact	D1. Short-sleeved work dress
B2. Hand disinfection after patient contact	D2. Hands and forearms with no rings, watches, or bracelets
B3. Correct use of gloves	D3. Short or restrained hair‡
B4. Correct use of plastic apron or protective gown	

*Variables B1 and B2 "yes" or "no" only, variables B3 and B4 also "not applicable" for situations where gloves and/or apron or gown are not necessary.
†Variables D1 to D3 "yes" or "no" only.
‡Not monitored in the departments. Monitored in the validation.

hygiene intervention, and to determine for how long the improved compliance is sustained. We also validate direct observations and self-reporting by HCWs as tools to monitor compliance with hygiene guidelines.

MATERIAL AND METHODS

Setting

The study was conducted at the departments of obstetrics and gynecology at 1 university hospital (department A, 35 beds), 1 district hospital (department B, 36 beds), and 2 minor general hospitals (departments C, 12 beds, and D, 10 beds) in the southeast health care region of Sweden. Each delivery and hospital room was equipped with 1 sink, with liquid soap, paper towels, and an alcohol disinfection agent dispenser. In most rooms, an additional dispenser was located at, or in close proximity to, each bed. In department A, alcohol rub was used throughout the study; whereas, in departments B, C, and D, alcohol rub replaced gel during the last 2 years of the study. All departments primarily used nonsterile vinyl gloves and provided moisturizers.

Observations

Two to 6 members of the staff (observers) at each participating department were educated by infection control nurses on hygiene guidelines and how to monitor the compliance with these among colleagues. The observers unobtrusively monitored their colleagues' compliance with 6 of the components of hygiene guidelines (Table 1) during moments of patient care, treatment, or examinations (bedside tasks). Each of the components was assessed individually.

Baseline

In 2008 prior to the hygiene intervention (baseline), a total of 217 direct observations on barrier precautions, and 227 on dress code, was performed at the 4 departments during 1 to 2 months.

Hygiene intervention

A multimodal and multidisciplinary hygiene intervention was launched once the baseline compliance was determined. All staff members were invited and urged by the heads of departments to participate. The intervention consisted of the following 10 parts:

1. A 1-hour-long lecture on hygiene guidelines, HAIs, and the importance of compliance with hygiene guidelines.
2. A workshop where each participant individually reflected on 23 statements and 3 questions on hygiene guidelines related to their daily work for 5 minutes. Subsequently, groups of 5 or 6 participants discussed their answers for 15 minutes. Finally, the entire group reflected on the statements and questions together with infection control nurses for 30 minutes.
3. Safety briefings,[15] ie, short discussions after each shift on infection control hazards and near misses in compliance were performed during a week. Situations identified were discussed once a month with the entire staff and also corrected.
4. Six posters, emphasizing compliance with hygiene guidelines and good hand disinfection technique, were posted at strategic places throughout the departments.
5. Infection control audits were performed at each department by infection control nurses together with care unit managers and 1 staff member. The audits included (a) questions on how the staff members acquire knowledge on hygiene guidelines, (b) inspection and discussion on local prerequisites and possibilities to adhere to guidelines and to improve the compliance with hygiene guidelines, (c) written summery of "(a)" and "(b)" used by the department for further hygiene improvement, and (d) feedback on the audit to all staff members.
6. Supporting visits and phone calls to the observers and care unit managers by infection control nurses when needed.
7. Regular feedback to the heads of the departments on the progress of the intervention.
8. Weekly graphical feedback on compliance rates to all of the staff members and the heads of departments.
9. Training in, and assessment of, hand hygiene technique by the use of a fluorescent additive to the alcohol rub and an ultraviolet device (Dermalux; KBD GmbH, Weinheim, Germany).
10. When observers indicated that the burden of monitoring compliance was too large, infection control nurses educated more observers.

Evaluation of compliance rates

The compliance was monitored continuously from the initiation of the hygiene intervention. The first evaluation of compliance rates was based on the 556 observations on barrier precautions, and 580 on dress code, performed during 4 months starting when the departments had reached and stabilized at a compliance rate of >80% (point of stability). In addition, an evaluation was based on the 335 observations each on barrier precautions and dress code performed during 4 months starting 3 years after the initiation of the hygiene intervention (follow-up).

