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ABSTRACTS

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Oral presentations

O1

Adherence to the clostridium difficile prevention and management toolkit

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Background and objectives Clostridium difficile infection (CDI) is one of the most important healthcare associated infections. Management guidelines for patients diagnosed with CDI[1] and a toolkit incorporating national guidance[2] were implemented across a Health Board area. The objective of this study was to quantify adherence to the risk assessment/management and treatment algorithm components of the toolkit.
Design Point prevalence survey of documentation of risk assessment in all patients admitted to randomly selected wards (n = 13). Prospective audit of the treatment algorithm applied to all patients with CDI during an 8 week period. Statistical tests: Fisher's exact test (significance level $p < 0.05$).
Setting Three acute adult hospitals, Scotland, UK.
Main outcome measures Frequency of completion of risk assessments, CDI severity markers and adherence to the treatment algorithm.
Results The point prevalence survey was applied to 287 patients; the risk assessment was present in 227/287 (79.1 %) records and fully completed on 67/227 (29.5 %) occasions. Of the 120/227 (52.9 %) patients identified at risk of CDI, actions were recorded for proton pump inhibitors, laxatives, antibiotics and malnutrition risk in 43/120 (35.8 %), 43/120 (35.8 %), 37/120 (30.8 %) and 42/120 (35.0 %) patients respectively. The treatment algorithm was audited in 29 patients. Prescriptions for causative antibiotics, laxatives or proton pump inhibitors were discontinued on 12/13 (92.3 %), 8/13 (76.9 %) and 14/18 (77.8 %) occasions respectively. Daily (days 1–5) monitoring of clinical severity markers (blood and temperature) occurred in 3/29 (10.3 %) patients and was more frequent in patients with very severe/life threatening CDI. The treatment algorithm was adhered to in 18/29 (62.1 %) patients several of whom had very severe/life threatening CDI. When disease severity was documented in the patient's notes, overall adherence was 5/5 (100 %) compared to 14/24 (58.3 %) when it was not documented ($p = 0.1336$).
Conclusions Appropriate documentation and use of the toolkit was not consistent. There was a tendency for documentation of severity and adherence to the algorithm in those with severe CDI. Causes of non-adherence to risk assessment/management processes should be identified and actions taken by the infection control team to implement safe practices to minimise incidence of CDI and manage the infection appropriately.

References

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(2) Scottish Antimicrobial Prescribing Group. Guidance to Optimise Antimicrobial Use and Reduce Clostridium difficile Associated Disease in Scottish Hospitals. Scottish Antimicrobial Prescribing Group, 2008

O2

Preliminary experience of routine voriconazole TDM in a tertiary care centre

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Background and objectives Voriconazole is active against several clinically important fungal pathogens. The variable pharmacokinetics makes it an excellent candidate for therapeutic drug monitoring (TDM). We evaluated the preliminary performance of TDM in our hospital.
Design A retrospective study, analyzing data from 15 months. Patients treated with voriconazole, in whom TDM was performed, were included. Recommendations on dose adjustments were based on

the therapeutic interval 1–5.5 mg/L.[1] A 50 % dose increase or decrease was advised, depending on subtherapeutic or toxic levels, followed by a control level after 4 days.
Setting University Hospitals, Leuven, Belgium.
Main outcome measures Number of hospitalizations (minimal length of stay: 4 days) during which voriconazole was started versus those in which TDM was performed. Number of ambulatory patients treated with voriconazole versus those in whom TDM was performed. Amount of non-therapeutic voriconazole levels. Amount of non-therapeutic first levels followed by control samples.
Results In 54 % of hospitalizations during which voriconazole was started (90/168 hospitalizations) and 60 % of ambulatory patients treated with voriconazole (25/43), TDM was performed. In total, 400 voriconazole levels were determined (331 hospitalized and 69 ambulatory patients), with an average(median) of 4(2) samples per hospitalization, ranging from 1 to 24 samples. 143 samples were non-therapeutic (58 toxic, 85 subtherapeutic), of which 52 were first levels (19 toxic, 33 subtherapeutic). 23 first levels (44.2 %) were not followed by a control level. In the remaining 29 patients, the non-therapeutic level was followed by a therapeutic level in 18 cases (62 %), showing the good performance of our dose adjustment algorithm. To our knowledge, this study is the first to report such a great amount of samples gathered in a short period.[2] Due to this frequent voriconazole TDM, we gain a lot of experience about voriconazole's pharmacokinetics.
Conclusions TDM of voriconazole is very frequently performed in our hospital, illustrated by the amount obtained in a relatively short period. Approximately, one-third of levels was non-therapeutic, underlining the benefit of TDM. Surprisingly, TDM was not performed in almost 50 % and an important part of non-therapeutic first levels was not followed by a control level, stressing the need for further implementation of monitoring in our center.

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O3

Consumption patterns and in vitro resistance of *S. Pneumoniae* to fluoroquinolones

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Background and objectives This study analyses consumption patterns of fluoroquinolones and documents in vitro resistance of *S. pneumoniae* to fluoroquinolones in ambulatory care in Belgium.
Design Data on fluoroquinolone consumption were derived from IMS Health. Respiratory blood isolates were taken from adults to test in vitro susceptibility of *S. pneumoniae* to levofloxacin and moxifloxacin. The *S. pneumoniae* strains were isolated in 15 clinical laboratories throughout Belgium. A hundred blood isolates per year were at random selected from 2004 to 2009.
Setting Ambulatory care in Belgium.
Main outcome measures Volume of fluoroquinolone consumption was expressed in terms of the number of defined daily doses per 1,000 inhabitants per day (DID). Consumption was valued at public prices pertaining to the year or month of consumption. Susceptibility and resistance of *S. pneumoniae* was expressed using the Clinical and Laboratory Standards Institute breakpoints.
Results Fluoroquinolone consumption increased from 24.1 million € in 1993 to a maximum of 44.4 million € in 2002, and then decreased to 35.0 million € in 2009. The volume of fluoroquinolone consumption has fallen consistently from 3.00 DIDs in 2003 to 2.66 DIDs in 2009. Fluoroquinolones were primarily used to treat urinary tract infections (36 % of consumption, volume of 0.95 DIDs) and lower respiratory tract infections (26 % of consumption, volume of 0.70 DIDs). The minimum inhibitory concentration (MIC) distribution of moxifloxacin and levofloxacin in *S. pneumoniae* isolates remained stable during 2004–2009 and resistance to moxifloxacin and levofloxacin was low ($\leq$1 %). Moxifloxacin was the most potent fluoroquinolone available for treatment of *S. pneumoniae* infections in Belgium with MIC90 of 0.19 mg/L.
Conclusions The volume of fluoroquinolone use remains well controlled and fluoroquinolones were primarily used in those indications where they have been shown to yield clinical benefit. The use of fluoroquinolones has not led, to date, to an increase in the rate of pneumococcal resistance to fluoroquinolones.

O4

Complex osteoarticular infections: an observational study of antibiotic prescriptions in an orthopaedic surgery ward

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Background and Objectives Patients suffering from complex osteoarticular infections are followed by a regional centre of expertise. Weekly multidisciplinary meetings are organised by this centre. During these reunions, surgeons, infectiologists, microbiologists and pharmacists discuss each case and decide which treatment to initiate. We record these therapeutic propositions. The aim of our work is to audit the contents of medical prescriptions following the meetings, and determine whether multidisciplinary decisions are applied, for all hospitalised patients for the whole length of their stay.
Design An observational study.
Setting Orthopaedic surgery ward of a teaching hospital.
Materials and methods At each meeting, we create a pharmaceutical record per patient. Using these records, we then audit patient's files in 3 steps: On the morning following the meeting ("day 0"), we search for the presence of the multidisciplinary decision in the medical prescription folder (with the following criteria: name of antibiotic, pharmaceutical form, route of administration, dose regimen, treatment duration).Then, from day 1 until discharge, we determine whether treatment is continued or modified. Finally, when patient is discharged from hospital, we audit the contents of the information in the discharge letter or prescription. We consider an item as non compliant if the information in the medical folder is absent or is different from the multidisciplinary decision.
Results The analysis of 176 files over a period of 5 months showed that on day 0, antibiotic, route and form were compliant with multidisciplinary decision in 87 % of prescriptions. However, treatment duration was only indicated in 37 % of prescriptions. From day 1 until discharge, 73 % of prescriptions were compliant on all criteria. Finally, the information in the discharge letter was complete (presence of all criteria) in 57 % only. A pharmaceutical intervention was made for 10 % of files.
Conclusions By participating in the multidisciplinary meetings, we contribute to the improvement of prescription quality. This work

allows us to promote good use of antibiotics and increase patient safety.

O5

Effect of pharmacy-guided TDM of vancomycin on achieving and maintaining recommended drug levels

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Background and objectives To evaluate the effect of newly established clinical pharmacy service—therapeutic drug monitoring (TDM) of vancomycin using a pharmacokinetic tool—on achieving and maintaining patient's therapeutic vancomycin levels.
Design Retrospective study on adult, non-intensive care unit (ICU) patients, treated in 2011 with vancomycin for at least 14-days with stable blood-creatinine levels (less than 40 % deviance from the baseline). TDM schedule followed the written protocol, aiming for the troughs of 10–20 mg/l. Blood samples for TDM analysis were taken on a pharmacist's request, sample analysis took place in an accredited laboratory. Only trough levels were measured. Collected were data on patient's age, sex, estimation of creatinine clearance, number of all vancomycin trough levels, number of pharmacist's recommendations, number of accepted pharmacist's recommendations by physicians and complete duration of treatment.
Setting Pharmacy, all wards (except ICU's and Pediatrics) in a large teaching hospital.
Main outcome measures Number of all trough levels and duration of treatment after acceptance of recommendations, number of trough levels and duration of treatment within the therapeutic range after acceptance of recommendations; estimated proportion of duration of treatment within the therapeutic range after following pharmacist's recommendations.
Results 28 patients met the criteria (14 women, 14 men). The average age was 64 ± 15 years and the average creatinine clearance was 75 ± 39 ml/min. A total of 216 vancomycin trough levels were determined. Of 193 pharmacist's recommendations, 186 (96 %) were accepted by physicians. After the acceptance of recommendations, 172 vancomycin trough levels were determined and 133 (77 %) of them were within the therapeutic range (10–20 mg/l). Using a graphical presentation we estimated that after the acceptance of pharmacist's recommendation, patients were within the therapeutic range in 85 % of treatment time.
Conclusions The established pharmacy TDM service seems to be successful. Pharmacists have an important role in managing vancomycin dosage regimen—acceptance of our recommendations provides good maintenance of therapeutic vancomycin levels.

