# Prevalence studies for Qualitative Assessment of Antimicrobial use

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**Abstract:**

**Background:** Knowledge regarding the antimicrobial prescribing pattern and rationale in the use of antibiotics helps to develop interventions for better antimicrobial utilization.This is an important tool to combat the prevailing Antimicrobial resistance among the various infections in healthcare practices.Point prevalence study (PPS) is a well-established methodology to measure the prevalence of antimicrobial use in hospitals at a given point in time. Data obtained from these studies can be fed back to clinicians thereby discussions happen to improve stewardship practices. Results of PPS can be used to evaluate quality indicators, to follow-up antimicrobial stewardship programs, and to support decision-making.

**Aim:** The aim of the study was to know the prevalence of antimicrobial use among inpatients on a given day (Point prevalence) and to have an insight about the antimicrobial prescribing pattern (choice of antimicrobial agent,indication, and route)in the institute.

**Methods:**Two-point prevalence survey (Nine months apart) of antimicrobial use was performed on January 20th 2021 and October 27th2021. All admitted patients at 8 a.m. on the day of the PPS were included. First PPS was by reviewing patient records one after the other manually, second PPS was online real-time capture of patient information using Forms app by a Survey team. The survey team reviewed patients' case sheet and noted antibiotics prescriptions on the date of the survey. Other important details such as admitting ward, age, gender, total number of patients on admissions, administered antibiotics and its route, their dosages, dosing intervals, patients' clinical diagnosis and indications for antibiotic use were collected.

**Results:** The prevalence of antimicrobial use in admitted patients with at least one antimicrobial was 52.3% and44.05 % in the first and second PPS respectively. The prevalence of more than one antimicrobial use was 46% in first PPS and 27.8% in second PPS.  Appropriate specimens for culture and susceptibility testing prior to start of antimicrobials was 36.36% in the first and 95.23% in the second PPS. The most preferred antibiotics in all the department specialities were Piperacillin –tazobactam and Meropenem and nearly half of the patients who were on antibiotics were mostly on Piperacillin-tazobactam which was administered via parenteral route.

**Discussion and Conclusions**: Antimicrobial use prevalence remained stable in comparison of both PPS but there was more insight in the choice of antimicrobials which was evident in the reduction of multiple antibiotic use by

second Point Prevalence. Also, evidentbetter understanding in the need for sending appropriate specimens prior to start of antimicrobials during the second PPS. These latter improvements are evident due to effective ongoing antimicrobial stewardship program in the hospital. The hospital is further stimulated to set local targets to optimize antimicrobial prescribing and use as a continuum.Thus, such PPS periodically will help in a trend analysis and target interventions objectively.

## Full Paper
## Introduction:

The most widely prescribed drugs in hospitals are the Antimicrobial agents[1].Due to inappropriate and unrestricted use of antimicrobial agents, there is rising antimicrobial resistance worldwide. During hospital stay nearly one-third of patients receive antibiotics and nearly 50% of the antibiotics are deemed unnecesary[2].Antimicrobial resistance is of a huge threat as it is associated with increased patient duration of hospitalization, expenditure, mortality, and morbidity.

Antimicrobial stewardship helps to curb emergence of resistance along with lowering mortality and morbidity. It is very essential to understand the antimicrobial pattern in an institution to ascertain appropriate stewardship interventions which will have the greatest impact on the likelihood of antimicrobial utilization in an institute[1]. Antibiotic usage surveillance, as part of the antimicrobial stewardship programme's core elements were recommended by Centers for Disease Control and Prevention (CDC)[3.] Evaluation of antimicrobial usage pattern can help in targeted stewardship interventions[4, 5, 6.].

There are several instances in the misuse of antibiotics such as over prescription of broad-spectrum antibiotics; irrational treatment of likely viral respiratory infections[7].Insufficient perception by prescribers on the use of inappropriate and irrational antibiotics remains a key challenge on the rates of resistance. Inappropriate usage of antibiotics is a major drive for antibiotic resistance[5]. In 2010 India was reported to be the world's largest consumer of antibiotics for human health at the rate of 12.9 x 109 units (10.7 units per person) [8]Hence Antibiotic stewardship remains the fundamental component to measure the quantity and quality of antimicrobial use. Quantitative measures of antimicrobial use in a hospital include defined daily dose (DDD).One drawback of quantitative measure is that if it can really measure the qualitative prescribing pattern of antimicrobials.Therefore Point prevalence surveys provides data to target antimicrobial use surveillance and interventions which are a resource-effective alternative to prospective surveillance. Point prevalence survey on antimicrobial use provides a clear picture of antibiotic use at a given point of time and can be repeated at regular intervals to monitor trends. Data obtained from these surveys can be fed back to clinicians and further discussions about improvisation in stewardship practices can be done.

