

## Prevention Programs

### **189. 3-Year Follow-up of the Impact of an Infection Control (IC) Program on the Incidence of Multi-drug Resistant Organisms (MDRO) and the Perception of Healthcare Workers (HCW) on Nosocomial Infections (NI) in a Teaching Hospital**

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Background: A significant increase in the incidence of NI due to MDRO was observed in a 900 bed teaching public hospital throughout 2002 and 2003. The attitude among HCW towards preventive measures against NI was negative, compromising compliance.

Objective: In order to improve the baseline level of knowledge about - and attitudes towards - IC precautions among HCW and to contain the incidence of NI caused by MDRO, the VigiGerme<sup>®</sup> IC program (Geneva University hospitals) was implemented throughout the hospital organization in 2004 and 2005.

Methods: Following outcome indicators were monitored before (baseline) and after training: a) knowledge, attitude and risk perception of NI and preventive measures among HCW; b) compliance of trained HCW with hand disinfection.

Results: A confidential, self-administered electronic questionnaire used at baseline (summer '04) demonstrated low knowledge of IC and risk perception of NI in a sample of 500 HCW. Consequently about 2,500 HCW (>80%) were trained in a 2h session on IC. Significant improvements ( $P<0.001$ ) in knowledge of IC and risk perception were demonstrated by 2,388 paired questionnaires electronically collected before and after training of individual HCWs and confirmed in 2006 with a repeated investigation with the electronic questionnaire among 500 HCWs. Compliance with hand hygiene significantly increased from 13% in 2004 to 31% (2005), 47% (2006) and 70% (2007); ( $P<0.001$ ). The incidence of MRSA infections decreased significantly ( $P<0.001$ ) year by year by respectively 46% (2004), 62% (2005) and 75% (2007) compared to 2003. A significant reduction of quinolone-resistant *E. aerogenes* ( $P=0.015$ ) and carbapenem-R *P. aeruginosa* ( $P<0.001$ ) was also noted.

Conclusions: The implementation of a systematic standardised program proved to be effective to improve perception and attitudes toward risks of NI. Specific training appeared to be the major determinant of "good knowledge". These changes influence patient-outcome as demonstrated by a significant and sustained reduction in MRSA infections and other MDRO.

### **190. Surveillance cultures for carbapenem-resistant *P. aeruginosa* and *Acinetobacter* spp.**

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**Background:** Surveillance cultures are used to identify asymptomatic carriers of multi-resistant microorganisms in the hospital. For non-fermenting gram-negative rods, the sites for surveillance cultures have not been well defined.

**Objective:** to compare surveillance cultures obtained from different body sites used to identify carriers of *Acinetobacter* spp. and carbapenem-resistant *P. aeruginosa* (CRPA).

**Methods:** A set of 3 surveillance cultures (oropharynx-OR, axillae-AX and rectum-RE) was collected from patients admitted to the Neurology ICU on the day of admission, 3<sup>rd</sup> day and weekly until discharge. Surveillance was directed to *Acinetobacter* spp. and CRPA. A patient was considered colonized if at least one of the cultures was positive or had a previous positive culture. Results were evaluated separately of each microorganism.

**Results:** A total of 1,070 sets of surveillance cultures from 443 patients was done (average: 2.42 sets per patient). A hundred and six patients were colonized by *Acinetobacter* spp. and 204 sets of cultures were obtained from patients considered colonized: 49 (22%) sets were negative; and 40% from OR, 32% from RE and 28% from AX were positive. A hundred and twenty sets were positive at only one site: 53 (26%) only at OR, 40 (20%) only at RE and 27 (13%) only at AX. Sixty-five sets of cultures were obtained from 31 patients colonized by CRPA of which 10 (15%) were negative, and 43% from OR, 32% RE and 35% AX were positive. Forty-one sets were positive at only one site: 17 (26%) only at OR, 13 (20%) only rectal and 11 (17%) only AX.

