Infection Control in Low and Middle-Income Countries

142. Infection Control since the Beginning: Experience of a New Hospital in a High Resistance Environment in Bogota, Colombia

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Background: Bogota, Colombia, has a growing problem of antimicrobial resistance in high complexity hospitals and, situated in the developing world, a high frequency of hospital acquired infections. A new hospital --belonging to one of the country's largest health organizations, was opened in 2006. We report the experience of establishing infection control strategies since the start of the hospital, in BogotÃ¡, Colombia.

Objective: To establish an infection control program in a new hospital.

Methods: In a new third level hospital in Bogota, a multidisciplinary infection control program was established (ICU team, epidemiology, infectious diseases professional, nurses and surgeons). Prevention strategies against device-associated infection in the ICU were implemented, patients coming from other hospitals in the city or with wide spectrum antibiotics were isolated, and hand-washing was promoted for all staff. A surgical site infection surveillance program (SSI-SP) was also established. An active surveillance was developed with monitoring of antibiotics consumption and the use of alcohol products.

Results: A third level hospital was started, with the ICU opening September 2006. The number of available beds was increased to 202 beds in October 2007. Until November 2007, no catheter related infections were found in the ICU. After two cases of ventilator associated pneumonia (VAP), a 12 month period without any VAP cases followed. The number of urinary tract infection remained below the 25 percentile. Close to 60% of reported hospital infections were related to surgery and the SSI-SP caught one-third of the surgical infections otherwise not reported. No transmission of methicillin resistant *S. aureus* (MRSA) were detected and the frequency of ESBL producers remained below 2.5 per 1000 patients. Alcohol products use was consistently higher in the ICU and the neonatal ICU.

Conclusions: Implementation of multidisciplinary infection control strategies in a new hospital in a city with a high percentage of resistance (MRSA 60% of isolates, ESBL around 10% of isolates in the ICU) in a developing country was highly effective to maintain a low number of hospital infections and multi drug-resistant isolates. Close monitoring of SSI and prevention strategies to support surgical teams are needed to avoid the main cause of hospital infections in this new hospital.

143. Development and Implementation of an Infection Control Program in Kenya

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Background: Healthcare personnel in resource-limited settings struggle to maintain basic infection control practices in healthcare systems strained with overcrowding, outdated facilities, and chronic shortages of supplies and personnel. The Centers for Disease Control and Prevention (CDC) partnered with the Kenya Ministry of Health (MoH) to address basic infection control in regional hospitals.

Objective: The main focus of this program was to build infection control capacity in Kenya's regional hospitals by delivering basic, but comprehensive infection control content to a group of nurses selected to be hospital resources advocating safer patient care initiatives.

Methods: The program was conceptualized as a multi-faceted package and began with launching a partnership between CDC and Kenya MoH to secure a commitment to support infection control initiatives over a minimum of 2 to 3 years. A core group of nurses was trained to implement and support infection control activities at eight hospitals. Material for didactic and interactive training focused on influenza pandemic preparedness and basic infection control principles including hand hygiene, respiratory hygiene, respiratory cohorting, and prioritizing personal protective equipment. Initial site visit activities included collecting baseline facility infrastructure and personnel data, conducting hand hygiene audits, providing staff education sessions, and developing tailored respiratory cohorting plans for select clinical areas.

Results: A nurse from each of the 8 selected Kenyan hospitals completed infection control training. The MoH was fully supportive of the program and facilitated field visits to reinforce the roles and responsibilities of the trainees. Initial hospital visits indicated that a lack of infection control knowledge and resource and/or personnel limitations were primary challenges to infection control in 75% of hospitals. A comprehensive resource-appropriate package comprised of field-tested content and training exercises were created and refined over six months. Baseline measures and longitudinal evaluation tools such as hand hygiene and respiratory cohorting audits were developed and implemented. Within the first four months of the project, five multi-disciplinary hospital infection control committees formed to address priority issues and solutions. The nurses' activities were reinforced through regular communication, additional training, and follow-up visits.

Conclusions: We describe an approach to building infection control capacity in resource-limited settings. Investment in training personnel, the development of resource-appropriate content, and fostering partnerships within the local government were well-received and regional hospitals remain engaged in infection control initiatives. Other resource-limited settings may benefit from this approach to implementing infection control programs.

144. Improvement in Healthcare Personnel Hand Hygiene Following Initiation of a Multifaceted Infection Control Program in Kenyan Hospitals

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Background: Improving hand hygiene among healthcare personnel is particularly challenging in developing countries where resources are limited and trained infection control professionals are rare. In 2007, the Kenyan Ministry of Health and the Centers for Disease Control and Prevention trained a cadre of nurses and doctors in infection control fundamentals, including practical methods for hand hygiene education, monitoring, and advocacy. Following two centralized workshops, staff received on-site hospital consultations to plan educational in-services, practice hand hygiene auditing, and promote administrative buy-in. Trainees also received bimonthly supervisory visits. To quantify success and encourage sustainability, hand hygiene audit data were regularly summarized and reported to trainees and to the Ministry.

Objective: To assess changes in, and predictors of, hand hygiene adherence following initiation of an infection control program in Kenyan Hospitals.

Methods: Between April and October 2007, 24 staff from eight hospitals audited high-risk patient care activities, defined as any form of direct patient contact (e.g. administering IV medication). Staff systematically documented hand hygiene opportunities, hand hygiene successes, the profession of each healthcare worker observed, and resources available on the audited ward. Adherence was calculated by dividing the number of successes by the number of opportunities observed. Predictors of adherence - including audit month, profession, and resource availability - were assessed using events-trials logistic regression analyses. Three to six full months of audit data were analyzed from each hospital.