O6

HPLC-UV for detection of voriconazole in saliva samples

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Background and objectives Voriconazole is a wide-spectrum triazole antifungal agent. The drug is known to display pharmacokinetic variability, implicating the need for therapeutic drug monitoring (TDM). The reference interval for voriconazole is defined at 1–5.5 mg/L in plasma.[1] For children and ambulatory patients, a method for TDM using less invasive sampling would be beneficial. Saliva is an excellent candidate, because of the easy and painless collection. The ratio of saliva to plasma concentrations seems to be stable at 65 % in healthy adults[2] and 30–40 % in immunocompromised patients.[3] The goal of this project was to develop and validate an analytic procedure for voriconazole analysis in saliva, supporting a less invasive method for TDM of voriconazole.
Design The analytical assay to determine voriconazole in saliva comprised liquid–liquid extraction followed by high performance liquid chromatography (HPLC). After adding internal standard butyl hydroxybenzoate and buffer KH_2PO_4 25 mM *p*H 6.5 to the saliva sample, voriconazole was extracted with diethylether. The dry residue was reconstituted in mobile phase solution and injected for analysis by reversed-phase HPLC followed by ultraviolet detection, with a detection wavelength of 258 nm. The mobile phase consisted of a mixture of methanol and buffer in a ratio of 65:35 v/v (isocratic elution at 1 ml/min).
Setting Laboratory for Pharmacotechnology and Biopharmacy, Department of Pharmaceutical and Pharmacological Sciences, KULeuven, Leuven, Belgium.
Main outcome measure Development and validation of the analytical assay for voriconazole analysis in saliva.
Results The developed analytical method allowed separating voriconazole (retention time 7.67 min) and the internal standard (retention time 11.25 min) from the sample matrix. The observed UV signal increased linearly with voriconazole concentrations between 0.044 and 5.59 mg/L. The mean relative error of standard samples at 0.044 and 5.59 mg/L varied between 1.5 and 8.5 %. Determination of the intraday and interday repeatability resulted in relative standard deviations all below 10 %.
Conclusions Voriconazole concentrations in saliva can be determined in an accurate and reproducible way with the developed assay. In a follow-up project, the method will be applied to investigate the correlation between plasma and saliva concentrations of voriconazole in different patient populations.

References

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Poster presentations

P1

Lille pharmaceutical opinions in infectious diseases: not so bad!

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Background and objectives In Lille University hospital, anti-infectives are personalized dispensed drugs, after both clinical and bacteriological data pharmacist analyses. The aim of the study is to review pharmacist interventions given on 21 drugs during 6 months.
Design The used method follows the French guidelines. However it is retrospective, excludes pharmacist on duty's dispensation, and the French Society of Clinical Pharmacy (SFPC) form is not completed on time.

Setting Lille University Hospital (during 6 months).
Main outcome measures The SFPC index form is used.[1] For each opinion, 3 main criteria are identified: problem, intervention and outcome. Problems can concern either dosage or a good use of medicine. Interventions are connected with the drug and the modalities of administration. They are either accepted, refused, or lost of followed up.
Results On the 1,749 patients, 44 pharmacist interventions are given: 23 on antibiotics and 21 on antifungals. Sub-dosage or overdose are involved in 41 % of the interventions. The other part, 59 %, includes non compliance with reference tables, not indicated drug, or a problem of way of administration. Propositions made by the pharmaceutical team are linked with posology adaptation (47.7 %). The exchange or addition of a drug and the optimization of the way of administration gather 22.7 % of interventions. A stop of a treatment is made in 29.5 % of the cases. The outcome shows that physicians agree in nearly 86 % of the cases, when a solution is proposed. Two patients are lost of follow-up.
Conclusions Only few interventions are given, what proves that physicians respect the international guidelines and the decisions taken by the multidisciplinary infectiology staff. When a problem is detected, the intervention is almost always accepted by doctors. The study will be completed by audits in the different departments and a discussion with the prescribers about medical satisfaction in pharmacist intervention. A quality approach also includes a new assessment and a comparison with this study when the system of prescriptions is computerized.

Reference

(1) http://sfpc.adiph.asso.fr/admin/pdf/fiche-intervention-pharmaceutique.pdf

P2

Carbapenems: practices in a Pediatric Hospital

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Background and objectives Carbapenems are broad-spectrum β-lactam antibiotics used for the treatment of multidrug-resistant bacteria including producers of extended-spectrum β-lactamases (ESBLs), AmpC β-lactamases and *Pseudomonas* species. To maintain superior efficacy, they must be used appropriately. Since April 2011, french guidelines impose to monitor the use of carbapenems. The objective is to describe their use.
Design We conducted a prospective, observational study during 1 year.
Setting Children hospital.
Main outcome measures Each prescription was analyzed by a team of pharmacist and biologist. Patient characteristics (sex, age, weigh, medical unit), dose, duration of treatment, reassessment at day 3, clinical use, microbiological data were collected.
Results A total of 243 patients received carbapenems and 326 prescriptions issued were analyzed. Imipenem accounted for 84 % (n = 247) and meropenem for 24 % (n = 79) of the prescriptions. The mean dosage of imipenem was 57.9 ± 16.9 and 68.5 ± 33.0 mg/kg/day for meropenem. The main use was empirical treatment (n = 212, 65 %) with previous infection or colonization by bacteria resistant to third-generation cephalosporins in two-third of the cases (n = 144). The pathogen was identified in 18.7 % of the cases. Other indications were the need to widen antimicrobial spectrum (20.6 %; 7.6 %) and surgical prophylaxis (6.5 %; 2.5 %). Thirty courses of imipenem were switched to meropenem because of adverse effects (nausea). All prescriptions were reevaluated at day 3. Long courses of antibiotics were noticed in hematology (14.7 ± 11.9 days) compared to other medical units (6.1 ± 5.3 days). In this unit, inpatients were frequently colonized by resistant-gram negative bacteria and carbapenems often prescribed by fear of bacterial translocation. Some neutropenic patients received one-month courses of antibiotics, which was unjustified. The second main prescriber was gastroenterology but long courses (6.9 ± 5.9 days) were explained by patients with cystic fibrosis chronically infected with *Pseudomonas species* who received multiple courses of meropenem.
Conclusions This study has highlighted a substantial proportion of unjustified long courses of carbapenems in particular in hematology. A future work will focus on this department and meetings with clinicians will be organized. To optimize the surveillance of antibiotics, a computerized system was developed to routinely collect data. Its access will be shared by pharmacists and biologists.

P3

HIV knowledge and attitudes of graduate and undergraduate pharmacy students in Qatar

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Background and Objectives Trials designed to evaluate university students' knowledge and attitudes of human immunodeficiency virus (HIV) in the Middle East have demonstrated several misconceptions.[1,2] Furthermore, research indicates a lack of knowledge about HIV correlates with negative attitudes.[3] The objectives of this study were to describe pharmacy students' knowledge and attitudes of HIV and to evaluate students' preferred sources of information about HIV.
Design This study was designed as a cross-sectional survey. The survey was developed based on the objectives of this trial and other related research. The survey was validated through a pilot survey in a sample of 5 pharmacy students and then administered to all undergraduate and graduate pharmacy students at Qatar University using Survey Monkey, an online survey tool. All students enrolled in a full-time pharmacy program at Qatar University were eligible to participate. Data was summarized descriptively.
Setting This study was completed within the College of Pharmacy at Qatar University in Doha, Qatar.
Main outcome measures Students' knowledge and attitudes of HIV pertaining to prevention and transmission of the infection.
Results A total of 49 respondents completed the survey with a response rate of 51 %. Although the majority of pharmacy students in Qatar are knowledgeable about HIV, several misconceptions about modes of transmission and strategies for prevention still remain. Pharmacy students' attitudes with respect to HIV infected individuals living amongst the general population, maintaining friendships with HIV infected individuals and using health care services were generally positive however some negative attitudes were evident across several domains. Pharmacy students reported their most common source of information about HIV was television and scientific literature and their preferred source of information about HIV was scientific literature and healthcare workers.
Conclusions Current educational strategies should further emphasize modes of HIV transmission and prevention. Instructors should encourage an open discussion about HIV-related beliefs and attitudes.

Finally, instructors should recommend supplemental literature on HIV for students to review. This data was presented on March 12–14th at The Dubai International Pharmaceuticals and Technologies Conference and Exhibition. The authors report no conflicts of interest.

