

Reproducibility of Results Achieved with the Use of an Electronic Hand Hygiene Surveillance and Feedback Monitoring Device, in Decreasing Healthcare Associated Infections

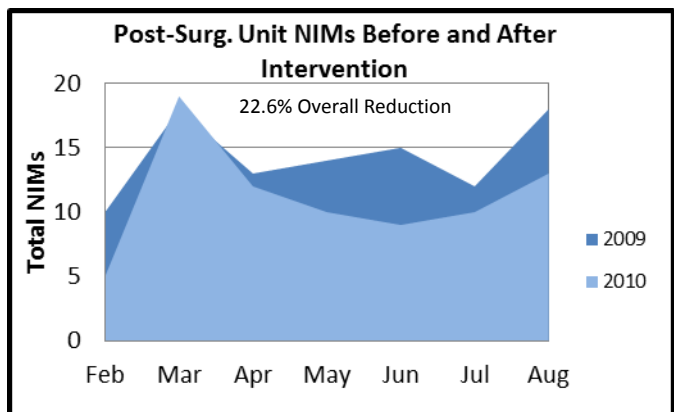
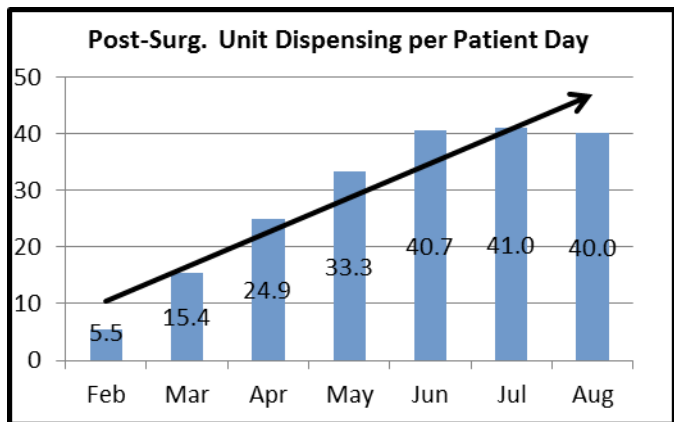
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OBJECTIVE: To evaluate the reproducibility of results achieved with the use of an electronic hand hygiene surveillance and feedback monitoring technology in efforts to decrease rates of healthcare associated infections.

DESIGN: A 6-month pilot program to include employees, patients, and visitors in hand hygiene monitoring to automatically gauge compliance along with total cleansing dispenser usage. Infection rates of the 6-month period were compared to the same months in the previous year.

SETTING: Princeton Baptist Medical Center Birmingham, AL; a 21-bed Medical Intensive Care unit of a 499-bed acute care hospital.

Background: Healthcare associated infections (HAIs) account for thousands of lives and millions of dollars lost every year. Overall, for each HAI that occurs, length of stay increases by 8.12 days, hospital costs increase by \$9,347 and a hospital net loss for the care is \$5,206 per patient.ⁱ Clinical managers and directors responsible for one of Princeton Baptist Medical Center’s post-surgical units chose to pilot an automated hand hygiene monitoring system. The multi-disciplinary team worked with Proventix Systems, Inc. to install and pilot the nGage system from February 2010 to August 2010. During this time period, they recognized a substantial increase in the number of hand hygiene solution dispensing. Dispensing rates rose from 5.5 dispenses per patient day in February to 40.0 dispenses per patient day in August. During the same time, there was an associated 22.6% decrease in the occurrence of HAIs per patient day as compared to the same months during the previous year.



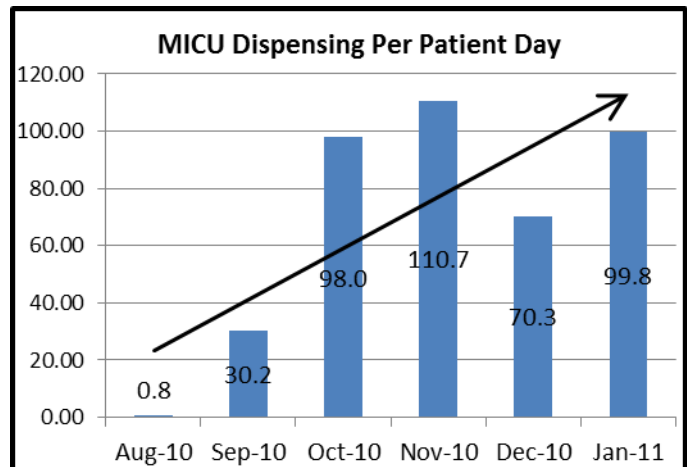
In order to verify that the pilot post-surgical unit results were reproducible, the Princeton Baptist team expanded deployment of the nGage to a critical care location, the Medical Intensive Care Unit. Results of the six month secondary deployment were measured and verified, and are presented here for consideration.