Results: Across hospitals, nurses completed 243 audits, observing 2113 hand hygiene opportunities. Overall adherence increased from 28.3% for the first full month of auditing to 59.8% for the last full month. The odds of adherence increased significantly with each additional month of auditing (aOR=1.27, 95% CI=1.20-1.35). When compared to non-nurses, nurses demonstrated more than twice the odds of adherence (aOR=2.20, 95% CI=1.76-2.62). Soap availability at hand washing stations significantly increased the odds of hand hygiene adherence (aOR=1.85, 95% CI=1.35-2.55) as did “visible and easy access to existing hand hygiene stations” (aOR=1.89, 95% CI=1.39-2.55).

Conclusions: Adherence to proper hand hygiene practices improved following initiation of a program designed to enhance infection control capacity in Kenyan hospitals. The program’s multifaceted approach combining centralized training, on-site supervision, and data feedback, may have contributed to the improvement. Provision of sufficient resources, as well as attention to hand hygiene practices and training across professions, is crucial to improving hand hygiene adherence.

145. Antibiotic Utilization in Pediatric Patients Admitted to a Referral Hospital in Botswana

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Background: In the United States up to 50% of antibiotic prescriptions are inappropriate. The implications of this include unnecessary financial costs and potential for selection of antibiotic resistance. Few data exist regarding the utilization of antibiotics for pediatric inpatients in resource-limited countries.

Objective: To describe the utilization of antibiotics administered in a pilot study of HIV positive and HIV negative pediatric patients admitted to a referral hospital in a resource-limited setting.

Methods: An observational chart review of all pediatric patients admitted to Princess Marina Hospital (PMH) in Gaborone, Botswana was performed. Data collected included HIV status, discharge diagnoses and antibiotics administered. The duration of antibiotics given to patients with an infection-related diagnosis as well as those with a non-infectious diagnosis was evaluated. Additionally, the duration of antibiotics received by patients with pneumonia was compared with current World Health Organization (WHO) recommendations. Wilcoxan rank sum test and Fisher's exact test were used when appropriate.

Results: Between March 5th and April 18th, 2007, 91 patients were admitted to PMH (53% female, 100% black and median age, 1.5 years; HIV prevalence, 22%). Fifty-eight patients (63.7%) had a discharge diagnosis that was infection-related while 28 (30.8%) patients had a non-infectious discharge diagnosis. Among the subset of patients receiving antibiotics for >48 hours, the median duration of antibiotic therapy was similar irrespective of whether an infection was identified (8 vs. 9days; z-score=0.662 p value 0.5). HIV patients without infection more frequently received antibiotics compared to HIV negative patients without infection (100% vs. 29%; p=0.016) (Table). Twenty-four patients had a diagnosis of pneumonia with a median antibiotic duration of 8 days (interquartile range, 4-10); 52% received antibiotics for greater than the WHO recommended 5 days.

Table: Frequency and median duration of antibiotics by infectious and non-infectious diagnoses

	Total Cohort		**HIV Positive**		**HIV Negative**	
	Infection (N=58)	***No Infection (N=28)***	***Infection (N=15)***	***No Infection (N=4)***	***Infection (N=43)***	***No Infection (N=24)***
Antibiotics≥ 48 hours	48 (83%)	11 (39%)	14 (93.3%)	4 (100%*)	34 (79%)	7 (29%)
Duration Antibiotics(interquartile range)	8 days (4-10)	9 days (6-14)	10 days (4-25)	10 days (6-21)	8 days (3-10)	8 days (4-14)

*(Fisher's exact test, p=0.016)

Conclusions: In patients with and without infection, the ultimate duration of antibiotics was similar. In the absence of an infectious diagnosis, HIV positive patients were more likely to receive at least 2 days of antibiotics. Among patients with pneumonia the median antibiotic duration was frequently longer than the current WHO recommended duration of 5 days. The data from this pilot study suggest that antibiotics may be used for longer than clinically indicated in this resource-limited setting. Further interventions to assist practitioners in the decision to stop unnecessary antibiotics may prove useful.

146. Controlling Multi-resistant Microorganisms in a Neonatal Intensive Care Unit: A 5-Year Experience

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Background: It is difficult to control nosocomial infections (NI) and multi-resistant bacteria in the Neonatal Intensive Care Unit (NICU), especially when there is overcrowding and understaffing. Our NICU works with a nurse aid-patient ratio of 1:4, and between 2001 and 2002, there was an increase from 9 beds to 16 beds, without new personnel addition. Since 2002, we experienced clusters of invasive infections caused by resistant 3rd-generation cephalosporin *Klebsiella pneumoniae* (K+) especially when admission rates were up. We have access to a microbiology laboratory that can perform only standard cultures and we never determined a source for these multi-resistant strains or if these strains were the same. Antibiotic restriction policies and other classic infection control measures to stop these infection clusters were implemented, but because we could not eradicate these resistant organisms, we decided to do surveillance cultures for them in an attempt to prevent future infection outbreaks.

