

Other

270. Patient Perception of Contact Precautions

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Background: Contact precautions (CP) are recommended for the management of patients colonized or infected with antibiotic-resistant bacteria and are used for an expanding number of hospitalized patients. Potential drawbacks to CP include physical isolation from other patients, stigmatization, fewer visits from healthcare workers and a higher frequency of service care errors. Patient opinion regarding drawbacks and benefits of CP has not been fully evaluated.

Objective: To survey patient opinion regarding drawbacks and benefits of CP.

Methods: Patients were approached in their rooms within 48 hours of admission to the general medical unit at the Baltimore Veterans Administration Medical Center. After obtaining informed consent, patients were administered a brief survey that included questions regarding patients' self-reported general medical conditions and their ability to perform activities of daily living (ADL) using the Katz ADL survey. We used Likert scales to assess opinions regarding the importance of described benefits and risks of CP.

Results: During the Fall of 2007 we surveyed 84 patients of which 93% were male and median age was 63 years (interquartile range (IQR) 55-75 years). 16 patients (19%) were on CI at time of admission. 56% of patients had been admitted in the past year (average 2 months ago). 68% reported no difficulties with ADLs. 14% reported isolated urinary incontinence and 18% reported need for assistance with other ADLs.

In reporting perceptions, the 10-point Likert scale was anchored at 1 = unimportant and 10 = very important. Avoiding a hospital-acquired infection (median 10, IQR 10-10), avoiding a bed sore (10, 10-10) or fall (10, 9-10), regular doctor visits (10, 8-10), regular nursing visits (10, 8-10), privacy (10, 7-10) and a rapid discharge (10, 9-10) were all rated as very important by participants. Assistance with bathing (1, 1-5) and eating (1, 1-2) were relatively unimportant to patients. Social interactions (8, 5-10) and visits from family and friends (10, 5-10) were variably important to patients.

Level of comfort with a description or experience of CP was polarized. On a 10-point Likert scale anchored at 1 = very uncomfortable and 10 = very comfortable, in patients already on CP, 8/16 (50%) indicated a score of 1 compared to 26/68 (38%) of those not on CP ($p = 0.41$, Fishers exact test). 5/16 (31%) of patients already on CP indicated a score of 10 compared to 24/68 (35%) of patients not on CP ($p = 1.00$, Fishers exact test).

Conclusions: Beneficial and negative outcomes potentially resulting from CP are important to patients, however level of comfort with CP was polarized. Larger studies

are warranted to better understand patient opinion as a consideration in the application of CP.

271. The Impact of Ultraviolet Radiation on Established *S. aureus* Biofilms *in Vitro*

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Background: *Staphylococcus aureus* is an important cause of surgical site and device related infections where biofilm formation plays a role in pathogenesis. Antimicrobial therapy often fails to eradicate the bacteria from these biofilm environments. Novel treatment modalities are needed. Planktonic bacteria, including *S. aureus*, have been shown to be quite sensitive to even brief exposure of Ultraviolet (UV) radiation.

Objective: The purpose of this study was to evaluate the impact of UV radiation *in vitro* on established *S. aureus* biofilms.

Methods: A CDC Biofilm Reactor system was used to generate biofilms from a clinical isolate of methicillin sensitive *S. aureus* on plastic coupons. A UV radiation source (240-260 nm wavelength) was directed onto the intact biofilms. Four doses of UV radiation were delivered by varying exposure durations (5 seconds, 15 seconds, 60 seconds, and 300 seconds) to a fixed intensity UV source. Biofilm bacteria were harvested by mechanical scraping and then disaggregated via sonication and vortexing. Quantitative assessment of bacterial survival in the UV exposed biofilm was assayed and compared to non-exposed biofilm and planktonic *S. aureus*.