**Conclusions:**

- Surveillance cultures did not detect colonization by *Acinetobacter* spp. in 22% of occasions and did not detect CRPA in 15% of occasions.
- The site in which positivity was highest was the oropharynx.
- No single surveillance site detected the majority of colonized patients.
- A combination of oropharyngeal and rectal swabs detected only 65% of patients colonized by *Acinetobacter* and 68% of colonized by CRPA.
- An important proportion of patients colonized by *Acinetobacter* spp. (13%) and CRPA (17%) was only detected by culturing the axillae.

### **191. Impact of PCV7 on Invasive Pneumococcal Disease in Scotland**

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**Background:** In September 2006, the 7-valent pneumococcal conjugate vaccine (PCV7) was introduced into the Scottish Routine Childhood Immunization Programme with a catch-up campaign to two years of age. The vaccine contains 7 of the 90 known serotypes, however, these 7 serotypes are known to cause the majority of invasive pneumococcal disease (IPD) in children.

There is a concern that there will be an emergence of resistant serotypes not contained in the 7-valent vaccine.

**Objective:** This study evaluated the impact of the 7-valent pneumococcal conjugate vaccine on invasive pneumococcal disease (IPD) in Scotland in children less than two years of age.

**Methods:** Health Protection Scotland has routinely collected data on IPD as part of the European Antimicrobial Resistance Surveillance System (EARSS) since 2003. Data collected between October 2004 and September 2007 inclusive were analyzed using chi-squared statistics. Serotype distribution and antimicrobial resistance was investigated.

**Results:** The total number of cases of IPD in Scotland has decreased since the introduction of the PCV7 into the Scottish Routine Childhood Immunization Programme.

The proportion of patients under 2 years of age presenting with IPD fell after the introduction of the vaccine ( $\chi^2 = 8.924$ ,  $df = 1$ ,  $p = 0.003$ ) in September 2006. There has been an increase in the occurrence of some serotypes not covered by the vaccine.

Antimicrobial susceptibility has remained relatively constant for penicillin and ciprofloxacin however there has been a significant increase in susceptibility to erythromycin.

**Conclusions:** The introduction of PCV7 into the routine childhood vaccination schedule in Scotland has resulted in a decrease of the incidence of vaccine-serotype IPD, and consequently a fall in the overall incidence of IPD. A decline in IPD incidence in children less than two years of age has also been observed. There has been a marked increase in susceptibility to erythromycin with no notable alteration in susceptibility to penicillin and ciprofloxacin. There has however been an increase in the numbers of serotypes not covered by the vaccine which highlights the fact that continued surveillance of IPD is essential.

## **192. Environmental Cleaning at the Cornerstone of Decreasing Healthcare Associated Infections including *Clostridium difficile* and Multi-drug Resistant Organisms (MDRO)**

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**Background:** Known risk factors for *Clostridium difficile* include antibiotic exposure and transmission of organisms from the environment and healthcare workers' hands. Meticulous cleaning of high-touch surfaces (HTS) can potentially decrease cross transmission of *C. difficile* and other pathogens. Prior to this study, cleaning was evaluated by a pass/fail visual inspection post cleaning; few issues were identified by this method. The Joint Commission and CDC recognize the importance of environmental cleaning, but have no advice on monitoring. To date, research focuses on post-cleaning data vs. actual observations of cleaning processes.

**Objective:** To optimize environmental cleaning of patient rooms, including isolation rooms, to potentially lead to decreased rates of *C. difficile* and MDRO.

Methods: Patient care unit-specific *C. difficile* rates were determined and cleaning was assessed on the highest units. Environmental Services' (ES) written cleaning policy, their pass/fail cleaning evaluation tool and CDC environmental guidelines for recommended cleaning solutions were all reviewed. A new observation tool was created to assess compliance with policy. Criteria were graded as adequate, not adequate (not thoroughly enough), not attempted, or cleaned with a non-approved solution. Per IRB approval, housekeepers were read a script to introduce the observer, inform them of intent, and given the option to decline.

