

Antibiotics Surveillance in Pediatrics In-Patients, a Point Prevalence Comparative Study between Kingdom of Bahrain and the European Union

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ABSTRACT

Objective: To determine the variation in drug, dose and indications of antimicrobial prescription in children admitted in the hospital and compare the results with the European countries.

Design: Point Prevalence Survey (PPS)

Setting: All existing pediatric and neonatal wards (medical, surgical, PICU, NICU) within Salmaniya Medical Complex.

Method: Data collection was performed using pediatric department and NICU forms. Essential data collected were the patient's biographical data and details about the antibiotics used.

Result: The pattern of antibiotics choice and use in Bahrain and the European Union was almost similar in pediatric units. Almost all antibiotics prescribed were on empirical basis.

Conclusion: There is a high rate of use of intravenous broad spectrum antibiotics in the pediatric services in Salmaniya Medical Complex for surgical prophylaxis and for medical reasons compared to European Union Centers.

The decision to prescribe antimicrobial agents should always be clinically justified and the reasons should be recorded in the patient's medical record. It is important not to prescribe antibiotics on "just in case" basis.

INTRODUCTION

Antibiotics are beneficial in bacterial infection, but have no role in viral afflictions. Besides that, many viral infections are mild and patients will recover with supportive measures. Antibiotics are not needed for every illness, and giving them to children when they are not needed could be potentially harmful; it exposes the child to the drug's potential side-effects and it boosts their resistance to antibiotics.

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The decision to prescribe antimicrobial agents should always be clinically justified and the reasons should be recorded in the patient's medical record. Antibiotics prescribed empirically in life-threatening conditions should be reviewed regularly after culture, clinical progress and laboratory results. Despite the effectiveness of antibiotics in the treatment of numerous bacterial infections, it is often used inappropriately. The misuse of antibiotics is currently one of the major public health issues worldwide¹. Factors influencing the misuse/overuse of antibiotics in the literature include psychosocial factors, such as behaviors, beliefs, and attitudes (e.g., self-medication & over-the-counter medication), parents' pressure, socio-economic status, education levels and lack of health information¹.

It is vital that the patient takes the correct antibiotic dose to ensure that bacterial resistance does not build up. Children must learn from an early age that hand washing and other hygienic practices reduce the risk of infections. They should also know why they should follow the instructions on taking prescribed antibiotics. Ensuring that children are vaccinated according to national immunization programs protects them against many serious diseases.

The European Society of Pediatric Infectious Diseases (ESPID) initiated a European project "Antibiotic Resistance and Prescribing in European Children" (ARPEC), funded by DG SANCO of the European Commission and it aims to improve the quality of prescribing antibiotic in children².

There is lack in the amount of information in relation to the types, dose, route, duration and indications of the antibiotics used for different clinically indications in adult and pediatric services in Salmaniya Medical Complex. Standardized European Surveillance of Antimicrobial Consumption point prevalence survey (ESAC PPS) is useful for screening prescription patterns and identification of quality indicators³.

The main aim of ARPEC is to develop a standard surveillance method of data collection that can be used throughout the European Union and beyond, in order to monitor rates of antimicrobial prescription in children. The Kingdom of Bahrain represented by Salmaniya Medical Complex was part of this initiative. The ARPEC project intends to determine the variation in drug, dose and indications of antibiotic prescribed for children admitted to hospital.

The aim of this study is to determine the variation in drug, dose and indications of antimicrobial prescription in children admitted in the hospital and compare the results with the European countries.

METHOD

Data collection was performed using pediatric and NICU forms. Essential data collected were patient's age, gender, weight, antimicrobial agent, dosage and frequency, route, diagnosis, site of infection or target for prophylaxis. In addition, the number of admitted patients and the number of total available beds in each department were used as denominator.

The timing of data collection differed according to the region involved. Non-European countries were planned in October 2012. Countries within the European region, Central and Western Asian countries and Northern America were planned in November 2012.

