

Efficacy of nGage™ by Proventix, an Electronic Hand Hygiene Surveillance and Feedback Monitoring Device, Against Healthcare Associated Infections

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OBJECTIVE. To evaluate the results of nGage™, an electronic hand hygiene surveillance and feedback monitoring technology developed by Proventix Systems, Inc., in efforts to decrease rates of healthcare associated infections.

DESIGN. A seven-month pilot program to include employees, patients, and visitors in hand hygiene monitoring to automatically gauge compliance along with total cleansing dispenser usage.

SETTING. Princeton Baptist Medical Center Birmingham, AL; a 42-bed Post Surgical unit of a 323-bed acute care hospital.

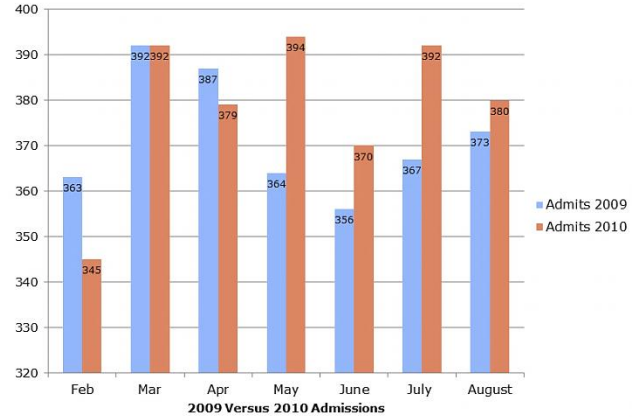
BACKGROUND: Healthcare associated infections (HAIs) account for thousands of lives and millions of dollars lost every year. A study noted that while care for patients with HAIs only accounts for 4.03% of all care delivered, the costs associated with their treatment make up 79% of net losses. Overall, 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.¹ The Centers for Disease Control, The World Health Organization (WHO) and The Joint Commission indicate effective hand hygiene as the single most important way to reduce infection risk. However, hand hygiene compliance monitoring methods, such as periodic surveillance, self-reporting, and aggregate volume measurements, are often inaccurate and hard to implement.² High levels of sustained hand hygiene compliance are elusive in healthcare facilities around the world.³ Because of the weaknesses of these previously utilized methods, healthcare and government agencies are calling for research and new sciences to be developed in order to measure hand hygiene compliance quickly, accurately, and without the use of extra personnel.⁴

DESIGN: A seven-month-long pilot study of an automated, point-of-care compliance monitoring and communication system implemented in a single unit which was live in February 2010. This technology is soap dispenser neutral and doesn't require a specific soap, alcohol or gel for

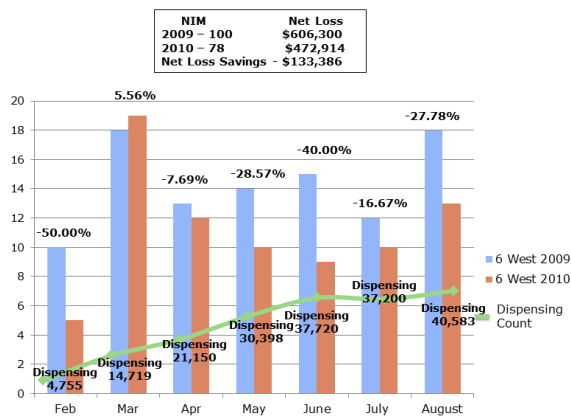
monitoring. Employees (51), including nursing and housekeeping personnel, were issued badges for the pilot program after an initial two-month period of a baseline dispensing monitoring only were recorded. Dispensing counts from both hand cleanser and soap dispensers were automatically tracked by hour, day, and month with the same system. 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 electronic markers as a consistently applied objective measure for the comparison infection rates of 2009 versus 2010 as indicators for healthcare associated infections. According to a study published in the *American Journal of Clinical Pathology*, nosocomial infection marker (NIM) analysis had a comparable sensitivity ($P > .3$) to and lower specificity ($P < .001$) than medical records review.⁵ Therefore, we chose to use NIMs as our method of measurement for the purpose of this investigation. The hospital has been using the system since 2002 and has confidence in its predictive value of identifying patients that stay longer and cost more as compared to similarly sick patients. Furthermore, for this study, we chose to let the necessity of hand hygiene when healthcare workers enter a patient room act as a proxy for all other opportunities for hand hygiene activities. Compliance was measured by

dispensing of cleanser on entrance and exit of the patient room. Soap and cleanser dispensers inside the patient room as well as those located outside but adjacent to the patient rooms in the hallways were included in the compliance measure. 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.⁶ Personal radio frequency ID (RFID) tags were distributed beginning the third month. Each participant wore one of these personalized RFID badges that measured when he or she had the opportunity to engage in hand hygiene activity (entered a patient room) and also measured whether he or she engaged in a hand hygiene activity, be it soap or cleanser. Both the opportunity and the hand hygiene event (yes or no) were recorded on the central server. NIMs were measured over the seven-month period that the system was piloted. Those infection markers were compared to infection markers that occurred over the same seven-month period for the previous year.