Objective: to describe our method of controlling resistant microorganisms

Methods: a routine of collecting weekly or biweekly rectal swabs in all NICU patients (pts) looking for K+ was started on December 2002 when a second cluster of invasive K+ infections occurred in the unit. A strict cohorting of infected or colonized pts was implemented until discharge from the unit until 2005; after that, cohorting was discontinued and affected pts were nursed with contact precautions. In 2005, we implemented the search for any 3rd generation cephalosporin resistant gram-negative rod (RGNR) plating the swabs in a media culture with 3rd generation cephalosporin on it. Daily active surveillance with crib-side rounds were performed by the NICU attending pediatricians, using the CDC definitions for NI. The NI data were expressed as # NI/1,000 patient-days, the RGNR colonization and infection rates were expressed as # of RGNR colonized or infected pts over 1,000 pt-days respectively.
Results: Data can be seen at the table. There was an important decrease of RGNR infection comparing 2003 and the following years (89% decrease comparing 2003

and 2006, 85% comparing 2003 and 2007). The total NI rate dropped 45% (2003-2006) and 38% (2003-2007).

Conclusions: In developing countries human resources are scarcer and sophisticated microbiology technology may not be readily available to help controlling outbreaks. Early recognition of colonized pts with surveillance cultures and early implementation of contact precautions seem to be working for us; it could be an alternative for settings with the same problems and little resources.

	YEAR 2003	YEAR 2004	YEAR 2005	YEAR 2006	JANUARY-SEPTEMBER 2007
# PATIENT (PT)-DAYS	4,252	4,168	4,340	4,226	3,033
# RECTAL SWABS	848	601	521	569	422
RESISTANT GRAM-NEGATIVE RODS (RGNR) POSITIVITY AMONG RECTAL SWABS (%)	2.5	1.2	5	5.4	4
RGNR COLONIZATION RATE/1,000 PT-DAYS	4.9	2.9	6.9	7.3	5.6
RGNR INFECTION RATE/1,000 PT-DAYS	2.11	0.23	0.23	0.23	0.32
RGNR INFECTION DECREASE COMPARING TO 2003 (%)		89	89	89	85
NOSOCOMIAL INFECTION (NI) RATE (#INFECTIONS/1,000 PT-DAYS)	20.22	14.09	10.13	11.1	12.6
NI DECREASE COMPARING TO 2003 (%)		30	50	45	38

Infections in Compromised Patients

147. Risk Factors Associated with Methicillin-Resistant *Staphylococcus aureus* Colonization on Hospital Admission among Oncology Patients at a Large Urban Hospital

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Background: The presence of antibiotic resistant organisms continues to plague healthcare facilities throughout the world. Colonization may often progress to infection in patients and therefore identifying risk factors is of great importance. While many studies have identified factors for general populations, few have focused on compromised patient groups.

Objective: To assess potential risk factors for colonization of Methicillin-Resistant *Staphylococcus aureus* (MRSA) on hospital admission among oncology patients.

Methods: A case-control study was conducted at a university-affiliated, tertiary care facility in the Midwest. Patients on two oncology units (leukemia/lymphoma and medical oncology) were screened for MRSA from 7/1/04 to 12/31/05. The admission swab (within 48 hrs of admission) identified 44 pts with MRSA. Thirty-five patients of 138 patients with methicillin sensitive *S. aureus* (MSSA) on admission were randomly selected. Controls were randomly selected in a 2 to 1 ratio from the patients with a negative swab within 48 hours of admission.

Results: A total of 231 patients were included in the analysis: 44 MRSA, 35 MSSA, and 152 *S. aureus* negative. Risk factors for MRSA colonization by multivariate analysis were over 5 admissions within a year (OR, 2.82 ; 95% CI, 0.75-10.64); chemotherapy within 30 days (OR, 2.97; 95% CI, 1.26- 7.04); antimicrobials within 30 days (OR, 2.27; 95% CI, 1.02-5.04); chronic skin disease (OR, 6.30; 95% CI, 1.73-22.99); and urinary drainage device (OR, 4.87; 95% CI, 1.53-15.53). Risk factors for any Staphylococcus colonization included over 5 admissions in the past year (OR, 4.21; 95% CI, 1.54-11.52), chemotherapy within 30 days (OR, 2.78; 95% CI, 1.40-5.51), chronic skin disease (OR, 4.40; 95% CI, 1.31, 14.77), and surgery within 30 days (OR 7.74, 95% CI, 1.45-41.22).

Conclusions: Risk factors for any *S. aureus* colonization on admission in oncology patients are consistent with previous studies in general patient populations. In addition, chemotherapy as a risk factor is a unique finding.

148. Human Parainfluenza Virus 3 Infection Outbreak in a Hematopoietic Stem Cell Transplant Unit: An Epidemiological Perspective

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Background: Human Parainfluenza Virus 3 (HPIV) is an important cause of morbidity and occasionally mortality among immunocompromised patients especially hematopoietic stem cell transplant (HSCT) patients. Early diagnosis and treatment is vital to identifying a HPIV infection and prevention of transmission. A retrospective study was implemented to examine causes, risk factors, mortality and trends of a HPIV outbreak during the summer of 2006 at a cancer center.

Objectives: The objective of the study was to describe risk factors and outcomes of HSCT patients who developed HPIV. The findings of the study were used to develop an infection control protocol for the prevention of nosocomial transmission of all community acquired respiratory viruses (especially HPIV).

