Antibiotics Point Prevalence

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Background: Antibiotics have changed the practice of medicine. The widespread use of antibiotics has led to the emergence of drug resistance. The Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (Global-PPS) is a motivated project to develop the point-prevalence surveys (PPS) carried out by the European Surveillance of Antimicrobial Consumption (ESAC).

Objective: To monitor the prescription of antibiotics, improve the quality of antibiotics prescription and determine the variations in drug prescription.

Design: A Prospective Study.

Setting: Salmaniya Medical Complex, Bahrain.

Method: The Laboratory of Medical Microbiology (UA, Belgium) designed the Global-PPS WebPPS program, a web-based application for data-entry and reporting. Online registration of participating hospitals on the WebPPS program was performed by the locally designated personnel. All wards in the hospital were included in the data collection. Three hundred seventy-two patients were included in the study. Data collected from 1 February 2015 to 30 April 2015 were documented.

Result: Three hundred seventy-two patients were included in the study. Three hundred and seven (82.5%) patients were adults, 45 (12.1%) were children and 20 (5.4%) were neonates. Two hundred sixty-three (70.7%) were on antibiotics. All the children, 45 (12.1%) were on antibiotics. ß-lactams **other than penicillin was prescribed in 158 (42.5%) patients followed by penicillin in 57 (15.3%) patients. The most common indication for antibiotics use was pneumonia, 43 (11.5%) patients and lower urinary tract infections, 31 (8.3%) patients.**

Conclusion: The point prevalence study has shown an overuse of antimicrobials with an increasing use of drugs, particularly among pediatrics. Therefore, antibiotic supervising initiatives to limit the overuse is needed.

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The widespread use of antibiotics has led to the emergence of drug resistance. The misuse of antibiotics is a major factor for resistance development. Patients who are hospitalized could frequently receive antibiotics; it was found that 50% of all antibiotics used may be inappropriate[1].

The Centers for Disease Control and Prevention (CDC) estimates that more than two million people are infected with antibiotic-resistant organisms, resulting in 23,000 deaths annually[2]. The misuse of antibiotics include the following: drugs prescribed unnecessarily, delay in antibiotics initiation in critically sick patients, the dose does not match the specific patient condition or infection, the duration is either too long or short, the antibiotic is not streamlined with the microbiological results, broad-spectrum antibiotic is used open-handedly, or narrow-spectrum antibiotic is used incorrectly[3].

The judicious use of antimicrobials could stop the development of antibiotic-resistant bacteria. In addition, decreasing use of antibiotics has been shown to lower the incidence of Clostridium diffcile infection[4]. It is advised to improve antibiotic prescription through establishing hospital antibiotic guidelines, consulting infectious disease physicians, a microbiologist and clinical pharmacist for their input regarding the use of the medications. An Antibiotic Stewardship Program (ASPA) could optimize the management of infections and lower the adverse effect of antimicrobials[5].

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The Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (GLOBAL-PPS) is a motivated project to develop the point-prevalence surveys (PPS) carried out by the European Surveillance of Antimicrobial Consumption (ESAC). The ARPEC projects were funded by the European Commission. The Global-PPS aims to have a standardized surveillance method of data collection that could be used to monitor rates of antimicrobial prescribing in hospitalized patients worldwide.

The aim of this study was to monitor the prescription of antibiotics, improve the quality of antibiotics prescription and determine the variations in drug prescription.

METHOD

Participating hospitals in the WebPPS program were registered online. The Laboratory of Medical Microbiology (UA, Belgium) designed the Global-PPS WebPPS program, a web-based application for data-entry and reporting. Data collected from 1 February 2015 to 30 April 2015 were documented. Data entry and validation was available for two months, after which, the window of data collection was closed. Three hundred seventy-two patients were included in the study. Three hundred seven (82.5%) were adult patients, 45 (12.1%) were children and 20 (5.4%) were neonates.

All wards in the hospital were included in the data collection. Each ward was surveyed only once. In addition, all beds in the same wards were surveyed on the same day to monitor the number of admitted patients.

All inpatients on antimicrobial agents at 8 o'clock on the day of the survey were included. Any antibiotics prescribed later during the day were not included. The study excluded ambulatory patients attending the hospital's day unit. Emergency admissions in the ward were excluded.

Antibacterial, antifungal, antituberculosis, antibiotics, anti-protozoal, antivirals and antimalarial were included in the drug survey. Topical antimicrobials and topical antivirals were excluded.