Results: The highest incidence of *C. difficile* on 7 patient care units ranged from 28-49 cases/10K patient-days (PD); significantly above the hospital rate of 17.3/10K PD. There were 83 room-cleaning observations on 7 units over 2 weeks: 74 daily (12/74 in contact isolation) and 9 terminal cleanings. Subgroup analysis was performed for all HTS in patient rooms, as most likely sources for cross transmission. HTS included doorknobs, bedrails, call button/TV remote/controls, phone, bedside and over-bed tables, counters, light switches, bathroom handrails, and all toilet surfaces/faucets. Terminal cleaning revealed 61% compliance with HTS; 12% were not adequately cleaned, 25% were not attempted to be cleaned and 2% were cleaned with a non-approved cleaning solution. Daily cleaning of HTS among the 7 units revealed 10-50% compliance with policy; 5-25% were not adequately cleaned, 45-73% were not attempted and non-approved solutions were used 0-11%.

Conclusion: Observations of the ES actual cleaning process provided an accurate mode to assess compliance with policy via an enumerated monitoring tool; additional breaches in room cleaning were also identified. ES administration and supervisors have re-drafted the cleaning policy with directives on the importance of daily HTS cleaning, appropriate sequences and approved cleaning solutions. ES supervisors are now performing real-time observations of the process.

### **193. Flu Vaccination Trends Among Hospital Staff in a Medical Center**

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Background/Objective: Vaccination among health care workers is an important component in the prevention of disease in the United States. Despite documented benefits of influenza vaccination, coverage among health care providers remain <50% (CDC, 2006). One of the national health objectives is to achieve health care provider vaccination levels of 60% or above. In order to improve the vaccination rate in Our Lady of Mercy Medical Center, we implemented a yearly flu vaccine campaign for the past three years. This year, we collected data on people who declined vaccination.

Methods: The yearly flu vaccine campaign includes: (1) provision of vaccine to all the employees free of cost; (2) rigorous distribution of vaccine using a two-pronged approach (a Pull team and Push teams encompassing all shifts and campuses) during our designated Influenza week; thereafter, vaccine was available in Employee Health Service; (3) mass education and advertisement through flyers, posters and conferences. Consent forms were signed by those vaccinated, and this year, we have implemented filling out declination forms (which included a short questionnaire on

reasons for refusal) Consent and declination forms were collected from 10/15 to 12/15/2007. The rate for 2007 was compared to previous years.

Results: The numbers of employees vaccinated in 2003,2004, 2005, 2006 are 239, 248, 660 and 924 respectively. This year, out of 2353 employees, there were 1386 respondents. 913 (39%) of employees were vaccinated in the hospital, 22 (1%) received the vaccine elsewhere, 451 (19%) declined and 967 (41%) did not respond. The overall vaccination rate for the hospital staff is 40% (935/2353). Of the employees who declined the vaccination (n=451): 43 (9.6%) believe they are not at risk, 47 (10%) believe the vaccine will not work, 241 (53%) refused due to fear of adverse effects, 14(3%) wanted further advice, 24 (5.4%) wanted to receive the vaccine elsewhere, 43 (9.6%) declined due to other reasons and 39 (8.7%) had a contraindication to the vaccine.

Conclusions: Each year, the Flu campaign pulls in an increasing number of vaccine recipients. However, despite efforts such as providing free vaccinations, widespread distribution and availability of vaccine, and education to eliminate flu vaccine myths, vaccination among health care workers remains low. Further strategies should be developed to counteract the known barriers against vaccine declinations (such as fear of adverse events). Of equal importance is to determine additional reasons why healthcare employees avoid the call for vaccination.