References

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P4

Surveillance of antibiotic use in nursing homes: the value of adding point-prevalence studies to pharmacy sales data

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Background and objectives Surveillance of antibiotic use is important in light of increasing antibiotic resistance. Traditionally pharmacy sales data has been used for antibiotic surveillance, but this method lacks information about indication for use and prescribed doses. In point-prevalence surveys (PPS) this information can be collected but PPS give only snapshots of the situation. We aimed to combine both methods and evaluate how these methods may be used for surveillance of antibiotic use in nursing homes.
Design For each nursing home, antibiotic sales data for 2009 were collected retrospectively from the pharmacy. Further, two one-day PPS were performed, April and November 2009. Setting: Five nursing homes in Norway, 2009, 548 residents in May and 516 in November.
Main outcome measures Antibiotic sales data for the year 2009 were calculated as DDD/100 bed days. In both PPS, data on residents using antibiotics were collected. Antibiotic use is presented as percentage of patients. Data collected was age, gender, risk factors for infections, indication for use, type of antibiotics and dosages.
Results Antibiotic use in 2009 was, according to the sales data, 10.6 DDD/100 bed days. In the PPS, 47 patients (8.6 %) used antibiotics in April and 42 (8.1 %) in November. Antibiotics for prophylaxis/therapy were used by 2.4 %/6.2 % of patients in April and 3.5 %/4.7 % in November. Altogether 24 substances were bought from the pharmacies in 2009, 15 of these were recorded in the PPS. The most frequent substance recorded in both methods were methenamine, 2.7 DDD/100 bed days (sales data), in PPS prescribed for prophylaxis of urinary tract infection (UTI) in 9 (April)/13 (November) patients, and pivmecillinam, 2.5 DDD/100 bed days, prescribed for UTI in 13 (April)/6 (November) patients.
Conclusions Sales data quantifies antibiotic use in nursing homes to be around 10 % (10 DDD/100 bed days) and identifies the most important substances used. PPS are complementary to sales data, in our study PPS-use was lower, but in the same range. Moreover, PPS adds information about patients, indications and dosages and in this way it is possible to evaluate the appropriateness of the most used antibiotics in nursing homes.

P5

Integration of anti-infectives in a smart pump library: feasibility and nurse satisfaction

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Background and Objectives Smart infusion pumps are aimed at making intravenous therapy safe. This technology requires the development and individualization of drug libraries for patient care areas. Standardized concentrations (SCs) and dosing limits that can or cannot be overridden must be defined. The objectives of this study were to evaluate the feasibility of including anti-infectives (AIs) with useful limits in a pump library and to evaluate users' satisfaction.
Design A consultation and validation process with pharmacists and physicians was used to determine SCs, dosing limits and AIs distribution in a drug library subset. Limits are expressed in dose rates (e.g., mg/kg/h) and must be applied to the AIs for which concentrations and administration times can be standardized. Only one limit that can be exceeded was set per AI and calculated by dividing the highest recommended and clinically-used dose (increased by 20 %) by the administration time. Three administration times were selected: 5, 30 or 60 min. The selected pediatric population limits had to be applicable to adults.
Setting CHU Sainte-Justine, Montreal, Canada.
Main outcome measures Description of the library's characteristics. Nurses' satisfaction 3 months post-implementation.
Results 177 medications including 37 AIs have been identified across nine libraries. 17 AIs (acyclovir, cefazolin, cefotaxime, cefoxitin, ceftazidime, cefuroxime, ciprofloxacin, clindamycin, fluconazole, gentamicin, levofloxacin, linezolid, meropenem, metronidazole, piperacillin, piperacillin-tazobactam, tobramycin) can be administered with fixed administration times and SCs. 20 AIs cannot since they are compounded in the unit by nurses rather than being centrally in the pharmacy. Nurses have identified positive elements: ease of selection of AIs in the pump library, display of the infused AI's name and clinical tools given to nurses to prepare AIs with SCs. Most AIs are administered in 30 min. Main negative elements reported refer to the display of irrelevant limits on the pump in certain circumstances (e.g., AIs re-dilution to avoid rinsing after administration).
Conclusions It is feasible to integrate AIs with useful limits in pump library provided SCs and standardized administration times are implemented. Overall, nurses were satisfied with the use of the libraries, but a continuous monitoring is necessary to avoid not-compliant practices.

P6

A 40-year perspective of clinical pharmacy services in infectiology in Canada

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Background and objectives Antimicrobial agents have been used in healthcare settings for almost a century. Hospital pharmacists have been involved in the optimal drug use for these agents through centralized and decentralized pharmacy services. Pharmacy practice models have significantly changed through this period. The objective of this study is to describe the evolution of the pharmacy practice models from 1972 to 2012.
Design Descriptive study.
Setting CHU Sainte-Justine, Québec, Canada.
Main outcome measures Identification of key milestones about the pharmacy practice models in infectiology through literature search, annual reports and the book "De l'apothicaire au spécialiste" published in 2011.
Results Ten key milestones have been identified: centralized multidose hospital drug distribution systems (1970s), adverse drug reactions evaluation and reporting systems (1980s), pharmacokinetics of aminosides and vancomycine (1990s), drug utilization reviews (1990–1995), targeted decentralized clinical pharmacists targeting antimicrobial agents within a hospital (1990s), centralized drug compounding of antimicrobial with bulk (1995-now), broad decentralization of clinical pharmacists per clinical programs including antimicrobial monitoring when applicable, with pharmaceutical care model (1995s-now), pharmacoeconomics of antimicrobial agents and decision-making (2000s-now), increased patients safety awareness and initiatives and antimicrobial agents antimicrobial (2000s-now), antimicrobial stewardship involving pharmacists and national initiatives in the context of increasing hospital-acquired infections and drug resistances (2005-now).
Conclusions While the concept of pharmaceutical care has contributed to decentralize pharmacists in inpatient and outpatient care settings, drug utilization problems with antimicrobial agents have reinforced the importance of having a pharmacist dedicated to a hospital-wide surveillance of these agents. An historical perspective of the evolution of pharmacy practice model in infectiology is useful for future perspective.

P7

Drug shortages and antimicrobial agents: a cross sectional France-Canada comparison and perspective

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Background and Objectives Drug shortages have significantly increased in Canada in the last decade with an average of 500 products on shortage per year for an average of 108 days of drug shortage duration. There are no similar data available for France. Antimicrobial agents are key drugs used in hospital and drug shortages add to the complexity of treating infections with underlying reported hospital-acquired infections and increasing drug resistances to these agents. The objective of this study is to compare the current situation of drug shortages for antimicrobial agents in France and Canada. Drug shortages were extracted from three online databases (AFSSAPS and OCP Office Commercial Pharmaceutique in France, Vendredipm in Canada).
Design Cross-sectional study.
Setting French and Canadian markets.
Main outcome measures Total number of antimicrobial agents (defined as a product for a specific common name, strength and format) on shortage on March 8th, 2012.
Results Six antimicrobial products and seven common denominations were reported to be on shortage in France on March 8th, 2012 (colimycine, fosfomycine, gentamicine, netilmicine, streptomycine, quinine, and ethambutol). Sixty-four antimicrobial products and twenty common denominations were reported to be on shortage in Canada on March 8th, 2012 (erythromycin, fluconazole, levofloxacine, quinine, humatine, mandelamine, gentamicine, clindamycine, tobramycine, cloxacil, penicilline, ciprofloxacine, trimethorpime-sulfamethoxazole, zyvoxam,amoxicilline-acide clavulanique, azithromycine, chloromycetine, ribavirine, norvir). There are numerous causes for drug shortages. The current difference in the number of products in France and Canada have not been formally explored by this cross-sectional study. We hypothesize that legally mandatory reporting of potential or planned drug shortages in France might contribute to a lower number of drug shortages. Also, nature of drug shortages (e.g. drug with no alternatives/some alternatives) to be reported on the different databases might influence the content.
Conclusions There are a significant larger number of antimicrobial agents in drug shortages in Canada than in France. Further studies are required to explore the reasons for such discrepancy.

P8

A national antimicrobial surveillance program: perspective of a mother–child teaching institution

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Background and objectives Health-acquired infections are well known, common and costly and include catheter-related bloodstream infection, ventilator-associated pneumonia, surgical site infection, and catheter-associated urinary tract infection. Also, infection rates of multidrug-resistant organisms are increasing in Canada. In the context of a 2010–2015 ministerial action plan for the prevention and control of nosocomial infection, a national antimicrobial surveillance program is implemented in Quebec starting April 1st, 2012. The objective of this study is to describe the perspective of a mother–child teaching hospital with this implementation.
Design Descriptive study.
Setting 500 beds—Centre hospitalier universitaire mère-enfant CHU Sainte-Justine (CHUSJ), Montréal, Canada.
Main outcome measures Description of the organization and the action plan implemented at a the hospital level.
Results The CHU Sainte-Justine had already in place an antimicrobial surveillance committee (ASC) that reports to the Pharmacology and Therapeutics Committee (PT). It also collaborates with the Infection Control Committee. Following the publication of the national directive, the ASC has revised its membership (4 pharmacists, 2 physicians), identified its 10 key 2012–2013 priorities, imported defined daily dose (DDD) in the pharmacy information system to publish a periodical report of DDD per 1,000 patient-days, days of therapy (DOT) and the mean mg/kg dose for antimicrobial surveillance, per wards, monthly. At least three drug utilization review targets have been identified and most drug utilization rules published on the intranet of the hospital will be revised within the next year. While decentralized pharmaceutical care do contribute to optimal use of antimicrobial in hospital, a transversal ASC is necessary and in line with the concept of antimicrobial stewardship
Conclusions A national antimicrobial surveillance program is being implemented in Quebec. This descriptive study illustrates the activity of a local ASC.

