

Patient Safety

261. Implementation of an Integrated Care Pathway for Patients with MRSA

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Background: The management and documentation of care when patients are identified with Methicillin-resistant *Staphylococcus aureus* (MRSA) and the subsequent communication with the patient and their family had been less than satisfactory in our organization. This became evident when medical and nursing notes were investigated in relation to litigation cases and Freedom of Information (FOI) requests. To standardize our approach and ensure patient safety with regard to the management of MRSA, an integrated care pathway (ICP) was developed. In order to judge the effectiveness of this approach an audit of patient notes was undertaken before and after implementation of the care pathway.

Objectives: To provide a tool that ensured all patients identified with MRSA received standardized care in accordance with national and local guidance and to ensure patients were fully informed about MRSA and its management and treatment.

Methods:

- A scannable form using Formic for Windows version 3 (Formic Ltd., London, UK) was devised for the purposes of auditing medical and nursing notes pre and post ICP implementation
- Five wards were identified to take part in the pilot study
- Pre audit involved a retrospective study of 24 patients' clinical notes
- Post audit involved a retrospective study of 13 patients' clinical notes
- In collaboration with clinical colleagues an MRSA ICP was devised
- Patient's assisted in creating a pictorial patient information leaflet

Results:










The pre and post implementation audits of the ICP showed a vast improvement in the management and documentation of patients with MRSA (Table). Patient's responded very favourably to the pictorial guide (Figure).

Pre and post clinical notes audit		
Note Review	Pre-audit	Post-audit
Was the IPCN notified?	33.3%	92.3%
Was an MRSA leaflet given?	4.2%	76.9%
Were the correct screening swabs sent?	66.7%	92.3%
Were MRSA Screening results recorded?	33.3%	61.5%
From medical/nursing documentation could it be identified that the patient was isolated?	8.3%	100%
Was there evidence of daily nursing documentation with regard	16.7%	76.9%

the management of MRSA?		
Was patient informed of their MRSA status?	20.8%	61.5%

Patient Pictorial Guide

Care Pathway For Patients With MRSA (Meticillin-resistant *Staphylococcus Aureus*)
 This pathway has been developed to give you a guideline of what to expect during your hospital stay. It supports a more detailed pathway used by clinical staff.
 Visitation may occur based on your individual situation.
Staphylococcus aureus is a germ found mainly in the nose and on the skin of many healthy people. It is normally harmless but can sometimes cause boils, abscesses and wound infections, particularly in those who are already unwell. Such infections can usually be effectively treated by commonly prescribed antibiotics. Some *Staphylococcus aureus* germs are resistant to a representative antibiotic called Meticillin and are referred to as, Meticillin-resistant *Staphylococcus aureus* (MRSA).

<p>Identifying MRSA</p> <p>MRSA has been identified from swabs taken from your nose and/or skin or wound</p>  <p>Further swabs will be taken during your stay to establish your MRSA status.</p>	<p>Treating MRSA Carriage</p> <p>If you are a skin carrier you will be requested to bath or shower for five days using an antiseptic wash that will be provided</p>  <p>If your nose is positive for MRSA a nasal cream will be prescribed and should be applied high up into both nostrils as prescribed for 5 days</p> 	
<p>Reducing The Spread Of Germs</p> <p>Clean hands will reduce the spread of germs. Wash hands or use the hand rubs during any of your bedside.</p> <p>If using hand rub: during, rub into hands as you would when washing with water. There is no need to rinse or dry.</p>  <p>You may be cared for in a single room. Keep your belongings to a minimum as this makes general cleaning easier.</p> 	<p>Visitors</p> <p>ALL visitors should wash their hands or use the available hand rub on entering your room and before leaving</p>  <p>Please ask visitors NOT to sit on any patient bed.</p> 	<p>Discharge Home Or Transfer To Another Hospital</p> <p>Details regarding your MRSA status will be forwarded to you and district nurse</p>  <p>You may be asked to continue treatment home or at another hospital.</p>  <p>Towels/washcloths, underwear and bed linen should be regularly laundered using a hot wash cycle as is compatible with the fabric</p>
<ul style="list-style-type: none"> The doctors and nurses will be available to answer questions. Please inform the ward nurse if you wish to speak to an Infection Prevention & Control Nurse. In a small number of patients MRSA may cause infection and antibiotics may be given 		