#### **194. Educational Interventions for Prevention of Healthcare-Associated Infection: A Systematic Review**

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Background: Healthcare-associated infections (HCAI) are associated with considerable morbidity and mortality. Education of healthcare providers is a fundamental measure to prevent HCAI.

Objective: To perform a systematic review to determine the impact of educational strategies directed at healthcare providers for reducing HCAI.

Methods: Multiple computerized databases for the years 1966 to November 1, 2006, supplemented by manual searches for relevant articles. English-language controlled studies and randomized trials that included an educational intervention and provided data on the incidence of one or more kinds of healthcare-associated infections were included. Because of extreme heterogeneity, a meta-analysis was not appropriate.

Results: Twenty-six studies used a number of different educational programs targeting varied study populations of healthcare providers to determine their effect on HCAI rates (catheter-related bloodstream infection, ventilator-associated pneumonia and catheter-associated urinary tract infection). Most were pre-post intervention studies and were implemented in the intensive-care setting. There was a statistically significant decrease in infection rates following intervention in twenty-two studies, with risk ratios ranging from 0 to 0.79. The beneficial effect of education was apparent in teaching and nonteaching institutions, and in lesser developed countries as well as developed nations. Studies had methodologic limitations and few

addressed the sustainability of the intervention or did a formal cost-effectiveness analysis.

Conclusions: The implementation of educational interventions may reduce HCAI considerably; however the magnitude of effect that education *alone* may have is unclear, since it is often used in conjunction with other strategies to reduce HCAI. Cluster randomized trials using validated educational interventions and costing methods are recommended to determine the independent impact of education on reducing HCAI and the cost-savings that may be realized with this approach

### **195. Critical Care Nurses' Knowledge of Evidence Infection Control Programs for Healthcare Based on CDC Guidelines Using a Questionnaire and Feedback about Misunderstandings.**

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Background: Critical care nurses have a major role in monitoring health care patients in an adult intensive care unit (ICU). The knowledge of infection control programs can reduce the rate infection in ICUs.

Objective: To develop a reliable questionnaire for evaluating critical care nurses' knowledge of evidence-based infection programs for healthcare setting by CDC and feedback about inadequate answers.

Methods: In April 2007, an anonymous questionnaire about infection control programs for healthcare was distributed to critical care nurses at a 32-bed adult ICU , from a 450-bed private hospital. The questionnaire included 19 questions: knowledge of pneumonia prevention associated to a mechanical ventilator (5 questions), attitudes toward contact precautions (4 questions), prevention of infection related to central venous catheter (5 questions) and prevention of infection related to urinary catheter (5 questions). The wrong answers were corrected with a brief explanation. The target was self reported compliance with infection control practice. The answers were considered right or wrong.

Results: There were 48 respondents with an overall survey compliance of 100%. Fifty-four percent of respondents did not know when breathing circuits with humidifiers have to be changed. Sixty-one percent of respondents were unaware of routine disinfection of breathing system and patient circuits. Ninety-two percent of nurses did not know when to put the patients in empiric contact precautions Seventy-seven percent of respondents answered wrongly about the appropriate antiseptic before catheter insertion and the antiseptic to remain on the insertion site. Also, in relation to prevention of urinary tract infection, the majority of the respondents (88%) did not know the adequate cutaneous antiseptics utilized to insert urinary catheter.

Conclusions: Lack of knowledge was indicated as a barrier for adherence to evidence-based practice. Misconceptions about effective prevention strategies can be important in decision about infection control. The knowledge about preventing

infection for health care is insufficient and educational programs on preventing infection health care and feedback are necessary to correct inadequate procedures.

### **196. Critical Factors Influencing Consistent Receipt of Influenza Vaccination**

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**Background:** Prior studies suggest only 40% of health care workers receive the influenza vaccine in any given year. The majority of studies focus on reasons for declining vaccination. Assessing reasons for accepting vaccination may inform strategies to increase vaccine uptake the following year. Healthcare staff receiving influenza vaccine may still be in need of education and encouragement about the yearly vaccine. We wanted to assess the utility of directing campaign materials to those in line to receive vaccination.