Point Prevalence Survey (PPS) was conducted on all existing pediatric and neonatal wards (medical, surgical, PICU, NICU) within the hospital. All pediatric patients less than 18 years old admitted in pediatric ward and all neonatal patients admitted in a Neonatal Intensive Care Unit, 'receiving antimicrobial prescription' active or ongoing were included.

Day hospitalization and outpatients were excluded. Emergency admissions admitted on the day of the survey were excluded. Psychiatric wards, children less 18 years admitted in adult ward and those above 18 years old admitted on pediatric wards were excluded. Therapy given topically by nasogastric tube as prophylaxis in intubated patients was not included in the PPS. Therapy given topically in the oral cavity was included.

The laboratory of Medical Microbiology (UA, Belgium) designed the ARPEC-webPPS program, a web based application for data-entry and reporting. After online registration, data were entered anonymously.

RESULT

Two hundred sixteen centers participated in the study, 165 (76.4%) centers in the European Region, 15 (7%) centers in the American Region, 8 (4%) centers in the African Region, 16 (7.4%) centers in the Eastern Mediterranean Region and 5 (2.3 %) centers in the West Pacific Region.

The total number of patients in the European Region (165 centers) were 84, 64 (76.2%) were admitted in the general pediatric medical ward, 12 (14.3%) in surgical wards, 5 (6%) in PICU and 3 (3.6%) in hematology/oncology department.

The number of the total beds in the European Region Centers was 119 most of them in the general pediatric medical ward (80 beds). The bed occupancy was 71% and mostly was used by the PICU (83%) and the least by hematology/oncology unit (27%).

The use of Penicillin in the medical pediatric wards in the European Region Centers was 31%, compared to 34% in Bahrain (SMC) Center; the use of other β -lactams antibiotics was 41% and 27% in Bahrain and European Centers respectively. Sulfonamide and trimethoprim were almost used equally in both centers 10% and 11% in Bahrain and European Centers respectively. None of the centers in Bahrain and Europe used Amphenicols for their patients in the medical wards. Macrolides were used more in the European Centers (9%) than Bahrain (0%). Three percent of patients in the European centers were on Quinolone Antimicrobials and 0% on Tetracyclines.

The majority of patients in surgical pediatric wards were on penicillin or other β -lactam antibiotics, 33% and 30% of the patients in surgical wards were on penicillin for treatment/prophylaxis purposes in Bahrain and European Centers respectively; the use of β -lactam was 32% in the European Centers and 33% in Bahrain Center. In the European Centers

the prescription of Macrolides was 5%, Quinolones was 1% and Sulfonamides and Trimethoprim was 4%. In Bahrain Center the prescription of Aminoglycosides was approximately 17% which is equivalent to the use of other antimicrobial other than β -lactams (including penicillin).

In the PICU setting, the majority of the patients in Bahrain Center was on Penicillin (30%), whereas, in the European Centers they were on other β -lactams (31%). Twenty percent of patients in Bahrain's PICU were on Aminoglycosides and 20% of them were on β -lactams. On the other hand, more variety of antimicrobials with different percentages were used in the European Union Centers such as Quinolones, Macrolides, Trimethoprim and Sulfamethoxazole. Tetracyclines use in the PICU was estimated to be used 10% in Bahrain and 0% in Europe.

In the lower respiratory tract bacterial infections, the most widely used antibiotic was amoxicillin with enzyme inhibitor 26% and Cefotaxime 5% in the European Centers. It was also noticed that 100% of the treatment was given empirically in Bahrain Center. The only used antibiotic in Bahrain for the lower respiratory tract infection was cefotaxime. In Europe, only 24% of the patients had targeted treatment and 76% were managed empirically, see figure 1.

