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### Research Article

## Antibiotics Utilization Pattern in Pediatric Ward: The Case from Tertiary Teaching Hospital, South West Ethiopia.

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### Abstract

**Background:** Antibiotics are powerful and effective drugs in the fight against infectious diseases caused by bacteria. They are among the most frequently prescribed drugs for pediatric patients. They are mostly prescribed as empirical therapy, rather than prophylactic or definitive therapy. Because of an overall rise in health care costs, lack of uniformity in drug prescribing and the emergence of antibiotic resistance, monitoring and control of antibiotic use are of growing concern. **Objective:** The objective of this study was to assess antibiotics utilization patterns in pediatric ward of Jimma University Specialized Hospital. **Methods:** Facility based a retrospective cross sectional study was conducted to assess the antibiotics utilization patterns in pediatric ward of Jimma University Specialized Hospital from January 27- February 07, 2014. Data was collected by using checklist which contains patient demography as well as pattern of antibiotics utilization. Systematic random sampling technique was used. **Result:** In this study, the major medical conditions for which antibiotics were prescribed include severe pneumonia (31.23%) and late onset neonatal sepsis with meningitis (20.60%). The most commonly used antibiotics were gentamicin and crystalline penicillin G which accounted for 21.69% and 18.30% respectively, while the most commonly prescribed multiple antibiotic was Ampicillin plus Gentamicin (21.9%) followed by Ceftriaxone & Gentamicin (18.1%). **Conclusion:** In general, there is high use of parenteral antibiotics and good generic prescription as well as antibiotics prescriptions from national EDL in the study area. Gentamicin and crystalline penicillin G were identified to be the most commonly prescribed medications in this pediatric ward.

**Keywords:** Antibiotics, Antibiotic utilization, Pediatrics, Jimma University Specialized Hospital

### Introduction

Antibiotics are substances or compounds which have the capacity to inhibit the growth of or to kill microorganism. The inappropriate and indiscriminate use of antimicrobial agents can potentially cause a number of problems. Resistances to antibiotics have been identified as a common problem in world at large [1, 2]. Despite antibiotics have saved millions of lives since their first appearance about fifty years ago, more and more people are dying from infectious disease that were curable but for which we no

longer have the right treatment. This probably due to bug resistance secondary to inappropriate use of antibiotics [3]. Since infants and children represent a large part of the population in developing countries, they are the most vulnerable population groups to contract illnesses. Due to this, the use of antimicrobial agents, especially antibiotics has become a routine practice for the treatment of pediatric illnesses [4, 5]. As prudent use of antibiotics will curtail health care costs and potential adverse effects to the individual taking

them, as well as diminishes the wide ecologic effect from pathogenic organisms, the issues of their availability, selection, and proper use are of critical importance to the global community [6]. Worldwide, it is estimated that over 50% of all medicines are prescribed, dispensed or sold inappropriately. In developing countries, while only 70% of pneumonia cases receive an appropriate antibiotic, about half of all acute viral upper respiratory tract infection and viral diarrhea cases receive antibiotics inappropriately [7]. Study conducted in India revealed that anti-infective agents were prescribed in 218 out of 286 prescriptions. 124 (43.4%) of these had a single antibiotic prescribed, 70 (24.5%) had two antibiotics prescribed, 21(7.3%) and 3(1.0%) had three and four antibiotics prescribed per prescription, respectively. The anti-infective agents were mainly used in the inpatient settings. Of the anti-infective agents, beta-lactam antibiotics were most commonly prescribed [51.9%]. These agents also accounted for large percentage of injectable. In total, 24.8% of the prescriptions had a drug prescribed as injectable [4]. A study conducted in pediatric hospital of Kathmandu Valley in 2004 indicated that the use of multiple antibiotics were 79%. Only one antibiotic was prescribed in 21%, two antibiotics in 37% (highest), three antibiotics in 28%, four antibiotics in 10% of and finally five or even more than five antibiotics were prescribed in about 4% of all cases. Cephalosporin was the top most frequently prescribed antibiotic (34%) followed by penicillin group (33%). In this study, 75% of the total antibiotics were administered parentally.