Conclusions: Pre and post implementation audits showed a vast improvement in the documentation and management of care for patients with MRSA. Patients and nursing staff viewed this ICP as an indispensable tool. After completion of the pilot study the ICP has been spread out to other wards and has been updated. Even though the Medical staff have been very supportive and see the benefits of this ICP, they have still to become fully committed to using the care pathway. ICPs are a useful tool to ensure patient safety and the delivery of quality care.

262. Effectiveness of Membrane-Integrated Filters to Decrease Microbial Counts in Shower-Generated Aerosols on a Blood and Marrow Transplant Unit

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Background: Tap water may be a potential source of infection in severely immunocompromised patients, particularly for organisms such as *Legionella* spp., *Pseudomonas* spp., *Aspergillus* spp., and *Mycobacterium* spp. However, there are no data or recommendations for patients undergoing myeloablative cancer therapy about limiting exposure to potable water. This study investigated the bacterial concentration and composition of aerosols generated in shower stalls in a Blood/Marrow Transplant (BMT) unit.

Objective: Determine if opportunistic pathogens in aerosols generated by showers in a BMT unit are eliminated after changing from conventional showerheads to membrane-integrated showerheads (0.2- μ m pores).

Methods: Shower water, shower aerosol, and background air samples were collected with and without membrane-integrated showerheads from 2 rooms in the Barnes-Jewish Hospital BMT unit from shower stalls fed by different plumbing system risers during 2 seasons, winter and summer 2007. Rooms are private and positively pressured with HEPA-filtered air. Aerosol samples were collected using a swirling aerosol collector for 90 min, allowing a total sample volume of 1.125 m³ to pass through each of 3 samplers. Shower aerosol samples were taken at a height of 1.5 m while the shower was running. Bacteria from concentrated shower water samples were grown on heterotrophic tryptic soy agar plates and CFUs were determined using standard methods. All samples were analyzed using epifluorescence microscopy, quantitative PCR, and 16S rRNA gene sequencing of cultured and noncultured specimens.

Results: Based upon direct cell counts with epifluorescence microscopy, the change in showerheads was the only significant factor (aerosol, $p < 0.010$; water, $p < 0.010$) among the different seasons, system risers, and showerheads. Direct counts showed that a membrane-integrated showerhead reduced the cell counts by 99.5% ($\pm 0.53\%$) and 37.4% ($\pm 13\%$) within the shower water and shower aerosol, respectively. Quantitative PCR results were comparable to these results ($99.0 \pm 1.4\%$ and $45.4 \pm 10\%$, respectively). Similarly, reductions in number of CFUs of the shower water grown on plates were found to decrease 99.0% ($\pm 1.3\%$) with use of the membrane-integrated showerhead. DNA of representative colonies from the water samples was extracted and PCR-amplified with universal bacterial 16S rRNA gene primers. Sequencing analysis yielded *Bacillus* and *Mycobacterium* spp. Most notably, *M. mucogenicum* colonies were identified in multiple nonfiltered shower water samples.

Conclusions: Use of membrane-integrated showerheads in BMT shower stalls reduced bacterial concentrations in both the filtered water and aerosol. Further research is needed to determine the impact of installing membrane-integrated showerheads on the incidence of nosocomial waterborne infections and outcomes in BMT patients.

263. Bacterial Colonization of Wrist Watches of Health Care Personnel (HCP)

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Background: Previous studies have documented bacterial colonization with potential pathogens of a variety of objects used or worn by HCP: stethoscopes, BP cuffs, pens, pagers, PDAs, phones, computer keyboards, charts, rings, neck ties, and lab coats. To our knowledge, no study has examined the possibility of colonization of wrist watches worn by HCP. Worn close to the hands by design, wrist watches could serve as unrecognized reservoirs of bacteria that would likely be unaffected by usual hand hygiene. This study is significant because the British Department of Health has recently banned the use of white coats and strongly discouraged the use of wrist watches by HCPs.