Validation of observations

Direct observations and self-reporting by HCWs, according to the Swedish protocol for monitoring compliance (Table 1),[16] was validated in all departments at 3 hospitals, using 3 separate methods. (1) Double appraisal (concordance between 2 observers). Pair wise, 76 educated observers, simultaneously and blinded, monitored the compliance for the same bedside task (n = 70). (2) Multiappraisal (concordance between several observers). At an educational meeting for observers, all of the observers (n = 226) monitored the compliance with hygiene guidelines for a prerecorded, videotaped bedside task. During both double and multiappraisal, each observer completed their protocol independently. (3) Self-reporting by HCWs (concordance between the observer and the observed, self-reporting HCW).

After monitoring a colleagues compliance with hygiene guidelines and completing the protocol, the 26 participating observers,

respectively, asked the observed staff member (n = 49) to complete a self-reported protocol for the same task (n = 51).

One of the authors (P-O.S) evaluated all the protocols.

Ethical approval

This study was approved by the Regional Ethical Board at Linköping University August 8, 2007 (M80-07).

Statistical analysis

Comparison between groups was performed using the χ^2 or Fisher exact test. $P < .05$ was considered significant.

RESULTS

Compliance rates

Figure 1 shows the compliance with barrier precautions at baseline, point of stability, and follow-up for each of the participating departments. Point of stability was reached 7 months to 1 year after the hygiene intervention was initiated. In all departments, a significant improvement in compliance was seen between baseline and point of stability. A continuous improvement from point of stability to follow-up was seen in department D, whereas a decline was seen in departments A and C. Overall, from baseline to follow-up, an improvement in compliance was seen in departments A, B, and D ($P < .001$), whereas it was close to significant ($P = .07$) in department C.

The compliance with the dress code was at the various points of evaluation at a high and sustained level. At baseline, it ranged from 79% to 98% in the 4 different departments, at point of stability from 98% to 99% and at follow-up from 97% to 100%.

At baseline, the individual component of barrier precautions with the lowest compliance was disinfection of hands prior to patient contact ($P < .001$). At point of stability, the compliance with the 4 components of barrier precautions ranged from 94% to 96% (data not shown). At follow-up, the compliance with disinfection of hands prior to patient contact and proper use of plastic apron or protective gown was significantly lower than disinfection of hands after patient contact and proper use of gloves. A significant decline in compliance with disinfection of hands prior to patient contact ($P < .001$) and proper use of plastic apron or protective gown ($P = .04$) was seen between point of stability and follow-up.

Physicians had significantly lower compliance with the dress code than midwives ($P = .05$) and registered nurse assistants ($P = .02$) at baseline. No other difference among professions regarding the dress code was noted. There were no significant differences among the professions regarding compliance with barrier precautions at the 3 points of evaluation, except for a difference between registered nurse assistants and midwives at follow-up ($P = .02$).

Validation of observations

In the double appraisal, 69 out of 70 observed bedside tasks could be evaluated. The compliance with 276 (4 × 69) components was monitored for barrier precautions and 207 (3 × 69) for the dress code (Table 1). There were 12 (2%) differences registered between observers regarding the 7 components: 4 concerning hand disinfection after patient contact, 6 regarding glove use, and 1 each concerning short sleeves and short or restrained hair. The evaluation differences were not significant.

From the prerecorded videotaped task, 95% to 100% of the observers (n = 226) correctly judged the 7 different components. There was no difference in concordance between observers when dividing them into experienced and new observers (data not shown).

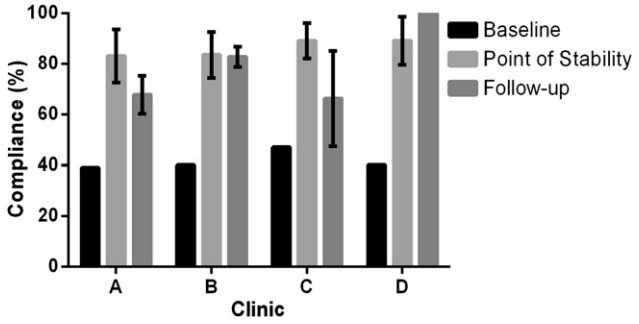

Fig 1. Compliance with barrier precautions, with standard deviations, at baseline; point of stability; and follow-up in departments A, B, C, and D.

