A Point Prevalence Study of the Use of Antibiotics in Six Tertiary Care Hospitals in the Kathmandu Valley, Nepal

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ABSTRACT

Background

Point prevalence survey (PPS) on antibiotic use developed by the WHO has already been used in many hospitals globally.

Objective

To obtain information on antibiotic prescribtion using point prevalence survey methodology in six private hospitals in the Kathmandu valley.

Method

This descriptive cross-sectional study was completed during 20th July to 28th July 2021 using point prevalence survey methodology. The study was conducted among inpatients admitted at or before 8:00 AM on the day of survey in various wards. Data was presented as frequencies and percentages.

Result

Maximum number of patients were above 60 years [34 (18.7%)]. Number of male and female participants were equal [91 (50%)]. Only one antibiotic was used in 81 patients (44.5%) followed by two antibiotics in 71 (39%) patients. Duration of prophylactic antibiotic use was one day in 66 (63.7%) patients. Blood, urine, sputum, and wound swabs were the common samples for culture. Cultures were positive for 17 (24.7%) samples. The common organisms isolated were E. Coli, Pseudomonas aeruginosa and Klebsiella pneumoniae. Ceftriaxone was the most used antibiotic. Drug and therapeutics, infection control committee and pharmacovigilance activities were present in 3/6 (50%) study sites. Antimicrobial stewardship was present in 3/6 (50%) and microbiological services was present in all hospitals. Antibiotic formulary and antibiotic guideline were present in 4/6 sites and facilities to audit or review surgical antibiotic prophylaxis choice in 2/6 (33.3%) sites, facility to monitor antibiotic use in 4/6 (66.6%) and cumulative antibiotic susceptibility reports in 2/6 (33.3%) study sites.

Conclusion

Ceftriaxone was the most used antibiotic. E. Coli, Pseudomonas aeruginosa and Klebsiella pneumonia were the commonly isolated organisms. Not all parameters for infrastructure, policy and practice and monitoring and feedback were present at the study sites.

KEY WORDS

Antibiotics, Point prevalence survey, Private hospitals, Tertiary care centers

INTRODUCTION

The ability of microorganisms to become resistant to antimicrobial therapies has long been recognized and is becoming increasingly apparent.[1] Resistance to antimicrobials is a big threat towards public health.[1-3] Continuous surveillance of antibiotics use may not always be possible and a point prevalence survey (PPS) methodology is a viable alternative. The WHO methodology for PPS is being used by many hospitals worldwide.[4] The methodology was designed to collect basic information on hospitalized patients from medical records and is important for managing and treating infectious diseases.[4]

Antimicrobial resistance (AMR) and healthcare infections (HAI) are problems in healthcare.[5] The WHO point prevalence study methodology is a well-known method to assess the use of antibiotics and the various types of healthcare infections in hospitals. In addition to this, it also measures the quality indicators for antimicrobial stewardship programs along with infection control programs and helps decision making process.[5]

There have been a few studies done in Nepal using this methodology. A study from Nepal used the clinical criteria of the European Center for Disease Prevention and Control to diagnose hospital acquired infections.[6] The present study was done with an objective of collecting information on the prescribing of antibiotics using PPS methodology in six private hospitals in Nepal.[4]

METHODS

The study design was a hospital-based point prevalence observational study. The study sites were six different private tertiary care hospitals located in the Kathmandu valley. The selection of these hospitals was done based on the convenience of the researchers and the location. The valley has the highest density of population and maximum number of people reside here. The number of private hospitals are more compared to the government hospitals in Nepal. Private healthcare facilities, (1386) is relatively higher among the healthcare facilities (2320) in province 3.[7] These six hospitals were private hospitals with fifty to hundred beds providing all inpatient services.

Convenience sampling method was used. The sample selection was as per the PPS methodology, where each patient should be selected from the hospitals having bed numbers less than 500.[4] The investigator had prepared a list of the patients admitted in the wards alphabetically. The patients were selected based on the eligibility criteria and. irrespective of whether they were receiving antibiotic treatment. The list was arranged alphabetically according to patients' surnames and their bed numbers were not considered. The data collector started from a random point and selected all the patients till the end of the list. The annual patient admissions ranged from 1000 to 3750 in all the hospitals. The number of ICU beds were between 6-11.

