Healthcare Preparedness and Public Policy

39. Avoiding Planning in the Dark: A Survey of Beliefs about Pandemic Influenza

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Background: Planning for pandemic influenza can be difficult because of unknown or unpredictable factors. Staffing levels are among the most unpredictable factors and would likely have the greatest impact on a hospital's ability to respond to a pandemic. Potential factors affecting staffing levels include employee illness, the need to provide care to other family member, and fear of illness.

Objectives: To examine the knowledge and beliefs of hospital employees about pandemic influenza.

Methods: An anonymous survey consisting of 10 questions was distributed to hospital employees on all shifts. The questions addressed influenza knowledge, vaccination history, and social factors that might impact staffing levels during a pandemic.

Results: 554 (>50%) surveys were returned. Ages ranged from 20-73 years, with the greatest number of respondents in the 40-59 age group (49.8%). 15.7% of respondents did not know what pandemic influenza was and departments with the highest percentage of respondents included Environmental Services (66.7%), Nutrition Services, (33.3%), and Nursing (13%). 49.6% of respondents do not receive influenza vaccination each year, but 65% of respondents believe that they have had influenza previously. 13.7% of respondents would still come to work if they had influenza. 30% of respondents would not be able to work if someone in their household had influenza. 33.8% of respondents had small children in there home and of these, 48.1% stated that they would be unable to come to work if their child's school or daycare were closed. 13.9 % of respondents stated that fear of getting sick themselves would keep them from coming to work or were undecided. The departments with the highest percentages of respondents included Anesthesia (30.8%), Surgical Services (18.5%), floor nurses (12.5%) and ICU nurses (12.5%).

Conclusions: Hospitals should consider surveying employees to determine factors that might negatively impact potential staffing levels in the event of pandemic influenza. At our institution we identified a need for education in many hospital departments, particularly those who employee individuals with lower levels of education. Interventions to improve protection of employees including improving levels of vaccination and providing adequate personal protective equipment are also critical. Lastly, support services, such as extended childcare services should be considered.

Antimicrobial Stewardship

40. Antibiotic Resistance of Pathogen Causing Hospital Acquired Infections in Vietnam

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Background: Multi-drug-resistant Gram-negative bacilli (GNB) are the main pathogen causing hospital acquired infections (HAIs) in Vietnam.

Objective: The aim of this study was to identify the most common Gram-negative organisms causing HAIs and their resistance patterns.

Methods: Samples from patients with HAIs were obtained during a six-month period in 2006 at a teaching hospital in southern Vietnam. Minimal inhibitory concentrations (MIC) for available antibiotics were determined by E-test methodology using standardized procedures and interpreted using NCCLS criteria. The production of extended spectrum beta-lactamase (ESBL) among *Klebsiella spp* and *Escherichia coli* was evaluated by E-test/ESBL strip

Results: A total of 100 aerobic GNB were isolated from 88 samples of patients with HAIs. The isolates collected were from patients with nosocomial pneumonia (45%), surgical site infections (21%), urinary tract infections (13%), skin infections (11%), and bloodstream infections (10%). The most common isolates included *Klebsiella pneumoniae* (n=25) , *Pseudomonas aeruginosa* (n=24); *Acinetobacter baumannii* (n=18); *Escherichia coli*(n=19). Their resistance patterns was summaried in the table below. ESBLs were detected in 50% of *E. coli* (9/18), 72.7% of *K. pneumoniae* (8/11).

	Rate of resistance (%)			
	K. pneumoniae	*P. aeruginosa*	*A. baumanii*	*E. coli*
imipenem	0	17.4	16.7	0
ertapenem	0	NA	NA	0
ceftazidime	76.2	52.2	78.9	38.9
ceftriaxone	90.5	60.9	83.3	61.1
cefoperazone	90.5	52.2	94.4	72.2
cefepime	33.3	52.2	72.2	44.4
piperacillin /tazobactam	38.1	21.7	50	11.1
ticarcilline/clavuanic	66.7	39.1	50	22.2
gentamicin	85.7	65.2	83.3	61.1
tobramycin	81.0	52.2	77.8	61.1
ciprofloxacin	57.1	39.1	72.2	66.7
levofloxacin	52.4	43.5	66.6	66.7

Conclusions:
The study showed a high resistance against third-generation cephalosporins and aminoglycosides in GNB causing HAIs. Prevalence of ESBL in *K. pneumoniae* and *E. coli* was higher than expected. Use of third-generation cephalosporins is common but apparently not appropriate in this setting, which could be an important cause of

greater spread of ESBL isolates. Surveillance of antibiotic use and selection of antibiotics based on resistance profiles is critical to control antibiotic resistance.