Results: The UV exposure led to a decrease in *S. aureus* of 1.5-2.4 log cfu/ml depending upon the duration of exposure to UV radiation. This was statistically significant when compared to biofilm controls at all exposure times ($p < .0001$). UV exposure times of 5, 15, and 60 seconds produced similar results. Not until 300 seconds of UV exposure was the response significantly different from other durations of delivered UV radiation. Sterilization could not be achieved in the biofilm samples with the delivered doses of UV. Exposure of planktonic *S. aureus* to UV led to a decrease of 4.8-5.6 log cfu/ml depending upon the duration of exposure. This was a statistically significant difference from corresponding *S. aureus* biofilm survival at the same level of UV exposure ($p < .0001$). Sterilization of planktonic samples was achieved at some radiation levels.

Conclusions: The results are encouraging that UV radiation could play a role in selected biofilm related infections, and deserves further investigation to define its role in clinical practice. Further studies are needed to assess the response of biofilm bacteria to UV radiation in conjunction with antibacterial agents or quorum sensing inhibitors.

272. Pay for Performance (PFP) Program Risk Assessment (RA) to Facilitate Appropriate Selection of Hospital Units for Implementation of Active Surveillance Testing (AST) and Transmission Reduction of Methicillin-Resistant *Staphylococcus aureus* (MRSA)

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Background: Highmark Inc, the largest health insurer in Pennsylvania, provides an opportunity for hospitals to partner with a payer to improve patient safety and clinical care through the Quality BLUE (QB) Hospital PFP program. Thirty one hospitals participate in the QB PFP program and meet these goals by working on 9 possible quality indicators. The MRSA indicator is designed to reduce transmission of MRSA and healthcare associated infections (HAI) by implementing AST and appropriate infection control procedures. For this indicator, hospitals selected 1 clinical unit in fiscal year (FY) 06, 2 in FY07, and 3 in FY08. Historically, units chosen did not always have high rates of MRSA HAI. Because AST requires significant resource utilization, a RA requirement was added to facilitate selection of clinical units in need of intensified efforts in MRSA control.

Objective: The specific aims of this initiative are to 1) incorporate a RA in the MRSA PFP indicator to provide direction to hospitals in choosing units for AST and prevention efforts and 2) analyze PFP participant's hospital-wide reported MRSA bioburden for future program goals.

Methods: MRSA RA instructions for FY08 consist of 3 options to assess unit specific bioburden of MRSA: calculate the historic rate by unit using patient days (PD) or patient admissions (PA) of MRSA 1) HAI, 2) clinical cultures (CC) positive (+), or 3) number of patients in isolation. Units with the highest rate of MRSA bioburden were chosen for MRSA units. Data was submitted to Highmark, reviewed by the QB team, and selection of units approved or disapproved.

Results: All 31 hospitals submitted detailed RA to QB PFP team: 22 (71%) used MRSA HAI method, 9 (29%) used CC + method. No hospital chose the analysis of patients in isolation. See Table.

# Hospitals	# Months	# MRSA HAI	# CC +	# PD	# PA	Rate per 1000 PD		Rate per 1000 PA	
						MRSA HAI	MRSA CC +	MRSA HAI	MRSA CC+
19	203	610		1,116,279		0.546			
7	82		1001	466,513			2.1457		
3	23	56			12,646			4.428	
2	17		76		16,062				4.7316
Total	325	666	1077	1,582,792	28,708				

Conclusions:

1. Our RA methodology provided options for hospitals to use available facility specific data, minimizing burdensome administrative data collection requirements, in the selection of units for MRSA indicator implementation.
2. Analysis of the RA by the QB team, in conjunction with hospital quality contacts,

provided an opportunity for contacts to assess the extent of MRSA bioburden in their facility and choose units in need of focus to implement control efforts.

3. To standardize future RA requirements, the FY08 PFP program was expanded to incorporate collecting and reporting of hospital-wide MRSA HAI rates per 1000 patient days. This standardized data collection methodology will provide the opportunity for comparison of QB participating hospitals' MRSA bioburden.

Quality Assessment

273. Dangerous COWs - An Analysis Of Disinfection Cleaning And Mobile Computer Keyboard Migration In The ICU Setting

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Background: Keyboards in Intensive Care Units (ICUs) have been shown to serve as reservoirs for resistant micro-organisms. With the development of computers on wheels (COWs) there is now a potential for their keyboards to serve as a mobile source of healthcare-associated pathogens if the COWs are not well cleaned and particularly if they are shared between patients without cleaning.

