American Journal of Infection Control 42 (2014) 702-7

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Evaluating and operationalizing an environmental auditing program: A pilot study

Laura Gordon BA, Natalie Bruce MScN, CIC *, Kathryn N. Suh MD, FRCPC, MSc, CIC, Virginia Roth MD, MBA, FRCPC

The Ottawa Hospital, Ottawa, Ontario, Canada

Key Words:
Quality assurance
Fluorescent marking
ATP bioluminescence

Background: Environmental auditing is an important tool to ensure consistent and effective cleaning. Our pilot study compared an alcohol-based fluorescent marking product and an adenosine-5′-triphosphate bioluminescence product for use in an environmental auditing program to determine which product was more practical and acceptable to users.

Methods: Both products were tested on 15 preselected high touch objects in randomly selected patient rooms, following regular daily cleaning. A room was considered a "pass" if ≥80% of surfaces were adequately cleaned as defined by manufacturers' guidelines. A qualitative survey assessed user preference and operational considerations.

Results: Using fluorescent marking, 9 of 37 patient rooms evaluated (24%) were considered a "pass" after daily cleaning. Using adenosine-5′-triphosphate bioluminescence, 21 of 37 patient rooms passed (57%). There was great variability in results between different high touch objects. Eighty percent of users preferred the alcohol-based fluorescent marking product because it provided an effective visual aid to coach staff on proper cleaning techniques and allowed simple and consistent application.

Conclusions: Environmental auditing using translucent, alcohol-based fluorescent marking best met the requirements of our organization. Our results reinforce the importance of involving a multidisciplinary team in evaluating and operationalizing an environmental auditing program.

There is convincing evidence that contamination of hospital environments contributes to the transmission of nosocomial pathogens such as *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus*, and vancomycin-resistant *Enterococcus*.[1-3] The thoroughness of hospital cleaning has traditionally been measured using visual inspections. These observations alone are ineffective in measuring environmental microbial contamination.[4] Infection control guidelines from several countries recommend that hospitals develop comprehensive environmental auditing programs that include a method to measure environmental cleanliness that is both objective and standardized.[5,6] A survey of Infection Prevention and Control Canada (IPAC-Canada) members conducted in 2013 by the IPAC Environmental Hygiene Interest Group identified that visual inspection was the most common quality assurance method used; fewer than half of respondents reported that adenosine-5′-triphosphate (ATP) bioluminescence and/or fluorescent marking was used in their centers (IPAC-Canada Environmental Hygiene Interest Group, unpublished data, 2013).

The 2 most common objective methods for environmental auditing are fluorescent marking and adenosine-5′-triphosphate (ATP) bioluminescence. Fluorescent marking is used to measure the action of environmental cleaning. A fluorescent marker is applied to a surface; absence of the mark when inspected with ultraviolet (UV) light indicates adequate friction was applied for proper cleaning. These measurements can be quantified by tabulating the number of marks removed and calculating benchmarks for standardization. However, this method does not measure the adequacy of disinfection. The ATP bioluminescence method measures the organic ATP on surfaces and has been used in the food industry for several decades. ATP is a proxy measure for bacteria on surfaces because ATP is produced by most living organisms. The measurement indicates the amount of organic matter but does not correlate with a bacterial count. ATP bioluminescence is relatively new technology in the hospital setting and standard thresholds have not been established.[7,8]

* Address correspondence to Natalie Bruce, MScN, CIC, The Ottawa Hospital, 501 Smyth Rd, Box 118, Ottawa, Ontario, Canada K1H8L6.

E-mail address: nbruce@toh.on.ca (N. Bruce).

All auditing products, associated software, and vendor support for this pilot project were supplied at no cost by the manufacturers.

Conflicts of interest: None to report.

http://dx.doi.org/10.1016/j.ajic.2014.04.007

Setting

Our pilot study occurred at The Ottawa Hospital (TOH), a multicampus 1,155 bed facility serving a population of 1.2 million in eastern Ontario. TOH is 1 of the largest teaching hospitals in Canada, with more than 140,000 emergency department visits and 50,000 admissions per year, an annual operating budget of $1.2 billion (Canadian), and more than 13,000 employees and physicians.

Our existing environmental auditing process was internally developed and used an oil-based, opaque fluorescent marking product originally designed to educate health care providers on proper hand hygiene technique. Housekeeping supervisors were responsible for conducting 3 environmental audits per inpatient unit per month. Auditing was a 2-day process whereby auditors would mark 21 predefined high touch objects (HTOs) in the patient environment with the marking agent on day 1. On day 2, the auditor would return to the room following the daily clean to determine if the product had been physically removed during the cleaning process. If the mark was still present, that HTO scored 0. If the mark had been removed, a score of 1 was assigned. If the mark had been partially but not entirely removed, a score of 0.5 was awarded. These scores were then aggregated and divided by the total number of objects marked in the patient environment. If a room failed the audit, housekeeping was required to reclean the entire patient environment. The oil-based product used for our existing environmental auditing process has numerous limitations. In particular, due to its consistency and opacity, the product may be visible to the naked eye, thereby making it apparent that the room is part of an auditing process. This can lead to unstandardized and unreliable results.