Drugs were prescribed in generic by 41% [5]. Point prevalence study of antibiotic use in a pediatric hospital in Italy showed that antibiotics were prescribed to 181 of the 412 patients (43.9%). The most frequently prescribed antibiotics were ceftazidime and the combination of amoxicillin and clavulanic acid. Of the 181 children who were treated with antibiotics, 78 (43.8%) received more than one drug. The prevalence of combination therapy was thus 18.9%. Antibiotics were prescribed empirically in 51.0% of cases; in 40.8% of cases the drugs were used for prophylaxis, and in 8.2% of cases the treatment was based on microbiological data. The

use of cephalosporins was almost evenly distributed between empirical therapy and prophylaxis, while penicillins were most frequently used for empirical therapy. Penicillins and aminoglycosides were the two categories of drugs that were most commonly prescribed on the basis of microbiological data [8]. A study done in Tamilnadu, India indicated that cephalosporins were the most often prescribed class of antimicrobials (56.36%) followed by penicillins (40.36%) and aminoglycosides (36.36%). Combinations of antimicrobials commonly given were Ceftriaxone + Amikacin (28 cases), Co-amox-clavulanate + Amikacin (20 cases) and Piperacillin + Tazobactam + Netilmicin (17 cases). The average number of antimicrobials prescribed per patient was 1.54. The commonest route of administration was injection (58.25%). Next common was oral route (38.20%) followed by topical application (3.53%). Among the individual antimicrobials Co-amox-clavulanate was the most commonly prescribed (30.54%) followed by Amikacin (29.45%) and Ceftriaxone (20%). Lower respiratory tract infection (LRTI) was the commonest diagnosis in this study, accounting for 108 cases followed by acute gastroenteritis [9]. As study done in Nigeria, proportion of encounters with injection prescribed was 43.14% and the percentage of generic drugs was 39.06%. Gentamicin, amoxicillin + clavulanate, cefuroxime, amoxicillin and cefotaxime were the most commonly prescribed antibiotics [10]. Study from Indonesia in pediatric wards indicated that the antibiotics were given to 48.7% of the patients. The greatest user of antibiotics was the age group of 1-5 year-old, 50% of patients had been given single antibiotic and the rest given combined antibiotics. Single antibiotics used were Cefotaxime (49.4%), Amoxicillin (20.7%), and Ampicillin (11.55%). Combined antibiotics used were Ampicillin + Chloramphenicol (34.5%), Cotrimoxazole (21.8%), Cefotaxime + Amikacin (5.7%), Cefotaxime + Cotrimoxazole (5.7%), and Cefotaxime + Isoniazid + Rifampicin + Pyrazinamide (5.7%) [11]. As a report from Palestine gastroenteritis was the most common cause of hospitalization, while upper respiratory tract infection (URTI) was the most common cause of parenteral antimicrobial agent administration. Two hundred and ten (61.8%)

patients received parenteral antimicrobial agents while 16 (4.7%) received both parenteral and oral antimicrobial agents. Single antimicrobial agent was prescribed for (50.6%) patients. Cefuroxime was the main single antimicrobial agent used; it was administered to (n=226) 70 (31%) patients [12]. The study from Bishoftu Hospital, East Ethiopia explored that among the most commonly prescribed antibiotics, Ceftriaxone accounted for 73 (43.50 %) followed by Gentamicin 43 (25.60 %). And also the most common reasons for which drugs was prescribed were pneumonia followed by gastroenteritis which made up 72 (56.25 %) and 12 (9.40 %) of the indications respectively. Out of the 242 total number of medication prescribed, parenteral route was accounted for 201 (83.1 %) and the proportion of drugs prescribed in generic name was high which was 234 (97.5 %) [13]. A study done in another part of Ethiopia, Hawassa University Referral Hospital showed that the percentage of antibiotics prescribed from essential drug list (EDL) and list of drug for referral hospital (LDRH) of Ethiopia was 1251 (90.6%) and 1381 (100%), respectively. The maximum number of drugs per prescription was 6 while the maximum number of antibiotic prescribed per-prescription was 3. The maximum number of injectable prescribed per prescription was 5 while the maximum number of generics per prescription was 6. The maximum number of antibiotics prescribed from either EDL or LDRH per prescription was 3. The mean number of antibiotics prescribed per-prescription was  $1.18 \pm 0.813$ . The mean number of injection prescribed per-prescription was  $1.48 \pm 0.766$ . Seven hundred fifty (64.2%) of the prescriptions were mono drug prescriptions from which 517 prescriptions (44.2 %) were single antibiotic prescriptions. The most frequently prescribed single antibiotic was penicillin G crystalline 146 (28.4%), followed by Ceftriaxone 128 (24.9%), Cloxacillin injection 66(12.84%), Ampicillin injection 58 (11.28%), Gentamicin 51 (9.92%) and Chloramphenicol injection 28 (5.45%). Four hundred sixteen (35.6 %) of the prescriptions were multiple antibiotic prescriptions and from these the combination of Ampicillin and Gentamicin took the largest portion with 113(27%), followed by Chloramphenicol and Cloxacillin 60(14.4%) [14]. The study done in JUSH pediatric ward in 2008 to assess drug

prescribing practice explored that from different categories of drugs, antibiotics were the most prescribed group counted for 224 (44.9%). Amoxicillin was the most prescribed antibiotic and counted for 53 (10.39%). About 418 (82%) of drugs were prescribed by generic name and 92 (18%) were prescribed by brand name.