From the self-reporting by HCWs, 49 out of 51 tasks could be evaluated. The compliance with 196 (4 × 49) components was monitored for barrier precautions and 147 (3 × 49) for the dress code. The compliance with barrier precautions and the dress code by self-reporting was 76% and 96%, respectively, and, when monitored by an observer, it was 71% and 94%, respectively. The differences in compliance between self-reporting and direct observation were not significant. There were 9 (3%) differences registered between self-reporting and direct observation regarding the 7 components: 7 concerning hand disinfection after patient contact and 1 each regarding proper use of plastic apron or protective gown and short or restrained hair.

DISCUSSION

This study shows that it is possible to improve the compliance with hygiene guidelines in general, and especially barrier precautions (Fig 1), by the use of a multimodal and multidisciplinary hygiene intervention. We did not measure the effect of each of the parts of the intervention and can therefore not relate the results to individual parts. Previous studies have shown that multimodal interventions generally generate an improvement in compliance with hand hygiene.[1-4] After the intervention was initiated, compliance with barrier precautions stabilized at an elevated level, compared with at baseline, in 3 out of 4 departments (Fig 1). In spite of continuous reminders, in the form of weekly graphical feedback on compliance rates and use of posters, the opposite trend in one department suggests that varied reminders are needed to maintain a high compliance with hygiene guidelines. A previous study used a larger number of posters and replaced them weekly.[4] The workshops gave the staff, according to their own statements, a deeper understanding of the importance of adherence to hygiene guidelines, which also was the aim of that part. This indicates that the intervention might have influenced the behavior of the HCWs because, in 3 of the departments, the compliance with barrier precautions was significantly higher at follow-up as compared with baseline. There are conflicting results regarding the long-lasting effect on compliance after educational programs.[4,9,10] However, in a recent Belgian study, the compliance rates stabilized at approximately 70% after 4 consecutive hand hygiene promotion campaigns.[17]

At baseline, the single component with the lowest compliance was hand disinfection prior to patient contact. Both the compliance with hand disinfection prior to patient contact and proper use of plastic apron or protective gown contributed to the overall decline in compliance from point of stability to follow-up. Hence, hand disinfection prior to patient contact is an important component to focus on when aiming at a long-lasting, high compliance with hygiene guidelines. Simultaneously, the compliance with the dress code is generally satisfactory and therefore would need less attention in a hygiene intervention.

No general differences were seen regarding compliance among the 3 main professions at the departments. Previous studies have shown a significantly lower compliance with hand hygiene among physicians than other professions.[18,19]

It would be interesting to evaluate the effect on HAI rates in relation to the change in compliance rates. Previous studies have shown both a decrease and no effect on HAI rates by improved compliance with hygiene guidelines.[4,20-22] However, because this study was performed at departments comprising both gynecology and obstetrics, we would expect low infection rates already from the beginning.[23]

In the double appraisal, 471 out of 483 assessed components were judged identical between observers. Also, on the basis of the observed prerecorded videotaped task, the concordance between the observers was high. In total, this indicates that direct observations is a valid tool for monitoring compliance with hygiene guidelines, supporting its role as the gold standard.[11] We also demonstrate that there is no significant difference in the compliance assessed by an observer and self-reported by HCWs. Therefore, self-reporting also seems to be a valid tool for monitoring compliance with hygiene guidelines, given a high level of knowledge on the importance of adherence with hygiene guidelines among all HCWs. Direct observations are considered time-consuming, and, therefore, self-reporting might be a complement.

We confirm that a multimodal and multidisciplinary hygiene intervention improves the compliance with hygiene guidelines. To ensure a long-lasting effect, a continuous focus on barrier precautions with varied reminders is required. We also validate, by 2 different methods, the use of direct observation as a tool for monitoring compliance.

Acknowledgment

The authors thank all of the observers who provided compliance data, Madeleine Karlsson for providing information on compliance rates, and Raymond Lenrick for proofreading the manuscript.