P9

Evaluation of the treatment of *Staphylococcus aureus* bacteremia based on three quality indicators in a University Hospital

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Background and objectives Bloodstream infections caused by *Staphylococcus aureus* (*S. aureus*) are a major cause of morbidity and mortality. It causes 20 % of all intravascular catheter-related bacteremias and about 35 % of endocarditis. Reported in hospital mortality is in the range of 20–30 %. An evaluation of the treatment of *Staphylococcus aureus* bacteremia was performed using three indicators developed in the ABS-project.[1]—% patients with community-onset bacteraemia who had echocardiography performed within 10 days after onset (ECHO)—% patient who have their iv catheter (peripheral or central) present at SAB onset removed within 10 days after onset (CATH)—% patients with MS (methicilline sensitive)-SAB with a duration of iv betalactam therapy >10 days within the first 14 days after onset (BL-THER). The study was approved by the local ethical committee.
Design Descriptive study.
Setting Ghent University Hospital.
Main outcome measures A retrospective analysis was performed on all cases of SAB in adult patients diagnosed during the 12-month period (January 2009 to December 2009) in the Ghent University Hospital. All cases were evaluated by an infectious disease physician and a clinical pharmacist. The data were compared with the results of the ABS study performed on 500 SAB cases in European hospitals in 2007 from whom 70 in the Ghent University Hospital (1).
Results A total of 40 SAB cases were assessed. 18 (45 %) were community onset, 28 (73.7 %) had an intravenous device in place at SAB onset and 31(77.5 %) were MS-SAB. Quality indicator values were: ECHO 38.9 %; CATH 63.6 %; BL-THER, 50.0 %. These values are lower compared to the results of the ABS study: ECHO 60.4 % (64.9 %); CATH 64.1 % (64.2 %); BL-THER 59.7 % (66.7 %). The results of the Ghent University Hospital data within the ABS study are mentioned between ().
Conclusions The results of this study confirms that the treatment of SAB can be improved. A guideline focussing on the three defined ABS-indicators will be developed by the local Antibiotic team and distributed towards all physicians. A multidisciplinary team composed by infectious disease physicians, microbiologists and clinical pharmacists will follow up prospectively all SAB patients in order to enhance the compliance to the guidelines.

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P11

The possible effect of sickness leave regulation on volume of antibiotic consumption in 30 European countries

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Background and objectives Many countries require a sick note to claim sickness leave or benefits, necessitating patients to consult a physician and often resulting in an antimicrobial prescription. Socio-economic, cultural and health-regulatory determinants have been demonstrated to be correlated with antimicrobial consumption. Therefore we evaluated the possible relation between different legitimate periods of uncertified sickness leave and antibiotic consumption.
Design Data on the length of sickness leave without medical certification (SLWC) were collected via e-mail surveys, the European Foundation for the Improvement of Living and Working Conditions and various websites. Countries with self-certification were coded as intrinsically having the longest period. Data on antibiotic consumption between 2000 and 2008 were obtained from the European Surveillance of Antimicrobial Consumption database. Using two-tailed Spearman's rho correlations, we compared the SLWC with the mean antibiotic consumption and also the relation between SLWC and other potentially influential parameters such as uncertainty avoidance index (UAI) and power distance index (Deschepper et al. 2008), age group distribution, physician density and national income (Masiero et al. 2010) and physician consultation rates (Chahwakilian 2011) (Data Organisation for Economic Co-operation and Development, 2000–2008).
Setting Database and literature review.
Main outcome measures Presence and strength of correlation between SLWC and antimicrobial consumption.
Results Sickness leave data could be obtained for 30 European countries. The median SLWC was 3.0 days, ranging between 1 and 14 days. There was an important inverse correlation between SLWC and antimicrobial consumption ($rho = -0.387$; $P = 0.035$), with also a similarly high correlation with UAI ($rho = -0.483$; $P = 0.013$). Controlling for the UAI greatly reduced the correlation between SLWC and antimicrobial consumption ($rho = -0.175$; $P = 0.40$). Of the other factors, none were found to be correlated with SLWC.
Conclusions These results indicate that legal requirements regarding sickness leave such as for self-limiting infections, at least partially influence the antimicrobial consumption patterns and interact with cultural aspects. In order to reduce antimicrobial consumption the different legislative bodies and healthcare regulators should screen their regulations on inadvertent counter-productive effects.

P12

Length of stay after reaching clinical stability drives hospital costs associated with community-acquired pneumonia

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Background and objectives Community-acquired pneumonia (CAP) has a considerable clinical and economic impact. The aim was to identify drivers of hospital costs associated with CAP, in particular the influence of patient characteristics, quality indicators and other treatment aspects.

Design Observational study of patients admitted with a confirmed diagnosis of CAP. For each patient, the Pneumonia Severity Index (PSI), time to clinical stability, length of stay, antibiotic therapy, outcomes, compliance with validated quality indicators,[1] and the different costs (pharmacy, laboratory and radiology, and total) were registered. After natural log transformation of the cost data, the influence of patient and treatment characteristics was analysed using regression analysis. For each remaining variable, the relative weight (RW) as a percentage of R^2 was calculated to allow quantification of its contribution to cost variation.
Setting one large university hospital and one medium-sized secondary care hospital in Belgium.
Main outcome measures identification of significant cost drivers and their individual impact on total costs.
Results Between October 2007 and June 2010, 803 patients could be included with a median total cost of 4,794.57€. The final regression model explained 83.9 % of total cost variation. The length of stay after clinical stability (RW = 42.8 %) and time to clinical stability (RW = 15.3 %) had the highest influence on total cost (respectively +6.3 % and +4.9 %/additional day; $P < 0.0001$). Other important drivers of higher costs were total therapy duration (+0.7 %; RW = 13.1 %; $P < 0.0001$), PSI score (+0.2 %/unit; RW = 10.2 %; $P < 0.0001$), age (+0.2 %/year; RW = 6.0 %; $P < 0.001$) and admission to intensive care (+18.1 %; RW = 4.8 %; $P < 0.0001$). Patients treated with moxifloxacin had significantly but limited lower costs (−13.5 %; RW = 0.5 %; $P < 0.0001$) when compared to patients treated without. Quality indicator compliance, including guideline-compliant antibiotic treatment and therapy streamlining had little influence.
Conclusions The most important driver of hospital costs associated with CAP was the time between clinical stability and actual hospital discharge. In order to substantially decrease costs of CAP treatment, this period should be rigorously evaluated for possible intervention targets e.g. a review of non-CAP related interventions during hospitalisation or an increased focus on home care, that would allow decreasing costs in CAP treatment in a substantial manner.

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P13

Toxic plasma voriconazole levels in a lung transplant recipient

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Background and objectives Invasive aspergillosis (IA) is a potentially life-threatening complication after lung-transplantation. Voriconazole (loading dose 6 mg/kg bid, maintenance dose 4 mg/kg bid) is currently first line treatment for IA. Because of its variable pharmacokinetic profile, trough-plasma-level monitoring is standard of care. Recommendations on dose-adjustments are based upon a therapeutic interval of 1–5.5 mg/L.[1] In this report, we describe highly toxic levels in a lung-transplant recipient which are presumably associated to incorrect storage of the voriconazole suspension.
Design Case report, based on clinical data and literature review.
Setting Surgical intensive care unit, University Hospitals Leuven, Belgium.
Main outcome measures Evaluation of voriconazole-levels in relation to pharmaceutical formulation.
Results A 22-year old CF patient (42 kg), who received a lung-transplantation, was treated with intravenous (IV) voriconazole (200 mg bid). IV voriconazole was switched into the oral (PO) suspension on day 10. Despite dose-adjustments up to 10 mg/kg bid, levels remained subtherapeutic during the first 14 days of treatment (<0.2, 0.3, 0.9 mg/L). Four days after augmenting the dose to 14 mg/kg bid PO, two toxic levels were measured (>20 and 16.3 mg/L). The patient did not show neurological adverse events. Therapy was interrupted until drug-levels normalized and became therapeutic (1.1 mg/L) a week after restarting therapy (200 mg bid PO). To our knowledge, voriconazole levels of 20 mg/L have rarely been seen in literature.[2–4] The cause of the toxic levels may be multifactorial. First, voriconazole pharmacokinetics in CF patients are highly variable.[5] Second, the manufacturer recommends keeping the reconstituted suspension at room temperature to avoid caking. Here, the reconstituted suspension was stored in the fridge, making it more difficult to obtain a homogenous dispersion. Administering a dose from a full bottle can lead to underdosing while administration from an almost empty bottle can induce overdosing. Other causes such as dose-miscalculations, incorrect sampling or administration, changes in GI transit time, concomitant therapy with CYP-inducers or sudden association of CYP-inhibitors were all excluded. Ultra-rapid-metabolism was excluded since levels of more than 2 times the upper limit were measured.
Conclusions This case-report illustrates the unpredictable pharmacokinetics of voriconazole and confirms the need for TDM. Neglecting the manufacturer's storage recommendations may potentially lead to pernicious consequences.

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P14

Managing oral valganciclovir treatment in symptomatic congenital cytomegalovirus infants

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Background and objectives Cytomegalovirus (CMV) is the most frequent viral congenital infection in newborns, leading to mental retardation, visual disorders and non-hereditary sensor neural hearing loss in infancy (SNHL). About 10 % of infected newborns are symptomatic at birth and 90 % of them could develop later significant neurological disorders in infancy. Currently there are no established pediatric recommendations and oral valganciclovir treatment is not accredited for congenital CMV infection. Recent studies[1–3] suggest that long-term antiviral therapy may prevent hearing loss by IV ganciclovir (GCV) followed by oral valganciclovir (V-GCV 14–20 mg/kg/12 h)in order to mitigate symptom progression for several months. We describe this unusual managing of long term oral V-GCV treatment in a congenital CMV infant.