About 458 (89.80%) of drugs were prescribed from EDL and about 52 (10.20%) of the drugs prescribed were not in the EDL of Ethiopia. The study showed that the most common diagnoses were pneumonia [15].

## Materials and Methods

### Study area & period

A retrospective cross sectional study was conducted to assess the antibiotics utilization pattern in pediatrics ward of Jimma University Specialized hospital (JUSH) from January 27 to February 07, 2014. JUSH is a teaching hospital located in Jimma town, Oromia region, south west Ethiopia, 346 km from Addis Ababa. Currently it became the only teaching and referral hospital in the southwestern part of the country. It runs an annual governmental budget of 25.06 million Birr with bed capacity of 450 and a total of more than 750 staffs of both supportive and professional. It provides services for approximately 9000 inpatient and 80000 outpatient attendances a year coming to our hospital from the catchment population of about 15,000 million people.

### Study design

A facility based retrospective cross sectional study using inpatient record cards was conducted in JUSH pediatrics ward to assess antibiotics utilization patterns. Pediatric population of age 14 years who admitted to Jimma University Specialized Hospital (JUSH) in 2013 and had taken antibiotics during that period was considered as study population.

### Inclusion criteria

All the pediatric patients who prescribed with antibiotics in pediatric ward of JUSH were included in the study. For repeated admission antibiotics were taken from the last admission.

The order sheet of patients' card which does not containing antibiotics were excluded from the study.

### Sample size

The required sample size was calculated using simple population proportion formula:

$$n = \frac{Z^2 pq}{d^2} = \frac{(1.96)^2 (0.449) (0.551)}{(0.05)^2} = 380$$

### Where

n=the required samples size

Z= 1.96, Standard score corresponding to 95% CI

P= 0.449 because the prevalence of antibiotics use in the study area was 44.9% [23].

q= 1-P =0.551; d= the margin of error tolerable, i.e. 5%.

Since the number of patients' cards in pediatric ward of JUSH who prescribed with antibiotics in 2013 was 817, using sampling size estimation method and finite population correction the total sample size was obtained as

$$nf = n / 1 + (n/N) = 380 / 1 + (380/817) = 380 / 1.47 = 259$$

Where nf= the desired sample size when the population is less than 10,000. To compensate for missed information and errors, 5% of the size (13) was added. Thus, nf = 272

### Sampling technique

All cards of patients which fulfill the inclusion criteria were selected by using systematic random sampling technique until the required sampling size would be obtained. 272 patients' card were selected by regular interval i.e. every 3<sup>rd</sup> card. The first card was taken randomly from the first three cards using lottery method.

### Data collection instrument & process

Data was collected by using data collection checklists. The checklist contains patients'

demographic data and patterns of antibiotics utilization.

### Data analysis and quality

The data was collected from inpatient cards using checklist. Data was cleared, categorized, compiled and coded before analyzed by using the Statistical Package for the Social Sciences (SPSS) version 16.0 software for windows. The results were presented using tables, figures and texts. Completeness, accuracy and clarity of the collected data were checked carefully before data analysis was made. Any erroneous, ambiguous and incomplete data was excluded.

### Ethical consideration

The official letter was obtained from school of pharmacy, college of Public Health & Medical Sciences, Jimma University. A Letter of permission was presented to JUSH, pediatric department. Verbal informed consent was obtained from workers in pediatric ward and card room of hospital prior to the data collection after the objective of study was made clear to them.

### Results

In this study, the analysis of demographic data showed that from the total 272 pediatric patients, 156 (57.35%) were male and 116 (42.65%) were female. Two hundred sixty (95.59%) were from Jimma zone and 12 (4.41%) were from areas outside Jimma zone One hundred sixty six (61.03%) of admitted patient were Muslim & one hundred sixty four (60.39%) of them were Oromo from their ethnicity group. One hundred six (38.97%) of admitted patients were infants which constituted the highest proportion (**Table 1**).

According to this study the most commonly prescribed antibiotic in pediatric ward of JUSH was Gentamicin which accounted for 128 (21.69%) followed by Crystalline Penicillin G 108 (18.30%) and Ampicillin 82 (13.90%) [**Table 2**].