Objective: To determine the prevalence of bacterial colonization of HCP wrist watches with healthcare-associated pathogens.

Methods: Aerobic bacterial cultures were obtained using cotton swabs moistened with sterile saline from 100 wrist watches worn by a convenience sample of attending physicians, residents, floor nurses, and critical care nurses at a tertiary teaching hospital. No subject was permitted to perform hand hygiene just before removal of the wrist watch for swab culture. The face and back of the watches were swabbed separately and inoculated onto sheep blood agar plates and incubated x 48 hrs. Bacterial colonies were identified macroscopically and when indicated, by gram stain by one of the authors, an experienced microbiology technician (KS). Bacterial identification and antibiotic susceptibilities were performed using standard laboratory methods: rapid coagulase test for *S. aureus* (Staphaurex@) and 1.0 mcg oxacillin disc for MRSA confirmation

Results: The 100 HCP in the study had been working in the hospital at least a year and worked a minimum of 15 days/month in direct patient care. 77% had worn their tested wristwatches for more than 6 months and 85% were wearing them every day at work. No gram-negative aerobic bacilli were isolated. *S. aureus* (MSSA) was grown from only one watch (back) with < 10 colonies on the blood agar plate. Of the 100 wrist watches sampled, 69 (69%) had bacterial growth and 31 had none. The faces of the wrist watches were less likely to have bacterial growth than the backs of the watches: 36/100 (36%) culture-negative vs. 47/100 (47%) culture-negative, $p = 0.10$ by χ^2 . The isolates from culture-positive watches included coagulase-negative staphylococci, alpha hemolytic streptococci, diphtheroids and bacillus species.

Conclusion: Wrist watches of healthcare workers appear to be less of a reservoir for potential pathogens when compared to published studies of bacterial colonization of other objects and apparel. Although our study is relatively small, it is reassuring that the wristwatch, worn usually continuously during patient care and in proximity to the hands, is an unlikely source for pathogens that could be transmitted to hospitalized patients and does not support the prohibition of the use of wrist watches when involved in patient care.

264. Healthcare-associated Inadvertent Feeding of Another Mother's Breast Milk in Infants

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Background: Breast milk may be a source of transmission of infectious agents. Therefore when banked, breast milk donors are screened via serology for a number of viral agents and syphilis. There is limited medical literature regarding inadvertent exposure of breast milk in infants.

Objective: To examine the factors and limited infectious disease risks associated with the inadvertent feeding of a mother's stored breast milk in a hospital setting to an infant other than that mother's child.

Methods: Community based Teaching Hospital with a Newborn Intensive Care Unit (NICU), Convalescent Nursery Unit (CNU) and Pediatric Ward; retrospective review of infant and maternal charts, pre-natal testing, post-incidence serology of HIV 1/2, Hepatitis B and C, RPR, HTLV I/II, and CMV obtained on mothers, and interviews with nursing personnel from January 1, 2005 to December 31, 2007.

Results: From 2005-2007, there were 9 instances of a single inadvertent feeding of stored frozen maternal breast milk (donor) to the incorrect child (recipient). Of these, 2 occurred on the Pediatric Ward, 4 in the NICU and 3 in the CNU. Analysis revealed the following causes for inadvertent exposures: Removing milk from the incorrect bag in a common storage area, warming bottles in a common tray, switching of bottles, incorrectly labeling bottles, bottle stored in incorrect tray, and placement of two different labels on a single bottle. There were 16 mothers involved, counted as 9 donors and 9 recipients. Prenatal testing was available for 15/16 mothers, with one mother having no prenatal care. Among 9 donor mothers, 8/9 had prenatal care with testing results available; however HIV testing was declined for 3/8. Due to delay in obtaining post-exposure laboratories, 1/9 children was placed on post-exposure prophylaxis. Post-exposure test results were available for 15/16 for all except HTLV I/II, of which 11 were available. Available test results were negative or reflective of vaccination except for maternal CMV. 9/9 recipient mothers tested positive for CMV IgG and 5/8 donor mothers were positive. With each incidence, a review of nursing policies and procedures was done with recommendations made.