Design Case report, based on clinical data and literature review.
Setting Pediatric department.
Main outcome measures Evaluation of pharmacokinetics and safety of oral valganciclovir therapy.
Results A boy infant (38 GW + 5 days, weight at birth 2,320 g) was hospitalized in pediatric department for thrombopenia and intrauterine growth retardation. Neurological examination of neonate revealed a microcephaly with intracranial calcifications, hearing deterioration and hypertonia. Excluding chorioretinitis, visual disorders appeared 2 months later. Identification of CMV in serum and urine led to start IV ganciclovir 5 days after entry for 6 weeks. Upon pediatricians' request, we proposed a V-GCV syrup formulation based on literature and adviced them to closely monitor serum levels during transition. Six months post initiation treatment, the child presents substantial improvement of visual and hearing deterioration but hypertonia persists. V-GCV is well tolerated and the antiviral treatment is still continued.
Conclusions Treating congenital CMV infants with long-term oral valganciclovir seems to be effective if therapy is promptly introduced. Decreasing viral load in congenital infection, V-GCV therapy may reduce prolonged hospitalizations and risks of infections in catheters compared with IV ganciclovir. Based on ongoing studies (www.clinicaltrials.gov NCT00031434/NCT00466817), prospective randomized trials are needed to evaluate pharmacokinetics and safety of oral valganciclovir therapy in congenital CMV infants.

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P15

Epidemiology of catheter-related infections in adult patients receiving home parenteral nutrition: a systematic review

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Background and objectives Catheter-related infection (CRI) is the most common and serious complication for adult patients receiving home parenteral nutrition (HPN). The aim of this systematic review is to provide epidemiological data on overall infection incidence, common pathogens and contributing risk factors.
Design Review of literature.
Setting Four electronic databases (Embase, Medline, IPA, Cinahl) were evaluated for studies concerning catheter-related infections for adult HPN patients, published between 1970 and February 2011. Methodological quality of included articles was assessed.
Main outcome measures The following data were extracted: patient and study characteristics, definition and incidence of CRI, microbiology and potential associated risk factors.
Results Thirty-seven articles were eligible for inclusion in this review. Extensive variability is observed in definition and terminology as well as in the expression of CRI rate. The overall CRI rate reported in the studies ranged between 0.47 and 5.3 episodes per 1,000 catheter days. Catheter-related sepsis rate varied between 0.42 and 3.20 and catheter-related bloodstream infection rate between 0 and 4.1 per 1,000 catheter days. Gram positive bacteria caused more than half of the infections. Significantly associated risk factors were multiple lumens, a smaller catheter caliber, the use of heparin lock or flush instead of other lock systems; management type of catheter; cannulation of the jugular vein; presence of venous thrombosis; a larger percentage of resected colon; number of drugs administered through the catheter; and patients in need for social assistance and welfare.
Conclusions This poster provides an overview of the catheter-related infection rate, causing pathogens and risk factors in adult HPN patients. The quality of included studies is low and the risk factors were often unclear because they are poorly defined. The human skin flora cause most infections so a good hand hygiene and training is essential. For optimal comparison of CRI rate, the use of standardized definitions is necessary.

P16

Posology of antibiotics and adjustment in renal failure

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Introduction Kidney failure is responsible for iatrogenic disorders observed during hospitalizations. These accidents could be prevented by a dose adjustment for drugs cleared by the kidneys. The objective of this study is to evaluate the dose adjustment of antibiotics according to creatinin clearance.
Materials and Method This is a prospective study over a period of 5 months in the urology department (female side) of the hospital Sahloul. The creatinin clearance is calculated in all patients treated with antibiotics according to the Cockroft Gault formula if age is below 65 years and according to 'Modification of Diet in Renal Disease (MDRD)' if age is over 65 years. In patients with Clearance <80 ml/min, the theoretical doses are calculated by reference to the summary of product characteristics SCP and the recommendations of various diseases and compared to those prescribed.
Results and discussions Of the 216 patients, 18 % have a reduced clearance. Of these, 77 % have values below 30 ml/min. Ofloxacin, ciprofloxacin and cefotaxime are the most commonly used antibiotics. An inadequate adaptation was observed in 42 % of cases with 37.5 % of patients overdosed and 63.5 % under dosed. In the service, when clearance is decreased, the dose adjustment of ciprofloxacin and ofloxacin is routinely achieved by reducing 50 % of the dose, whereas, according to the SPC, the adjustment should be made while taking into consideration the value of creatinin clearance. All adaptations of cefotaxim were under dosed. Indeed, it is recommended to reduce the dose to 50 % only when the Clearance <5 ml/min.
Conclusions Our study showed a gap between theoretical dosages adapted to creatinin clearance and those prescribed. An adjustment respectful of recommendations is necessary in order to avoid any risk of therapeutic failure or a possible toxicity.

P17

Evaluation of prescription of fluoroquinolones

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Introduction The fluoroquinolones are characterized by their bactericidal activity and broad spectrum. Their good diffusion in various parenchymal tissue and the intracellular mechanism of action make them preferred antibiotic in many indications in hospitals. Considering the good bioavailability, the oral route is recommended in different indications. Our study aims to evaluate the proper use of this class of antibiotics.
Materials and method This is a retrospective study of 1 year in the renal unit. Items that were analyzed are the indication and the route of administration.
Results Ninety-one prescriptions of fluoroquinolones have been found. The injectable route was used in 58 % of cases with an oral relay in only 8 % of cases. 72 % of prescriptions involved urinary tract infections (acute cystitis 80 %, pyelonephritis 20 %). Based on the recommendations of the 2008 AFFSAPS fluoroquinolones are indicated in urinary infections. However, during the complicated cystitis, the injectable route is not necessary but in more than half of the cases studied, this route was used for the treatment of cystitis. In 23 % of cases, the indication was pneumonia. However, according to the guidelines (AFSSAPS 2005) the only recommended quinolone in the lower respiratory tract infections is levofloxacin (only in patients with comorbidities and the elderly). In cases of suspected atypical germs, macrolides are indicated as first line.
Conclusions The relay by oral route offers greater comfort for the patient, and a very important health economy. This practice should be generalized and this can be done thanks to multidisciplinary work. On the indication, it is essential to refer the recommendations to avoid misuse that can cause emergence of bacterial resistance.

P18

Dosing of aminoglycosides to an assessment of posology

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Introduction The bactericidal activity of aminoglycosides against many nosocomial bacteria make them frequently prescribed antibiotics of choice in hospitals. However, their use is difficult due to their low therapeutic index and wide interindividual variation affecting the relationship between dose and serum concentration. Thus, therapeutic monitoring by measuring blood concentrations is justified for a better efficacy and to avoid toxicity. The objective of this study was to evaluate the doses of aminoglycosides by performing the dosage of amikacin and gentamicin in hospitalized patients.
Materials and method It is a prospective study conducted in the urology department during a period of 4 months. For any prescription of amikacin or gentamicin, two blood samples were made: a peak (30 min after the end of the first infusion) and a residual (24 h after the last administration). Items that were analyzed are the indication, dosage and duration of treatment.
Results The study included 112 patients (36 % gentamicin, amikacin 64 %). 87.5 % of patients treated with amikacin were given doses below 15 mg/kg/day. 80 % of patients who received gentamicin, received doses less than 3 mg/kg/day. All patients were under dosed implying therapeutic ineffectiveness against nosocomial germs, in addition to possible risk of subsequent resistance. 26 % of prescriptions exceeded a period of 5 days. However, no residual rate higher standards was noted. This could be explained by reduced prescribed dosages.
Conclusions Respect of the dose range of 15–30 mg/kg/day of amikacin and 3–8 mg/kg/day for gentamicin is essential to ensure their effectiveness. As recommended by the AFSSAPS, a dosage is not necessary if the treatment does not exceed 3 days and if no pharmacokinetic change are expected.

Reference

Bon usage des aminosides administrés par voie injectable: gentamicine, tobramycine, nétilmicine, amikacine AFFSAPS Mars 2011

P19

Antimicrobial stewardship rounds in a general hospital in Ireland

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Background In Ireland, antimicrobial stewardship is a key requirement of the national standards for the prevention and control of healthcare associated infection. To comply with these standards, an antimicrobial stewardship program should be developed and implemented in each healthcare facility. The program should be evidence based and reflect the size, complexity and specialities of the hospital and be led by a consultant microbiologist. Each facility should also have access to an antimicrobial pharmacist. In Naas General Hospital, a multidisciplinary round is undertaken once weekly by the antimicrobial stewardship team. This team consists of a consultant microbiologist and antimicrobial pharmacist. Patients are referred to the team for review by clinical pharmacists, nursing staff and non-consultant hospital doctors. On the round, a clinical review is undertaken, regarding the appropriateness of the antimicrobial agent in terms of choice, dose, route, duration and clinical progress. Consequent recommendations are documented in the patient healthcare record for action by the medical or surgical team.
Design A prospective observational survey. Data were inputted and analysed using SPSS.
Setting Naas General Hospital, a 243 bed teaching hospital of Trinity College Dublin. This hospital has a catchment population of 150,000 and serves a predominately rural population.
Main outcome measures Number and type of antimicrobial stewardship interventions.
Results Seven multidisciplinary antimicrobial stewardship rounds were undertaken from January 2012 until March 2012. Data were collected for 51 patients and 62 interventions. There were 8.8 interventions per round and 1.2 interventions per patient. The most common type of intervention related to course length recommendation (29 %), stop antimicrobial course (17.7 %), guide to further treatment (12.9), switch to an alternative agent (7.5 %), IV to PO switch (7.5 %), dose recommendation (6.5 %), add antimicrobial to regimen (4.8 %), therapeutic drug monitoring (4.8 %). Vancomycin (16 %), meropenem (14.7 %), piperacillin-tazobactam (13.3 %), linezolid (10.7 %), metronidazole (9.3 %) and flucloxacillin (8 %) were the antimicrobials most commonly subject to an intervention by the team.

