Original Article

A pilot point prevalence study of antimicrobial drugs in indoor patients of a teaching hospital in Central India

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Abstract

Aim: To evaluate the point prevalence of antimicrobial drug use by using point prevalence survey method. **Methodology:** A cross-sectional point prevalence study was done on patients admitted in AIIMS Bhopal hospital. This study included all inpatients receiving an antimicrobial that were on the ward at 8 AM on a specific day in May 2018. Information regarding age, gender, occupation, income group, diagnosis, patient's present/past medical history, treatment, any adverse drug reactions, and investigations are recorded in a pro forma. **Results:** A total of 77 patients (31.95%) were included out of total 241 patients who received at least one antimicrobial. Of patients who received at least one antimicrobial, diagnosis was mentioned in 83.11% of prescriptions. Targeted treatment was given to 10.38% of patients. Reasons for antimicrobial were recorded in 12.98% of patients. Most common healthcare infection recorded was catheter-associated urinary tract infections followed by postoperative surgical site infections. Penicillin with beta lactamase inhibitors was most commonly prescribed antibiotic group followed by third generation cephalosporins and fluoroquinolones. Stop or review date was recorded in 19.48% of patients. Parenteral administration was given to 30.55% of patients. Compliance to guidelines was followed in 64.11% of patients. Local antibiotic guideline and antibiogram were available in hospital. Biomarkers were utilized in 9.77% of patients to guide the choice of therapy. **Conclusion:** Availability of antibiotic policy, antibiogram, local antibiotic guidelines, drugs, and therapeutic committee were some of the encouraging findings. Diagnosis was mentioned in majority of prescriptions. Most patients were prescribed oral antimicrobial drugs, which can reduce complications with parenteral route. Underutilizations of microbiological facilities, prolonged use of antibiotics for surgical prophylaxis, and polypharmacy were areas of concern.

Keywords: Antibiotic stewardship, antimicrobial drugs, point prevalence survey

Introduction

Surveillance systems monitoring antimicrobial use and resistance are the cornerstones of successful implementation of sustainable antimicrobial stewardship programs. They improve decision making and enable assessment of the effects of interventions.[1,2] A point prevalence survey is a well-established method that is applicable and beneficial in hospitals all over the world. Point prevalence refers to the prevalence measured at a particular point in time. Point prevalence studies can identify priorities for rational prescribing of drugs. The paucity of information and data about the quantity and quality of antimicrobial prescribing is a key barrier to the successful development and implementation of antimicrobial stewardship programs internationally. Surveillance systems to monitor antimicrobial use and resistance are needed to improve decision making and assess the effect of interventions.[3] Furthermore, auditing of, and feedback on, prescribing practices complements and improves[4] other core stewardship interventions (e.g. empirical therapy according to guidelines).[5,6]

The Global Point Prevalence Survey (Global-PPS)[7] of antimicrobial consumption and resistance was developed

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after the fourth World Healthcare-Associated Infections and Antimicrobial Resistance Forum. Its aim was to assess the international prevalence of antimicrobial use and resistance, with an emphasis on countries with low resources, support, and expertise. The Global-PSS complements WHO's Global Antimicrobial Surveillance System (which provides a standardized approach for collection, analysis, and sharing of data for antimicrobial resistance) by providing a validated method for measuring the quality of antimicrobial prescribing and the effect of interventions to improve prescribing. Governments can use this tool to support antimicrobial stewardship frameworks as part of their WHO National Action Plans, and the UN's Interagency Coordination Group on Antimicrobial Resistance could use it for international mapping of antimicrobial prescribing and resistance in hospitals, and to build a sustainable hospital surveillance framework with a focus on low-income and middle-income countries.

Family medicine physicians are using antimicrobials on routine basis for the treatment of various infectious diseases. Point prevalence study can be used as a tool for measuring the quality of antimicrobial prescribing and the effect of interventions to improve prescribing. The primary goal of antimicrobial stewardship is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use. Additional benefits include improving susceptibility rates to targeted antimicrobials and optimizing resource utilization. Prospective audit with intervention and feedback is an important strategy for antimicrobial stewardship programs. The misuse of antibiotics has also contributed to the growing problem of antibiotic resistance, which has become one of the most serious and growing threats to public health. Unlike other medications, the potential for spread of resistant organisms means that the misuse of antibiotics can adversely impact the health of patients who are not even exposed to them.