RESULT

Multiple countries from all continents except Antarctica participated in the point prevalence project. Some countries have participated with more than one hospital. The highest number of participants was from Europe with 23 countries and 200 hospitals. The second highest contribution of hospitals was from Asia with total 54 hospitals, see table 1.

Table1: Countries and Hospitals in the Project

Continent	No. of Countries	No. of Hospitals
North America	2	22
South America	4	20
Africa	2	5
Europe	23	200
West and Central Asia	9	25
East and South Asia	6	29
Australia and New Zealand	2	9
Total	**48**	**310**

Three hundred seventy-two patients from our institution were included in the study. Three hundred seven (82.5%) patients were adults. One hundred four (28%) patients were from the general adult medical ward, 163 (43.8%) from surgical wards, 19 (5.1%) from the Intensive Care Unit (ICU) and 21 (5.6%) from hematology/oncology ward; 263 (70.7%) patients were on antibiotics, see figure 1.

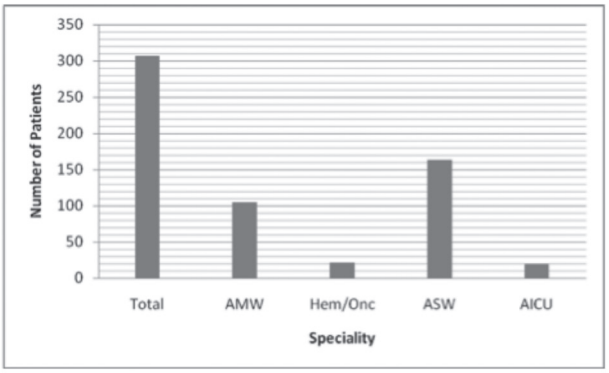

Figure 1: The Prevalence of Antibiotics Use among Adults
AMW: adult medical ward **ASW:** adult surgical ward
Hem/Onc: hematology/oncology **AICU:** adult intensive care unit

In pediatrics, all 45 (12.1%) patients were on antibiotics; 31 (8.3%) patients were from the pediatric general ward, one (0.3%) patient from hematology/oncology unit, 10 (2.7%) from the pediatric surgical ward and 3 (0.8%) from the ICU, see figure 2. In addition, 20 (5.4%) neonates admitted in the neonatal ward were on antibiotics.

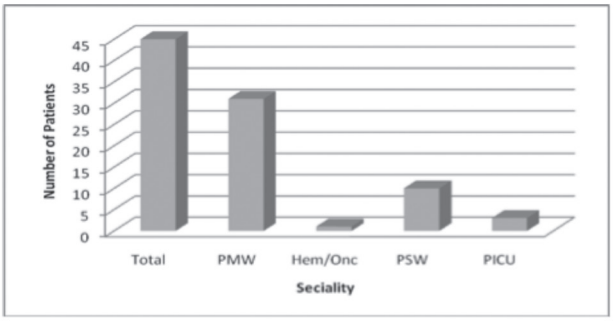

Figure 2: Prevalence of Antibiotics Use among Pediatrics
PMW: pediatric medical ward **PSW:** pediatric surgical ward
Hem/Onc: hematology/ oncology **PICU:** pediatric intensive care unit

The most commonly used antimicrobials were as follows: Other ß-lactams 158 (42.5%), penicillin 57 (15.3%), other antimicrobials 55 (17.8%), macrolides 17 (4.6%) and 14 (3.8%) aminoglycosides, respectively, see figure 3.

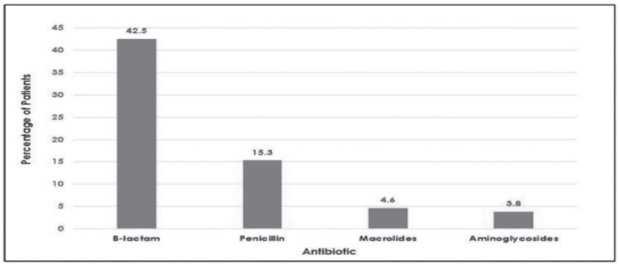

Figure 3: Antibiotics Use in Bahrain's Hospital

In our study, ß-lactams other than penicillin were used in 215 (57.8%) patients as follows: 92 (24.7%) patients received third generation Cephalosporin, 64 (17.2%) patients received second generation Cephalosporin, 52 (13.9%) patients received Carbapenems and 7 (1.9%) patients received fourth generation Cephalosporin, see figure 4.