**Methods:** We surveyed a convenience sample of 300 health care workers in line to receive the influenza vaccine from October-November of 2007 at a tertiary care academic medical center. Vaccinations were offered free of charge to all medical center staff. Staff who declined vaccination were required to submit declination surveys electronically (100% sample). Results from each question were tabulated and questions on perceived adverse events were compared between recipients and those who declined the vaccine (Chi square test).

**Results:** Overall, 3921 vaccines were dispensed in the two month period. A total of 1463 surveys were received between Oct.-Nov. 2007 from those receiving (N=303) and those declining (N=1160) the vaccine. Among those receiving the vaccine, 84% had received the vaccine the prior year and only 61% reported they would definitely receive it the next year. Top reasons (multiple reasons allowed) for receiving the vaccine were "Prevents me from getting the flu" (83%), "Prevents others/patients from getting the flu" (60%), and "Convenience" (39%). Notably, misconceptions on whether the vaccine could result in the flu were higher among those receiving (140/295, 47%) versus those declining the vaccine (341/1160, 29%),  $p < 0.001$ . Willingness to receive the vaccine appeared to be more related to convenience. Half (57%) of recipients said they were unwilling to wait longer than 10 minutes to receive the vaccine, and 90% would not be willing to pay \$20 to receive the vaccine through other venues. Doctors and nurses were more willing to pay \$20 to receive the vaccine (16%) versus other medical center staff (7%). Two percent of staff receiving the vaccine stated they would be relieved if the vaccine supply ran out before they received it.

**Conclusions:** Belief that the influenza vaccine could cause the flu does not appear to prevent a large proportion of staff from receiving the vaccine. In fact, misconception that the vaccine could cause the flu was more prominent among recipients than non-recipients. Convenience was a major factor in vaccine update with more than half of staff being unwilling to wait >10 minutes or pay externally to receive the vaccine if not provided at work. Convenient locations and rapid access to free vaccine with less than 10 minutes of deviation from usual routines could potentially influence up to 40% of staff who were not definitively certain they would receive the influenza vaccine next year.

### **197. An Education Program to Increase Knowledge of and Immunization with Adult Pertussis Vaccination Among Parents of Newborns**

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Background: Pertussis is a cause of significant morbidity and mortality among children, and infection in infants and children causes exposure to hospital personnel. The Advisory Committee on Immunization Practices (ACIP) recommends pertussis vaccine for adults having close contact with infants. Household members and parents are responsible for a large proportion of transmission to infants, thus vaccination of parents is of primary importance for the control of infant pertussis.

Objective: To increase awareness and knowledge of pertussis among parents of newborns, and to assess the effect of this program on parental acceptance and uptake of vaccination from their providers.

Methods: Prospective study carried out in our Neonatal Intensive Care Unit (NICU)/Continuing Care Nursery (CCN) and newborn nursery (NN) units. From June - September 2007, parents and grandparents were invited to participate in our education program to learn about the risks and transmission of pertussis, as well as the benefits and side effects of pertussis vaccination. We evaluated their knowledge and feelings about vaccination before and after our intervention using chi-square testing. Callbacks were done at least 6 weeks later to document uptake.

Results: Of 195 people approached, 150 parents/grandparents (77%) were surveyed. 63 participants were from the NICU/CCN and 87 from the NN. Demographics between the 2 groups were similar. Only 25% of NICU/CCN parents and 40% of NN parents knew that pertussis immunization is subject to waning immunity ( $p=0.06$ ). 52% knew pertussis is transmitted through air droplets and coughing. 85% of parents were not aware of ACIP recommendations. 78% felt the educational intervention was very helpful. Parental knowledge significantly increased after our education program ( $p<0.01$ ). Parents of all newborns considered their baby significantly more at risk for infection, and were more willing to receive the vaccine after our education program (all  $p$  values  $<0.05$ ). 21% were still unsure/unwilling to receive the vaccination afterwards. Of 138 parents who agreed to callbacks, 56% were successfully contacted and 8% were immunized.