The aim of the present study was to determine the prevalence of use of antimicrobials among inpatients on a given day (Point prevalence) on a preplanned two different PPS. To outline antimicrobial prescribing pattern (choice of antimicrobial agent, indication, and route).

## MATERIALS AND METHODS:

Point prevalence survey was conducted in a 450 bedded Quaternary care hospital including all wards and ICUs. Study was approved by the Institutional Ethical Committee. Data collection was carried out on a specific day pre-assigned on all inpatients in hospital . These patients must be on admission at 8:00 am on the day of survey. Thus, those patients in whom antibiotic was initiated after 8am on the day of the survey were excluded. Also, excluded if antibiotic therapy was stopped before 8am on the day of survey. Other obvious exclusions are Outpatient parenteral antibiotic therapy (OPAT), discharged patients waiting for transportation, patients in emergency room,outpatient dialysis, daycare patient, outpatient clinic.

The First PPS Survey audit was done retrospectively manually in person reviewing the medical case sheet records of the inpatients on January 20 [th,] 2021.The second PPS survey was donerealtime through online Forms App, on  October 27 [th] 2021 by a Survey team.A survey team was formed who gathered all information at specific units after a brief training on  data collection and outline of the

study. the objectives of the study, purpose of collection of such data, evaluation of patient data, their individual roles and responsibilities. The source of completing patient data collection tool was through review of patient medical records for both first and second PPS.

Data collection tool included  age,gender,date and time of admission, department,number of cultures sent before initiation of antibiotics, name of antibiotics ,date &time of administration of antibiotics ,dose,route, clinical diagnosis,duration,frequency, new antibiotics added ,whether antibiotics were continued,changed,escalated,de-escalated after the culture results ,name of oral & parenteral antibiotics too on the date of survey was obtained real time.These informationwasbased fromWHO methodology[13] for point prevalence survey on antibiotic use in hospital.

Based on the definitions given by WHO, indications for antimicrobial utilization as Hospital, Community acquired infections, surgical antimicrobial prophylaxis were noted. Based on clinical grounds and WHO PPS guidelines survey team has taken decision if patient had infection (Hospital or community acquired). Diagnosis of hospital acquired infections were made as infections occurring after 48 hrs of admission into hospital. Use of Antimicrobials for infections were identified as empiric or definitive.

Empiric therapy is defined as when antimicrobial started for presumed infection without pathogen or source of infection being identified. Definitive therapy is defined as when patient started on antimicrobial treatment after identifying source of infection/isolation of pathogenic micro-organism. Prophylaxis is defined as use of antimicrobial agents to prevent infection when infection was not already established.

**RESULTS:**

| OBSERVATIONS | FIRST PPS SURVEY (Jan 20 th ,2021) | SECOND PPS SURVEY (Oct 27 th ,2021) |
|---|---|---|
| Total inpatients | 63 | 143 |
| Prevalence rate of antibiotic use in different wards and ICU | 52.3% (33patients). Ward -28(51.8%) Total ward patients -54 Total ICU-9 ICU Antibiotics on use - 5-(55.55%) | 44.05% (63 patients). Ward-40(38.46%) Total ward patients - 104 Total ICU-39 ICU Antibiotics on use 23-(58.97%) |
| ICU patients on antibiotics | 5/9=55.55% | 23/39=58.97% |
| More than one antibiotic was administered for patients | 46% | 27.8% |
| Mean age of patients on antibiotic order was | 40 | 40 |
| Prevalence of commonly used antibiotics used in our Hospital | Beta-lactams+beta lactamase inhibitors – 21.21%.(7/33) Carbapenems – 18.18%(6/33) Third generation cephalosporin's – 15.15%(5/33) Azoles – 9.09%(3/33) Others (Fluroquinolones/Antiviral drugs/Rifaximin) – 6.06%(2/33) | Beta-lactams+beta lactamase inhibitors – 44.44%(28/63) Carbapenems – 22.22%(14/63) Third generation cephalosporin's – 15.87%(10/63) First generation cephalosporins-11.11%(7/63) Quinolones-3.17%(2/63) Azoles –6.34%(4/63) Fluoroquinolones – 3.17%(2/63) Rifaximin – |

| | | 14.28%(9/63) |
|---|---|---|
| Percentage of cultures done for patients on antibiotics | 12/33=36.36% | 60/63=95.23% |
| Antibiotics commonly used | Inj.Piperacillin tazobactam 4.5 g, (7/33)(21.21%)<br><br>Inj.Meropenem 1gm(6/33)(18.18%) | Inj.Piperacillintazobactam 4.5 g ((24/63)(38.09%),<br><br>Inj.Meropenem 1gm (14/63)(22.22%) |