Methods: The study examined fourteen cases of HPIV infection among cancer patients. Patients were selected based on their culture positive report during April to October of 2006 and their medical records were reviewed. Information about the duration of symptoms was collected from the infection control department at the cancer center. Lodging information was gathered from the local family lodge.
Results: All 14 patients (10 men and 4 women) were adults (20-82 years old). Most patients received HSCT (5 allogenic and 6 autogenic) or Chemotherapy (N=3). The cancer diagnoses included acute myeloblastic leukemia (N=2), acute lymphoblastic leukemia (N=2), multiple myeloma (N=4), non-Hodgkin lymphoma (N=3), Hodgkin's lymphoma (N=1), chronic lymphoblastic leukemia (N=1), and chronic myeloblastic leukemia (N=1). Ten patients were neutropenic during the 15-day period before or

after HPIV infection. Eight patients had stayed in the family lodge prior, during or after HPIV affiliated with the cancer center. Three patients developed secondary pneumonia, which included the following pathogens: cytomegalovirus, *Pseudomonas aeruginosa*, and *Aspergillus spp*. One person with HPIV infection died from non-infectious causes.

Conclusion: The nearby lodge may have resulted in nosocomial transmission of HPIV. Neutropenia may have contributed to more severe HPIV infection. Awareness of the lodge as a possible site of HPIV nosocomial transmission allowed for targeted infection control interventions, which contributed to the termination of the outbreak.

149. Particle Monitoring is a Useful Tool for Assurance of Air Quality during Hospital Construction

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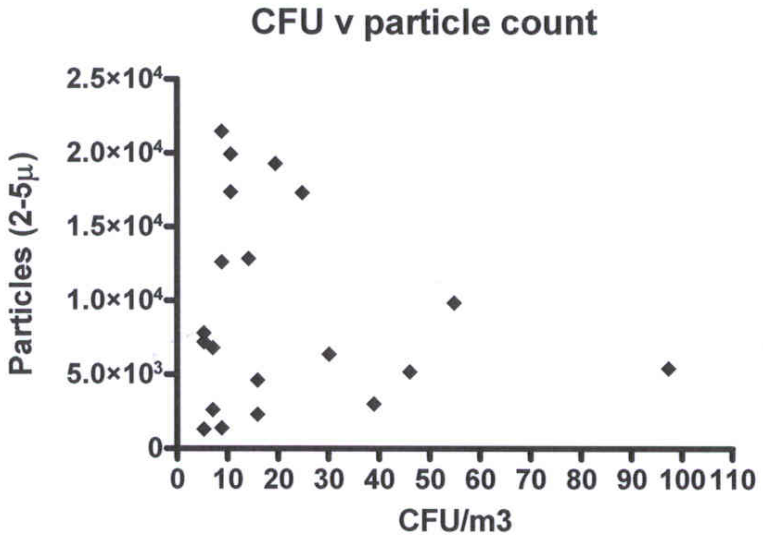
Background: Dust control during hospital construction poses a unique challenge to healthcare epidemiology programs. Traditional means to monitor dust and fungal spores in the air consists of culturing the air for fungi which is limited by cost, personnel demands, and time lag to results. In 2007, we initiated particulate monitoring as part of our construction risk minimization program.

Objective: Assess the usefulness of air particulate monitoring as part of the hospital construction risk minimization program.

Methods: A hand held laser air particulate counter (GT-521, Met One, Grants Pass, OR) was used to measure particles 2-5 uM in size from air samples outdoors, from patient care areas adjacent to construction zones, and from referent patient care areas away from construction zones. Quantitative fungal cultures of air were performed from a subset of time points. Particulate counts in peri-construction zones substantially above baseline triggered further investigation.

Results: From 3/30/07 to 12/28/07, 4712 particulate measurements were performed. Mean particulate counts during construction in the Solid Organ Transplant Unit and Cardiac Cath Lab did not vary significantly from pre-construction baseline: Transplant Unit: mean 16,528 + 1522 vs 16,507 + 895, respectively ($p = 0.99$); Cath Lab: mean 5553 + 930 vs 8169 + 736, respectively ($p = 0.44$). In HEPA-filtered units, particle counts were significantly lower than other inpatient areas: 2778 + 175 (range: 60-12,930) vs 11,959 + 271 (range: 320-552,960) respectively, ($p<0.0001$). Carpeted patient care areas exhibited higher mean air particulate counts than non-carpeted areas: 18,882 + 535 (range: 2390-158,680) vs 4313 + 209 (range: 320-63,720), respectively ($p<0.0001$). Outdoor air registered higher mean particulate counts than indoor air: 20,045 + 581 (range: 1160 - 90,880) vs 11,617 + 263 (range: 60-552,960), respectively ($p<0.0001$). On 6 separate occasions, elevated particle counts near construction zones revealed breaches in protocol or other structural deficiencies that led to specific interventions. When particle counts were compared to fungal cultures, correlation was poor (Spearman $r = 0.0047$, $p = 0.84$) (Figure 1).

Conclusions: Particulate monitoring is a quick, efficient, and effective means to monitor air quality associated with hospital construction. Particle counts during construction can be immediately compared to baseline measurements and investigation and intervention can be quickly performed to limit patient exposure to construction dust. Additional protective measures should include impervious physical dust barriers between construction and patient care areas and maintenance of negative air pressure in construction zones.



Methodological and Statistical Issues

150. Measurement of Infection Control Behavior in Acute Care

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Objective: A significant obstacle to healthcare associated infection prevention is achieving consistent adherence to recommended infection control practice1-2. To support our ongoing infection prevention intervention research, we developed a computer-based, standardized observation method to measure infection control behavior at the acute care bedside.