41. Impact of Antimicrobial Stewardship Programs (ASPs) on Antimicrobial (AM) use in a Pediatric Teaching Hospital

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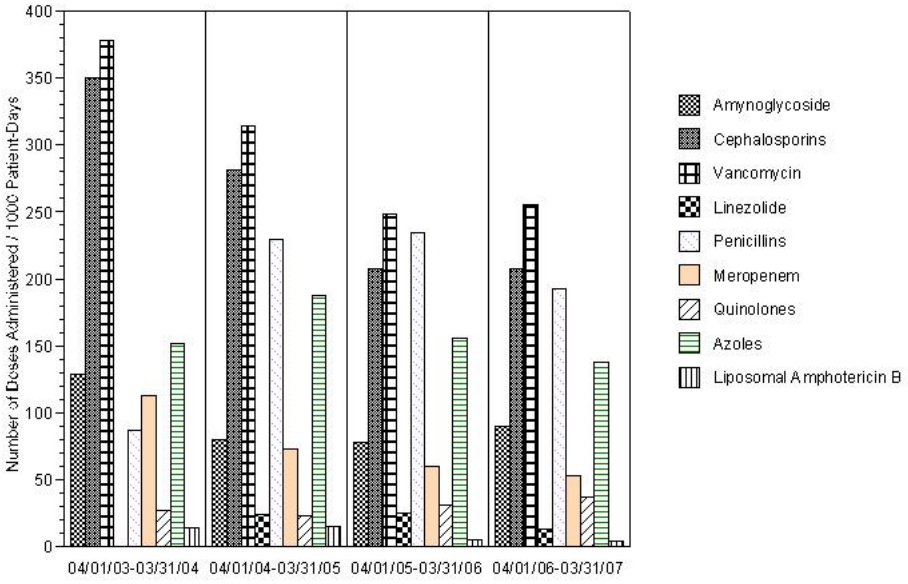
Background: ASPs are an effective strategy to ensure that AMs are used in accordance with scientific evidence to improve patient outcome, minimize AM resistance and reduce hospital costs.

Objective: Analize the impact of an ASP on AM use and resistance at a pediatric teaching hospital.

Methods: In April 2004, active surveillance of 15-targeted AM (amikacin -AMK, amphotericin B, cefepime -CEF, ceftazidime-CEFT, ceftriaxone, ciprofloxacin, fluconazole, levofloxacin, linezolid, meropenem -MER, piperacillin-tazobactam - PIPT, ticarcillin-clavulinc acid -TICA, tobramycin, vancomycin -VAN, and voriconazole) was implemented ADHC. AMs were selected based on spectrum of activity and cost. Indications for AM use were incorporated as mandatory fields using the Institution computerized information system (CIS). CEFT and TICA were removed from the formulary and CEF and PIPT were added. An automated report of AM prescribed, doses and patient demographic and microbiology data was generated and reviewed by a pharmacist and an infectious disease physician. AM use defined by the number of doses administered per 1000 patient days (DA/1000PD) was measured before and after the implementation of the ASP. AM susceptibilities were obtained from the microbiology department.

Results:
During the study, 173,546 doses of targeted-AMs were administered in 14,225 patients. The mean age was 7.5 years. Male:Female ratio was 0.5. The total targeted-AM use declined overtime by 21% (1250 DA/1000 PD to 988 DA/1000 PD, P=<0.001). Figure 1 depicts targeted AM by class. Assessment of other selected AMs showed reduction of non-targeted AM use. From 2004 to 2006 *P. aeruginosa* susceptibility to MER and AMK increased from 94% and 95%, to 98% and 99%, respectively ($p<0.01$). Susceptibility of K. pneumonia isolates to CEF and gentamicin increased from 91% to 96% and 97%, respectively ($p<0.01$). E. cloacae susceptibilities to CEF and MER remained between 98%-99% and 100%, respectively. The increase use of CEF was not associated to increase in CEF-resistant *P. aeruginosa* and other GN bacteria. The introduction of PIPT was associated to increase in PIPT-resistant to E. cloacae but not to other GN bacteria. During the study period, while the number of VAN doses administered decreased significantly, the number of patients infected with MRSA and MSSA significantly increased ($p<0.01$). The number of infected patients with VRE decreased from 10 patients in 2004 to 2 patients in 2005 and 2006.