References

1. Pittet D. Improving adherence to hand hygiene practice: a multidisciplinary approach. Emerg Infect Dis 2001;7:234-40.
2. Dubbert PM, Dolce J, Richter W, Miller M, Chapman SW. Increasing ICU staff handwashing: effects of education and group feedback. Infect Control Hosp Epidemiol 1990;11:191-3.
3. Tromp M, Huis A, de Guchteneire I, van der Meer J, van Achterberg T, Hulscher M, et al. The short-term and long-term effectiveness of a multidisciplinary hand hygiene improvement program. Am J Infect Control 2012; 40:732-6.
4. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Infection Control Programme. Lancet 2000;356:1307-12.
5. Kampf G. The six golden rules to improve compliance in hand hygiene. J Hosp Infect 2004;56(Suppl 2):S3-5.
6. Aboelela SW, Stone PW, Larson EL. Effectiveness of bundled behavioural interventions to control healthcare-associated infections: a systematic review of the literature. J Hosp Infect 2007;66:101-8.
7. Naikoba S, Hayward A. The effectiveness of interventions aimed at increasing handwashing in healthcare workers: a systematic review. J Hosp Infect 2001; 47:173-80.
8. Gould DJ, Drey NS, Moralejo D, Grimshaw J, Chudleigh J. Interventions to improve hand hygiene compliance in patient care. J Hosp Infect 2008;68:193-202.
9. Pessoa-Silva CL, Hugonnet S, Pfister R, Touveneau S, Dharan S, Posfay-Barbe K, et al. Reduction of health care associated infection risk in neonates by successful hand hygiene promotion. Pediatrics 2007;120:e382-90.
10. Gould D, Chamberlain A. The use of a ward-based educational teaching package to enhance nurses' compliance with infection control procedures. J Clin Nurs 1997;6:55-67.
11. WHO guidelines on hand hygiene in health care. Available from: http://www.who.int. Accessed May 30, 2012.
12. Boyce JM. Hand hygiene compliance monitoring: current perspectives from the USA. J Hosp Infect 2008;70(Suppl 1):2-7.
13. Haas JP, Larson EL. Measurement of compliance with hand hygiene. J Hosp Infect 2007;66:6-14.
14. The National Board of Health and Welfare: Guidelines for barrier precautions and the dress code in health care etc. Available from: http://www.socialstyrelsen.se/sosfs/2007-19/. Accessed January 15, 2013.
15. Safety briefings. Available from: www.ihi.org. Accessed May 30, 2012.
16. Instructions: National point prevalence measurement of barrier precautions and the dress code. Available from: http://www.skl.se/BinaryLoader.axd?OwnerID=bb46d173-b010-4557-9288-a7d454043da7&OwnerType=0&PropertyName=EmbeddedImg_71c656ee-198d-4764-aef5-08a396342d01&FileName=C%3A%5CUsers%5Cslef1%5CDesktop%5CTemp%5CPPM-BHK+HT12+Instruktioner.pdf&Attachment=False. Accessed January 15, 2013.
17. Costers M, Viseur N, Catry B, Simon A. Four multifaceted countrywide campaigns to promote hand hygiene in Belgian hospitals between 2005 and 2011: impact on compliance to hand hygiene. Eurosurveillance 2012;17. pII=20161.
18. Scheithauer S, Oude-Aost J, Heimann K, Haefner H, Schwanz T, Waitschies B, et al. Hand hygiene in pediatric and neonatal intensive care unit patients: daily opportunities and indication- and profession-specific analyses of compliance. Am J Infect Control 2011;39:732-7.
19. Randle J, Arthur A, Vaughan N. Twenty-four-hour observational study of hospital hand hygiene compliance. J Hosp Infect 2010;76:252-5.
20. Chen YC, Sheng WH, Wang JT, Chang SC, Lin HC, Tien KL, et al. Effectiveness and limitations of hand hygiene promotion on decreasing healthcare-associated infections. PloS One 2011;6. e27163.
21. Rupp ME, Fitzgerald T, Puumala S, Anderson JR, Craig R, Iwen PC, et al. Prospective, controlled, cross-over trial of alcohol-based hand gel in critical care units. Infect Control Hosp Epidemiol 2008;29:8-15.
22. Marra AR, Guastelli LR, de Araujo CM, dos Santos JL, Filho MA, Silva CV, et al. Positive deviance: a program for sustained improvement in hand hygiene compliance. Am J Infect Control 2011;39:1-5.
23. PPM VRI. Available from: www.skl.se. Swedish. Accessed May 30, 2012.