Objective: The purposes of this study were: 1. To evaluate the thoroughness with which keyboards were being cleaned in our ICU; 2. To track the movement of potentially contaminated keyboards associated with COWs.

Methods: The thoroughness of disinfection cleaning of keyboards in a sixteen bed ICU in an academic medical center was evaluated using an invisible fluorescent targeting tool to covertly evaluate the daily cleaning of our washable keyboards. The fluorescent marker, which dries invisibly and is only detectable using an ultraviolet lamp, can be removed by gentle rubbing with a moist cloth or disinfectant wipe. The fluorescent marker was placed in three strategic locations on each keyboard and re-evaluated one to four days later. The COWs were tracked by their serial numbers and their location was monitored daily for several weekly cycles.

Results: The thoroughness of cleaning was evaluated for 34 keyboards over a five month period. Initially none of the keyboards were cleaned after four days. Following education and feedback, the thoroughness of daily cleaning improved to 25%. When it was found that essentially all of the cleaned keyboards were located in non-patient care areas further work process analysis disclosed that the ES staff were reluctant to clean the in-use patient care keyboards on COWs. The fifteen keyboards on COWs were monitored over several four to seven day periods. Over the short term most of them remained in their original locations, either in the hallway or in patient rooms. However, during a five month follow-up all eight of the original keyboards which were continuously available for analysis had migrated into a patient room on at least one occasion with six of the eight (75%) migrating back to the hallway at least once. Of the eight keyboards on COWs, two had migrated into and later out of an MRSA contact isolation room.

Conclusions: The use of an indirect fluorescent marking tool allowed for an objective analysis of the thoroughness of environmental disinfection cleaning of computer

keyboards in our ICU. While clerical keyboards not located in patient contact areas were cleaned somewhat more thoroughly after education and performance feedback (25%), only 21% (3 of 14) of keyboards on COWs were cleaned on a daily basis. Tracking the COWs confirmed their migration into and out of patient rooms, including isolation rooms. These findings have prompted an ongoing evaluation of cleaning policies of all patient area computer keyboards at our institution.

274. Development of an Automated System for Monitoring Compliance with Admission Surveillance Cultures (AdmSCs) for MRSA and VRE

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Background: Active surveillance including AdmSCs for MRSA and VRE facilitates proper patient isolation and accurate detection of healthcare-acquired transmission. 5 ICUs and 3 units serving high-risk groups (HIV, solid organ transplant, and acute leukemia) at the Johns Hopkins Hospital (JHH) routinely collect AdmSCs. These units have requested routine feedback on their compliance with AdmSC. Also, the state of Maryland will soon require healthcare providers to report AdmSC compliance. However, collecting compliance data manually is time-consuming and impractical in a high-volume healthcare setting.

Objective: To develop and validate a system that measures and provides timely reporting of AdmSC compliance using JHH healthcare epidemiology and infection control's clinical decision software (TheraDoc, v3.3.2).

Methods: Participating units collect AdmSCs for MRSA and VRE from all patients. Surveillance Cultures (SCs) are also taken either weekly or on discharge. An algorithm was designed to measure AdmSC compliance in these units. MRSA and VRE SCs were identified by their universal service code. An SC counted as an AdmSC if it was taken within 24 hours of patient admission to the unit, its collection location matched the admitting unit, and it was not cancelled. SCs taken the day of admission but with a time stamp before admission were counted as AdmSCs. Some units collect AdmSCs in the operating room or emergency department holding areas, and the algorithm accounted for this.

A sample of AdmSCs identified by the algorithm was validated against manually-collected data. False negatives occurred if the algorithm missed an AdmSC and false positives occurred if the algorithm incorrectly detected an AdmSC. The reasons for false negatives and positives were investigated.

Compliance data were reported monthly to the units starting 11/2007.