Materials and Methods

This was a cross-sectional point prevalence observational study. Single day hospital-wide point prevalence survey was conducted to assess the quality of antimicrobial drug prescribing. The study was conducted among inpatients admitted in the 15 wards of 13 medical and surgical departments including superspecialties—general medicine, general surgery, obstetrics and gynecology, pediatrics, pediatric surgery, orthopedics, nephrology, urology, pulmonary medicine, burns and plastic surgery, ophthalmology, E.N.T., and dentistry at AIIMS Bhopal hospital, Madhya Pradesh. All study data were completely anonymized, and no unique identifiers were recorded. Furthermore, the survey did not require direct contact with patients. Thus, patient consent was not required. Patients of both sex and all age groups admitted in all medical and surgical wards were included. Patients admitted in the ICU were excluded. Hospital-based residents and nurses were responsible for completing the PPS. They were asked to do a one-day survey, during which all wards had to be audited once. All inpatients with ongoing antimicrobial treatment and who were on the ward at 8 AM were included. Total ward inclusion at the hospital level was requested but not mandatory. Data collection was done with two forms, one for ward-level data (i.e., recording of denominators, such as the total number of inpatients on the ward) and one for patient-level data (recording of numerators). For each patient receiving at least one antimicrobial, we gathered data about patient characteristics, the antimicrobials received, their diagnosis, and the therapeutic indication according to predefined lists. Two major categories—treatment and prophylaxis—were used, each of which consisted of two main types of indication. The former category comprised therapeutic antimicrobial prescribing for both community-acquired and health-care-associated infections (infections that become symptomatic 48 h after hospital admission). The latter category included antimicrobial prescribing for both surgical and medical prophylaxis. For patients receiving surgical prophylaxis, administration had to be checked in the previous 24 h to encode the duration of prophylaxis as either one dose, one day (i.e., multiple doses given in one day), or more than one day. Additional indicators of antimicrobial-prescribing quality were documentation of the diagnosis in the patient's notes at the start of treatment, the choice of antibiotic being compliant with local guidelines, and documentation of a stop or review date for the antimicrobial in the notes. Additionally, empirical or targeted treatment (i.e., based on microbiology data from a relevant clinical specimen, such as blood or sputum, excluding screening tests) was recorded. Finally, we recorded use of biomarkers (C-reactive protein, procalcitonin, etc.) that were used to guide antimicrobial therapy. Antimicrobials included antibiotics for systemic use, antimycotics and antifungals for systemic use, drugs to treat tuberculosis, oral antibiotics prescribed as intestinal anti-infectives (e.g., oral vancomycin), nitroimidazole derivatives, neuraminidase inhibitors, and antimalarials. No discussion or personal judgment on the appropriateness of antibiotic prescribing was allowed during the survey.

Data analysis

We focused on prescribing of antibiotics for systemic use, which we report as the number of treated patients, the number of therapies, and the number of prescriptions. Therapy was defined as one treatment (i.e. receiving at least one antibiotic) per diagnosis. A prescription was defined as the use of one substance by one route of administration. Antimicrobial prescribing rates were expressed as a percentage of patients on antimicrobials, or as a percentage of all antibiotic or antimicrobial prescriptions (proportional use).

Results

A total of 77 patients (31.95%) were included out of total 241 patients who received at least one antimicrobial. Of patients who received at least one antimicrobial, diagnosis was mentioned in 83.11% of prescriptions (as depicted in Table 1). Targeted treatment was given in 11.12% (8) patients. Stop or review date was mentioned in 19.48% (n = 15) patients. Parenteral administration was given in 30.55% (n = 23) patients. Local antibiotic guidelines and antibiogram were available.

Table 1: Antimicrobial quality indicators for adult inpatients (*n*=77)

Item	Percentage
Diagnosis documented	83.11% (64)
Targeted treatment (based on microbiological tests)	11.12% (8)
Reason recorded (community acquired or hospital acquired)	12.98% (10)
Stop or review date recorded (postprescription review)	19.48% (15)
Parenteral administration	30.55% (23)
Compliant to local guidelines	64.11% (49)
Use of biomarkers (CRP, Procalcitonin)	9.77% (7)