Conclusions: Implementing an integrated prospective audit using the hospital's CIS, with real time feedback to prescribers, lead to the reduction of targeted and non-targeted AM use, improving and preserving AM susceptibility to selected pathogens and AMs, except for PIPT and *E. cloacae*.



42. Vancomycin (V) Use over 6 Years at a University Teaching Hospital-the impact of introducing antibiotic stop orders on Defined Daily Dose (DDD)-, Days of Therapy (DOT)- and Number of Doses (Doses)/1000 Patient Days, an interrupted time series analysis

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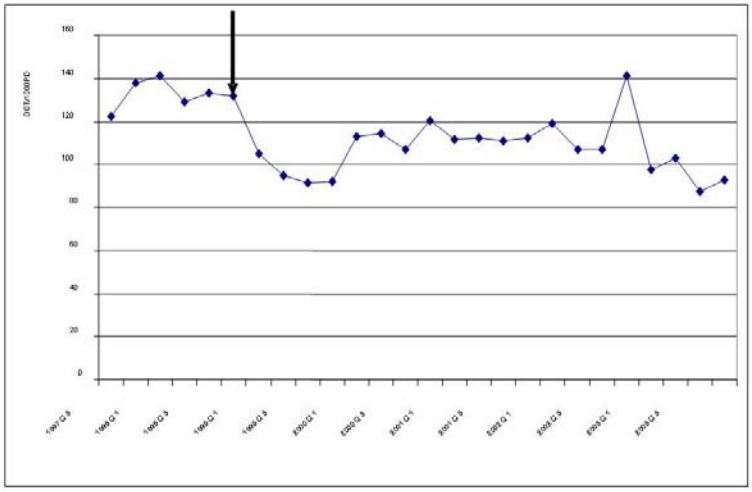
Background: The risk of nosocomial infections from VRE caused many hospitals to institute antimicrobial stewardship programs (ASP) to restrict use of Vancomycin. Since 1999, the VCU Health System (VCUHS) has restricted Vancomycin use to 4 days, after which the ASP practitioner must approve continuation.

Objective: The purpose of this study was to assess the effect of this policy on Vancomycin use in our institution.

Methods: Retrospective study of Vancomycin use at VCUHS using an interrupted time series design for two different time periods: 1) the two years prior to implementation of the policy (January 1, 1997 - January 1, 1999); 2) the four years after initiation of the policy (January 2, 1999 - December 31, 2003). Vancomycin use by quarter was extracted from billing records and expressed as DDD-, DOT- and D/1000 patient days (PD).). A segmented regression analysis was performed to assess both the change in use and slope of the regression line after intervention.

Results: The change in Vancomycin use measured by DOT/1000PD was significant (Figure: mean change in use = -28.0 DOT/1000PD, p = 0.0017, R2 = 0.49) and by D/1000PD (mean change in use = -25.0 D/1000PD, p = 0.012, R2 = 0.53). By DDD,

the change in use was also significant (mean change in use = -12.2 DDD/1000PD, p = 0.031, R2 = 0.40). Figure 1.



Conclusions: An automatic stop order implemented to reduce Vancomycin use at VCUHS was effective. Alternative measures of drug use to the DDD are available and can produce similar results to conventional DDD measures and may be more feasible in selected settings.

43. Antibiotic Management Team Impact

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Background: On Jan. 2, 2007 we began a new Antimicrobial Management Team (AMT) at the University of Minnesota Medical Center and Univ. of MN Children's Hospital, Fairview (UMMC/UMCH) , University Campus. The hospital is a tertiary care facility with 300 beds on this campus.

Objective: Our goals were to decrease inappropriate use of antibiotics, optimize antibiotic use, decrease nosocomial acquisition of antibiotic resistant bacterial infections or colonization and decrease *Clostridium difficile* diarrhea cases. In addition our goal was to decrease antimicrobial costs and provide more cost effective care.
Methods: The AMT program allows providers to order restricted antibiotics, according to our hospital guidelines, without upfront approval. But a retrospective chart review is done the following day, M-F, by a dedicated PharmD and a M.D. with infectious disease expertise. Formal written recommendations are placed in the medical record on the AMT form. In addition verbal recommendations may be made. Our previous restricted antibiotic program required the prescribing provider to get approval to use a restricted antibiotic from the on call ID doctor prior to use. Despite this we still saw inappropriate utilization and increasing costs. We planned to compare the outcome of the new AMT program to the old system.