Methods: We programmed a portable tablet computer to capture the context and all observed activities performed by a health care worker within a discrete sequence of bedside activities. All data were time stamped and included the health care worker type, beginning and end of a sequence, patient and environment contacts, infection prevention behaviors, and medical equipment handling/cleaning. Two separate researchers conducted simultaneous, independent observations of inpatient hospital rooms for a total of 14 hours. Reliability statistics (percent agreement, kappa, intraclass correlation) were obtained from comparison of mapped data extracted from the database tables.

Results: The observation context included contact isolation in 17 rooms and standard precautions in 30 rooms. One hundred sequences averaging 4.8 minutes in length and representing a cumulative total of 8 hours of bedside activities were observed. Health care workers were registered nurses (n=54), nursing technicians (n=15), non-nursing professionals (15), respiratory therapists (n=7), non-nursing technicians (n=5), and physicians (n=4). Frequency of observed activities were patient/environment contacts (n=288), hand hygiene (n=115), glove use (n=51), other personal protective equipment (n=8), and medical equipment use (n=23). Percent agreement ranged from 86.5-100%, kappa ranged from 0.82-1.0, and intraclass correlation was 0.98.

Conclusions: We conclude that the measurement method reliably captures infection control behavior at a level of detail missing from conventional measurement methods. We are developing algorithms to extract quantitative metrics of infection control behavior for use in the context of infection prevention practice improvement research.

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151. Patient-days, Central Line-days, Urinary Catheter-days and Ventilator-days: are these Denominators Really Adjusting Rates in Intensive Care Units?

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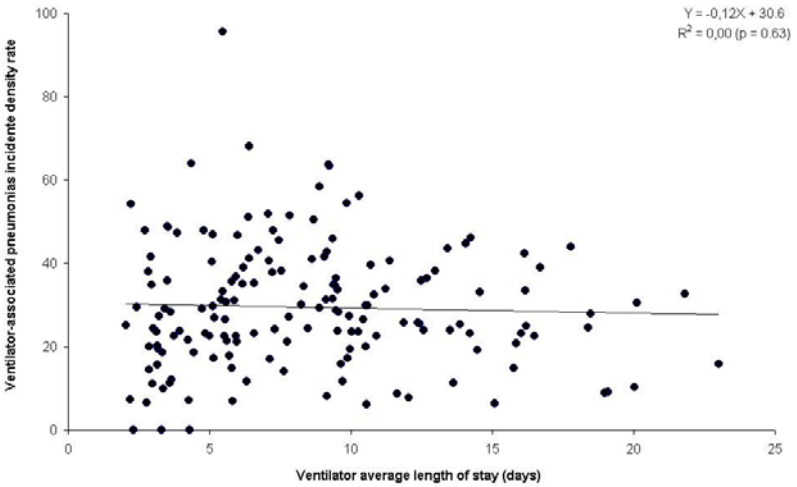
Intensive Care Units (ICU) have high rates of Nosocomial Infection (NI) due to increased severity of illness, prolonged exposure to invasive devices and procedures, and length of intensive care unit stay. These factors can differ among units or even in a same ICU through the time. In an attempt to control the influence of risk factors in the NI rates in ICU the main method proposed by National Nosocomial Infection Surveillance System - NNIS/CDC is the use of denominator-days (e.g.: patient-days rate or device-days for site-specific rates). The objective of this work is to evaluate if the use of patient-days , central line-days, urinary catheter-days and ventilator-days as denominators really to adjust ICU NI rates.

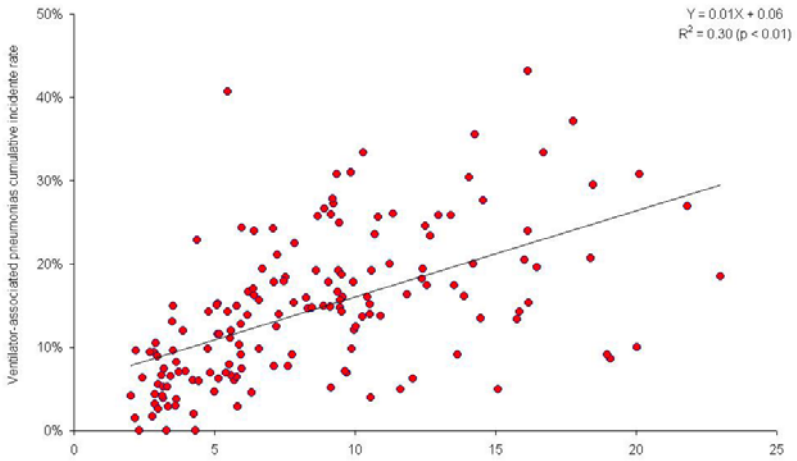
Methods: we applied the Adult and Pediatric Intensive Care Unit Surveillance Component of NNIS system in 5 adult intensive care units by using the monthly report form in each ICU, but we changed this protocol in a new version. This new monthly report form enable us to calculate the Average Length of Stay for the

patients and for each invasive procedure: urinary catheter (UC-LOS), central line (CL-LOS) and respirator (RESP-LOS). The generic X-LOS is calculated by the following formula, adapted from the original NNIS System: X-LOS = (a + b + c)/(d + e); where: a = number of previous days spent in the ICU by patients (or by patients with invasive procedure) present in the ICU on the first day of the month; b = total of patient-days (or device-days); c = number of additional days of patients (or patients with invasive procedure) present in the ICU on the last day of this month, who will stay in the ICU; d = number of patients (or patients with invasive procedure) in the ICU on the first day of this month; e = total of new arrivals (or new patients with invasive procedure) during this month. Linear regression methods were used to evaluate the adjustment of each denominator in ICU rate against Average Length of Stay (ALOS) and X-LOS. Monthly rates were calculated in the five ICUs between Jan/1994 and Jun/2007, which generated 455 valid rates (only rates calculated by using more than 25 denominators were validated to this study).