Data collection was completed within eight working days at each study site. Data collection was done from 20th July to 28th July 2021. The approval was obtained from all the sites before the conduct of the study. Ethical approval was obtained from the Nepal Health Research Council (NHRC) dated 23rd May 2021 with a reference number 3172.

Inclusion criteria: All inpatients with ongoing antimicrobial treatment and admitted before 8 AM on the day of the study were included as per the WHO PPS survey methodology criteria. Similarly, inpatients administered at least one antibiotic were included. Patients of both gender and all age groups admitted in medical, and surgical wards were included. Patients given antibiotics by different routes of administration like oral, parenteral, rectal or through inhalation were also included. The wards studied were paediatric ward, surgical ward, paediatric intensive care unit, neonatal medical ward, neonatal intensive care unit, adult medical ward andadult intensive care units. High risk wards like transplantation were also included.

Exclusion criteria: The patients receiving antibiotics therapy after 8:00AM on the day of survey or patients whose antibiotics were stopped before 8:00AM on the day of survey were excluded.

Day surgery wards, psychiatry wards, and renal dialysis units and covid wards were not included. Outpatient clinics, patients discharged, relatives of the children, patients receiving outpatient parenteral antibiotic therapy were also excluded. Topical antibiotics, ophthalmologic antibiotics, antiviral agents, anti-fungal and drugs used for the treatment of tuberculosis were also excluded.

Data Collection tool was a standard WHO tool for PPS. The investigators visited the hospital wards in a single day and completed the data collection tool by accessing patient medical file, lab reports, cardex containing information on medicines prescribed for the patients and prescription papers. As it was a point prevalence study, reports and medicine records of the study day was only considered.

The data collection tool had two parts. First part was for hospital related information on infrastructure, policy, and practice, monitoring and feedback and second part contained sections for obtaining information on hospital details, ward details, patient details, antibiotic details, and the microbiological data details. The second part form had various sections. First section was about the hospital data including the hospital's name, number of beds, number of ICU beds, annual admissions, ownership (public or private). Information on ward name, number of beds in the ward, and total patients admitted in the ward at the time of the study were also noted.

Third section focused on the patient's details. Patient's demographics, underlying infectious diseases, comorbidities, details of surgery were included. Fourth

section included information regarding the microbiological data referring to culture and sensitivity results from clinical samples. Different samples like blood, urine, or any other relevant sample were collected. The fifth section focused on information about antibiotics taken by the patients. Patient's age, gender, name of the ward, diagnosis, use of antibiotics were recorded.

The data was collected by a team of medical doctors at all the study sites. The microbiological results of the patient's samples on the day of survey were also collected. The culture tests with the organism/s isolated were also recorded. Details about the antibiotics, generic name, brand name, dosage form, strength, unit dose or combination form, frequency, and routes of administration and therapeutic or prophylactic use were recorded for every patient on antibiotics on the day of survey. Starting time of the antibiotics was also noted.

The collected data forms were checked for accuracy and completeness. Descriptive data analysis was done and the data presented as frequencies and percentages.

RESULTS

Maximum number of patients were of age group above 60 years 34 (18.7%). There were equal number of male and female participants, 91 (50%) as shown in table 1.

Ward wise distribution of the patients showed maximum number of 38 patients from the surgery ward (20.8%) followed by Gynecology and Obstetrics and Plastic Surgery wards each with 25 (13.5%) patients. Medical wards had 18 (9.8%) patients, and Intensive care unit (ICU) 13 (7.1%) patients as shown in figure 1.

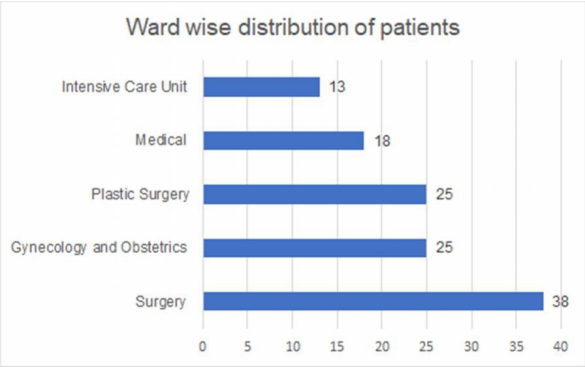

Figure 1. **Ward wise distribution of patients**

The common diagnoses were as follows

Flame burns 8 (4.37%), Pneumonia 7 (3.8%), cholelithiasis 6 (3.27%), high voltage electric burn 5 (2.7%), neonatal sepsis and urinary tract infection 4 (2.2%). Common comorbidities were diabetes 15 (8.2%), hypertension 19 (10.4%), and chronic kidney disease 2 (1.1%).