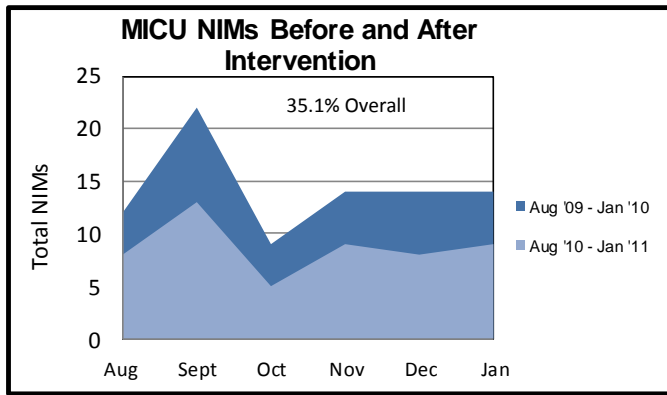
Design: A six-month-long pilot study of an automated, point-of-care hand hygiene compliance monitoring and communication system implemented in August of 2010. Researchers selected the Medical Intensive Care Unit (MICU) because ICUs typically have higher infection rates due to the average complexity of patient mix, the frequency of invasive device use and the higher severity of illness and comorbidity within the patient population. After a two month period of recording baseline dispensing, employees (77), including nursing and housekeeping personnel, received Radio Frequency Identification (RFID) badges for the pilot program. Dispensing counts from both alcohol-based hand rub solution and soap dispensers were automatically tracked by hour, day, and month with the same system. The hand hygiene surveillance technology is soap and alcohol-based cleanser solution neutral. There was no requirement for brand specific soap, alcohol or dispensing device necessary to facilitate monitoring. Results were measured and compared with infection rates from the same time for the previous year.

Methods: For the purposes of this study, we used an objective, reproducible electronic proxy for healthcare associated infection called the Nosocomial Infection Marker™ (CareFusion). According to a study published in the *American Journal of Clinical Pathology*, Nosocomial Infection Marker (NIM) analysis had a comparable sensitivity (86%) and specificity (98%) for the identification of HAI to that of medical records review.ⁱⁱ The hospital has used this algorithm-based measure since 2002 as a marker to identify patients with incrementally

longer hospital stays and higher direct costs due to HAIs. The ability to consistently apply this objective measure across all patients during the baseline and study periods made the NIM a preferable method of measurement for the purposes of this investigation.

A study in *Infection Control and Hospital Epidemiology* cited that according to WHO guidelines, more than 90% of room entries can be identified as a hand hygiene obligating event.ⁱⁱⁱ During the study period, caregivers wore RFID badges to allow active 24/7 monitoring. As stated above, personal RFID tags were distributed at the beginning of the third month. Opportunities for hand hygiene were determined by proximity sensing of caregiver entry into the patient room, and hand hygiene compliance was confirmed by the caregiver activation of a sensor within the dispenser when normally accessing a solution for hand washing. No workflow changes were necessary to measure the opportunity for hand hygiene or compliance with the opportunity. Soap and sanitizer dispensers inside the room and those located adjacent to the patient room in the hallways were included in the compliance measure. The rate of infection marker occurrence during the study period was compared to the rate for the same six month period of the previous year.





Results: At the six-month mark of the pilot, the NIM per 1,000 patient days rate had decreased by 35.1% in the MICU as compared to the same months during the previous year. The number of patient days for the baseline and study periods was comparable (2030 patient days in 2009/2010 and 2028 in 2010/2011) with only slight month-to-month variation. During the first month of the pilot the MICU had a total of 9,995 hand hygiene dispenses, equating to 30.2 dispenses per patient day. For the sixth and final month, hand hygiene dispenses had increased to a total of 35,713, or 99.8 dispenses per patient day. Based on previously published HAI cost data the 35.1% reduction in NIMs reflects a decrease of 239 patient days and reduced hospital net losses of over \$200,079.

	NIMs	Net Loss
Pre-Installation: Aug '09 – Jan '10	85	\$515,355
Post-Installation: Aug '10- Jan '11	52	\$315,276
Net Loss/Savings		\$200,079

Conclusion: These results suggest the ability to reproduce improvements in infection rates and increased rates of hand hygiene compliance with the use of the hand hygiene monitoring system. Consistent support from hospital leadership at the executive and unit level as well as the engagement of the employees on the pilot unit were key elements to successful implementation and intervention. We also believe that the

improved results with the use of the hand hygiene monitoring system are, in part, attributable to lessons learned throughout the earlier post-surgical unit installation of the technology. This experience suggests the use of an automated hand hygiene surveillance and communication system produces reproducible increases in hand hygiene compliance and associated reductions in HAIs, patient days, and net losses.

Expansion: As a result of the second-phase success, Baptist Health System has expanded the services to additional hospital units and other facilities in the corporate network. We will use the combined results for greater population community-based studies.

GENERAL OBSERVATIONS:

Lean Advances: Also worth noting are the Lean initiatives Baptist Corporate has in place to reduce healthcare associated infections. Corporate-wide, Princeton Baptist Medical Center attributes 50% of the overall NIM reduction to the culture change due to the installation of the hand hygiene monitoring system.

Additional notes: The systematic adoption process has integrated the automatic observational capabilities into normal hospital operations. To protect patients, improved hand hygiene compliance is required of patients and visitors as well. During observations, we recognized increased hand hygiene events by both patients and visitors.

ADDITIONAL STUDY OPPORTUNITIES:

Future System Functionality: Also noted during this pilot was the opportunity to use this technology to achieve other patient safety goals, increased patient satisfaction, employee efficiencies, and risk reductions by incorporating passive RFID technology into other facets of clinical settings.

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Potential conflicts of interest; all authors report no conflicts of interest relevant to this article.

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