Results: 8,912 unit admissions from 1/7 to 12/1/2007 were included in initial development and testing. For validation, 116 admissions were reviewed for MRSA compliance and 89 for VRE compliance (1.3% and 1.0% of all admissions), in which 59 and 53 AdmSCs were taken, respectively. For MRSA AdmSCs, the algorithm had a sensitivity of 100% and a specificity of 98.2%. For VRE AdmSCs, sensitivity was 88.3% and specificity was 87.8%. False negatives occurred because the algorithm

missed some AdmSCs taken in holding areas. False positives occurred when SCs taken >24 hours after admission were counted as AdmSCs. Anecdotally, personnel from the participating units reported that this information was helpful to them.

Conclusions: The accuracy of the automated monitoring system proved acceptable. The algorithm for VRE requires further refinement. The algorithm is potentially a less labor-intensive method of to provide healthcare providers timely feedback on compliance with AdmSC and to facilitate mandated state reporting of compliance with AdmSC.

275. How to Use a Centralized Data Repository to Improve the Efficiency of Quality Research and Improve Care at the Bedside through Physician Buy-in

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Background: Many hospitals have a repository for financial, administrative, or clinical data. The integration of all three categories in real time is rare. Many quality improvement projects that were unfeasible due to chart abstraction can now be accomplished through electronic resources.

Objective: Demonstrate how a data warehouse can improve the efficiency of quality research. Demonstrate how technology has been successfully used to improve care at the bedside. Describe the methods used to obtain physician buy-in.

Methods: We previously had a financial data warehouse and during 2007 we integrated clinical components, including laboratory, microbiology, pathology, pharmacology, GI/Pulmonary labs, and radiology. Once the data was available, creating meaningful reports required the skills of programmers, clinicians, and statisticians.

Results: Many quality improvement projects which were previously insurmountable were accomplished using the data repository. A proxy for poor quality of care in the emergency department (ED) is returning to the ED and being admitted within seven days. We narrowed the 3,088 ED cases in June 2007 to 43 patients whose medical records we could peruse to determine why they were not admitted during the first visit. Another example focuses on an adverse effect from hydrochlorothiazide (HCTZ). HCTZ is a first-line treatment for hypertension but it can cause acute gout. We identified approximately 14,000 outpatients with hypertension and isolated the 20 hypertensive patients who received HCTZ and then developed gout. Out of these, HCTZ was appropriately discontinued in 14 patients. We contacted the providers for the other 6 patients to recommend they stop the HCTZ. A preventative service registry was created for colorectal cancer screening. Clinic managers and physicians can access through our intranet reports showing the percentage of patients current with screening recommendations at the enterprise, clinic, and provider level. Patient mailing labels are generated so that campaigns can target those who need to be screened. A chronic disease registry was developed for our hypertensive patients. A point of care interface allows our clinicians to print individualized patient handouts that trend blood pressures and medication refills. An infection control-based project for Joint Commission physician competencies focused on surgical site complications including wound infection, postop wound dehiscence, and intra-abdominal abscess.

Conclusions: There are a plethora of quality initiatives that are now possible through our data repository. We have only uncovered the tip of the iceberg. Possible future infection control projects include a real-time surveillance database for MRSA, multi-resistant gram-negative bacteria, VRE, etc. or a registry for patients with HIV or hepatitis.

Product Evaluation

276. Monitoring the Effectiveness of Hospital Cleaning Practices Using an ATP Bioluminescence Assay

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Background: Monitoring the adequacy of cleaning high-touch surfaces in hospitals is recommended, but visual inspection may not accurately reflect the level of cleanliness achieved.

Objective: Evaluate the potential usefulness of monitoring hospital cleaning practices by using an ATP bioluminescence assay (3M, St. Paul, MN).