Only one antibiotic was used in 81 patients (44.5%) followed by two antibiotics in 71 (39%) patients. Catheter was used

Table 1. **Background characteristics of the participants**

Age	Percentage
1-10 years	11 (6)
11-20 years	17 (9.3)
21-30 years	40 (22)
31-40 years	39 (21.4)
41-50 years	21 (11.5)
51-60 years	20 (11.0)
> 61 years	34 (18.7)
Gender	
Male	91 (50)
Female	91 (50)
Underlying disease	
Yes	3 (1.7)
No	177 (97.3)
Use of catheter	
Yes	175 (96.2)
No	7 (3.8)
Type of catheter	
Central vascular catheter	12 (6.9)
Urinary catheter	51 (21.9)
Peripheral vascular catheter	95 (54.3)
Peripheral vascular catheter and Urinary catheter	17 (9.7)
Antibiotics used in surgical prophylaxis	
Yes	77 (67)
No	38 (33)
Number of antibiotics used in prophylaxis	
None	106 (57.9)
1	45 (24.9)
2	31 (16.9)
3	1 (0.5)
Duration of use of antibiotics for prophylaxis	
30 mins to 1 hour	17 (19.3)
One day	42 (47.7)
Two days	12 (13.6)
Three days	10 (11.4)
Four days	7 (8)
Culture	
Yes	67 (37.4)
No	112 (62.6)
Specimen	
Blood	20 (29)
Urine	20 (29)
Sputum	2 (2.9)
Wound	21 (30.4)
Other	6 (8.7)
Culture result	
Positive	17 (24.7)
Negative	35 (50.7)
Not available	17 (24.7)

Table 2. Characteristics of antibiotic prescription in participating hospitals (n=183)

Number of antibiotics prescribed	
None	21 (11.6)
One	81 (44.5)
Two	71 (39)
Three	9 (4.9)
Four	1 (0.5)
Types of antibiotics prescribed	
Ceftriaxone	60 (32.7)
Levofloxacin	28 (15.3)
Piperacillin and Tazobactam	18 (9.8)
Metronidazole	15 (8.1)
Meropenem	12 (6.5)
Azithromycin	10 (5.4)
Amikacin	10 (5.4)
Cefuroxime	7 (3.8)
Ceftriaxone and Sulbactam	7 (3.8)
Ceftriaxone and Tazobactam	6 (3.2)
Cefotaxime	4 (2.1)
Gentamicin	4 (2.1)
Flucloxacillin	3 (1.6)
Linezolid	3 (1.6)
Nitrofurantoin	3 (1.6)
Vancomycin	2 (1.0)
Cotrimoxazole	1 (1.0)
Clindamycin	1 (1.0)

in 175 (96.2%) patients and the type of catheter used was peripheral vascular catheter in 95 (54.3%) patients followed by urinary catheter in 51 (21.9%) patients. Use of antibiotics for prophylaxis was seen in 77 (67%) patients. Duration of prophylactic antibiotic use was one day for 66 (63.7%) patients. Culture was done for 67 (37.4%) samples and the types of samples tested were blood. urine, sputum, and wound swabs. The culture result was positive for 17 (24.7%) samples as shown in table 1.

Commonly isolated organisms were E. Coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Citrobacter koseri, Staphylococcus aureus and Acinetobacter baumannii. Surgeries were done in 83 (45.6%) patients. Common types of surgeries were laparoscopic appendectomy, emergency caesarian section, cholecystectomy, and transurethral resection of prostate (TURP).

The most used individual antibiotic was ceftriaxone, 32.7% followed by levofloxacin, 15.3% (Table 2). Parenteral route of administration was most common. The most used antibiotic group was cephalosporins 71 (38.6%) followed by fluroquinolones, 28 (15.3%) and combination of penicillin with beta lactamase inhibitors, 18 (9.8%).

Half of the study sites had a Drugs and Therapeutics Committee. Four hospitals had functioning Infection Prevention and Control Committees. Half of the study sites were having functioning committee on pharmacovigilance. All hospitals had microbiological laboratory/division within the hospital. The facilities also had access to microbiological services outside the hospital.