CRP: C-reactive protein

Adherence to guideline was 64.11%. The combination of penicillin with a β-lactamase inhibitor was the most commonly prescribed class, mainly amoxicillin with β-lactamase inhibitors, and piperacillin with β-lactamase inhibitors. The second and third most commonly prescribed antibiotics were third-generation cephalosporins (mainly ceftriaxone) and fluoroquinolones (mainly ciprofloxacin and Levofloxacin. The top four indications for antibiotic prescription were pneumonia, skin and soft tissue infections, intra-abdominal infections, and urinary tract infections. The most commonly prescribed antibiotics for community-acquired infections was amoxicillin plus clavulanic acid. Third-generation cephalosporins were the second most commonly prescribed (mainly ceftriaxone) antibiotics for community-acquired infections, followed by levofloxacin. Most commonly prescribed antibiotics for healthcare associated infections were piperacillin plus tazobactam, fluoroquinolones, meropenem, and vancomycin. Cefazolin was the most commonly prescribed antibiotic for surgical prophylaxis and sulfamethoxazole–trimethoprim was the most commonly prescribed antimicrobial for medical prophylaxis. The stop or review date for antibiotic treatment was poorly documented. Biomarkers [C-reactive protein (CRP) or procalcitonin] was used in 9.77% (*n* = 7 patients) to guide the antimicrobial therapy.

Discussion

To identify inappropriate antibiotic prescribing, we investigated five indicators of quality, which could easily be used to set benchmarks for quality improvement of antibiotic use in hospitals.[8] In our study, diagnosis was mentioned in 83.11% (*n* = 64) of prescriptions [Figure 1]. Documentation of the reason for prescription ensures communication of diagnosis and treatment among clinicians and other health-care providers, and allows for recording of prescription stop or review dates and other interventions such as de-escalation. In our study, targeted treatment was given in only 10.38% (*n* = 8) prescriptions [Figure 2]. This was serious concern and showed underutilization of microbiological facilities.When symptoms start 48 hours after admission to hospital, it is supposed to be due to healthcare associated infections (HAI). In Community acquired infections (CAI) , symptoms start less than 48 hours from admission to hospital or present on admission. These healthcare-associated infections (HAIs) include central line-associated bloodstream infections, catheter-associated urinary tract infections, and

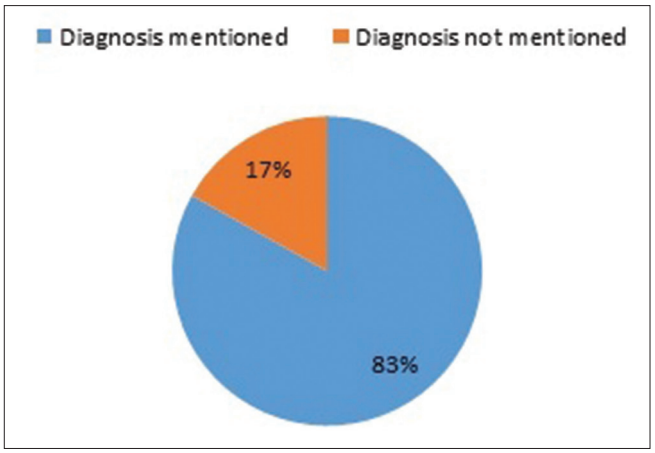

Figure 1: Documentation of diagnosis

ventilator-associated pneumonia. Infections may also occur at surgery sites, known as surgical site infections. In our study, A reason was recorded (community acquired or hospital acquired) in 12.98% (10) patients [Figure 3]. Most common healthcare associated infection was catheter associated urinary tract infections followed by surgical site infections. Formal review, the second indicator, of the appropriateness of an antimicrobial administered within 48 h of the initial order (postprescription review)[9] refers to the existence of a policy or agreed intervention preventing unnecessarily long antibiotic courses and ensures that the chosen antibiotic and its route of administration is still appropriate. Such a policy can reduce selection pressure, and prevent adverse effects such as drug-related toxicity and damage to the normal intestinal bacterial flora leading to Clostridium difficile infection. In our study, stop or review date was mentioned in 19.48% (*n* = 15) prescription, which is an area of concern [Figure 4]. A stop or review date was recorded for less than a third of antimicrobials prescribed in southern Europe, west and central Asia, and Oceania.[10] This review process should be targeted as a key intervention, and the effects of such intervention should be measured with repeated point prevalence surveys.[11]

Parenteral administration, the third quality indicator, was 30.55% (*n* = 23) in our survey [Figure 5]. Parenteral prescription was most common in west and central Asia, Latin America, and eastern and southern Europe,[12] where it accounted for more than 80% of patients on antibiotics. Broad-spectrum antibiotics are commonly administered in these regions (such as third-generation cephalosporins), and broad-spectrum oral antibiotics are scarce. The switch from intravenous to oral antibiotics has many advantages, including reductions in catheter-related complications, health-care costs, and duration of hospital stays, and is recognized as a key metric for stewardship processes in hospitals.[13,14] However, to what extent different administration routes affect antimicrobial resistance is not known.[15]