Conclusions: Inadvertent feeding of one child's maternal breast milk to another child is an uncommon but not rare event in a hospital. The major recommended nursing change is to perform a two person check of labels before feeding, as is done before blood transfusions. This potentially would have prevented all but one described exposure. The risk of transmission of infectious diseases is very low for a single inadvertent feeding. Although this sample is small, the only theoretical risk was for CMV transmission based on available laboratories. If transmission of CMV had occurred, it would not be possible to determine if it was from maternal transmission or the inadvertent single feeding of the incorrect breast milk.

Surveys

265. Implementation of Guidelines by Iowa's Healthcare Facilities (HCFs)

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Background: The Institute for Healthcare Improvement (IHI) translated evidence-based guidelines (EBG) about care of central venous catheter (CVCs) & ventilators (V), & about infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA) into implementation bundles.

Objective: To assess the extent to which HCFs in Iowa have implemented IHI's CVC, V, & MRSA bundles.

Methods: In 5/07, we surveyed infection control professionals (ICPs) who attended Iowa's annual infection control seminar to assess implementation of each component of IHI's CVC, V, & MRSA bundles. We used Chi-square or Fisher's exact tests to compare categorical variables & considered a p-value of ≤ 0.05 as statistically significant.

Results: ICPs from 82 HCFs responded. 46 (56.1%) HCFs were in communities of $\leq 10,000$ inhabitants & 63 (76.8%) had < 100 beds. 32 (39%) HCFs provided only acute care, 31 (37.8%) provided acute care & other types of care, & 18 (22%) provided only skilled or long-term care. 48 (59%) of the responding HCFs had > 0 but < 1 ICP. Only 44 (53.6%) HCFs had a microbiology lab onsite. HCFs with > 100 beds were more likely than smaller hospitals to have a lab ($p = 0.05$). 45 (54.9%) HCFs did some cultures to identify patients (pts) with MRSA & this practice was not associated with HCF size. However, 36/45 (80%) obtained cultures only from pts who had MRSA previously & 25/45 (55.6%) obtained cultures only on admission. No HCF used rapid tests to identify carriers. 76 (92.7%) HCFs teach employees to do hand hygiene; 51/76 (67.1%) observe practice and feedback adherence (OPFA). 57 (69.5%) isolate colonized pts, 78 (95.1%) isolate infected pts, & 40/78 (51.3%) OPFA. Only 22 (26.8%) HCFs monitored the effectiveness of cleaning & this practice was related to size ($p = 0.02$). 50 (61%) HCFs use CVCs; CVC use was not associated with HCF size. 43/50 (86%) HCFs use maximal sterile barrier precautions & 19/43 (44.2%) OPFA. The subclavian vein was the preferred site for 39 (78%) HCFs & 12/39 (30.8%) OPFA. Most (37/50; 74%) use chlorhexidine (C) to prepare the skin; 17/37 (45.9%) OPFA. Only 11/50 (22%) assess the need for CVCs daily; 9/11 OPFA. Use of C was the only practice that was significantly more common in HCF with > 100 beds. 29 (35.4%) HCFs use V; HCFs with > 100 beds were more likely to use V ($p < 0.0001$). 25 (86.2%) HCFs keep the head of the bed at $> 30^\circ$ & 16/25 (64%) OPFA. 17 (58.6%) HCFs use sedation vacations & 12/17 (70.6%) OPFA. 21 (72.4%) HCFs assess daily patients' readiness to be extubated & 11/21 (52.4%) OPFA. 18 (62.1%) HCFs use prophylaxis for peptic ulcers & 14/18 (77.8%) OPFA. 18 HCFs use prophylaxis for deep vein thromboses & 15/18 (83.3%) OPFA. Practices associated with V were not affected by HCF size. Of the HCFs, $\leq 50\%$ reported implementing all components of the bundles (MRSA = 9.4%, CVC = 18%, V = 50%).