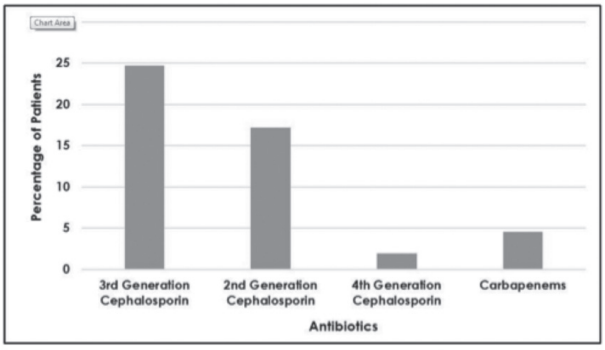

Figure 4: Use of ß-Lactams **other than Penicillin**

The study showed that the use of antimicrobials in the adult medical wards were as follows: 53 (14.2%) ß-Lactams other than penicillin, 26 (6.9%) penicillin, 25 (6.7%) other antimicrobials and 13 (3.5%) used macrolides; some patients were on two antibiotics, see figure 5.

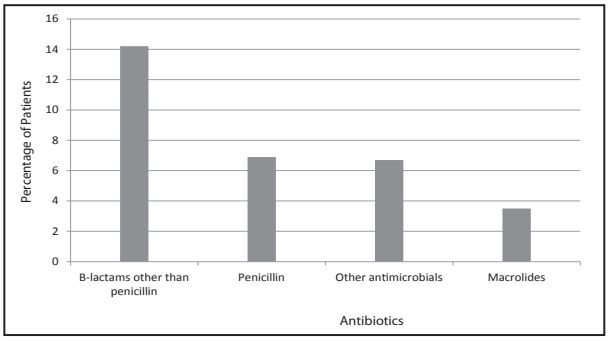

Figure 5: Antibiotics Use in Bahrain Medical Wards Including Adult and Pediatrics

ß-lactams other than penicillin were the most commonly used antibiotics by surgeons followed by penicillin, see figure 6.

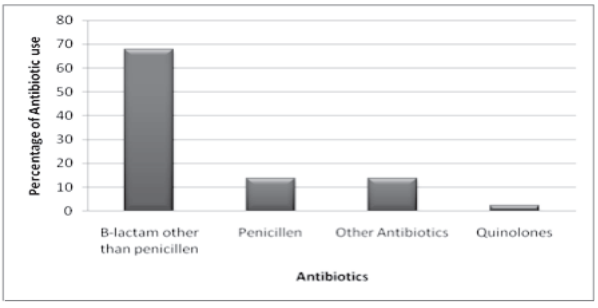

Figure 6: Antibiotics Use in Bahrain's Hospital Surgical Wards (Adult and Pediatrics)

Eleven (3%) adult patients were treated in the ICU, five (1.3%) patients were on ß-lactams other than penicillin, one (0.3%) patient was on penicillin, one (0.3%) patient on Tetracycline, 3 (0.8%) patients were on other antimicrobials and one (0.3%) on aminoglycosides and quinolones, see figure 7.

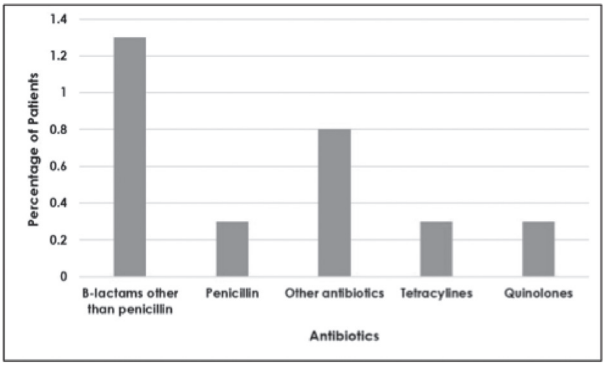

Figure 7: Antibiotics Use in Bahrain's Hospital Adult ICU

Eight (2.2%) patients in the adults ICU were managed with ß-lactams other than penicillin; the majority received Carbapenem, followed by third generation Cephalosporin and second generation Cephalosporin, see figure 8.