Conclusions Audit of the activities of the antimicrobial stewardship team allows target areas to be identified and complex interventions to be developed.

P20

Botulinum toxin A: an overview of clinical use in a French teaching hospital

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Background and objectives Botulinum toxin A therapeutic uses are potentially large and thus subject to off-label prescribing. We investigated the patterns of use of botulinum toxin in patients hospitalized in a 2,400 bed-French teaching centre.
Design Data regarding the use of botulinum toxin A were prospectively collected from patient charts by a pharmacy resident during a three-month period. Data were analyzed according to the French summary of product and the medical literature (Pubmed).
Setting Teaching hospital.
Main outcome measures We evaluated the frequency of off-label prescribing in terms of indications and dosing.
Results During the three-month period, 197 hospitalized patients (82 % adults, 18 % children under 12 years) received botulinum toxin A injections. Botulinum toxin A was prescribed in a neurology unit (32 %), a physical medicine and rehabilitation unit (16 %), a paediatric surgery unit (16 %), an urology unit (10 %) and a dermatology unit (5 %). Other patients (21 %) were treated in ophthalmology, maxillofacial surgery and gastroenterology units. Injections were performed using nerve stimulation (55 %), a cystoscope (21 %) or anatomical localization (31 %). General anaesthesia was used for 9 % of the patients while 26 % received a local anaesthetic injection. 48 % of the patients did not undergo anaesthesia. Regarding indications, 37 % of the prescriptions were off-label but were supported by the medical literature. Dosing was in accordance with the maximal recommended dose in all patients.
Conclusions Off-label prescribing of botulinum toxin A was significant in our population of hospitalized patients. Off-label use was supported by the medical literature.

P21

First global antimicrobial stewardship survey: interim analysis of non-UK European data

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Background and objectives Antimicrobial stewardship (AMS) has been surveyed to continental level, but never worldwide. This survey aimed to quantify the delivery & impact of AMS across the world.
Design This is an open web-based survey of hospitals using SurveyMonkey© software with good practice methodology [1–3]. Interim analysis after 1 month was planned. The survey was disseminated through microbiology, infectious diseases and pharmacy networks & websites. Data analysis will be qualitative comparing delivery of AMS by continent.
Setting This is a worldwide survey of hospitals that was piloted in 11 countries over 6 continents.
Main outcome measure A literature review identified published surveys and standards for AMS. The survey aimed to quantify those aspects of AMS that were being delivered; the barriers to delivery; funding & staffing of AMS; and its impact on financial, safety and resistance outcomes.
Results By the initial deadline, 513 hospitals worldwide with 298 from Europe (including 122 from the United Kingdom (UK)) had entered data. 26 non-UK European countries entered data (range: 1 (many) to 24 (France); average 6.7; mean 3). 65 % of hospitals had AMS standards & 19 % were planning them. 74 % had an AMS Committee, 58 % had an AMS Programme in place & 25 % had one planned. Lack of Information technology was the main barrier. Antimicrobial or infectious diseases pharmacists were present in 86 % of AMS committees. On average, there was 8 h per week of pharmacist time for AMS from the 75 responses. 80 % have an antimicrobial formulary, 69 % guidelines, 58 % restriction, 40 % day 3 review, 50 % IV to oral switch guidance & 57 % have dose optimisation on request. 61 % have AMS ward rounds mainly on intensive care & medicine. 34 centres have formally assessed their AMS programmes and overall have shown reductions in expenditure, broad spectrum & inappropriate prescribing, but no decrease in length of stay or reduction in antimicrobial resistance.
Conclusions AMS appears to be well developed in many parts of Europe with some good outcome data. Further data collection will continue for 2 more months.

P22

Medication reconciliation at an infection ward

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Background and objectives Medication reconciliation is the first part of the Integrated Medicine Management (IMM) model, which now is under implementation at the Hospital Pharmacy Trust Norway. Studies documenting effect of the IMM model has been performed among others geriatric patients. However, the model has to our knowledge not been evaluated at infection wards. The purpose of the study was therefore, to conduct medication reconciliation at an infection ward.
Design In this intervention study the pharmacist conducted a standardised interview with patients who prior to admission handled their own medications at home. For patients who could not be interviewed or were not responsible for handling their own medications, an updated medication list from relevant level of care was obtained. This list obtained from the interviews/caregivers was compared with the patient's drug chart at admission to hospital. Discrepancies were discussed with the physician in charge and the physician adjusted the medication list if relevant.
Setting Department of Infectious Diseases at a university hospital.
Main outcome measures Type and number of discrepancies between the patients' drug chart at admission and the list obtained from the interview/caregiver.

Results 53 patients were included, average age 58.3 years and 54.7 % men. 60.4 % of the patients had discrepancies in their drug chart recorded at admission to hospital compared to information obtained from interview/caregivers. A total of 87 discrepancies were identified in 32 patients, 2.7 discrepancies per patient. The most frequent discrepancies were omission of drug and wrong dosage. Most discrepancies were associated with drugs belonging to group N, A and C according to ATC codes. For 70 % of the discrepancies the physician accepted and adjusted the medication list.
Conclusions Discrepancies in the medication history for patients admitted to an infection ward are common. Medications used in the treatment for infectious diseases are often involved in drug interactions and it is therefore important to know the patients complete medication list. The medication reconciliation part in the IMM-model is suitable at an infection ward and the physicians acknowledged the discrepancies. The model is contributing to seamless care when patients are transferred between different levers of care.

P23

Clinical use of linezolid: interest of an approach of evaluation of the professional practices

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Aim of study Describe the use of linezolid and estimate the relevance of its use with regards to the recommendations made by its marketing authorization and optimize its therapeutic follow-up. Linezolid is used to treat bacterial GRAM positive infections: community and nosocomial pneumonia and skin and soft tissue infections.
Materials and methods Retrospective study performed in records of patients treated with linezolid using a grid of data collection according to clinical audit targeted method. A first round was performed over a period of 4 months (January–April 2010), to make an inventory of the clinical use of linezolid and implement improvement actions. Then a second round (October 2010–January 2011) was conducted to assess the effectiveness of actions implemented. The collected data concerned the conformity of the prescription, implementation and monitoring of the antibiotic therapy.
Results and discussion Forty-two patient's records were analyzed in the first round and 17 in the second round. In 78 % of the cases, linezolid is prescribed out of marketing authorization indications in the first round. These indications are varied: septicemias (29 %), fever syndromes (19 %), central catheter infections (14 %), urinary infections (7 %), prosthesis infections (2 %), and ascitic fluid infections (2 %).Considering the results obtained on the indications and reassessment of antibiotic therapy, we, in collaboration with the Committee of anti-infective and based on the marketing authorization recommendations, implemented recommendations of proper use of linezolid. These have been validated in Commission of drug and medical devices and serves as a tool to aid for its prescription and monitoring. It was sent to different care unit with a presentation of the results of the first round of study to inform but also to raise awareness about safe use of this antibiotic. In the second round, we obtained a significant improvement with 22 % of indications out of marketing authorization: septicemias (35 %), central catheter infections (6 %), and urinary infections (6 %).
Conclusions In the context of proper use of antibiotics, recommendations of proper use of linezolid have been set up in collaboration with infectious disease specialists in order to supervise the use of linezolid and prevent the emergence of resistant strains.

P24

Presence of vancomycin resistant *Entrococci* in the Clinical Center Banja Luka

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Background and Objectives During the past two decades enterococci have become more common and problematic pathogens. First vancomycin resistant enterococcus (VRE) was described in 1988 and since then the prevalence of VRE has rapidly increased. Data report from the National Nosocomial infections Surveillance system (NNIS) indicate that in 2000 there was 20–30 % isolates of nosocomial VRE infections.[1–3] The aim of our study was to measure the prevalence of VRE isolates in the Clinical center Banja Luka which included isolates from all samples.
Design Retrospective data collection.
Setting Clinical Center Banja Luka.
Main outcome measures The primary outcome was to estimate the prevalence of VRE using all isolates in the past 2 years.
Results Data were collect retrospectively during the time period of 1st Jan 2010 to 31st Dec 2011. These data has been obtained and processed by the Institute for Microbiology of our hospital. In the study, we measured the sensitivity of all isolates of *Enterococcus* spp. to vancomycin obtained from surgical wounds, urinary tract, blood culture and catheters swabs. It is important to note that the number of isolates does not match the number of patients because the samples were taken several times from the same patient.
We found 1,766 isolates of *Enterococcus* spp. obtained from the samples. Out of this number, 1,707 (96.7 %) were sensitive and 59 (3.3 %) were resistent to vancomycin. In 2010 there were 32 (3.2 %) resistant of 986 isolates and in 2011 there were 27 (3.5 %) resistant of 780 isolates.
Conclusions Result shows that precentage of VRE (3.3 %) is not to high despite the larger number of isolates compared to the number of patients. In 2008, the number of VRE (*E. faecium*) isolates reported to European Antimicrobial Resistance Surveillance System (EARSS) was less or equal to 5 % in 13 of 24 countries, but Greece, Ireland and the UK reported more then 25 % VRE isolates. However, the treatment of VRE infections in our hospital is sometimes a great challenge where we are witness of multidrug resistance for *Enterococcus* spp. Knowing that antibiotics such as linesolid, quinupristin/dalfopristin and daptomycin is less accessible in our country makes them more difficult to treat.