Antimicrobial stewardship program was present only in three out of six hospitals. This was measured by questions under the heading of infrastructure. The areas assessed were existence of a program to ensure proper antibiotic use, availability of the antimicrobial stewardship team, and identification of a physician to lead such activities in the study sites.

The organizational structure responsible for antimicrobial stewardship was present in all hospitals. The availability of antimicrobial stewardship team was seen only in 4 hospitals. Four hospitals had a pharmacist responsible for ensuring appropriate antibiotic use. The outpatient parenteral antibiotic therapy (OPAT) unit was present in all the study sites.

Similarly, antibiotic formulary and the formulary based on the Essential Drug List was present in half the study sites. The antibiotic guideline and a local antibiotic guideline were present in four out of six hospitals. The local antibiotic guidelines were present in only two hospitals. There was a routine practice for approval of the specified antibiotics by a physician and pharmacist in half of the hospitals.

The system for communicating the results of audits and reviews for antibiotics were present in all hospitals. All the healthcare facilities in this study monitored antibiotic use reported by hospital activity denominator as shown in table 5.

Only two hospitals had published their annual report focused on antimicrobial stewardship and cumulative antibiotic susceptibility report during the past year. Majority of the hospitals (4/6) were having a facility for participating in a national antibiotic resistance surveillance program.

There was no participation from any of the study sites in a national antibiotic use surveillance program. The cumulative number of blood cultures done in all the sites ranged from 576 to 3546. None of the facilities had the list of antibiotics out of stock.

DISCUSSION

There are many factors contributing towards antimicrobial resistance, like availability of antibiotics over the counter, poor patient compliance, poor hygiene, overuse by healthcare professionals, irrational prescribing, and lack of proper infection control practices.[4] The overuse of

Table 3. Infrastructure of the hospital

Infrastructure	H1	H2	H3	H4	H5	H6	Overall Percentage
Does your facility have a functioning Drugs and Therapeutics Committee in the hospital?	Yes	Yes	Yes	No	No	No	3/6=50%
Does your facility have a functioning Infection Prevention & Control Committee in the hospital?	Yes	Yes	Yes	Yes	No	No	4/6=66.7%
Does your facility have a functioning committee on pharmacovigilance in the hospital?	Yes	Yes	Yes	No	No	No	3/6=50%
Does your facility have microbiological laboratory/division within the hospital?	Yes	Yes	Yes	Yes	Yes	Yes	6/6=100%
Does your facility have access to microbiological services outside the hospital?	Yes	Yes	Yes	Yes	Yes	Yes	6/6=100%
Does your facility have a formal antimicrobial stewardship program accountable for ensuring appropriate antibiotic use?	Yes	Yes	Yes	No	No	No	3/6=50%
Does your facility have a formal organizational structure responsible for antimicrobial stewardship? (e.g., a multidisciplinary committee focused on appropriate antibiotic use, pharmacy committee, patient safety committee, or other relevant structure)	Yes	Yes	Yes	Yes	Yes	No	5/6=83.3%
Is an antimicrobial stewardship team available at your facility? (e.g., greater than one staff member supporting clinical decisions and implementing a comprehensive programme [= set of interventions] to ensure appropriate antibiotic use)	Yes	Yes	Yes	Yes	No	No	4/6=66.7%
Is there a physician identified as a leader for antimicrobial stewardship activities at your facility?	Yes	Yes	No	No	No	No	2/6=33.3%
Is there a pharmacist responsible for ensuring appropriate antibiotic use at your facility?	Yes	Yes	Yes	Yes	Yes	No	5/6=83.3%
Does your facility provide any salary support for dedicated time for antimicrobial stewardship activities? (e.g., percentage of full-time equivalent staff for ensuring appropriate antibiotic use)	Yes	No	No	No	No	No	1/6=16.7%
Does your facility have the information technology (IT) capability to support the needs of the antimicrobial stewardship activities?	No	No	No	No	No	No	6/6=100%
Does your facility have an outpatient parenteral antibiotic therapy (OPAT) unit?	Yes	Yes	Yes	Yes	Yes	Yes	6/6=100%

