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Major Article

Smartphone text message service to foster hand hygiene compliance in health care workers

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Background: Health care-associated infections are a major worldwide public health issue. Hand hygiene is a major component in the prevention of pathogen transmission in hospitals, and hand hygiene adherence by health care workers is low in many studies. We report an intervention using text messages as reminders and feedback to improve hand hygiene adherence.

Materials and methods: The study is a historical comparison proof-of-concept study. Eighteen health care workers were monitored during 12 months by a radiofrequency identification system. Afterward we sent 2 types of text messages, congratulation or encouragement, and we studied the evolution of hand hygiene adherence.

Results: We recorded 15,723 hand hygiene opportunities, 8,973 before intervention and 6,750 during and after the intervention. Using a multilevel logistic regression analysis, we found a significant increase in hand hygiene adherence during the intervention (odds ratio, 1.68) compared with the historical period.

Discussion: Despite limitations due to the type of study, a text message encouraging personnel to be more vigilant is effective in increasing hand hygiene adherence in health care workers.

Conclusions: Text message feedback should be incorporated into multimodal approaches for improving hand hygiene compliance.

Health care-associated infections (HCAI) affect 5%-15% of patients hospitalized in developed countries, causing an increased duration of stay, mortality in Europe estimated to reach 50,000 deaths per year, mortality in the United States reaching 99,000 deaths per year, and a financial burden of €13-24 billion in Europe.[1] Up to 30% of patients admitted to intensive care units develop HCAI.[2] The most frequent types of infection are urinary tract infections, surgical site infections, bloodstream infections, and pneumonia.[3] Moreover, the use of broad spectrum antibiotics favors the development of multidrug-resistant organisms, especially infections dues to carbapenemase-resistant enterobacteriaceae, causing a worldwide public health problem because they are associated with life-threatening infections lacking significant therapeutic possibilities.[4,5] Multidrug-resistant pathogens are usually contracted in hospital environments.

Contaminated health care worker (HCW) hands play a very important role in the transmission of health care-associated pathogens. Hand transmission of pathogens requires several conditions: The presence of the organism on a patient's skin, the transfer to a HCW's hand, the survival of the organism on the hands, the lack of good hand hygiene, and finally the cross-transmission of the organism.[1]

Many studies have evaluated the compliance of HCWs with hand hygiene. A systematic review and meta-analysis performed

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Conflicts of interests: PB is a codiscoverer of MediHandTrace, part owner of the patent, and is participating in a MediHandTrace start-up company.

JK and YT participated equally in the study.

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by Ofek Shlomai et al[6] concerning interventions improving hand hygiene compliance in neonatal units indicates that educational campaigns, reminders, easy access to hand hygiene sanitizers and UV sensors improve hand hygiene, and that performance feedback can greatly improve compliance with hand hygiene. Another systematic review by Erasmus et al[7] found an overall compliance rate of 40% for hand hygiene, with compliance of only 21% before contact with patients. The overall compliance with hand hygiene remains low in many studies, and is probably lower than what is already known, because the gold standard for monitoring hand hygiene is the direct observational survey, which is prone to the Hawthorne effect.[8,9]

A multimodal intervention, including feedback and reminders seems to play a very important role in the success of hand hygiene campaigns. To improve compliance with hand hygiene in our ward,[10] we aimed to evaluate the influence of text message feedback on hand hygiene compliance of our HCWs. To do so, after a 12-month period spent monitoring the personnel with our automatized continuous monitoring system[11] without any outside intervention, we sent a weekly text message to HCWs, encouraging them in better compliance with hand hygiene or congratulating them for their good compliance. We report here the behavioral changes of HCWs toward hand hygiene consequent to this smartphone feedback.