The most commonly used antibiotics in all the specialities were Piperacillin –tazobactam and Meropenem and nearly half of the patients who were on antibiotics were mostly on Piperacillin-tazobactam which was administered via parenteral route.

**DISCUSSION:**
These surveys regarding point prevalence helps to understand common prescribing pattern of antibiotics, alsoit's a simple tool to monitor effectiveness of antibiotic stewardship protocols in an institute. This point prevalence methodology has been developed with the aim of collecting baselineinformation on the use of antibiotics in hospitals and is expected to be repeated once every few years. It is however, possible to adapt and tailor the methodology for specific purposes, such as follow-up surveys to assess specific interventions or to support the objectives of improving quality of care or aspects of Infection Prevention and Control (IPC).

The present study pointed its antimicrobial utilization is almost same when compared with two national studies 51.6% &61.5 % [9,10]. Major proportion nearly73.65% usage were for therapeutic indications in second PPS survey. The most common antibiotic prescribed in the study for therapeutic purposes were Piperacillin tazobactam and meropenem. This rate of utilization, purpose and choice of antibiotic is justified considering the nature of referrals and prior hospitalization history substantiations.

Osowicki Joshua et al and Gharbi M et al studies report beta lactam plus beta lactamase enzyme inhibitor combinations as the most prescribed similar to the present study antimicrobialutilization [11,12].

At end of First PPS survey the Culture of cultures (Initiation of antibiotics prior to culture) was not fully compliant. Also, thereferral cases in Quaternary Care where patient were already on antibiotics. Subsequently during second survey, more options were available for easy documentation in High end antimicrobial form, checklists to ensure cultures were taken prior to initiation of antibiotics.

At the end of second survey, we could see a drastic improvement in the high-end antimicrobial form adherence rate due to persistent follow up by antimicrobial stewardship team. Rationale/clinical diagnosis for sending culture tremendously improved. Culture of culture

compliance improved. Justification in thehigh-end antimicrobial forms with respect to empiric therapeutic choices werementioned.This data wasdiscussed with the respective clinicians and presented in the antibiotic stewardshipmeeting for everyoneand correction points were discussed.These discussions gave them an insight that their prescriptions were audited and needed judicious use reinforcing appropriate use.

Interventions that strengthened the practise evident in the second PPS include High end antibiotic form adherence rate improved dramatically upon persistent follow-up by team. Surgical Antibiotic Prophylaxis (SAP) Compliance monitored judiciously too.Antibiogram Stratifications steps with more clarity on site specific empiric choice guidance, although Periodic Whole Hospital Antibiogram is available and discussed every 6 months in the antimicrobialstewardship meetings with clinicians.Surgical Antibiotic Prophylaxis (SAP) policy and the institute Treatment guidelines available in hospital information system for easy access.

## CONCLUSION:
This kind of study needs to be done at predefined intervals to monitor trends in antimicrobial prescribing pattern; this can slowly become a key performance indicator and the results of this survey provide a good initial estimation of institutional antimicrobial use. These audits when done at regular intervalshelps to monitor trends and antimicrobial utilization in the institute.If any deviation found in antimicrobial prescribing patterns can be discussed with clinicians to curb down the unnecessary use of antimicrobials. This would result in a reduction in hospital antimicrobial consumption, thereby reducing mortality and morbidity because of drug resistance in the long run.

## STUDY LIMITATIONS:
This study is done as a snap shot at a particular day and time which is reasonably affected by variation in day-to-day practice, trends, and seasonality of prevailing community infections for antimicrobial use. In this study, the investigators could record all the findings from medical case records of the patients on that date and time of the survey thus significant culture findings laterwere not taken for analysis.

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None

**Ethical committee approval code – Ref. No. ECR/1276/lnst/TN/2019/075.**

## DISCLOSURES:
The authors report no real or perceived vested interests that relate to this article that could be construed as a conflict of interest.

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