Table 4. Policy and practice of the hospital

Policy and practice	H1	H2	H3	H4	H5	H6	Overall Percentage
Does your facility have an antibiotic formulary (including unrestricted and restricted antibiotics) updated continuously?	Yes	Yes	Yes	No	No	No	3/6=50%
Is your antibiotic formulary based on the Essential Drug List?	Yes	Yes	Yes	Yes	No	No	4/6=66.7%
Does your facility have an antibiotic guideline?	Yes	Yes	Yes	Yes	No	No	4/6=66.7%
Does your facility have a local antibiotic guideline?	Yes	Yes	Yes	Yes	No	No	4/6=66.7%
Are your local antibiotic guidelines based on local antibiotic susceptibility to assist with antibiotic selection for common clinical conditions?	Yes	Yes	No	No	No	No	2/6=33.3%
Does your facility have a written policy that requires prescribers to document an indication in the medical record or during order entry for all antibiotic prescriptions?	Yes	Yes	No	No	No	No	2/6=33.3%
Is it routine practice for specified antibiotic agents to be approved by a physician or pharmacist in your facility? (e.g., preauthorization?)	Yes	Yes	Yes	Yes	Yes	No	5/6=83.3%
Is there a formal procedure for a physician, pharmacist or other staff member to review the appropriateness of an antibiotic at or after 48 hours from the initial order (post-prescription review)?	Yes	Yes	Yes	No	No	No	3/6=50%

antibiotics is present worldwide and has caused a big threat as half of the patients are receiving unnecessarily antibiotics.[8] There is a lack of information about the actual consumption of antibiotics and its use in Nepal. This mandates researchers to obtain information about the use of antibiotics in different healthcare settings in the country for promoting rational use of antibiotics.

The possibility of continuous data collection on the prescribing pattern of antibiotics use is very rare. High workload and the lack of resources might be the possible reasons for the same. PPS methodology has been used in many hospitals globally. United States and the European Union have also developed and conducted their regional surveys using PPS methodology.[9,10]

A similar methodology has been developed by WHO targeted toward the needs of low- and middle-income countries. This methodology enables the comparison of the use of antibiotics at various healthcare levels.

WHO has a set for the core variables for analyzing the data and its interpretation for implementing the follow-up activities.[4] A study was done in Nepal using clinical criteria of the European Center for Disease Prevention and Control for diagnosing the hospital acquired infections. The findings showed that majority of patients (87.5%) were on antibiotics and more than half the patients (53.5%) were on two or more antibiotics. The common healthcare infections identified were pneumonia, urinary tract infection and surgical site infections.[6]

Table 5. Monitoring and feedback of the hospital

Monitoring and feedback	H1	H2	H3	H4	H5	H6	Overall Percentage
Does your facility monitor whether the indication is captured in the medical record for all antibiotic prescriptions?	Yes	Yes	No	No	No	No	2/6=33.3%
Does your facility audit or review surgical antibiotic prophylaxis choice and duration?	Yes	Yes	No	No	No	No	2/6=33.3%
Are results of antibiotic audits or reviews communicated directly with prescribers?	Yes	No	No	No	No	No	1/6=16.7%
Does your facility monitor antibiotic use?	Yes	Yes	Yes	Yes	No	No	4/6=66.7%
Does your facility monitor antibiotic use by grams (Defined Daily Dose [DDD]) or counts (Days of Therapy [DOT]) of antibiotic(s) by patient per day?	Yes	Yes	Yes	Yes	No	No	4/6=66.7%
Is monitored antibiotic use reported by hospital activity denominator (by number of admissions/discharges or by number of bed-days/patient-days)?	Yes	Yes	Yes	Yes	Yes	Yes	6/6=100%
Has an annual report focused on antimicrobial stewardship (summary antibiotic use and/or practices improvement initiatives) been produced for your facility in the past year?	Yes	Yes	No	No	No	No	2/6=33.3%
Has your facility produced a cumulative antibiotic susceptibility report in the past year?	Yes	Yes	No	No	No	No	2/6=33.3%
Is your facility participating in a national antibiotic resistance surveillance program?	Yes	Yes	Yes	No	No	No	3/6=50%
Is your facility participating in a national antibiotic use surveillance program?	No	No	No	No	No	No	6/6=100%
How many blood cultures have been made in the past year? Number	1000	576	3650	1545	1000	3546	
List of antibiotics out of stock at the facility during the survey period.	NA	NA	NA	NA	NA	NA	