Conclusions: Iowa's HCFs have implemented components of IHI's CVC, V, & MRSA bundles. Few HCFs have implemented all components & few do active surveillance cultures on high risk populations.

266. Risk Factors For Death In A Cohort Of Patients With And Without Health Care Associated Infections In Finnish Acute Care Hospitals, 2005

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Background: The first national prevalence study for health care associated infections (HAI) in Finland was performed in 2005.

Objectives: The study allowed us to analyse risk factors for death among hospitalized patients with special reference to HAI and the usefulness of McCabe classification and Charlson index in measuring the effect of underlying diseases on mortality.

Methods: Data from the national prevalence study constituted the basis for the register linkage. The study included all inpatients (n=8234) in acute care wards for adults in 30 hospitals. The Center for Disease Control and Prevention (CDC) definitions for HAIs were used and McCabe classification for comorbidity was collected. In total, 753 HAIs were recorded in 703 patients (prevalence of HAI patients, 8.5%). Using the date of the prevalence study and the patient's national identity code, data on discharge diagnoses (International Classification of Diseases (ICD)-10 codes) for Charlson index were obtained from the National Hospital Discharge Registry, and the dates of death from the National Population Information System.

Results: Of all inpatients, 425 (5.1%) died within 28 days from the study day; death rate was higher in HAI patients than in those without HAI (9.8% vs 4.7%, p<0.001). In univariate analysis, risk factors for death were age >65 years, male gender, intensive care, severe comorbidity, and HAIs, more precisely pneumonia/other respiratory tract infections and gastrointestinal infections, whereas the preceding surgery was a protective factor. Rapidly (OR, 8.3; 95%CI, 6.2-11.2) and ultimately fatal (OR, 57.5; 95%CI, 40.5-81.8), vs. non-fatal underlying diseases according to McCabe classification were associated with death, and similarly, Charlson index >3 vs. ≤3 (OR, 4.0; 95%CI 2.8-5.7). In multiple regression analysis, age >65 years, intensive care, McCabe classification or Charlson index, gastrointestinal tract infection and pneumonia/other respiratory tract infections were independent predictors for death. In the analysis stratified by McCabe index HAI decreased survival only among patients with non-fatal underlying diseases.

Conclusions: Certain types of HAI increased the risk of death. McCabe classification as a predictor of death has advantages over Charlson index when assessing the severity of underlying diseases because it is easy to collect in context of a prevalence study.

267. Multidrug-Resistant Organism Policies and Practices at Healthcare Facilities

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Background: Although CDC/HICPAC, SHEA and APIC have recently addressed management of multidrug-resistant organisms (MDROs), areas of uncertainty still exist.

Objective: To gain insight from network members regarding which MDROs were considered most problematic and to gauge the scope/range of current practices for areas of controversy regarding MDROs.

Methods: A 17 element electronic questionnaire was sent via e-mail to members of the SHEA/APIC Communication Network [a network of infection prevention control (IPC) /healthcare epidemiology professionals via a cooperative agreement with CDC, DHQP] in 4/07. Electronic and mailed reminders were sent, responses collected and aggregated in SurveyMonkey.com software through 7/07. Results were shared on Network webpages.

Results: Responses were received from 610 individuals (of 1522 e-mail invitations, 50 -100 undeliverable e-mails, 43% response rate) in 49 states, Washington DC, Canada and UK. Respondent's credentials were: MD/DO/MBBS 6.7%, RN/BSN 75.9%, MPH/MS/MSc 18.1% and from: university hosp 10.0%, community teaching hosp 24.6%, non teaching hosp 38.1%, city/county hosp 19.4%, VA 2.1%, and LTCF/rehab 5.9%. Eighty nine percent (89%) had read CDC's Guideline, "Management of MDROs in Healthcare Settings, 2006"; 69.2% indicated that the guidelines will directly impact their IPC program. Those who said it would not impact their programs indicated that they were already doing, have limited resources, or didn't have MDROs.