Results: In the first 11 months of the AMT team. A total of 1109 patients had 2013 interventions recommended. See table below for results of theses interventions. The use of 7 restricted antibiotics went down; imipenem, meropenem, voriconazole, micafungin, ablecet and linezolid and 3 went up ceftazidime, caspofungin and vancomycin. Overall the use of echinocandins, carbapenems and fluoroquinolones went down. Costs savings for the first 11 months of 2007 was $386,261. Average antibiotic costs decreased by $4.25/patient day. Most of the savings were in anti-fungal agents. Approximately 50% of the cost savings were due to reduced utilization of antibiotic agents and 50% due to favorable contracting with pharmaceutical companies. New nosocomial VRE cases ,infection or colonization, decreased from 137 in 2006 to 128 in 2007. New nosocomial MRSA cases , infection or colonization, decreased from 53 in 2006 to 44 in 2007. *C. difficile* diarrhea cases increased. There was no difference in length of stay : adult med -surg and ICU Ave. LOS was 4.8 days in 2006 and 2007 Jan-Nov. On the Univ. Campus peds service ave. LOS was 6.9 days 2006 and 6.5 days 2007 Jan.-Nov. There was no increase in mortality data for the first 3 quarters of 2007 compared with 2006, UHC Data /Mortality Index 0.79 Q 1,2,&3 2006, 0.74 for Q 1,2 &3 2007.

Conclusions: Since institution of the AMT there has been a decrease in the use of several restricted antibiotics, significant cost savings and no negative impact on patient length of stay or mortality.

Intervention Totals			
Number of AMT forms completed and filed on charts	Adult Patients 1034	Pediatric Patients 75	All patients 1109
Interventions	Number (percent)	Number (percent)	Number (percent)
All Interventions	1871 (100.0%)	142 (100.0%)	2013 (100.0%)
Total number of recommended interventions accepted	1091 (58.3%)	69 (48.6%)	1160 (57.6%)
Total number of recommended interventions declined	430 (22.98%)	49 (34.5%)	479 (23.8%)
Total number of agree with current antibiotic management	350 (18.71%)	24 (16.9%)	374 (18.6%)

44. Infectious Diseases Pharmacist Activities within an Antimicrobial Stewardship Program

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Background: Several strategies exist for implementing antimicrobial stewardship including prior authorization, prospective review with prescriber feedback, prescriber education, antibiotic order forms, and automatic stop orders. An antimicrobial stewardship program (ASP) was established at the Hospital of the University of Pennsylvania (HUP) in 1994 and incorporated many of these antimicrobial

stewardship strategies. However, little has been published on the daily activities required of infectious diseases (ID) pharmacists who implement these strategies within a well-established, comprehensive ASP.

Objective: The purpose of this study was to classify and quantify the actions of ID pharmacists within an ASP.

Methods: The ASP receives calls for antimicrobial recommendations and approvals through a dedicated pager system. Four ID pharmacists cover the pager weekdays from 8 am until 5 pm and weekends from 9 am until 1 pm and rotate days in which they receive antimicrobial consultations. Each consultation involved reviewing the patient case and the request with the calling practitioner, as well as, reviewing medications, microbiology, laboratory, and radiographic data, signs and symptoms of infection and other clinically pertinent patient information. An ID attending physician was always available for assistance with complex consultations. An online documentation system was developed to save and store each antimicrobial consultation received by the ID pharmacists in a SQL® database. Based on previously received consultations, a 17-category classification list was developed to describe the activities required of the ID pharmacists during each consultation. Each ID pharmacist was responsible for classifying the consultations that they received.

Results: On weekdays from June 20, 2007 until November 21, 2007 a total of 4847 (mean 46 per day, range 26-64 per day) antimicrobial consultations were documented by the ID pharmacists with 7659 classifications listed.

Activity		**Percent of Consultations**
Recommended not to start/change antimicrobial therapy or to stop current antimicrobial(s)		4.0%
Modify/add/change antimicrobial request		14.2%
Provide dosing modifications/recommendations		28.4%
Provide complete antimicrobial regimen or significantly modify a regimen		14.9%
Agree w/ requested antimicrobial regimen w/:	No changes	18.2%
	Only dosing modifications	41.0%
Provide additional instruction for non-medication interventions (e.g. obtain ID consult, cultures, labs, remove catheters, etc.)		19.4%
Provide assistance w/ avoiding/managing a medication:	Allergy	1.7%
	Interaction	2.6%
	Adverse reaction	0.3%
Perform literature evaluation/review for request		0.5%
Provide general drug information		4.6%
Obtain additional patient information beyond what was discussed during consultation (e.g. contact microbiology for isolate information, review previous inpatient chart, etc.)		1.8%
Contact ASP attending physician/ID physician/attending physician		2.1%

