RESEARCH BRIEFS

Recurrent Visual Electronic Hand Hygiene Reminders in the Anesthesia Work Area

Hand hygiene decreases the incidence of healthcare–associated infections.[1] As a specialty, anesthesiology has made important strides in improving patient safety during the perioperative period, but hand hygiene practices of anesthesia providers in the operating room remain inadequate.[2,3] Among medical specialists, anesthesiologists may be among the worst performers in hand hygiene.[4] Loftus et al[5] recently demonstrated that bacterial transmission in the anesthesia work area might be associated with a higher rate of 30-day postoperative infections, which may affect up to 16% of patients undergoing surgery.[5] Additionally, the hands of anesthesia providers frequently carry bacterial pathogens and have been associated with contamination of intravenous stopcock sets.[6] The high density of tasks performed during the first hour of anesthesia care may be a barrier to adequate hand hygiene practices.[7]

Tasks that contribute to the high task density of the first hour of anesthesia care include infusing medications intravenously, manipulating the airway, configuring the anesthesia work station, and placing intravascular lines. We aimed to evaluate whether a recurrent visual electronic hygiene reminder could increase the frequency of hand hygiene events.

METHODS

This observational study was performed at Jackson Memorial Hospital, an urban 1,000-bed hospital in Miami, Florida. We randomly selected 20 second-year anesthesia residents, this cohort was then randomized into 2 groups: one group started with the intervention and the other group comprised the control. In each group, 10 residents were observed over 1 hour during the control and intervention periods. Within 1–5 days after the original observation, these study participants were observed a second time in the opposite group. Observations were performed by authors D.R.A. and A.M., starting at the time of entry to the operating room. The observer was seated inside the room within view of the anesthesiology resident, but the purpose of the study was concealed from the resident for the duration of study. The intervention consisted of an electronic visual reminder stating, "Please Sanitize Your Hands," which was shown for 60 seconds every 15 minutes on a monitor immediately adjacent to the vital signs display. Each study participant was exposed to the reminder 4 times over 1 hour per observation. Participants in the control group were not exposed to any visual reminders. During intervention and control observations, hand sanitizer was placed on the anesthesia machine. With the goal of maintaining a similar task density, the surgical cases were limited to elective upper and lower extremity orthopedic surgeries with an American Society of Anesthesiologists' physical status score of 1–3.

Statistical Analysis

We used a generalized linear mixed model to analyze a 2×2 crossover design. We began with a Poisson model using total hand hygiene as the outcome with group (ie, reminder first vs reminder second), time (1 vs 2), and their interaction as fixed effects. The random term was the subject nested within group. A heterogeneous compound symmetric covariance matrix was used to represent the correlated data structure. The interaction of group with time was significant ($P = .011$), indicating a carryover effect; namely, the order of presentation had an effect on the outcome. Therefore, we ran a second Poisson model using the first observation only. SAS 9.3 (SAS Institute, Cary, NC) was used for all analyses.

RESULTS

We evaluated 20 second-year anesthesiology residents over 2 months. Residents had a mean age of 31 ± 2 years, and 60% were male. The interaction between reminder and sex was not significant (reminder, $P = .966$; sex, $P = .972$; and interaction, $P = .970$), so this variable was dropped. The subsequent analysis showed that the reminder was significant ($P = .006$), but sex was not significant ($P = .919$).

The group that started in the control arm had a total of 2 hand hygiene events during 10 hours of observation and 21 hand hygiene events during 10 hours of intervention

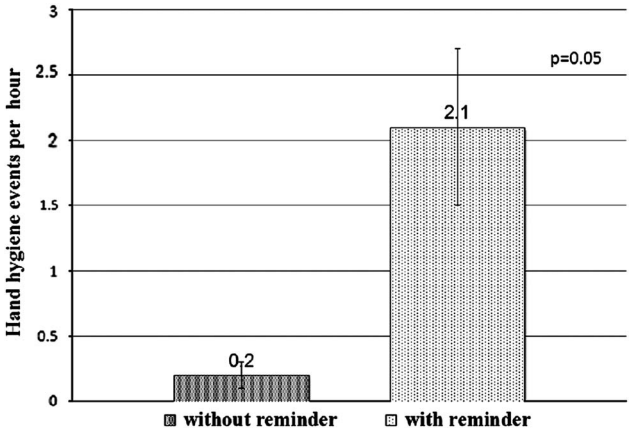


FIGURE 1. Hand hygiene events per hour performed by anesthesia residents in the intervention group, ie, no reminder followed by a simple, periodic, visual hand-hygiene reminder.

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TABLE 1. Total Number of Hand Hygiene Events Performed by Anesthesia Residents With or Without a Visual Reminder Recorded During 10 Hours of Observation

	Observation 1 (1 hour)	Observation 2 (1 hour)	Total No. of Hand Hygiene Events
Group 1 (n = 10)	No Reminder	Reminder	
No. of hand hygiene events	2	21	23
Group 2 (n = 10)	Reminder	No Reminder	
No. of hand hygiene events	23	21	44

(0.2 ± 0.1 vs 2.1 ± 0.6 [mean ± standard error], respectively; $P = .05$) (Figure 1). The group that started with the intervention first had a total of 21 hand hygiene events during 10 hours of intervention and 23 hand hygiene events as the subsequent control group (Table 1). Given the substantial carryover effect, the second group was not included in the final analysis; thus, the advantage of a crossover trial was lost.

DISCUSSION

We implemented an electronic reminder that was successful at increasing the hand hygiene rate. Interestingly, when used initially, the reminders produced a behavioral effect in the subsequent observation. Future trials could use a longer washout period to account for the carryover effect. A study by Koff et al[8] reported that hand hygiene 7 to 8 times per hour reduced stopcock contamination from 32.8% to 7.5%.