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P25

Analysis of the initial antiretroviral therapy in HIV-infected patients and economic impact

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Background and Objectives Different antiretroviral therapy (ART) for naïve patients is available according to scientific recommendations. The aim of this study was to determine which ART regimens are used and to identify opportunities to improve efficiency.
Design HIV patients initiating ARV in 2010 and 2011 were identified from a regional public health database. All regimens were analyzed according to GESIDA recommendations (Spanish AIDS Study Group)[1] and the budgetary effects were estimated.
Setting Barcelona Health Region (year 2011: 5,029,329 inhabitants), Catalan Health Service, Spain.
Main outcome measures Number of treatment-naïve patients, ART drugs used, drug expenditure (€).
Results 1,445 patients in 2010 and 1,434 in 2011 started ART. In 2011, 74.6 % (1,070) were preferred regimens according to GESIDA, representing an improvement of 5.9 % over 2010. The overall use of raltegravir and maraviroc regimens as initial therapy decreased (to 4.2 from 6.6 % and to 0.5 from 1 %, respectively). A non-nucleoside analogue regimen (42.0 %) and a boosted protease inhibitor regimen (25.7 %) remained the most commonly used. The use of emtricitabine/tenofovir increased to 68.1 from 60.9 %, efavirenz to 35.8 from 34.4 %, darunavir/ritonavir to 13.9 from 8.3 % and atazanavir/ritonavir to 10.1 from 9.9 %. Abacavir/lamivudine regimen decreased (to 6.6 from 7.8 %), although the prevalence of the mutation HLA-B*5701 in Spain that would contraindicate abacavir administration is only 6 %[2].Average monthly cost of initial regimens used in 2011 decreased by 35.9 %. The most economical regimen (abacavir/lamivudine/efavirenz) was only used in 2.3 % of patients (3.5 % in 2010), and the most expensive (tenofovir/emtricitabine/raltegravir) in 1.0 % (1.5 % in 2010); the incremental cost was €522.21/patient/month. The most common regimen continued being tenofovir/emtricitabine/efavirenz (33.5 % in 2011 vs. 30.9 % in 2010).Analysis of patients classified in other treatment options should be expanded: some treatment regimens are recognized as alternatives; other patients could come from clinical trials or have started treatment at other hospitals.
Conclusions The utilization of preferred first ART regimen in treatment-naïve patients has improved and in terms of efficiency has led to reduce drug expenditure. However, areas of optimization of efficiency should be explored when designing a therapeutic regimen since ART represent a substantial opportunity cost for healthcare systems.

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P26

Outcomes of pharmacist's interventions regarding kidney function on prescribing restricted antimicrobial agents

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Background and Objectives Misuse of antibiotics has significant consequences, such as therapeutic failure, drug toxicity, bacterial resistance or increased costs. The aim of our study was to improve the prescription of antibiotics regarding kidney function, so we wrote recommendations to inform physicians.
Design From June to November 2011 we performed a study in which we included hospitalized patients that were receiving antimicrobial agents from the restricted list. Patients receiving vancomycin are excluded (pharmacokinetic TDM pharmacy service).
Setting All wards in a large teaching hospital.
Main outcome measures Number of written recommendations, type of dose modification needed, physician's acceptance rate of the interventions.
Results Over 6 months we processed 1,765 restricted antimicrobial order forms. 172 interventions were made (9.7 % of all analyzed prescriptions) for 120 patients (52.5 % men, mean age 73.5 ± 12.2). 42.4 % patients were placed in ICUs. Included recommendations were for seven different antimicrobial agents: 21.5 % for imipenem/cilastatin, 20.9 % for meropenem, 15.7 % for piperacillin/tazobactam, 13.4 % for ertapenem, 12.8 % for cefepime, 12.2 % for ceftazidime and 3.5 % for amikacin. The patients had the average serum creatinine of 253 mmol/L and GRF was 28 mL/min on average. In 166 cases the GFR was below 60 mL/min and in the 6 remaining patients it was above 120 mL/min. In 51.2 % of cases we recommended longer dosing intervals, in 16.9 % dose reduction, in 10.5 % dose reduction and longer dosing intervals, in 10.5 % increased dose and longer dosing intervals, in 8.1 % shorter dosing intervals, in 1.7 % dose reduction and shorter dosing intervals and in 1.2 % of cases increased dose. When we look at the outcomes, we see that in 25.6 % of cases our recommendations were fully accepted, in 6.4 % partly, in 36.6 % of cases the recommendations weren't accepted and for 54 cases we don't have the information about the outcomes (these also include therapy changes—9.3 %, discontinuance of antimicrobial therapy—7.4 %, and death of the patient in the following 48 h—37 %).
Conclusions Clinical pharmacists as critical members of the healthcare team are involved in assuring appropriate prescribing of antimicrobials and providing consultations to physicians, which results in safer and more effective medication use.

P27

A drug utilization review of colistin in a trasplant hospital

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Background and Objectives Colistin, has gained popularity in recent years due to the increasing number of multi-drug resistant gram-negative bacterial infections in the nosocomial setting. A drug utilization review of Colistin was carried out in a transplant hospital from August 2011 to February 2012. The purpose of the review was to

assess the appropriateness of Colistin use based on indication and susceptibility testings.
Main Outcome Measures Any patient receiving at least one dose of IV Colistin was included in the review. Data gathered included age, gender, weight, diagnosis/reason for admission, dose, antibiogram (before/after treatment), duration of therapy, and specific drugs used in combination (if any).
Results 68 patients were reviewed, with an average age of 54.4 years. Of 208 completed courses of Colistin therapy, 35 were for monotherapy and 173 were for combination therapy. 178 courses were for targeted therapy, while 26 were for empirical therapy. Of the 178 targeted therapy courses, 34.8 % were indicated for *Klebsiella pneumoniae*, 21.3 % for *Pseudomonas aeruginosa*, 3.9 % for *Enterobacter aerogenes*, 3.4 % for *Stenotrophomonas maltophilia*, and 0.6 % was indicated for C*itrobacter* species. Of the 208 completed courses, 11.5 % of the courses were given despite a resistant MIC result either from the indicated organism or from a different infecting organism, 26 % of the courses were given and had no sensitivity results, and 62 % of the courses were given with sensitive MIC results.
Discussion With mortality rates on the rise and a lack of new therapies in the pipeline, Colistin has made a resurgence as a last-line agent in treatment of gram-negative infections. Because of its narrow spectrum of activity and slow development of resistance, more clinicians are favoring Colistin use. However, there is still a lack of quality PK/PD studies and no internationally unified dosage form. The main outcomes that were used in this review were surrogate endpoints (i.e. changes in laboratory values and MIC), which are examples of disease-oriented evidence. More studies should be done to assess the impact of Colistin on overall patient morbidity/mortality in comparison with other antibacterial agents. It is also important to discern Colistin's overall contribution to combination therapy.

P28

Management of a patient colonized with a carbapenem-resistant enterobacteriaceae

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Background and Objectives The rapid and worldwide spread of carbapenemase-producing Gram-negative bacteria (CPGNs) is a major concern for medical community. Strict application of infection control guidelines seems to be the first defence line against outbreak of CPGNs infection in healthcare setting. We describe measures implementation after detection of a carbapenem-resistant *Klebsiella pneumoniae* (CRKP) colonization in a 3 year-old child hospitalized in a french pediatric oncology ward. An investigation was conducted, according to the new French health authority's recommendations, to determine if others patients were cross-contaminated. Logistic and economic supports involved in this active surveillance testing were evaluated.
Design A prospective study of patient's medical records.
Setting Pediatric Oncology ward, IGR, Villejuif, France.
Main outcome measures After microbiological detection of the index patient, contact patients were identified and placed on contact isolation. Following national guidelines, stool cultures or rectal swabs were performed three repeated times at a week interval. The overall cost of these investigations was calculated adding cost of bacteriologic measures and time spent by the infection control team.
Results 37 patients were defined as patient contact (patient who shared same health care workers or same care unit). Among these patients, only 30 were screened. Fourteen of them were tested three times as recommended, 6 of them two times and 10 once. These 64 cultures were negative for CRKP. This investigation mobilized a member of the infection control team during 30 h and the global cost of microbiological test was about 8,400 €.
Conclusions Early detection is recognized as the key in preventing transmission and spreading into community settings. But early detection intends to clearly identify high-risk patient's profile and screening strategy. In our case, in the absence of a local screening protocol for new patients, the CRKP was detected after 10 days of hospitalization, although patient came from a high endemic zone. In addition, high turn over in acute care unit represents a difficulty in seeking all patients contact and screening them during 3 weeks. Investigation required by a unique patient represented a significant cost, and health-care settings must provide additional resources to efficiently minimise CPGN spread.

P29

Case report of hyperuricemia caused by pyrazinamide in the Clinical Centre Banja Luka

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Background and Objectives Pyrazinamide is a bactericidal antibiotic that is used as first-line drug treatment of tuberculosis (TB) and multi-drug-resistance tuberculosis (MDR TB) treatment (for resistance to Rifampicin (R) and Isoniazid (I)). Adverse effects of antituberculotic drugs are very common and often cause discontinuation of therapy. We present a case of patient who developed hyperuricemia during his treatment of MDR TB in the Clinical Centre of Banja Luka (CCBL).
Design A retrospective review of medical history.
Setting Clinical Centre Banja Luka.
Main outcome measures The main outcome was monitoring the occurrence of adverse effects during the treatment of MDR TB.
Results A retrospective review of medical history of patient treated with antituberculotic drugs was performed. 1992th, 56-year old patient was treated for the first time with R 600 mg, I 300 mg, ethambutol (E)1,200 mg, pyrazinamide (Z)1,600 mg and Ranitidine 150 mg, daily, for 6 months. 2002th it was a recurrence of the disease and it was diagnosed the form of MDR TB. Patient continues MDR therapy with streptomycin (S) 15 mg/kg, E 1,200 mg, Z 1,600 mg, Ofloxacin 800 mg and Ranitidine 150 mg, daily. One month later, patient complained of pain and swelling in the left ankle, weakness with limited mobility. Medical history of the patient was collected from the Lung clinic at the CCBL.
Laboratory results, done month after the beginning MDR TB treatment, showed an increase of uric acid in blood 820 μmol/L (202–410 μmol/L), erythrocytes sedimentation rate 45/90 (30/60), White Blood Cells 9.6 (4.3–10.8 [GREEKX] $10^3/mm^3$), while renal and liver parameters remained within normal values. Sensitivity test showed resistance to all drugs in the first line treatment, Ofloxacin and Protionamide and sensitivity to p-acetaminophen (PAS), Cycloserine, Amikacin and Capreomycin.
Conclusions The laboratory results and clinical presentation of inflammatory processes led to conclusion that it was gout after which Z was excluded from the treatment (a conclusion consistent with the literature and de-escalation therapy). In accordance to World Health Organization guidelines for the treatment of MDR TB and sensitivity test, it was introduced next therapy: Moxifloxacin 400 mg, PAS 8 g,

Cycloserine 500 × 2, daily and Amikacin 1,000 mg every second day, for a period for 20 months. Monitoring was necessary for further disease evaluation and patient treatment.