ID consult/ID physician recommendation	2.2%
Intervention considered significant (e.g. incomplete HAART regimen, untreated positive culture, etc.)	0.4%
Other	1.8%

When documented, the most commonly requested antimicrobial was vancomycin (984/4847). Assistance with the selection of the complete or a component of the antimicrobial regimen was requested 14.2% (686/4847) of the time.
Conclusions: Very few of the antimicrobial consultations received by the ID pharmacists required no changes to the antimicrobial regimen requested by the caller. Although dosage recommendations were the most common activity, modifying or providing the complete antimicrobial regimen was a frequent activity as well. In light of these results, ID training of pharmacists should be mandatory to participate in an ASP.

45. Childcare Center Directors' Opinions Regarding Antibiotic Use for Childhood Illnesses

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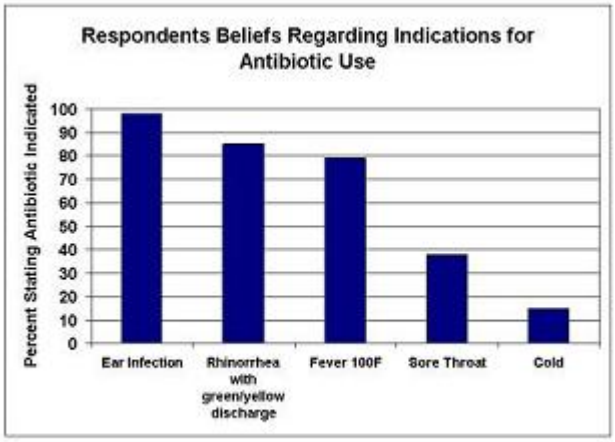
Background: Widespread use of antibiotics is one of the factors driving emergence of antimicrobial-resistant pathogens. Pre-school children experience frequent rhinorrhea or cough that are primarily caused by viruses. Childcare providers can influence misuse of antibiotics by requiring antibiotic use for such illnesses before allowing return to childcare centers. This may motivate parents to pressure physicians for unnecessary prescriptions.

Objective: To guide educational interventions, we surveyed childcare providers in Pennsylvania to assess knowledge and attitudes regarding use of antibiotics.
Methods: In 2006 we emailed questionnaires to childcare centers that were participating in a quality improvement program (PA Keys) sponsored by the Pennsylvania Department of Public Welfare's Office of Child Development. Questions asked about demographic characteristics, policies regarding child illnesses, and opinion regarding antibiotic usage. We analyzed 135 surveys completed by childcare center directors.

Results: Respondents were mostly female (98%) and the majority (70%) had completed college; 60% were 26-45 years of age. 97% of respondents worked in facilities with written child illness exclusion policies. While several criteria were used to exclude children, respondents mostly cited policies or guidelines developed by the facility (95%), state regulations (89%), local public health agency (37%), and Centers for Disease Control and Prevention (34%). Respondents' opinions on likelihood that childcare exclusion polices would be enforced until children with various illnesses received antibiotics varied: 56% of respondents indicated that children with fever of 100 °F would sometimes or always need antibiotics to return to

childcare care while 40% thought children with ear pain or pulling their ears needed antibiotics. Responses regarding personal beliefs regarding antibiotics for children differed: 98% of respondents believed physicians should prescribe antibiotics for ear infections while 15% thought they should be prescribed for a cold (Figure). Over 90% of the directors expressed interest in information on childcare infections, infection control and appropriate use of antibiotics.

Conclusions: While childcare centers play a critical societal role, they may contribute to overuse of antibiotics. Most childcare directors in this study believe children require antibiotics for illnesses due primarily to viral pathogens. Directors of childcare centers may influence parents to seek unwarranted prescriptions for antibiotics. Interventions targeted to childcare centers should be included in community efforts to promote judicious use of antibiotics.



46. CLSI Standards on Presentation of Data and Interpretation of Antibiograms: What Else Could Be Presented?

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Background: Recently the Clinical and Laboratory Standards Institute (CLSI) has developed a consensus guideline for the analysis and presentation of data on antibiograms interpretation and antimicrobial susceptibility trends. Among other recommendations they suggest to present only the first isolate per patient irrespective of the body site from which the specimen was obtained and the antimicrobial susceptibility pattern. This may be the most controversial aspect of the guideline, because this could exclude from the analysis a series of specimens, which could eventually change the final susceptibility trends presented, maybe excluding from the final analysis the variable of days of hospitalization.