Conclusions: Our educational program was effective in increasing parental knowledge of pertussis and willingness to receive the vaccine. Some parents were still unsure or unwilling to receive the vaccine even after our educational intervention, and immunization uptake was low. Further research needs to be done to identify and reduce barriers for parental vaccination, such as implementing immediate postnatal maternal vaccination programs.

### **198. Comparison of the Impact of an Educational Program on Decreasing Catheter-related Bloodstream Infection Using Two Different Interventions**

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**Background:** Central venous catheter-associated bloodstream infections (CVC-BSI) are a frequent cause of morbidity and mortality in intensive care settings. Many studies have showed that education and training of health-care providers on care practices of central venous catheter is an important element to decrease and prevent CVC-BSI.

**Objective:** The purpose of this study was to evaluate the impact of two models of educational interventions on the reduction of rates of CVC-BSI.

**Methods:** This study was conducted in two medical intensive care units (ICU) in a teaching hospital of University of São Paulo, Brazil. In ICU A, with seven-bed, we applied a continuous education program consisted of pretest, a period of observation, and lectures. Observation and lectures were repeated every three month. In ICU B with eleven-bed a single intervention consisted of a pretest, and a period of observation was applied. Lecture was done only once immediately after the observation period. All observations to following the CVC dressing, manipulation, and care were blinded. A database was performed using the program EPIINFO, CDC, version 6.0. Chi-square was calculated comparing the pre and postintervention periods.

**Results:** The educational intervention decreased the CVC-BSI rates in both ICU.

ICU	Preintervention BSI Rates per 1,000 cvc-days	Postintervention BSI per 1,000 cvc-days	Reduction of CVC-BSI	P value
A Continuous intervention	9.8	2.3	76%	<0.05
B Single intervention	14.4	5.5	62%	<0.05

The adherence to the overall catheter-care policy improved significantly in the postintervention period in both ICU ( $p < 0.01$ ). Only two BSI were identified in the ICU A during the 9 months of the postintervention period.

**Conclusions:** A multiple educational strategy targeted to specific problems, observed during a careful evaluation of CVC care practices, and changes of policies can decrease rates of CVC-BSI and improve adherence to CVC care.

The results are more effective when the education is continuous and focused on health-care providers. Developing a continuous intervention model easy to be applied and sustained is better than a single intervention.

### **199. Performance of a Multidisciplinary Team in the Prevention and Control of Healthcare-Associated Infections in Adult Intensive Care Unit: 10 Years Experience**

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**Background:** The Intensive Care Unit (ICU) is critical for transmission or acquisition of health care associated infections (HAIs) due to the patients' gravity, high device utilization, antimicrobial use and staff workload. Efficient and permanent prevention and control programs are difficult to be implemented and maintained. In 1996 a multidisciplinary team was created to support the actions of the Infection Control Service (ICS) having ICU team, medical and nursing coordination sharing the responsibility for the process and results. This team was formed by ICU staff and was named Infection Critical Care Team (ICCT).

**Objective:** To describe the role of the ICCT and the impact of its work in an adult ICU.

**Methods:** The work was developed in a 38-bed adult ICU in a private hospital. in São Paulo city, Brazil.. The activities developed by ICCT (priorities and strategies) were resolved by the participants evaluating the HAIs rates, problems and needs which were perceived. They were the following: revision of manuals and procedures based on the national legislation, guidelines and recent publications; health care workers training on different aspects of infection prevention and control; evaluation of the structure; process audits with immediate intervention to risk elimination; HAIs data and audits results feedback; control of antimicrobial-resistant pathogens; antimicrobial use policies, publication of e-journal (intranet) and others. Active surveillance was done for all patients in ICU systematically by ICS. The activities of ICCT were accompanied by evaluating of HAIs rates in the pre-implementation period of ICCT (1992-1996) and post-implementation (1996-2006).