The fourth quality indicator referred to the existence of, and adherence to, antibiotic treatment guidelines. In our study, adherence to guidelines was recorded in 64.11% (*n* = 49) prescriptions [Figure 6]. Guideline compliance referred only

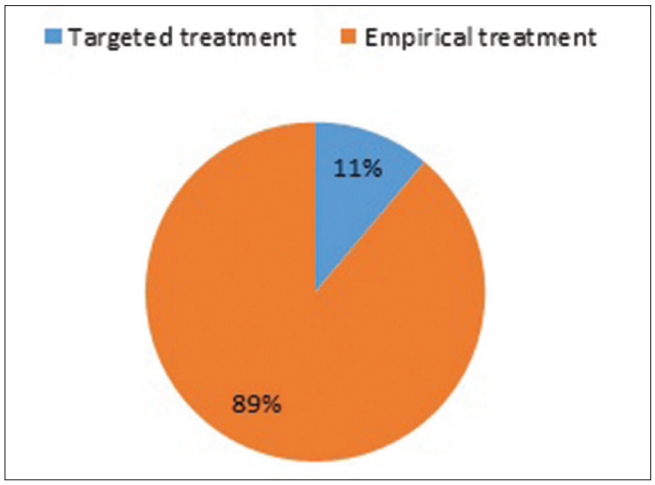

Figure 2: Treatment prescribed

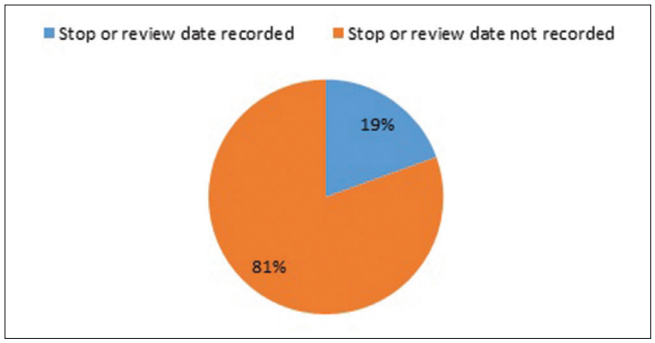

Figure 4: Postprescription review

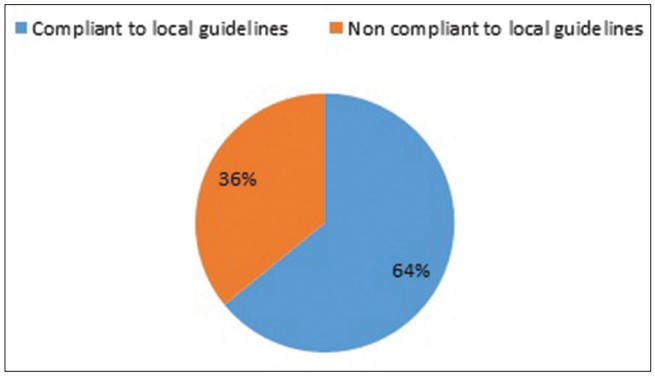

Figure 6: Compliance to local guidelines

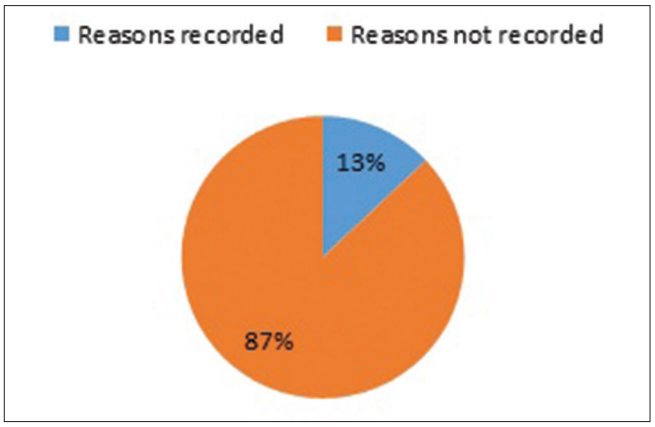

Figure 3: Reasons recorded (Community acquired infections or Healthcare associated infections)