Objective: Establishing that the time of the diagnosis of infection is crucial for antibiotic choices in a health care facility, we evaluate the susceptibility pattern in patients with the diagnosis of infection before 15 days in hospital and after this period of hospital stay.

Methods: From march/2006 to December/2007 we performed a susceptibility trend analysis including only patients with clinical diagnosis of infection. All positive cultures from all sites were analyzed.

Results: Five hundred and forty seven specimens were analyzed (248 in ≤14-days group and 299 in the >14-days group). For ciprofloxacin, ceftazidime, cefepime there were statistically significant difference comparing both periods of time. The susceptibility pattern for ciprofloxacin was: 85.9% (N=159) of specimen tested were susceptible to ciprofloxacin in the ≤14-days group and 69.8% (N=155) were susceptible in the >14-days group (P<0.001; OR 0.38; IC 0.22-0.64). For cefepime the susceptibility pattern was: 75.3% (N=113) of susceptibility in the ≤14-days group and 53.5% (N=92) in the other group (P<0.001; OR 0.38; IC 0.23-0.62). For ceftazidime, in the early infection group the susceptibility was 91.5% (N=108) versus 75.6% (N=118) in the late group (P<0.001; OR 0.29; IC 0.13-0.64). For vancomycin, Piperacillin+tazobactam or the carbapenems there were no differences in comparison of both groups.

Conclusions: We are in accordance with the CLSI guidelines, but analyzing only documented cases of hospital infection, we emphasize the importance of adding the information of days of hospitalization in the presentation of data of antibiograms. This practice could help the medical staff to better choose the empirical antimicrobial therapy of healthcare-associated infections.

47. Implementation of an Antimicrobial-Control Program in a University Cardiac Center in Brazil

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Background: The inadequate use of antimicrobial drugs has several consequences in terms of development of drug resistance, elevation in costs higher levels of mortality. Antibiotic management interventions are lacking in many healthcare institutions, especially in a developing country like ours. Therefore, implementation of strategies for a more judicious use of antimicrobial agents has become mandatory.

Objective: Evaluate the impact of implementation of an antibiotic control program on the antibiotic consumption and cost in a developing country setting.

Methods: We conducted a four-year quasi-experimental study in a 250-bed cardiology care center. Data were analyzed from jan/2004 to dec/2007 and an antibiotic control policy was instituted in july/2007. The policy consisted in a daily review of all antibiotics prescribed, by an infection disease specialist. The review of the patients charts were made electronically but the infection control reply was a written suggestion put in the patient's records. In urgent cases or if the recommendation was not followed a telephone contact was made direct to the assistant physician. Quinolones, third generation cephalosporins, carbapenems and vancomycin were restricted. The carbapenems were only dispensed by pharmacist after a phone call to the infectious disease specialist and an order to dispense de medication was made. The recommendations were followed by a trainee graduating in pharmacy. Antibiotic usage was standardized by defined daily doses (DDDs) per

100 patient-days and two periods of time were compared: 18 months before the introduction of the program (jul/2005), and after this period of time, another 30 months. The acceptance rate of the suggestions made by the infection control was recorded and analyzed during a seven month period in 2007.

Results: The median consumption in DDDs per 100 patient-days before and after the implementation of the program is as follows: 2.67 and 2.76 for ciprofloxacin; 0.09 and 0.04 for ceftazidime; 6.71 and 0.19 for the carbapenems; and 2.37 and 1.74 for vancomycin. During 7 months 914 patients (1178 antibiotic prescriptions) were followed. A prescription change was recommended for 591 (50.2%) of prescriptions - 51.0% were related to the antibiotic choice; 42.3% related to the number of days of prescription; 15.6%, related to the route of administration; and 1.1%, related to the dose. The rate of compliance with recommendations was 57.5% and, in these cases, 91.9% was occurred until 48 hours of the recommendation. This resulted in a reduction of 66.3% in the cost with antibiotics in the institution: in 2004 the total cost was 367,887.64 US dollars, and in 2007 this cost was 112,266.35.

Conclusions: This work emphasizes the importance of antibiotic control in all settings. A rate of compliance with the recommendations of approximately 60% is considered good and resulted in a reduction in consumption and costs with antibiotics.