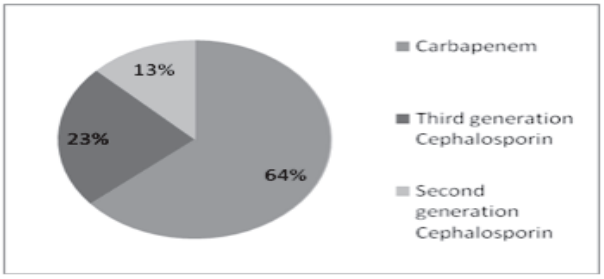

Figure 8: Prescription of B-Lactam other than Penicillin in Bahrain's Adult ICU

In the pediatrics ICU, two (0.5%) patients were using a combination of macrolides, penicillin and other antimicrobials.

In the NICU, aminoglycoside was used in six (1.6%) patients. Penicillin in five (1.3%), other ß-lactams were used in four (1.1%), four patients (1.1%) were on other antibacterial and one patient (0.3%) on sulfonamides and trimethoprim, see figure 9.

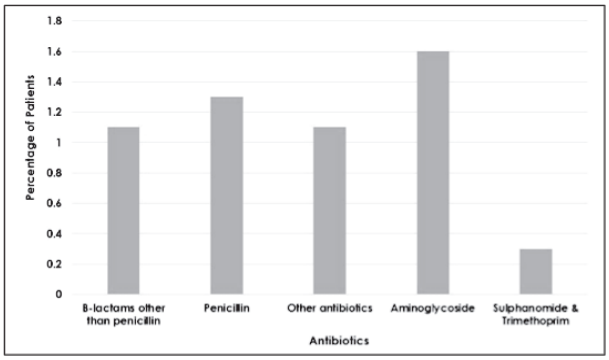

Figure 9: Antibiotics Use in NICU

In our study, 141 (37.9%) patients had a community-acquired infection (CAI), and 116 (31.2%) patients had a hospital-acquired infection (HAI). Twenty-two (5.9%) CAI patients had targeted treatment with antimicrobials and 119 (31.9%) were treated empirically. Seventy-four (19.9%) HAI patients had targeted treatment and 42 (11.3%) patients received empirical antimicrobial management, see figure 10. One hundred twenty-

one (32.5%) patients had antimicrobials as a prophylaxis. Surgeons had a higher rate of antimicrobial prophylaxis, 103 (27.7%) patients compared to medical wards, 18 (4.8%) patients.

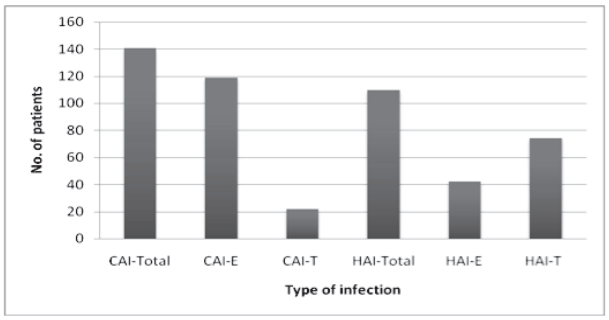

Figure 10: Community Acquired Infection and Hospital Acquired Infection
CAI: community acquired infection
CAI-E: community-acquired infection with empirical treatment
CAI-T: community-acquired infection with targeted treatment
HAI: hospital acquired infection
HAI-E: hospital acquired infection with empirical treatment
HAI-T: hospital acquired infection with targeted treatment

The reasons for the therapeutic use of antibiotics were documented in 153 (41.1%) patients; 43 (11.6%) patients had pneumonia, 31 (8.3%) patients had lower urinary tract infections, 15 (4%) patients had gastrointestinal infections, 15 (4%) patients had skin and soft tissue infections, 13 (3.5%) patients had sepsis, 10 (2.7%) patients had pyelonephritis, 7 (1.9%) patients had ear, nose and throat infections, 6 (1.6%) patients had bone and joint infections, 5 (1.3 %) patients had bacteremia and 8 (2.1%) patients had other infections, see figure 11.

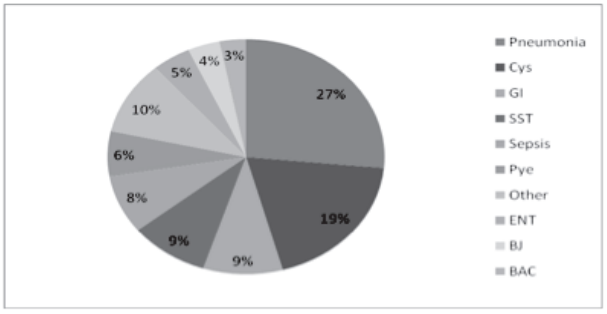

Figure 11: Ten Diagnoses Treated with Therapeutic Antimicrobials
Cys: lower urinary tract infection **GI:** gastrointestinal
SST: skin and soft tissue
Pye: upper urinary tract infection **ENT:** ear, nose, and throat
BJ: bone and joint **BAC: b**acteremia

The reasons for using antimicrobials in all wards were only mentioned in the medical notes of 106 (28.5%) patients, followed by 77 (20.7%) in surgical notes and 51 (13.7%) in ICU notes. The surgeons follow the guidelines of antimicrobials prescription in 99 (26.6%) patients followed by internists in 51 (13.7%) patients and the ICU in 23 (6.2%) patients, see table 2.