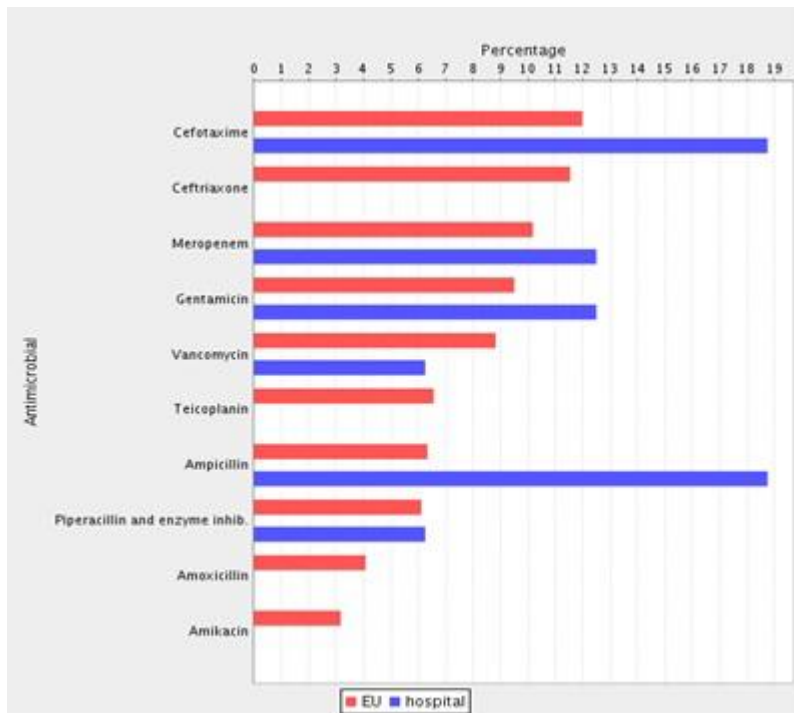


Figure 1: Frequently Used Antibiotics in Bahrain and the European Union Centers

In sepsis, the most prescribed antibiotic was Cefotaxime in both Centers with 18.8% in Bahrain and 12% in Europe. The least used by the European was Amikacin (3.5%); Vancomycin was the least used by Bahrainis (6.1%). Meropenem and Gentamicin were used equally in Bahrain in 12.5% of cases. In addition to Cefotaxime, Ampicillin was frequently used in septic patients in Bahrain (19%). In the European Centers, the most widely used antibiotics are Cefotaxime and Ceftriaxone (12%). Meropenem (10%), Gentamicin (9.8%) and Vancomycin (8.9%) are among

the frequently used antibiotics used in the European Centers. The majority of these antimicrobials were used empirically, 89% and 81% in Bahrain and Europe Centers respectively.

In gastroenterology and urinary tract infections, no data were available from Bahrain Center. In European centers, Metronidazole was the most frequently used drug (31.5%). The least used antimicrobial was Trimethoprim by 2.5%.

The duration of prophylaxis in surgical cases was not exceeding one day in Bahrain Center in most cases. In the European Centers, the duration exceeded one day in the majority of patients, see figure 2. The most common drug used as surgical prophylaxis was β -lactam followed by Penicillin in both Centers, see figure 3.

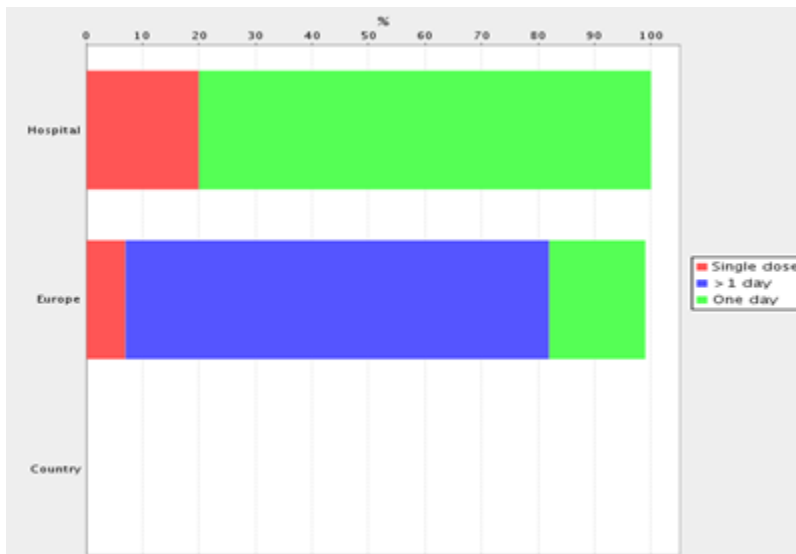


Figure 2: Duration of Antibiotic Prophylaxis in Surgical Cases in Bahrain and European Centers