**Results:** The HAIs rates per 1000 patients-day in pre-implementation period was 39,5 while the post-implementation period was 23,5 with 40,6% reduction. The ventilator-associated pneumonia in pre-implementation period was 30,9 and in the post-implementation period was 15,4 with 50% reduction.

**Conclusions:** This study showed that the method is useful in decreasing HCI rates and ventilator-associated pneumonia in ICU, creating teams which are more committed to infection control prevention.

## **200. Healthcare Worker Willingness to Comply with Universal Glove and Gown Precautions**

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Background: Novel infection control strategies aimed at decreasing hospital-acquired infections are needed. A universal glove and gown policy, where healthcare workers (HCW) don personal protective equipment before contact with all patients, may be an effective strategy to decrease the transmission of bacteria causing nosocomial infections. However, HCW acceptance of, and therefore compliance with, this strategy may be a major barrier to implementation.

Objectives: To determine willingness of HCW to wear gloves and gowns for all patient contacts and to identify potential barriers to a universal glove and gown policy.

Methods: As part of a larger interventional trial to examine the efficacy of universal glove and gown precautions, HCW in the medical intensive care unit (MICU) at an inner-city tertiary care hospital were surveyed prior to the study intervention to determine willingness of healthcare personnel to comply with a universal glove and gown policy. All HCW in the MICU were asked to participate. Self-administered questionnaires were distributed to HCW during a brief educational session describing universal glove and gown precautions and were collected at the end of this session. HCW willingness to wear gloves and gowns for all patient contacts (i.e. willingness to comply with universal glove and gown precautions) was collected as the primary variable. This variable was measured on a scale of 0 ("not at all willing") to 10 ("100% willing"). The amount of perceived barriers to wearing gloves and gowns for all patient contacts was recorded as a secondary variable.

Results: At the time of questionnaire distribution, the MICU was staffed by 142 HCW (130 nursing staff and 12 physicians) and 95 questionnaires were completed (67%). Among respondents 60% were nurses, 19% patient care technicians, 7% physicians, and 13% other. Eighty-seven respondents rated their willingness to wear gloves and gowns for all patient contacts; the mean response was 8.9. In total, 50 respondents (58%) reported that they were "100% willing" to comply with universal glove and gown precautions; while no respondent reported that they were "not at all willing" to comply. Eighty-six respondents rated the presence of barriers they thought would preclude compliance with universal glove and gown precautions (0 being "no barriers" and 10 being "too many barriers"). Nineteen (22%) reported "no barriers" and 11 (13%) reported "too many barriers" (median response, 5).

Conclusions: We found that the majority of HCW were willing to comply with universal glove and gown precautions despite some potential barriers having been identified including the time needed to put on glove/gown, adequate supply of gloves/gowns, compliance by other staff members, and the discomfort and inconvenience of wearing gowns.

## **201. Evaluation of Point-of-Use Hollow Fiber Membrane Filters for Control of Legionella and Other Waterborne Bacteria at a Large Hospital Campus**

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Background: Some hospitals have attempted to control *Legionella* bacteria in potable water systems by continuous treatment with copper-silver ions or chlorine dioxide. Although these disinfection technologies have been generally successful in some

instances, neither has been effective in controlling *Legionella* at infrequently used faucets and showers. Point-of-use (POU) filters may therefore be useful at infrequently used faucets and showers, as well as at outlets located in burn units (for *Pseudomonas*) and other high-risk patient areas, as a supplemental remedial measure to continuous chemical treatment.

POU filters could eliminate the need to disinfect the entire potable water system when *Legionella* bacteria are found at infrequently used or problem outlets. Systemwide hyper-chlorination or high-temperature water shock is disruptive, costly, and potentially dangerous.