The purpose of our study was to determine if an alternative environmental auditing process or auditing product better met the needs of our organization as determined by ease of use, user acceptance, and relevance of results.

Definitions and assumptions

ATP bioluminescence refers to the quantitative measurement of organic ATP on surfaces.[5] Surfaces are wiped using a special swab and results are quantified using a handheld device. The amount of ATP, both microbial and nonmicrobial, is expressed in relative light units (RLUs).[5] *Fluorescent marking* refers to a product that is used to mark HTOs before cleaning. Our study tested an alcohol-based fluorescent marking product that dries clear on surfaces and can be removed using friction applied with a moist cloth. Following a daily or discharge clean, an auditor can use UV light to determine if the marks have been effectively removed during the cleaning process. *HTO*s are objects and surfaces that have frequent contact with hands. Examples include door knobs, bedside rails, light switches, hand rails, faucets, and toilet flush handles.[6] *Patient environment* refers to both the immediate space around a patient that may be touched by a patient and health care workers and a patient's washroom.[6] *Auditors* were TOH housekeeping supervisors who took part in the pilot study to test different environmental auditing products. The qualitative survey administered to auditors included questions about the existing auditing product in addition to the 2 new products tested.

For the purpose of our study, we assumed that our auditors were familiar with the existing auditing process using oil-based florescent marker and for this reason did not include it as part of the pilot auditing study.

METHODS

We designed and administered a 20-day pilot study to test 2 commercially available auditing products: a translucent, alcohol-based UV fluorescent marking product, available in a prefilled pocket-sized dispenser, and a product that measures ATP bioluminescence. For this study, our auditing team was a triad consisting of a housekeeping supervisor (the auditor), an infection control professional (ICP), and a project manager. The housekeeping supervisors conducted all audits using both products, the ICP timed each audit to capture the labor intensity associated with each product, and the project manager recorded the pilot data. To assess user preference among housekeeping supervisors, the pilot was designed to allow each full-time weekday housekeeping supervisor to conduct daily audits with both products for a period of 1 week. In total, 10 supervisors participated in the pilot study.

One audit was conducted per day at each of the hospital's 2 inpatient acute care sites. Patient rooms were audited before and after daily cleaning (not terminal cleaning). For feasibility purposes, convenience sampling was used to carry out the pilot study. Units and patient rooms were selected at random by the auditing team to imitate existing daily auditing practices. The products were tested on a variety of units, including medical, obstetrics, psychiatric, and step-down units. Operating rooms, the emergency department, and outpatient clinics were excluded from the study because these areas were not part of existing auditing practices. Rooms where patients were following contact precautions were also excluded, because we routinely use sodium hypochlorite to clean these rooms, which may confound the results from the ATP bioluminescence product.[6]

Fluorescent marking

We selected 15 patient environment HTOs to be measured. These HTOs were selected based on published recommendations.[5,6] Although auditing using the fluorescent marker could be performed in 1 day, for our evaluation auditing was a 2-day process. On day 1, the auditor marked the 15 preselected HTOs using the fluorescent marking agent and recorded this information as well as room number and date into a portable, handheld device provided by the manufacturer. On day 2, the auditing team returned to the room following the daily clean to determine if the fluorescent markings had been removed during the daily cleaning process.

A score of 1 was awarded if the mark had been removed during the cleaning process and a score of 0 if a mark was present. To control for auditor subjectivity, we assigned 0 to marks that were partially removed. The scores were then aggregated and divided by the total number of HTOs measured in the patient space to arrive at a total score for the room. This information was recorded by the auditor in the software application on a handheld device. The results were then automatically uploaded wirelessly to a web-based portal supported by the manufacturer. We considered a room to have "passed" if it scored $\geq$80% based on current recommendations.[5]

ATP bioluminescence

To parallel the process using the fluorescent marker, auditing with the ATP bioluminescence method was also a 2-day process for our evaluation. On day 1 the auditor swabbed the same 15 HTOs selected for fluorescent marking to test ATP bioluminescence, using 1 swab per HTO. The swab was then inserted into a portable data capture device supplied by the manufacturer that provided a measurement of the bioburden on the surface measured in RLUs. The results were saved within the data capture device and uploaded via a docking station to a web-based portal supported by the vendor. On day 2, after daily cleaning, the auditor swabbed the same 15 HTOs as the previous day and obtained RLU values for each swab; however, the repeat assessments were not necessarily obtained immediately after daily cleaning. Again, the data were