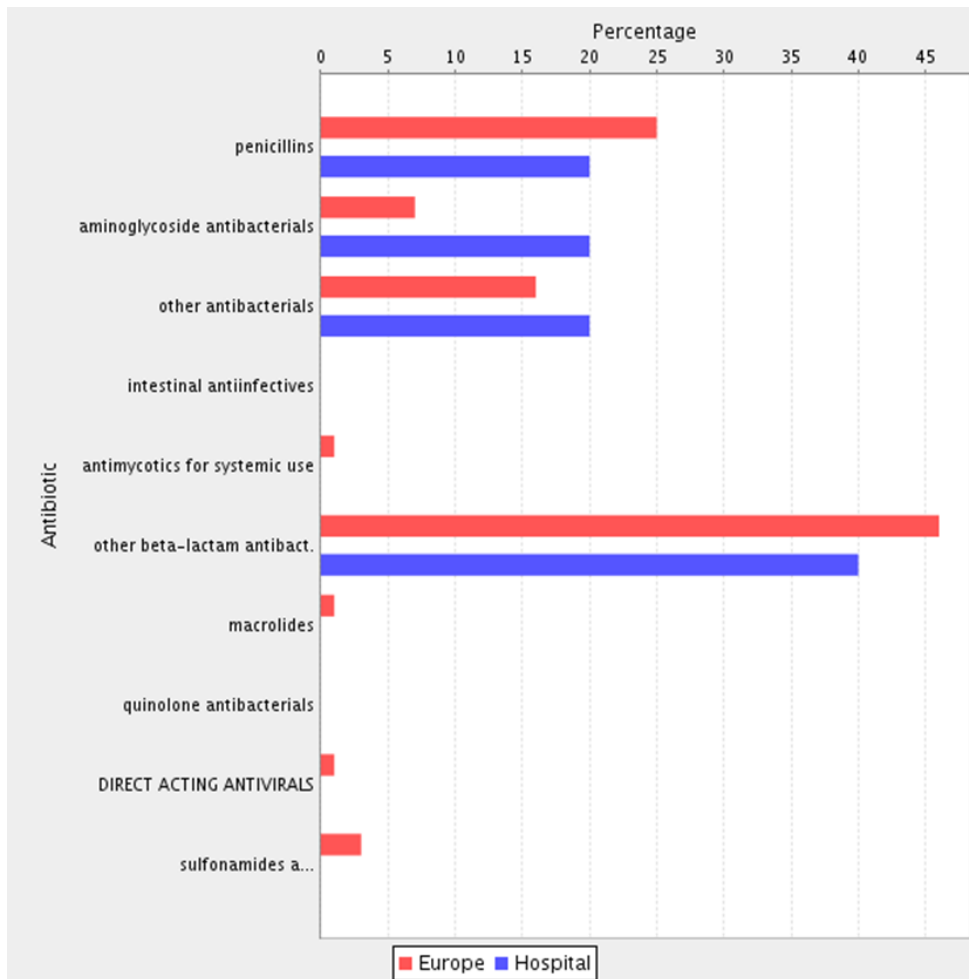


Figure 3: Frequently used Antibiotics in Surgical Prophylaxis in Bahrain and European Union Centers

In the NICU of the European Centers, Penicillin group is the major antibiotic used (32%) followed by Aminoglycosides (27%). Macrolides, Quinolones, and Sulfonamides and Trimethoprim Antibacterial were used in 1% only.

In the case of sepsis for NICU patients, Gentamicin was the most used drug in the European Hospitals, more than 23%, whereas in Bahrain's Hospital, Meropenem was exceeding all other antimicrobials, around 24%, followed by Ampicillin 20% and Gentamicin 20%, Vancomycin 17.5% and Cefotaxime 8%. In European Centers, Benzylpenicillin, Vancomycin and Ampicillin were prescribed in almost equal percentages of 11-12.5%. Tobramycin, Flucloxacillin and Amoxicillin were least used in Europe in about 2.5%. Most of these medications were prescribed empirically in both centers, see figure 4.