**Objective:** The objective of the study was to evaluate the efficacy of POU dual stage hollow fiber membrane filters for control of *Legionella* and *Pseudomonas* bacteria in hospital potable water systems.

**Methods:** At a large hospital campus in the eastern United States, test filters were placed on outlets that had consistently tested positive for *Legionella* bacteria so that a good comparison could be made between test results for filtered and unfiltered water. Water samples were tested for *Legionella*, *Pseudomonas*, and total heterotrophic bacteria. A diverter valve was installed upstream of the filter so that water at each test faucet could be sampled before and after the filter. Samples were collected in April, May, and July 2007. Flow rate was also tested.

**Results:** In total, *Legionella* was found in 24 of 31 unfiltered samples and in 0 of 19 filtered samples. Heterotrophic bacteria were found in 22 of 30 unfiltered samples and in 6 of 19 filtered samples. *Pseudomonas* was not detected in any sample, filtered or unfiltered.

At each faucet, the filter cut the flow rate approximately in half. The filters reduced the flow rates by 32% to 51%, with an average of 45%. Surprisingly, the flow reduction was less on 7/24/07 than on 5/16/07 for two of the three faucets. Although the shower filter seems to be well designed, we found that the faucet filter prototype was not practical for some types of faucets and sinks.

**Conclusions:** The data indicated that hollow fiber membrane point-of-use filters may be a cost effective option on certain showers and faucets. However, the faucet filter that was tested was not practical on some sink designs.

Additional research should be conducted to test new faucet filter designs for efficacy in blocking pathogens, flow rate reduction, and ease of use. Additional testing will also determine if the source of the heterotrophic bacteria detected in some of the post-filter samples was from the water flowing into the filter, or the filter itself having become contaminated during manufacturing.

## **202. Rates of Hospital Associated Infections due to VRE, ESBL Producing Enterobacteriaceae and *Clostridium difficile* During a Hospital-Wide MRSA Control Effort**

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**Background:** In October 2001 we started a MRSA control effort on a surgical unit. This effort was expanded to the SICU in October 2003. Because of sustained

reductions in the rate of MRSA infection achieved on these units, MRSA control efforts were expanded to all acute care units at VA Pittsburgh Healthcare System during the 4<sup>th</sup> quarter of FY 2005.

Objective: To determine the effect of the MRSA control initiative on the rates of other multiply resistant hospital pathogens.

Methods: Key components of effort included surveillance cultures for MRSA obtained from all patients on admission, removal of barriers to hand hygiene and appropriate, regular feedback to staff regarding rates of compliance, transmission and infection. Unit staff were notified of positive microbiology results for MRSA, VRE, ESBL + organisms, and *Clostridium difficile* by an automated twice daily printout generated by the hospital computer scan of microbiology results. There was no specific targeting of other resistant organisms, and no effort to change antibiotic usage practices.

Results: Rates of hospital associated infections due to antibiotic resistant organisms are shown in the table; rates are shown as infections per 1000 patient days.

	FY04	FY05	FY06	FY07
MRSA HAI	0.94	0.56	0.44	0.44
VRE HAI	0.34	0.25	0.26	0.13
ESBL HAI	0.05	0.10	0.13	0.03
HA-CDAD	1.00	1.44	0.69	0.76

Whole facility rates of hospital associated MRSA were significantly lower in the post - expansion period (FY06-FY-07) than in the pre - expansion period (FY04-FY05; P = .018). The decline in *C. difficile* infection rates was highly significant (P<.0001). VRE rates declined; the difference was not significant (P=.26). Rates of ESBL + organisms remained low throughout both periods.

Conclusions: Efforts to control infection caused by one multiply resistant organism may be associated with reductions in infection rates due to other pathogens. Potential contributing factors include improved hand hygiene and isolation practices, timely notification of staff of culture results, and an emphasis on staff involvement in infection control.