Table 2: ICU, Surgical and Medical Wards Quality Indicators

	Medical	Surgical	ICU
Reason in notes	106	77	51
Guidelines missing	6	6	5
Guidelines compliance	51	99	23
Stop/Review Date	58	24	6

The most common antibiotics used in the treatment of sepsis in adults and pediatrics (excluding NICU patients) were Ceftriaxone followed by Linezolid, Meropenem and Ampicillin. The least prescribed were Piperacillin and enzyme inhibitor. Amoxicillin, enzyme inhibitor, and Vancomycin were not prescribed in both age groups. In this study, Clarithromycin, Meropenem and Amoxicillin were used to treat pneumonia (community or hospital acquired infection).

DISCUSSION

The objective of antibiotics control is to control the emerging and rapidly increasing antibiotics resistance[6]. The ideal method is to have all patients treated with the most effective, least costly and least toxic for a precise duration of time that is needed to cure or prevent an infection[7].

This study has revealed an increasing use of antimicrobials and drugs in pediatric departments; it has reached 100% in most of the wards, including the ICU. Overuse of antimicrobials would not only encourage drug resistance, but also cause a high financial burden. Reducing the burden of antibiotics-resistant infections by just 20% would save 3.2 to 5.2 billion dollars in health care costs each year and reduce 11.3 million additional in-hospital days for patients with bacterial resistance infections[8]. A study found that implementing guidelines for the treatment of community-acquired pneumonia may help in the use of shorter courses of therapy and thus, saving money and improving patient safety. In addition, targeting certain infections may lower antibiotics use[9].

Antibiotics are frequently used in approximately 30% of patients undergoing surgery to prevent postoperative surgical site infections (SSI). Improper utilization of antibiotics could increase resistance towards antibiotics, morbidity, mortality and cost of health-care[10]. In one study, 26.4% patients received the right antibiotic therapy and 73.6% patients received at least one course of inappropriate antibiotic therapy. The most common causes of inappropriate prophylactic antibiotics were inappropriate timing and duration, choice of antibiotics and indication[11]. Similarly, in our study, it was noticed that the reasons for antibiotics prescription were not documented for the majority, and no review or update for the antibiotics were made. The most commonly used antibiotic was Cephalosporin, particularly the third generation, whether for prophylaxis or treatment.

A Spanish national multicenter study analyzed all patients admitted to ICUs who received antibiotics within the first 6 hours of diagnosis of severe sepsis or septic shock. The study concluded that β-lactams, including Carbapenems, are the most frequently prescribed antibiotics in empiric therapy in patients

with severe sepsis and septic shock[13]. In our study, the most common antibiotics used in the treatment of sepsis in adults and pediatrics (excluding patients in NICU) was Ceftriaxone (a third generation Cephalosporin) followed equally by Linezolid, Meropenem (Carbapenem) and Amoxicillin.

The Spanish study confirmed the increased survival in patients managed with combination therapy. Previously, multidrug-resistant pathogens were found almost completely in nosocomial infections. However, community-acquired infections are now often caused by antibiotic-resistant bacteria. Therefore, initial therapy frequently includes a combination of different antimicrobial agents due to increasing multidrug-resistant gram-negative pathogens in the community[14,15].

In our study, the antibiotic use, particularly in pediatric patients, should be reviewed and assessed by clinicians and clinical pharmacists. In one study, several methods to prevent overuse of antibiotics were found: computerized order entry supported by a clinical summary and need for the drug prescription, ward-based clinical pharmacists and improving the clinical/verbal communication among nurses, physicians and pharmacists[16].

CONCLUSION

This study reveals the high rate of antimicrobial use for the different clinical indications and a high rate of use of broad spectrum antibiotics. This emphasizes the importance of antimicrobial stewardship program and the need to strengthen all its elements.

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Competing Interest: None.

Sponsorship: None.

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