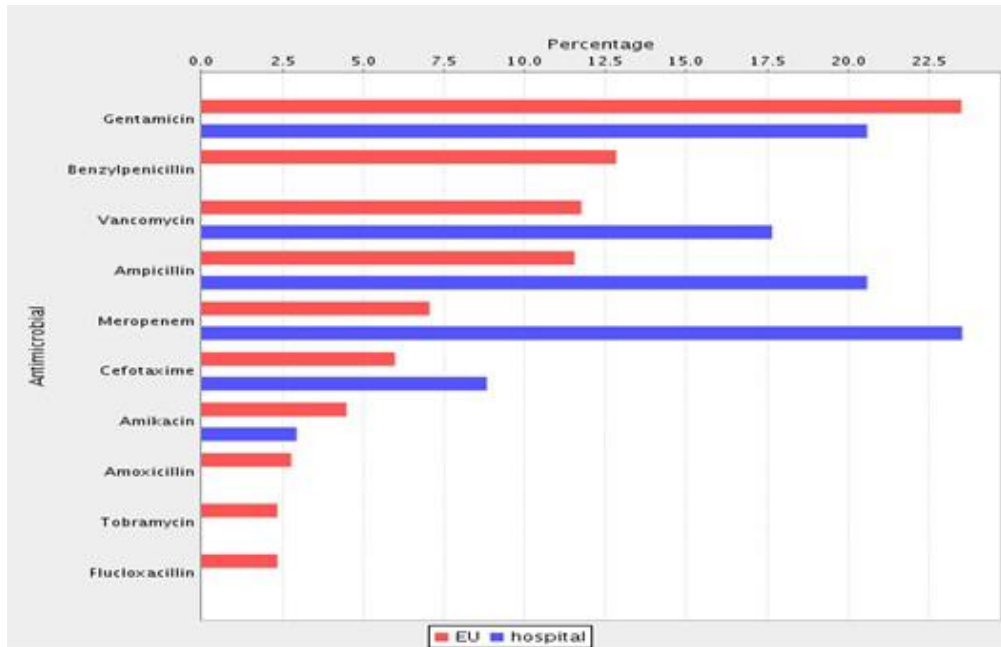


Figure 4: Most Used Antibiotics for Sepsis in Neonatal Patients

The European Centers used some of the antimicrobials as medical prophylaxis for neonatal patients at high risk. The percentages were not much different from those used for treatment purposes as Gentamicin was the most used (31%) followed by Ampicillin and Benzylpenicillin.

There is higher rate of multiple antibiotics use in Bahrain centers (53%) compared to European centers (33%). There is also a higher rate of antibiotics use for surgical prophylaxis in Bahrain (80%) compared to the EU centers (38%) but none received the antibiotic prophylaxis more than 24 hours, see table 1.

Table 1: Prescription Patterns for Pediatric Patients

	Hospital(%)	Country(%)	Europe(%)
All patients under antibiotic treatment			
IV Therapy	30(83%)	0(0%)	2192(71%)
Multiple antibiotics	19(53%)	0(0%)	1025(33%)
All surgical patients			
Receiving surgical prophylaxis	4(80%)	0(0%)	218(38%)
Surgical prophylaxis >1d	0(0%)	0(0%)	163(75%)
All PICU patients			
Receiving surgical prophylaxis	0(0%)	0(0%)	54(16%)
Surgical prophylaxis >1d	0(0%)	0(0%)	35(65%)
Multiple antibiotics	3(50%)	0(0%)	168(49%)

DISCUSSION

The Centers for Disease Control and Prevention (CDC) estimate that more than 100 million antibiotic prescriptions are written each year in the ambulatory care setting; with so many prescriptions written resistance would be promoted⁴. It is vital that the patient takes the correct dose for the time indicated to ensure bacterial resistance does not build up. Broad-spectrum antibiotics are used too often when a narrow-spectrum antibiotic would have been just as effective⁵. In one study, up to 50% of parents had a pre-visit expectation of receiving an antibiotic prescription for their children, and one-third of physicians perceived an expectation for a prescription³. Because of these expectations and the time constraints on physicians, prescribing an antibiotic may seem preferable to explaining why an antibiotic is unnecessary⁶.