Results: we analyzed 10 linear regression model (table 1). Only the incidence density rates of central line-associated bloodstream infections (BSI) and ventilator-associated pneumonias (PNEU) are independently of the central line average length of stay and ventilator average length of stay, respectively.

Conclusion: Only central line-days and ventilator-days really adjust BSI and PNEU rates.





152. The Impact of Secondary Billing Codes for Hospital-Acquired Infections on Hospital DRG Payments - A Pilot Study

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Background: With increased attention to hospital-acquired infections, concern has been raised that by increasing the complexity of a patient's care, based on secondary coding, hospital-acquired infections increase the amount of money hospitals receive for patient care under the DRG system. In 2005, the Pennsylvania Health Care Cost Containment Council reported that hospital charges in 2004 for patients with reported HAIs were $1.4 billion more than for patients without HAIs. In October 2007, CMS announced it would not pay for secondary diagnoses associated with certain hospital-associated complications, including catheter-associated UTI, mediastinitis following CABG, and central line-associated bloodstream infections.

Objectives: To determine if secondary codes for hospital-acquired infection changed reimbursement rates for Medicare & Medicaid patients (paid by DRG).

Methods: In 2004, Pennsylvania acute care hospitals began reporting catheter-associated UTIs, central line-associated bacteremias, ventilator-associated pneumonias and selected surgical site infections to the state. That year, our hospital reported 71 hospital-associated infections in Medicare and Medicaid patients. We reviewed all secondary diagnoses, removing secondary codes that could have identified the specific hospital-acquired infection reported, and then resubmitted the case through the DRG grouper to determine if the relative weight of the case (basis for reimbursement) would change without those secondary codes.

Results:

	UTIs	**Central Line Bacteremia**	**Ventilator Pneumonia**	**Multiple Infections**	**Surgical Wound Infections**	**Total**
Patients	51	8	9	2	1	71
Relative Weight INCREASED by deleting codes	0	0	0	0	0	
Relative Weight DECREASED by deleting codes	0	0	0	0	0	
Impact of Hospital Infection on Reimbursement	0	0	0	0	0	

Removing secondary codes for catheter-associated UTIs (51 patients), ventilator-associated pneumonias (9 patients), central line-associated bacteremias (8 patients), and 2 patients with multiple infections did not change the Relative Weight for any case. Reimbursement was not increased by the presence of any hospital-acquired infection. Many cases did not have Relative Weight strongly influenced by concurrent co-morbidities. Admissions that developed hospital-acquired infections averaged 15-

20 secondary diagnosis codes, so many other co-morbidities contributed to the patient's severity of illness.

Conclusion: Hospitals receive very little additional reimbursement for hospital-acquired infections for those patients covered by a DRG payment system. Thus, most of the additional cost of treating HAIs is borne by the hospital. Reduction in HAIs would provide significant financial benefit to hospitals.

153. How to Use Electronic Resources for Infection Control-Based Physician Competencies

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Background: There is increasing demand on infection control programs to provide infection related quality indicators for physician competencies, driven largely by recent regulatory mandates from agencies such as the Joint Commission. Chart abstraction is labor intensive and infection control staffing at many institutions has not increased despite these mandates. Therefore accomplishing these tasks through more efficient electronic resources is desirable.

Objective: Demonstrate how a data warehouse can improve the efficiency of data abstraction for an infection control-based project for Joint Commission physician competencies.

Methods: Our facility has a data repository of financial, administrative, and clinical data. In order to create meaningful reports, the skills of a programmer, clinician, and statistician were required. The clinician provided guidance for selecting the types of surgeries and outcomes for the project. The non-trauma operations selected were cholecystectomy, lung resection, colon resection, appendectomy, and thyroidectomy. The outcomes included inpatient mortality, complications, and length of stay. The complications chosen were wound infection, procedure-related laceration, postoperative wound dehiscence, transfusion, and intra-abdominal abscess. The programmer extracted the data for these relevant fields using ICD-9 codes. The statistician analyzed the results.

Results: In November 2007 there were 57 procedures with four complications and two mortalities. Data were then stratified by type of procedure. Table 1 is an example of the comparison between the surgeons for appendectomies. The number of cases ranged from 1 to 6 per surgeon and the median length of stay was 2 days (interquartile range 0.5 - 4). Only one surgeon had any morbidity or mortality related to their procedures. The time commitment to develop the program was six hours (4 hours programming, 1.5 hours clinical, and 0.5 hour statistical). If this had been done through manual chart review, the infection control program estimated this would have taken 28 hours. In the future, it will take less than 30 minutes per month to obtain the measures since the process has been developed.