Future studies could use existing eye-tracking technology or surveys to assess whether the anesthesia providers saw the hand hygiene reminder. Moreover, our visual hand hygiene reminder was not associated with sound, which might have also helped attract the anesthesia provider's attention to the screen. Whether a recurrent visual hand hygiene reminder would eventually succumb to alarm fatigue has not yet been determined. Furthermore, future studies could use existing hardware such as the electronic anesthesia record and the vital sign displays to show hand hygiene reminders.

Nevo et al[9] found that, compared to other visual cues studied such as flickering lights and line-of-sight placement of the sanitzer dispenser, the most significant increase in hand hygiene events occurred when informing participants of a surveillance system. Although difficult to implement, this strategy could be further explored in future larger studies. In our study, the number of hand hygiene events during the first hour of anesthesia care remained dismally low in spite of periodic visual reminders. Additional and complementary strategies must be explored to improve hand hygiene among anesthesia providers in the ongoing effort to reduce healthcare–associated infections.

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Reasons for Removal of Emergency Department–Inserted Peripheral Intravenous Cannulae in Admitted Patients: A Retrospective Medical Chart Audit in Australia

It has been reported that the peripheral intravenous cannula (PIVC) is the first choice of vascular access device for patient treatment in the emergency department (ED).[1] The number of PIVC insertions in our Australian ED is more than 35,000 per year. Concern arises when ED-inserted PIVCs are used exclusively for blood sampling because this may lead to unused PIVCs being left in situ after patients are transferred to the ward, increasing risk of infection. The rate of unused or *idle* PIVCs inserted in the ED has been reported at 45%-50%.[2,3] PIVC insertions in the ED have been identified as a cause for phlebitis and bacteremia, leading to their premature failure.[4] Analysis of 5 years of prospective data from 2 hospitals in Australia found a high incidence of catheter-related *Staphylococcus aureus* bloodstream infections with 39.6% of such infections associated with PIVCs inserted in the ED.[5] As a result, routine PIVC replacement should be considered after 24 hours for PIVCs inserted under emergent conditions[6] and after 96 hours for those inserted under nonemergent conditions.[5] These worrying statistics prompted the design of the current study that was performed to investigate how and why PIVCs are used in the ED, and during the subsequent hospital admission, as well as the documented rationale for removal of ED-inserted PIVCs by ward staff. To our knowledge, there is no prior study investigating this phenomenon.

We planned a retrospective audit of 370 medical charts of patients who had been admitted from the ED with a PIVC from December 1, 2013, through January 31, 2014, during a previous quality improvement initiative.[7] Our large tertiary ED in Western Australia provides a 24-hour emergency service for adult patients. At the time of our study our census suggested approximately 64,000 patients presented to the ED with an approximate 50% admission rate (35% to inpatient stay and the remaining 15% to short-stay assessment unit).

Items included in the audit were age, gender, patient size, type of intravenous therapy given (fluids, antibiotics, and/or analgesia) or bloods taken through the cannula, Peripheral Vein Assessment Score (PVAS, the current peripheral cannula daily assessment tool at our hospital) for each day, dwell time of the PIVC, the rationale for removal (infiltration, phlebitis, occlusion, accidental removal, no longer needed, routine replacement, not documented), evidence of the type and number of other vascular access devices inserted, length of hospital stay, and whether the PIVC was used for intravenous/medication therapy in ED or in the hospital (unused/idle PIVC).

This study was approved as a quality improvement initiative and deemed to be of low risk by the human research ethics department at Sir Charles Gairdner Hospital (no. 158).

Data were analyzed using descriptive statistics. Outcomes of key interest to this study were dwell time, documented complications, unused cannulae, and rationale for removal. Data analyses were conducted in SAS, version 9.3 (SAS Institute).

We analyzed medical charts of 131 patients. For demographic characteristics, see Table 1. Documentation of the PVAS was missing for 19% on day 1, for 23% on day 2, for 26% on day 3, for 27% on day 4, and for 48% overall (ie, at least any of the 4 days). The unused or idle PIVC prevalence was 16%. In total, 51% of PIVCs had an undocumented rationale for the ED-inserted cannula's removal, yet 37% of patients were subjected to a subsequent PIVC insertion. No infections were identified. We suspended our medical chart audit early because of the futility in obtaining data, in favor of a future prospective observational study.

Our results clearly identified that the rationale for removal of the most common medical invasive device used in hospitals was poorly documented in the patient's medical record—in our case, more than half were not documented. This implies that the level of PIVC failure may be underreported and thus underestimated. In more than one-third of the patients whose cannulae were removed, subsequent cannulae were inserted, suggesting that the initial cannulae failed or were removed owing to concern over the potential infection risk of ED-inserted PIVCs. Both are concerning regarding patient outcomes as well as the potential legal liability of nondocumentation of removal for an invasive medical device.

Although the recorded number of idle PIVCs from the ED was lower (16%) than recent figures (50%),[2] it still amounts to unnecessary use of a medical device. Whilst this may hint that some ED clinicians have no definitive rationale for inserting a PIVC, it is of concern that patients are exposed to avoidable potential risks of hospital-acquired PIVC infection, in addition to the trauma and discomfort of an insertion. It is possible that a portion of the idle PIVCs may have been appropriate due to potential patient clinical deterioration. We found it difficult to confirm this using the medical chart review method. The importance of good quality documentation for medical chart audits for providing confidence in results has been argued when the medical record review methodology is used.[8]

Our hospital uses a locally developed PVAS that isolates failure to an infection/phlebitis problem alone. This may lead to

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