*NA=Not available

In a study in central India, the most prescribed class of antibiotics was combination of combination of penicillin with a β-lactamase inhibitor. Cephalosporins and fluoroquinolones were second and third mostly prescribed antibiotics.[9] Third generation cephalosporins were seen as the commonest antibiotic used in a study from Nepal.[6]

Our study showed the most used individual antibiotic as ceftriaxone, 32.7% followed by levofloxacin, 15.3% and parenteral route of administration was most common. These findings are like another study done in Latin America, eastern and southern Europe and west and central Asia, in which more than 80% patients were on antibiotics. This study also showed the use of broad spectrum of antibiotics in these countries.[11]

Our findings showed that 24.9% of patients were prescribed at least one antibiotic. This finding was lesser than another study, where patients prescribed with at least one antibiotic was 27.1%.[12] The findings of this study shows that the duration of use of antibiotic in prophylaxis ranged from half an hour to four days. Studies have suggested that the appropriate time to use antibiotic as a prophylactic is 1-2 hours before the surgical procedure to ensure the presence of the good amount of drug in serum and tissues.[12-15] The duration of use of antibiotics for prophylaxis in our study, which was less than another study done in Belgium, where the duration was 1 to 5 days.[12] This advocates that antibiotic prophylaxis use was not being done as per the guidelines.

The culture results were positive in 24.7% of samples. Commonly seen organisms were E. Coli, Pseudomonas aerigenosa and Klebsiella pnemumoniae, Citrobacter koseri, Staphylococcus aureus and Acinetobacter baumannii. This finding was similar from a study done in Belgian hospitals where the isolated organisms were Escherichia coli, Staphylococcus aureus and Pseudomonas aeruginosa.[12]

Low- and middle-income countries can face challenges in identifying the pathogenic organisms. The unavailability of cost effective biological and clinical markers adds to the identification problems.[16] Recommendations for an effective antimicrobial stewardship programs include the optimal use of antibiotics, and ensuring the correct dose for correct duration which can limit the adverse effects and AMR.[17]

The findings also suggested that the use of antibiotics is maximal in surgery wards and minimal in ICU and Medical wards which was very similar to a study from Vietnam.[5] The reason behind the maximum use of antibiotics maybe the pre and post-operative use of antibiotics in surgical patients.

Drug and therapeutics and infection control committees, and pharmacovigilance activities were present in 3/6 (50%) study sites. Antimicrobial stewardship was present in 3/6 (50%) and microbiological services was present in all hospitals. A functioning drug and therapeutics committee is a necessity for ensuring the safe and rational use of medicine in any healthcare system. This can be of great help for adverse drug reaction reporting as these reactions may be a possible danger for the Nepalese people for several reasons like use of natural products, alternative therapies, and the immature systems for detecting and reporting of adverse drug reactions.[18]

For the policy and practice part, formulary for antibiotics was present in half the hospitals. The antibiotics guidelines were present in 4/6 hospitals. The antibiotic susceptibility cumulative report for the last year was present only in 2/6 hospitals.

Antimicrobial policies and guidelines can be helpful for the containment of the problem of AMR.[19,20] "National action plan for the containment of antimicrobial resistance was framed in 2016 in Nepal. Aa national antibiotic treatment guideline was developed in 2014 but it has not been widely implemented.[20,21] Creating a hospital formulary with the details of antibiotics suitable for different conditions is always useful.[19]

A study from Nepal recommends strict implementation of the antimicrobial guidelines and the national plan.[20] Hospital-based antimicrobial stewardship programs are effective for ensuring the proper use of antibiotics.[19,22] Hospital-wide audits of the use of antibiotics can be an important measure for strict vigilance regarding the use of antibiotics.[19]

This is one of the few studies using WHO PPS methodology in Nepal and can be compared with studies using a similar methodology done elsewhere.

There are some limitations for the study. The information about the inadequate dosing, the interval between the dosages and the resistance profile of the microorganisms were not addressed. And, this study was done only in six private hospitals of Kathmandu valley and does not represent the data from different hospitals in Nepal.

CONCLUSION

WHO PPS methodology was used in this study. Not all the parameters for infrastructure, policy and practice and monitoring and feedback were present at the study sites. It is recommended that these types of studies should be done at periodic intervals for monitoring the use of antibiotics and the effectiveness of antimicrobial stewardship and infection control programs.

Further research is needed to be done periodically to obtain data on the use of antibiotics in all levels of healthcare systems of Nepal.

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