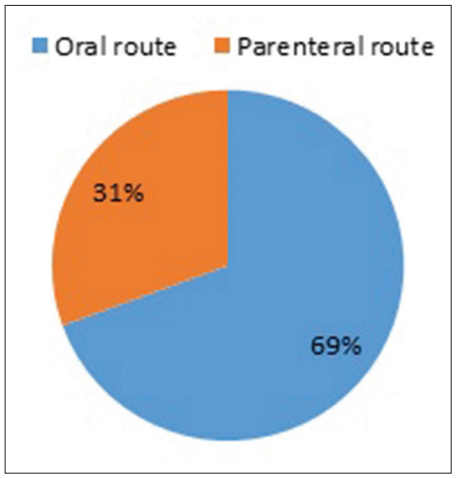

Figure 5: Route of antimicrobial drug administration

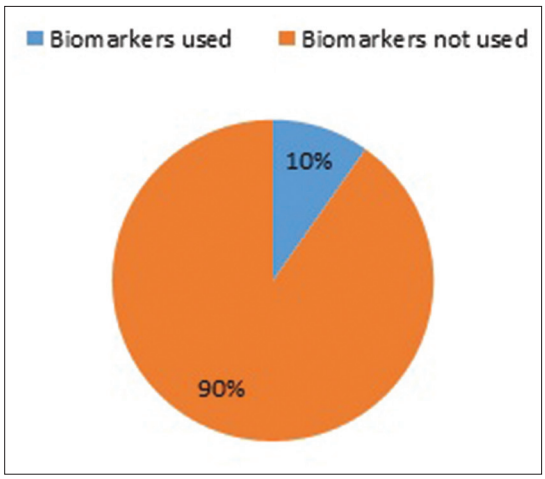

Figure 7: Use of biomarkers

to the choice of drug for therapeutic or prophylactic use. In our study, adherence to guideline was 64.11% (n = 49) prescriptions. A systematic review and meta-analysis[16] showed that guideline-adherent empirical therapy was associated with a significant relative risk reduction for mortality of 35%. The reason for poor compliance with guidelines is uncertain and probably multifactorial. Local resistance patterns, clinical uncertainty, and fear of treatment failure could all have roles. The fifth quality indicator concerned prolonged surgical prophylaxis, which was common in our survey. Antibiotic prophylaxis for more than 24 h for most surgical indications does not prevent development of postoperative infections compared with surgical prophylaxis for 24 h or less, but increases the risk of antimicrobial resistance and side-effects.[17] In the absence of preoperative infection or severe complications, prolonged postoperative antibiotic prophylaxis is unnecessary. In our study, biomarkers (CRP or procalcitonin) was used in 9.77% (n = 7 patients) to guide the antimicrobial

therapy [Figure 7]. Clinicians can also utilize serum markers in order to decide whether antibiotics ought to be prescribed in a given patient-reactive protein (CRP) is an acute-phase reactant, and CRP level measurements are frequently used to aid in the diagnosis of bacterial infections. Procalcitonin[18] is a hormone that has emerged as a promising marker for the diagnosis of bacterial infections and may be used to support clinical decision making for the initiation and discontinuation of antibiotic therapy. It has been shown that procalcitonin level is highly sensitive and very specific than the CRP level for differentiating bacterial from either viral or noninfective causes of inflammation. Studies have demonstrated that higher levels of procalcitonin are found in severe bacterial infections than in viral infections and nonspecific inflammatory diseases. Procalcitonin can also be used as most specific biomarker for sepsis in intensive care units.

Conclusion

A point prevalence survey can be used as a tool for measuring the quality of antimicrobial prescribing and the effect of interventions to improve prescribing. A PPS offers relatively high-fidelity, cross-sectional quantitative insight into patterns of drug use.[19] The strengths of this survey lie in its comprehensive nature, with the inclusion of every indoor patient in hospital with ongoing antimicrobial treatment. In the absence of electronic prescribing, a PPS is the only way to obtain such a comprehensive picture of drug use in hospital. Ideally, PPS should be multicentric but due to limitation of resource, manpower, and time, we had conducted this PPS only our own center. They can give a gross picture of drug consumption. A PPS is not useful for assessing appropriateness of drug prescribing against a gold standard or for subgroup analyses. Rather, it is useful for identifying under-recognized areas of prescribing. The study showed the feasibility of doing the PPS which focused on antimicrobial prescribing with a simple and convenient method. Some of the encouraging finding of the study was that local antibiotic guideline was available and compliance to guideline was good. Diagnosis was documented in majority of prescriptions. Most patients were prescribed oral antimicrobial drugs, which can reduce complications with parenteral route. There was good collaboration with other clinical specialties. However, prolonged and irrational use of antibiotics for surgical prophylaxis was noted in surgical indoor patients. Some of areas of concern were that microbiological facilities were underutilized. Stop or review date was not routinely mentioned. Biomarkers were relatively underutilized for decision making. The limitations of our study were that it was not multicentric and sample size was relatively small.

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Nil.

Conflicts of interest

There was no conflicts of interest.

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