RESULTS: At the seven-month mark of the pilot, NIMs had decreased by 22.0% overall on the pilot unit as compared to the same months during the previous year. The number of patient admissions was accounted for during this study and there was very little difference in total admits to the pilot unit (2602 versus 2652) over the seven months with only slight month-to-month variation. The month of May started with a celebration on the fifth which was to coincide with the WHO Hand Hygiene Day. During this month the pilot unit achieved a greater than 28% decrease in NIMs even though patient admissions had increased over 7% for the month of May. We attribute these results to a combination of the personalized tags being distributed, the education provided by and about the RFID technology, and the active messaging at the control unit. During the pilot period the overall hospital NIMS decreased 4% with total hospital admissions slightly increasing for the same time period. Also noted and reflected in the chart was an increase in dispenser usage after the tags were issued as well as a subsequent decrease of NIM incidence. This confirms numerous studies that indicate that while hand hygiene education is important, compliance improves when personnel are monitored.⁷ Since the introduction of the hand hygiene compliance monitoring system and the 22.0% reduction of NIMs, the cost studies for our hospital over this seven-month period on just 2652 patient admissions reflected a decrease of 159 patient days and reduced hospital net losses of over \$133,386.



Overall Results of Pilot	
	<i>Seven Month Pilot</i>
NIM Reduction	22.00%
Length of Stay Reduction	159 Patient Days
Reduction in Net Losses	\$133,386
	<i>Annualized Estimate</i>
NIM Reduction	22.00%
Length of Stay Reduction	273 Patient Days
Reduction in Net Losses	\$228,662

Source: Princeton Baptist Medical Center data

CONCLUSION: Improved hand hygiene improves the quality of patient care. The implementation of an electronic hand hygiene surveillance and feedback-monitoring device resulted in a significant reduction in nosocomial infection markers. With hospital leadership at the executive and unit level as well as the engagement of the employees on the pilot unit throughout the implementation, this unit observed significant reductions in NIMs, patient days, and net losses. These numbers indicate opportunities for hospital-wide and national reductions in healthcare costs and patient lives lost if applied across the country. Using national statistics of 1.7 million HAIs⁸ with an average per patient cost of \$20,549 per HAI (based on adjusted 2007 dollars), results in a national cost of more than \$35 Billion as depicted in Table 8 below.⁹ Applying a 22% reduction nationwide would correlate to a national savings of over \$7.8 Billion.

Table 8: Range of estimated annual direct medical cost of all HAIs adjusted by the preventable proportion of infections

	Range of Estimates (billions \$)	20% of infections preventable (billions \$)	50% of infections preventable (billions)	70% of infections preventable (billions)
2007 CPI-U	\$28.4 - \$33.8	\$5.7 - \$6.8	\$14.2 - \$16.9	\$19.9 - \$23.7
2007 CPI hospital inpatient services	\$35.7 - \$45.0	\$7.1 - \$9.0	\$17.9 - \$22.5	\$25.0 - \$31.5

GENERAL OBSERVATIONS: We do not believe the reduction in HAIs was solely due to improved healthcare worker compliance. To protect patients, improved hand hygiene compliance is required of patients and visitors as well. During observation, we recognized increased hand hygiene events by both patients and visitors. They enjoyed the active messaging the technology offers at each cleanser dispensing and they also followed the staff's example. The active messaging varied after each dispensing to provide patient satisfaction suggestions, HAI reduction tips by individual source, motivational quotes and award recognitions. We sought staff feedback to determine their personal experiences with and opinion of the product. They reported that they were encouraged by the across-the-board improved compliance results and improved patient outcomes. The real-time feedback of messages around education and encouragement along with goal settings and reward recognition has been valuable and

motivated the staff to continue to improve their hand hygiene diligence. While staff initially voiced concern about being tracked, they recognized that the ultimate goal was to protect patients. It appears the systematic adoption process has integrated the automatic observational capabilities into normal hospital operations.

ADDITIONAL STUDY OPPORTUNITIES:

Additional System Reporting: Also noted during this pilot was the opportunity this technology offers to assist with other patient safety goals, increased patient satisfaction, employee efficiencies, and risk reductions. We will work with vendor to further create these capabilities and determine their ability to improve quality and hospital efficiency.

Expansion: As a result of first-phase success, Baptist Health System will be expanding the services to additional hospital locations and the other three facilities in the network (Shelby Baptist, Citizens Baptist, Walker Baptist). We will use the combined results for greater population community based study.

Personal Hand Hygiene Awareness: This expansion along with increased reporting of personal compliance statistics and messaging at the control unit will help sustain the culture change that we believe this technology has facilitated around hand hygiene compliance. The previously noted opportunities for enhanced patient care will also be incorporated into the piloted locations for future expansion.

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