MDRO Key Data	% Respondents (n=610)	
Track Incidence of Healthcare associated MDROs	88.0%	
Facilities who track & calculate rates	55.0%	
	Organisms tracked	
	MRSA	97.0%
	VRE	91.6%
	ESBLs	55.9%
	Acinetobacter sp	37.4%
	Pseudomas sp.	31.3%
Active Surveillance Cultures Done	62.1%	
	Screen for Specific Organisms	
	MRSA	93.7%
	VRE	49.7%
	ESBL	10.5%

Antimicrobial Stewardship Program/Committee	Yes	41.1%
	No	58.9%
Increase in MDRO Status over last 3 years	Gram positive MDROs (i.e., VRE, MRSA, <i>S. pneumoniae</i>)	68.4%
	Gram negative MDROs (i.e., ESBLs, <i>Acinetobacter</i> sp., <i>Stenotrophomonas</i> sp., <i>Pseudomonas</i> sp., <i>Burkholderia cepacia</i> , <i>Ralstonia pickettii</i>)	38.1%

Almost 90% of respondents agreed that “MDROs are one of the most challenging infection control and prevention issues facing them and their facility today. “MRSA was cited as the most problematic MDRO for their facility and in general” (83% for both). Respondents indicated the most interest for future topics: discontinuation of isolation, surveillance cultures, education and training and protocols for eradication (in that order).

Conclusions: Almost 60% of participants did not have an antimicrobial stewardship program which may correlate with the respondents predominately being from non-teaching facilities. Most cite increases in MDROs and particular concern about MRSA, while an increase in gram negative MDROs was only noted in 1/3 of the respondents. Our survey provides information on current policy and practice on MDROs and areas for future focus.

268. Survey of Nurses` Practices Regarding Central Venous Catheter Care and Hand Hygiene in Finnish Intensive Care Units

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Background: Intensive care patients with central venous catheters (CVCs) are at risk of catheter-related infection, which increases morbidity, mortality and health care costs. Infection control practices, including care of intravenous administration sets and catheter sites, are undertaken by nurses.

Objective: To assess the practices of nurses regarding CVC care and hand hygiene in Finnish intensive care units (ICU).

Methods: A self-administered questionnaire was sent to nurses working in adult ICUs (n=29) of all 5 tertiary and 15 secondary care hospitals. Responders (n=420) from each ICU were randomly selected from morning and night shifts. The questions covered five components of Centers for Disease Control and Prevention (CDC) guidelines for the prevention of intravascular catheter related infections: catheter insertion, catheter and catheter-site care, replacement of administration sets, hand hygiene, and documentation of practices as well as infection surveillance including feedback.

Results: The response rate was 85% (356/420): 59% of the responders were from tertiary care hospitals, 71% worked in mixed ICUs, and 61% had >5 years of working experience in ICUs. Most often appropriate practices were followed in infection surveillance (94%), hand disinfection after removal of gloves (91%) and before touching the administration sets (86%), mask in catheter insertion (93%), and skin disinfection with appropriate antiseptic during dressing changes (85%). The practices were less appropriate as follows: replacing administration sets more frequently than 72-hours intervals (56%), large sterile sheets in catheter insertion (48%), hand disinfection before touching the disconnecter of the administration set (30%), cleaning injection ports before accessing (23%), and getting no regular feedback of infection surveillance in their unit (23%). The overall adherence to the CDC guidelines was better in secondary care hospitals (59%) than in tertiary care hospitals (59% vs 44%, $p < 0.01$) and also in mixed ICUs than in surgical ICUs (48% vs 44%, $p < 0.01$). Nurses reported to document a huge number of different issues ($n = 865$), mostly commonly changes at the catheter site.

Conclusions: Although the results of the survey were based on self-reporting, not on observation, remarkable gaps in infection control practices related to CVC care and hand hygiene were detected. There was also a lot of variation individually and between hospitals. Finnish ICUs could benefit from regular quality control based on internationally accepted guidelines, which are available in Finnish infection control text books.