Neonatal sepsis is a life-threatening condition that needs an urgent action. The initial clinical presentation of neonatal sepsis is non-specific. In this study, there was high use of broad spectrum antibiotics such as third generation cephalosporin. In a study in Turkey, the authors recommended that third-generation cephalosporins should not be used in the initial therapy of suspected sepsis which might lead to the emergence of drug-resistant microorganisms⁷.

It is recommended that all patients should receive coverage for MRSA infections, according to the WHO principles of treating sepsis in pediatric. These recommendations are applied to the countries and hospitals which have a high rate of MRSA infection. In Bahrain, we do not have a high rate of MRSA infection. Treatment for *Pseudomonas* species should be included for children who are immunosuppressed or at risk of infection with these organisms, such as those with cystic fibrosis. Coverage for enteric organisms should be added whenever clinical features suggest genitourinary (GU) and/or gastrointestinal (GI) sources, perforated appendicitis or bacterial overgrowth in a child with short gut syndrome. When treating empirically, antibiotics which can be given by rapid intravenous bolus (e.g., beta-lactam agents or Cephalosporins) should be administered first followed by infusions of antibiotics, such as Vancomycin, which must be delivered slowly.

In this study, neonatal and other pediatric patients with diagnosis of sepsis, Vancomycin was not used widely as expected in both European and Bahrain Centers. Substantial percentage of patients was not covered by MRSA antimicrobial agent. In genitourinary infection, patients were covered by antimicrobial targeted to possible enteric organisms; most patients were on Metronidazole (31%). Our results also showed that there is a high rate of broad spectrum antibiotics which will lead to multidrug resistant organisms. In a study, interventions can reduce antimicrobial resistance or hospital-acquired infections, and could improve clinical outcome⁸.

In this study, it is clear that there was some variation in the prescription of antibiotics similar to what has been reported in other studies; in a study, the authors compared pediatric antibiotic prescription rates between Viareggio (Italy) and Funen (Denmark), found that pediatric antibiotic prescription rate is substantially higher in Viareggio compared with Funen⁹.

In this study, there is a higher rate of utilization of broad spectrum antibiotics in surgical prophylaxis which needs to be regulated to prevent multidrug resistant microorganisms. On the other hand, our physicians were following the international guidelines for the duration of

antibiotic prophylaxis which is less than one day. There is a need for more detailed and clear guidelines for the use of antibiotics in surgical prophylaxis in pediatrics because the existing guidelines were developed mainly for the adult population¹⁰.

CONCLUSION

We found that in Bahrain, there is a high rate of utilization of broad spectrum antibiotics in pediatric services for surgical prophylaxis and for medical indications compared to the European Union centers. Our physicians are following the international guidelines in limiting the duration of antibiotic used for surgical prophylaxis to less than one day.

We identified the targets for quality improvement in antimicrobial prescription by limiting the use of the third generation cephalosporins in pediatric and neonatal wards. In addition, to limit the use of broad spectrum cephalosporins for surgical prophylaxis, avoid excessive use of antimicrobial combinations and utilize narrow versus broad spectrum antibiotics.

In European and Bahrain Centers most of the medications were prescribed empirically (80%).

We recommend proper interventions that could lead to the reduction in antibiotics overuse which may include: (1) health education campaigns and professional education (2) doctor-parents interactions, where the parents gets involved in the decision making process and (3) implementing a new policy for delaying antibiotics prescription for 48 hours which will give the self-limiting conditions time to heal without the use of medications.

Author contribution: All authors share equal effort contribution towards (1) substantial contributions to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes

Potential conflicts of interest: No

Competing interest: None. **Sponsorship:** None.

Submission date: 19 August 2013. **Acceptance date:** 15 January 2014.

Ethical Approval: Approved By Research Committee for the Secondary Care, Ministry of Health, Bahrain.

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