Table 1. Appendectomy

Table 1. Appendectomy								
Surgeon	Number of	Median	Mortality	Wound Infectio	Procedure-related	Transfusion	Postop Wound	Intra-abdomin

	Cases	LOS, days (IQR)		n	Laceration		Dehiscence	al Abscess
A	5	0 (0-2)	0	0	0	0	0	0
B	5	1 (0.5-13)	0	0	0	0	0	0
C	6	3 (1.8-6.5)	17%	17%	0	0	0	0
D	5	5 (1-16.5)	0	0	0	0	0	0
E	1	1 (1-1)	0	0	0	0	0	0
F	5	1 (0.5-1.5)	0	0	0	0	0	0
G	3	2 (1-2)	0	0	0	0	0	0

Conclusions: Useful infection related data that also meets needs of JCAHO physician competencies can be achieved through the data repository. There are a plethora of quality initiatives that are now possible through our data warehouse. 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.

Healthcare-Acquired Urinary Tract Infections

154. Validation of an Electronic Signal to Reduce Unnecessary Catheter Use

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Background: Catheter-associated urinary tract infections (CAUTI) are one of the most common nosocomial infections. The most important modifiable risk factor is duration of catheterization. Urinary catheters are often used inappropriately, and physician awareness that catheters are in place is low. Criteria for appropriate use of urinary catheters have been successfully developed. Advances in health information technology make it possible to incorporate these criteria into a real-time electronic surveillance system, allowing continual monitoring of catheter use.

Objective: To electronically identify hospitalized patients with indwelling urinary catheters who may no longer require catheterization.

Methods: The test hospital's electronic medical record already contained much of the necessary information to determine the appropriateness of catheterization. Logic was developed that generated an electronic signal indicating a catheter was in place based on nurse charting data. Validation of this signal was conducted by direct observation, followed by a manual validation of the electronic signal alerting the caregiver of the presence of unnecessary catheters.

Results: The first phase of validation consisted of manual review of the catheter status of a sample of hospitalized patients. Over 200 patients were examined by a physician and researcher to determine if a urinary catheter was in place. These results were then compared with a computer generated list of patients who were identified as having a catheter in place. It was determined that the electronic signal had a sensitivity of 82% and a specificity of 93% with a positive predictive value (PPV) of 94%. This was believed to be sufficient to proceed to Phase II of the validation, where the electronic signal assessing catheter necessity was validated. The computer logic generating this signal was reviewed and implemented, and a manual validation was conducted by two physician researchers on three occasions. Results from this validation indicated that the electronic signal for potentially unnecessary catheters had a PPV on initial runs of 46%. During this process, key factors were identified that could improve the performance of the logic. These factors included mobility status, urine output, Glascow Coma Scores, blood pressure, ventilator status, admission diagnosis and surgical status. By incorporating these factors into the computer logic, a PPV of 89% could be achieved.

Conclusions: A system for electronically identifying hospitalized patients who have urinary catheters that may no longer be necessary could be a useful tool for alerting physicians to the presence of inappropriate catheterization, and potentially for reducing CAUTI rates. Further work will involve refining the logic to include additional factors to enhance the accuracy of the signal indicating inappropriate catheterization.

Occupational Health

155. Survey of Knowledge and Attitudes of Risk of Tuberculosis (TB) Among Newly Hired Healthcare Personnel (HCP) With Latent TB: Implications for Intervention

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Background: Approximately 10% of the 2500 HCP hired annually at the Cleveland Clinic have latent TB but few elect to be treated for latent tuberculosis.

Objectives: To determine the attitude of newly hired HCP with latent TB regarding treatment with INH and the potential impact of a blood test for TB on acceptance of treatment for latent TB.

Methods: Questionnaire on knowledge and attitudes on TB and latent TB administered in telephone interview that included prior immunization with BCG and

perceived risk for developing TB. Approved by IRB.

Case Ascertainment: A computerized list
was obtained from Occupational Health for all HCP hired between Jan 1-June 30, 2007 with latent TB (defined by TST > 15 mm and/or verified past positive.

Results: 142 HCP with latent TB identified during 6 month study period of whom 32% (45 HCP) completed the survey and included in the study. Mean age was 32 years, 56% were women, and 69% had direct patient care activities. Notably 82% were foreign born and 78% had history of BCG vaccination (60% as infants). No one believed their risk for developing TB was very likely and 68% believed the BCG was reason for positive tuberculin skin test. 73% were willing to have a blood test for TB and 66% stated a positive test would convince them to take treatment for latent TB.

Conclusions: Newly hired foreign born HCP with latent TB were cautious about LTBI treatment. This may be due to their perceptions of the effect of prior BCG vaccination on the results of the TST and the effectiveness of BCG vaccination in preventing TB. The use of blood tests for TB in lieu of TST may increase the acceptance of LTBI treatment among these HCP.

156. Attitude of Health Care Workers (HCW.s) towards Post Exposure Prophylaxis Management for HIV (PEP-HIV) in North Ethiopia

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Background: With modest estimate 0.8-18.5% of HIV infections among HCW's occurred due to occupational injuries[1]. Of these at least half occurred in sub-Saharan Africa [1.] PEP reduces risk of HIV infection by 81%[1]. In Ethiopia PEP service started in hospitals since September 2004. However the service was not evaluated so far.

Objective: The objective is to quantify number of significant exposures, PEP use during this condition and to identify reasons for not using the service.

Methods: Retrospective survey, with pre formatted self administered questioner done among 121 health care providers in six public hospitals of Ethiopia's Amhara region to quantify number of significant exposures, PEP use during this condition and the reason for not using the service.