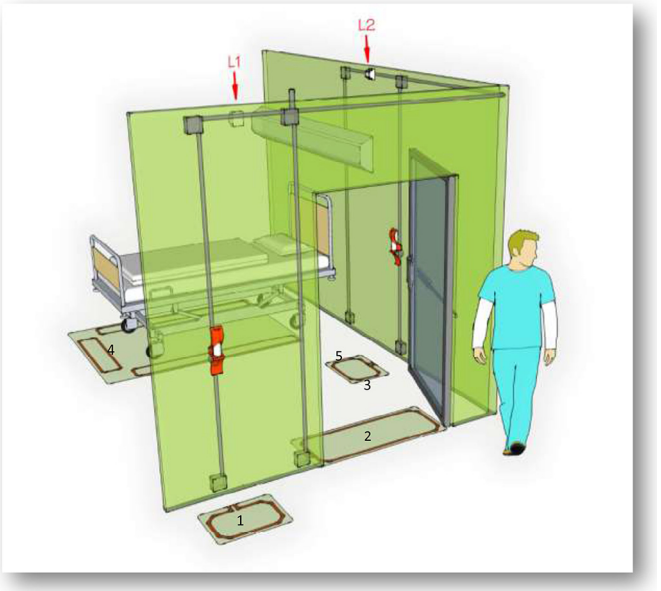

Fig 1. Schematics of a room equipped with an MediHandTrace system (MediHandTrace SAS, La Garde, France). 1 = Outdoor hand disinfection. 2 = Entrance. 3 = Indoor hand disinfection before contact. 4 = Contact with patient. 5 = Indoor hand disinfection after contact.

MATERIALS AND METHODS

The study took place in the Infectious Diseases Department of the North Hospital in Marseille, France, between October 2014 and August 2015. The ward is composed of 15 rooms and divided into 2 sectors, among which 7 single patient rooms have been equipped with MediHandTrace (MHT; MediHandTrace SAS, La Garde, France), a radiofrequency identification-based (RFID) real-time automated continuous recording system.[11]

The MHT monitoring system

Hand hygiene alcoholic dispensers were installed outside and inside each room. The MHT system is an automated RFID microchip traceability system identifying in real time a HCW's entrance and exit, and recording the use of a hydroalcoholic solution inside and outside the room in each of the 7 rooms where it is implemented (Fig 1). It has been evaluated against video recording with an accuracy of 99.2%, sensitivity of 95.65%, and specificity of 100%.[11] Personal electronic microchip-tagged shoes were given to all the participants in this study. A short demo video is available at https://www.youtube.com/watch?v=d1Oa7vNT_iQ.

The population

Eighty-eight HCWs had tagged shoes and were monitored, including doctors, residents, medical students, nurses, nursing assistants, and housekeeping personnel aged between 21 and 56 years. We excluded participants who refused to participate in the study, participants who did not work for the entire period of the study, participants who did not have at least 50 recordings before the feedback period, and participants who did not receive any text messages. Finally, 18 staff members working full time in the department were included to participate in this study, among them 2 doctors (11.11%), 8 nurses (44.44%), 5 nursing assistants (27.78%), and 3 housekeeping personnel (16.67%). These staff members gave their consent to be included in the study, and were present for the entire duration of the study.

The study design

This study was a nonrandomized before–after comparison study with alternate periods of intervention during which we monitored the participants' compliance with hand hygiene for 360 days before starting to send text message feedback to define a baseline. For organizational purposes, we established alternate intervention periods following this pattern: Half of HCW participants in the study received a text message every Monday for 4 weeks. After 4 weeks, we stopped sending messages for 48 days, and we started sending text messages to the other half of the participants every Monday for 4 weeks. We performed this entire procedure 3 times in succession. We then regrouped the 2 groups and studied them simultaneously. We divided the study into 4 periods, the first being the 360 days before receiving the messages; the second period consisted of 28 days during which we sent a text message once a week to the participants (phase 1), and 48 days following during which we did not send any text message (phase 2); then a third and fourth period identical to the second period. The duration of the fourth period was a little shorter because we sent messages for only 21 days (Fig 2).

Studied variables

Compliance with hand hygiene was defined as rubbing hands together with a hydroalcoholic solution inside a patient's room immediately before patient contact.

In our system, this was recorded as a "3-4. . .." sequence, reflecting taking the hydroalcoholic solution from the distributor inside the room while at the same time being in contact with antenna No. 3 (sequence 3) and before contact with antenna No. 4 (sequence 4). No hand hygiene before patient contact was recorded by all sequences as "no 3 before 4" (Fig 1).

The period of intervention was the period during which we sent text messages every Monday of every week.