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P30

Antimicrobial resistance of gram-negative bacteria in the Clinical Centre Banja Luka

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Background and Objectives The infections caused by bacterial strains resistant to broad-spectrum antibiotics increase mortality and morbidity, extending hospitalization and treatment costs at all levels of the health system.[1–3] The aim of this study was to present the bacterial resistance to commonly used antibiotics in the Clinical Center of Banja Luka (CCBL).
Design Retrospective analysis of microbiological maps.
Settings Clinical Centre Banja Luka.
Main outcome measures To estimate the prevalence of bacterial resistance to analyzed antibiotics in above mentioned periods of time.
Results Antibiotic resistance data were obtained by retrospective analysis of microbiological maps for the months of April, June and August in 2010th and April, June, August and 2011th, formed by the Institute for Microbiology of CCBL. It was analyzed resistance of gram-negative bacterial strains to commonly used antibiotics in the infectious treatment in CCBL. The number of resistant strains in relation to the total number of strains tested to certain antibiotic are presented for each year separately. Resistance of microorganisms to selected antibiotics in 2010th: Ceftriaxon: *Klebsiella* spp. 58.22 % (131/225): *Pseudomonas* spp. 78.81 % (93/118), *Acinetobacter* spp. 87.34 % (69/76); Meropenem: *Klebsiella* spp. 9.32 % (22/236), *Pseudomonas* spp. 57.62 % (102/177), *Acinetobacter* spp. 74.43 % (99/133); Ciprofloxacine: *Klebsiella* spp. 29.64 % (83/280), *Pseudomonas* spp. 69.38 % (136/196), *Acinetobacter* spp. 79.59 % (117/147); Amikacin: *Klebsiella* spp. 18.18 % (48/264),: *Pseudomonas* spp. 65.21 % (120/184), *Acinetobacter* spp. 73.48 % (97/132). Resistance of microorganisms in 2011th: Ceftriaxon: *Klebsiella* spp. 73.61 % (159/216), *Pseudomonas* spp. 89.40 % (135/151), *Acinetobacter* spp. 97.08 % (133/137); Meropenem: *Klebsiella* spp. 9.58 % (16/167), *Pseudomonas* spp. 74.10 % (103/139), *Acinetobacter* spp. 75.18 % (103/137); Ciprofloxacine: *Klebsiella* spp. 41.90 % (75/179), *Pseudomonas* spp. 79.19 % (118/149), *Acinetobacter* spp. 92.42 % (122/132); Amikacin: *Klebsiella* spp. 44.16 % (87/197), *Pseudomonas* spp. 87.68 % (121/138), *Acinetobacter* spp. 75.37 % (101/134).
Conclusions Results obtained by analyzing microbiological maps show a high level of resistance of microbial strains to antibiotics. Trend of rise of bacterial resistance in 2011th in relation to the 2010th year is noticed. Taking into account the consumption of antibiotics, which is one of the main causes of antimicrobial resistance, it is necessary to take appropriate measures to reduce the number of multiresistant bacteria such as rationalisation of the antibiotic usage as forming guidelines for antibiotic prophylaxis and treatment.

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P31

Inappropriate prescribing of piperacillin-tazobactam in a Belgian Teaching Hospital

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Background and objectives The use of broad-spectrum antibiotics has increased over the past years in our hospital. Our study evaluated the appropriateness of Piperacillin-Tazobactam (Pip/Tazo) prescribing according to previously identified quality criteria.
Additionally, we evaluated documentation in medical charts for indications which is recognized as a quality indicator of antibiotic prescribing.[1]
Design A retrospective, chart review study.
Setting Wards at the Belgian teaching hospital including all patients enrolled from February to March 2010 and undergoing prophylactic or therapeutic treatment for at least 24 h.
Main outcome measures Treatments were assessed by a physician and a pharmacist according to clinical situation and hospital's guidelines. These following criteria were evaluated: indication, dosage, correct-timing of step down therapy and/or iv-to-oral switch, and duration of Pip/Tazo and total antibiotherapy. Prescriptions were assessed for individual and cumulative criteria.
Results One hundred and seventeen prescriptions were evaluated. Inadequate indications or dosage regimens were inappropriate for 3.4 and 20 % of Pip/Tazo prescriptions, respectively. Timing was inadequate in 34 % of cases, whilst lengths of Pip/Tazo and total antibiotic treatments were too long (35 and 27 %, respectively) or too short (5.4 and 8 %, respectively). 66 % of prescriptions were inadequate for all four criteria.
Documentation was found for only 38 % of prescriptions.
Conclusions Gaps in quality of Pip/Tazo prescribing were identified and lack of documentation for indications impairs continuity of care. Managerial structures and collaboration between infectious disease physicians and pharmacists may improve the quality of antibiotic prescribing and avoid unnecessary costs of Pip/Tazo.

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P32

Inter-rater reliability between a pharmacist and an infectiologist in an antibiotic audit

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Background and objectives Clinical audits on prescribing antibiotics give valuable information on local practices. Unfortunately, these are time-consuming and therefore difficult to perform by infectiologists directly involved in patient care, especially because of lack of time. The study assessed: (1) the adequate inter-rater reliability between a clinical pharmacist (CP) and an infectiologist in evaluating quality criteria of Piperacillin-Tazobactam (Pip/Tazo) prescribing; (2) cost effectiveness of iv-to-oral (IV-PO) switch therapy.
Design A retrospective chart review study.
Setting Wards at a Belgian teaching hospital including all patients enrolled from February to March 2010 and undergoing prophylactic or therapeutic treatment of Pip/Tazo for at least 24 h.
Main outcome measures Treatments were assessed by a physician and a pharmacist according to clinical situation and hospital's guidelines. These following criteria were evaluated: indication, duration of Pip/Tazo and total antibiotherapy, dosage, correct-timing of step down therapy and/or IV-PO switch. Assessments were done by a clinical pharmacist and an infectiologist independently for all criteria (except dosage) as well as combined criteria. Inter-rater reliability was calculated using a non parametric kappa test[1].
Results One hundred and seventeen patients were enrolled. Inter-rater reliability was very good for correct-timing of step down therapy and/or iv-to-oral switch ($\kappa = 0.88$) and good for the indication, total duration and combined criteria ($\kappa = 0.65$, 0.66 and 0.68 respectively). Additionally, earlier IV-PO switch would have resulted in 80 days of Pip-Tazo prescriptions yielding a 3000 € savings over 2 months.
Conclusions Quality of antibiotherapy prescriptions may be evaluated by a senior CP or infectiologist as inter-rater reliability was substantial to excellent in our study. Make use of trained experienced CP instead of infectiologist for antibiotherapy audits is appropriate and cost effective (as pharmacists are cheaper than physicians). Moreover, pro active pharmacy services should be implemented in order to ensure adequate IV-PO switch.

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P33

Development of a clinical intervention (e)-tool to support pharmacists in the review of paper prescriptions of anti-infective drugs

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Background and objectives Legislation, and also the JCI-accreditation system, requires that the hospital pharmacist should review all patients prescriptions before delivering medication. This is a real challenge, as there is no electronic prescribing system, there is a very limited number of clinical pharmacists on the wards, and the anti-infective policy requires a strict follow-up of the use of anti-infective medication.
The objective is to support the pharmacist back office in his goals to enhance the effectiveness, efficiency and safety of the anti-infective therapy, to monitor the step-down, the switch IV-PO policy, dose and frequency, patient safety goals (such as allergy/intolerance, detection of interactions, contra-indications, dose monitoring….) through the development of a clinical intervention e-tool.

Pharmaco economically the implementation of this tool will contribute to the reduction of the economic cost of the anti-infective therapy for the patient, the hospital and the society.
Design First, a standard anti-infective prescription model, excel-file, has been created and has, besides the standard information (patient- and prescriber identification, name-dose-form-frequency of the drug…) extra information blocks such as 1-indication, 2-allergy/intolerance, 3-kidney function, 4-pregnancy and lactation, 5-medication to be crushed. Secondly, the relevant guidelines that have been performed in the hospital (such as empiric, prophylactic and therapeutic guidelines, step-down and switch iv-po advises, dose and frequency schemes, relevant interactions) are linked to this excel-file.
Setting Clinical pharmacy back office.
Main outcome measures The development of the clinical intervention supporting tool
Results The supporting tool is an excel-file, in which hospital guidelines and other clinical relevant information is integrated on one screen, that facilitates the review of the paper prescriptions. The tool has been validated by the pharmacy staff.
Conclusions The clinical intervention e-tool supports the pharmacist in his professional role to optimize a patient oriented effective, qualitative and safe pharmaceutical care.