Results: Questioners were given to 122 HCW's and 121 respond with 99.2% respondent rate. There were 228 significant occupational exposures in the last one year (113 mucosal & 83 percutaneous & 32 through none intact skin) and 46 sources were found negative. PEP was not given to 171 (94%) legible HCW's. Mentioned reason in 93 (51%) was because HCW's didn't want to be tested for HIV by their own

colleague. Testing was not done in 71 (39 %) events because exposed HCW's think the risk is very low.

Conclusions: Low risk perception & fear of stigma are the two major reasons for low PEP service in this area. User friendly counseling & testing for PEP should be devised to improve PEP up take rate.

Reference: 1. Julian Gold and Maggy Tomkins, the Albion Street, Centre, Sydney, Australia, Occupational Post Exposure Prophylaxis for HIV, September 2005, 1-20.

157. Rates of Occupational Exposures To Bloodborne Pathogens In A Network Of Community Hospitals

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Background: Occupational exposure to bloodborne pathogens (OEBBP) lead to increased hospital costs, stress, and, rarely, transmission of a serious, life-threatening disease. Most epidemiologic studies of OEBBP focused on tertiary care hospitals and yet the majority of healthcare is provided in community hospitals in the US. Recently, Australian investigators reported that small community hospitals had lower rates of occupational exposures than larger community and tertiary care centers.

Objective: The objective of this study was to determine the rates of OEBBP in a network of community hospitals in southeastern USA.

Methods: OEBBP, defined as sharps injury or mucous membrane/non-intact skin exposure to potential infectious material, were prospectively collected from 32 community hospitals in the southeastern US (median 210 beds, range 30-537) from 1/2003 to 12/2006 (the "study period"). Incidence rates of OEBBP were reported per 10,000 patient-days (pt-days). Rates of OEBBP were examined by type of healthcare worker (physician versus non-physician) and by hospital volume. Hospitals were stratified into three groups based on tertiles of patient volume: 60,000 pt-days/year (n=11). Kruskal-Wallis one way ANOVA was used to compare the median rates of OEBBP in each stratified group.

Results: A total of 3375 incidents of OEBBP occurred during the study period (aggregate incidence rate of 7.7 per 10,000 pt-days). Non-physician employees had a significantly higher rate of OEBBP compared to physicians (mean 6.3 v. 1.4 per 10,000 pt-days, $p<0.001$). Hospitals with higher patient volumes had higher rates of occupational exposure: small hospitals with 60,000 pt-days (6.7/10,000 pt-days). Both medium and large-volume hospitals had higher rates of OEBBP compared to small hospitals ($p<0.001$ for both comparisons). Rates of OEBBP at medium and

large community hospitals were not significantly different.

Conclusions: The rate of OEBBP among non-physician employees was 4.5-times higher than the rate of OEBBP for physicians in our network of community hospitals. Possible explanations for this finding include a higher number of potential exposures among non-physician employees, educational deficiencies, or under-reporting by physicians. Community hospitals with higher number of annual patient days had higher rates of OEBBP than small hospitals.

158. Proposed Methodology for Reporting the Rate of Percutaneous Injuries (PI) Occurring in Surgical Settings

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Background: The incidence rate of PI is typically reported as number of PI per 100 occupied beds. However, this method may not accurately reflect the incidence of PI in the operating room (OR) because it does not capture procedures performed on an outpatient basis. A measure of incidence that uses the number of operative cases as the denominator may allow more accurate reporting and comparison of PI rates in the OR,

Objective: To devise a more useful measure of PI in surgical settings.

Methods: Data from the Mount Sinai Medical Center in New York was extracted from the National Surveillance System for Health Care Workers (NaSH). The hospital wide total number of HCW blood and body fluid exposures (BBFE) was obtained for identical time periods (January to June) in 2006 and 2007. BBFE were reported by the location in which they occurred and by the type of exposure (i.e., PI, mucous membrane, mucous membrane/skin, skin or bite). The number of occupied beds was calculated from the hospital average daily census report. The overall PI incidence rate was calculated as the total number of PI per 100 occupied beds. OR case volume was ascertained from the perioperative services volume report. The total number of PI in the OR was calculated and the incidence rate reported as the number of PI per 1000 OR cases.

Results: Between 2006 and 2007, the overall PI incidence increased from 14.8 to 16.7 PI per 100 occupied beds: a 13 % relative increase. From January to June 2007, the total number of BBFE was 181, of which 82 % were classified as PI (n=148). 48 (32.4%) of the PI occurred in the OR. Comparing 2006 to 2007, the absolute number of PI in the OR increased from 42 to 50, a 19% relative increase. Over the same time period, after adjusting for surgical volume, the incidence of PI per 1000 OR cases increased from 2.96 to 3.34, a 13% increase (p=0.57).
Conclusion: In the setting of a dynamic OR case volume, which increasingly involves

procedures being performed on an outpatient basis, reporting the absolute number of PI per 100 occupied beds is not the most accurate measure of PI occurring in the perioperative setting. Given that one-third of all PI occurred in the OR, future educational interventions and evaluation of new safety devices will focus on the perioperative setting.

Percutaneous Injuries (PI) in the OR		
	Jan-Jun 2006 OR cases	Jan-Jun 2007 OR cases
January	2255	2473
February	2184	2340
March	2529	2447
April	2151	2423
May	2509	2658
June	2538	2634
Total OR cases	14,166	14,975
Number of PI in the OR	42	50
Rate (number of PI per 1000 OR cases)	2.96	3.34