Methods: Phase 1. Moistened swabs were used to culture 5 high-touch surfaces (bedside rails, overbed tables, TV remotes, toilet seats, toilet grab bars) before and after (B/A) daily cleaning in 20 patient rooms. Swabs were inoculated onto blood agar plates and aerobic colony counts (ACC) were determined after 48 hrs of incubation. Adjacent areas of the same 5 high-touch surfaces were sampled at the same times B/A cleaning using specialized ATP detection swabs that were inserted into a luminometer, which yields relative light unit (RLU) readings. RLU readings were uploaded to a desktop computer for data analysis. ACC and RLU readings obtained B/A cleaning for each of the 5 surfaces were compared using Wilcoxon signed ranks tests. Correlation between ACC and RLU for each surface was determined using Spearman correlation coefficients. Phase 2. In-service sessions on the importance of following cleaning protocols were given to housekeepers by an infection control practitioner. Two environmental service managers used ATP swabs to sample the 5 high-touch surfaces B/A daily cleaning in 42 patient rooms. For rooms sampled, housekeepers were told in advance that ATP readings would be obtained B/A cleaning. RLU readings B/A cleaning were compared using Wilcoxon signed ranks test, and ATP readings obtained after cleaning in Phases 1 and 2 were compared using the Mann-Whitney U test.

Results: Phase 1. ACC obtained after cleaning were significantly lower than before cleaning for grab bars ($p = .02$) and toilet seats ($p = .03$), but not for bedside rails ($p = .07$), overbed tables ($p = .20$) or TV remotes ($p = .55$). Similarly, RLU readings obtained after cleaning were significantly lower than before cleaning for grab bars ($p = .03$) and toilet seats ($p = .01$), but not for the other 3 high-touch surfaces. The level of correlation between ACC and RLU readings was low (R^2 ranging from .36 to .65), although statistically significant ($p = .02$ or less for all surfaces). Phase 2. RLU readings after cleaning were significantly lower than before cleaning for grab bars ($p = .001$), toilet seats ($p < .001$), bedside rails ($p < .001$), overbed tables ($p < .001$) and TV remotes ($p = .005$). RLU after cleaning in Phase 2 were lower (i.e., surfaces

were cleaner) than after cleaning in Phase 1 for grab bars ($p = .053$), bedside rails ($p = .002$), and overbed tables ($p = .017$).

Conclusions: The ATP bioluminescence assay studied provides a quantitative assessment of cleanliness of high-touch surfaces in patient rooms. RLU readings can be used to determine the impact of training sessions and real-time monitoring on the adequacy of routine cleaning practices.

277. The Roles of Individual Variation and Sebum Levels on Antiseptic Action on Skin

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Background: Topical antimicrobial products are applied to a patient's skin prior to surgery to reduce the risk of nosocomial infections. A variety of agents, for example, chlorhexidine gluconate and povidone-iodine have been used for over fifty years. The ability to eradicate organisms as a function of site of application and potentially as a function of the patient's unique environment can alter the ability of these agents to eradicate organisms and formed the focus of the study.

Objective: The study was designed to address three questions: are antiseptic agents different from one another in ability to eradicate organisms, is there a subject specific response to antiseptics, and does sebum act as a determinant in microbial skin density.

Methods: The investigation was a prospective, randomized, open-label study. The study was carried out using Good Clinic Practices. Twenty (20) subjects in good health between the ages of 18 and 75 formed the study group. Skin on the back was used as the investigative site for each of four currently available antiseptic agents, chlorhexidine gluconate, povidone-iodine, isopropanol, and ethanol. The response to the agents was measured with colony forming units of each organism before and after application.

Results: All four antiseptic agents were found to have identical ability to kill both anaerobes and aerobes. There was subject-to-subject variation in the response to antiseptic agents that was correlated with the initial microbial density on the subject's skin that was observed for both aerobes and anaerobes. Sebum levels were correlated with efficacy of antiseptics for both anaerobes and aerobes.

Conclusions: The efficacy of antiseptic agents could be divided into two groups, depending on initial microbial density: subjects with initial colony forming unit densities of less than 4 logs demonstrated different results compared to those with initial densities greater than 4 logs. Speciation of aerobic organisms demonstrated that for those subjects with initial densities greater than 4 logs, coagulase negative staphylococcal species persisted after antiseptics and were associated with lower numbers of other organisms.