**Table 1:** Patients' demographic characters in JUSH pediatric ward from January 27-February 07, 2014

<b>Variables</b>	<b>Frequency</b>	<b>Percentage</b>	
<b>Age</b>	0-28days	10	3.68
	29days-12months	106	38.97
	2years-5years	102	37.5
	6years-10years	34	12.5
	11years-14years	20	7.35
	Total	272	100
<b>Sex</b>	Male	156	57.35
	Female	116	42.65
	Total	272	100
<b>Religion</b>	Muslim	166	61.03
	Orthodox	55	20.22
	Protestant	43	15.81
	Others	8	2.94
	Total	272	100
<b>Ethnicity</b>	Oromo	164	60.39
	Amhara	60	22.06
	Gurage	28	10.25
	Silte	11	4.00
	Others	9	3.30
	Total	272	100
<b>Residency</b>	Jimma zone	260	95.59
	Other area	12	4.41
	Total	272	100

**Table 2:** Type of antibiotics used in pediatric ward of JUSH from January 27-February 07, 2014

<b>Antibiotics</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Gentamicin</b>	128	21.69
<b>Crystalline penicillin G</b>	108	18.30
<b>Ampicillin</b>	82	13.90
<b>Ceftriaxone</b>	72	12.20
<b>Chloramphenicol</b>	60	10.17
<b>Cloxacillin</b>	42	7.12
<b>Amoxicillin</b>	26	4.41
<b>Metronidazole</b>	20	3.39
<b>TTC ointment</b>	17	2.88
<b>Erythromycin</b>	8	1.36
<b>Cotrimoxazole</b>	8	1.36
<b>Vancomycin</b>	6	1.02
<b>Ceftazidime</b>	5	0.85
<b>Anti TB</b>	4	0.68
<b>Others</b>	4	0.68
<b>Total</b>	590	100

TTC-Tetracycline, TB-Tuberculosis

As indicated by table 3, among the combinations of antibiotics Ampicillin and Gentamicin took the largest portion with 46 (21.90%), followed by

Ceftriaxone and Gentamicin 38 (18.1%) & Crystalline Penicillin G and Chloramphenicol 34 (15.71%)

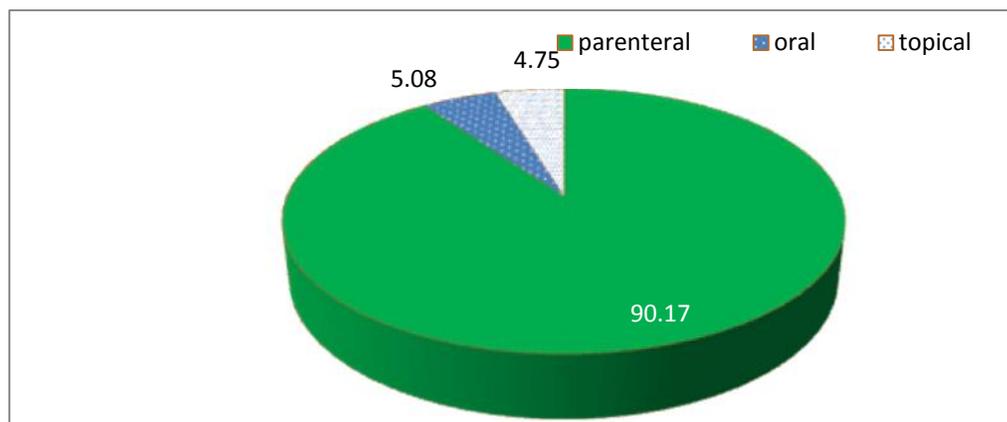
**Table 3:** The frequency and percentage of multiple antibiotic prescriptions in pediatric ward of JUSH from January 27-February 07, 2014

Antibiotics	Frequency	Percentage
Ampicillin + Gentamicin	46	21.90
Ceftriaxone + Gentamicin	38	18.10
C.pen G + Chloramphenicol	33	15.71
Cloxacillin + Chloramphenicol	13	6.19
Ampicillin + Gentamicin + Metronidazole	12	5.71
Ceftriaxone + Metronidazole	10	4.76
Ceftriaxone + Gentamicin+ Metronidazole	10	4.76
Ceftriaxone + Cloxacillin + Metronidazole	8	3.80
Ampicillin + Gentamicin + Metronidazole + TTC eye ointment	8	3.80
Ampicillin + Gentamicin +Cloxacillin	7	3.33
Ampicillin + Gentamicin + CAF	7	3.33
Ceftriaxone + Cloxacillin + CAF eye drops + TTC ointment	5	2.38
Cloxacillin + CAF + Metronidazole +Ceftriaxone	4	1.90
C.pen G + CAF + TTC ointment + Gentamicin ear drops	4	1.90
Ceftriaxone + Cloxacillin + CAF	2	0.95
Vancomycin + Ceftazidime + Clindamycin ointment + CAF eye drops	2	0.95
Anti TB + Amoxicillin	1	0.48
<b>Total</b>	<b>210</b>	<b>100</b>

C.pen G-Crystalline penicillin G, TTC-Tetracycline, CAF-Chloramphenicol, TB-Tuberculosis

Figure below showed the routes of administration of antibiotics identified by this study. Accordingly, out of the 590 total number of

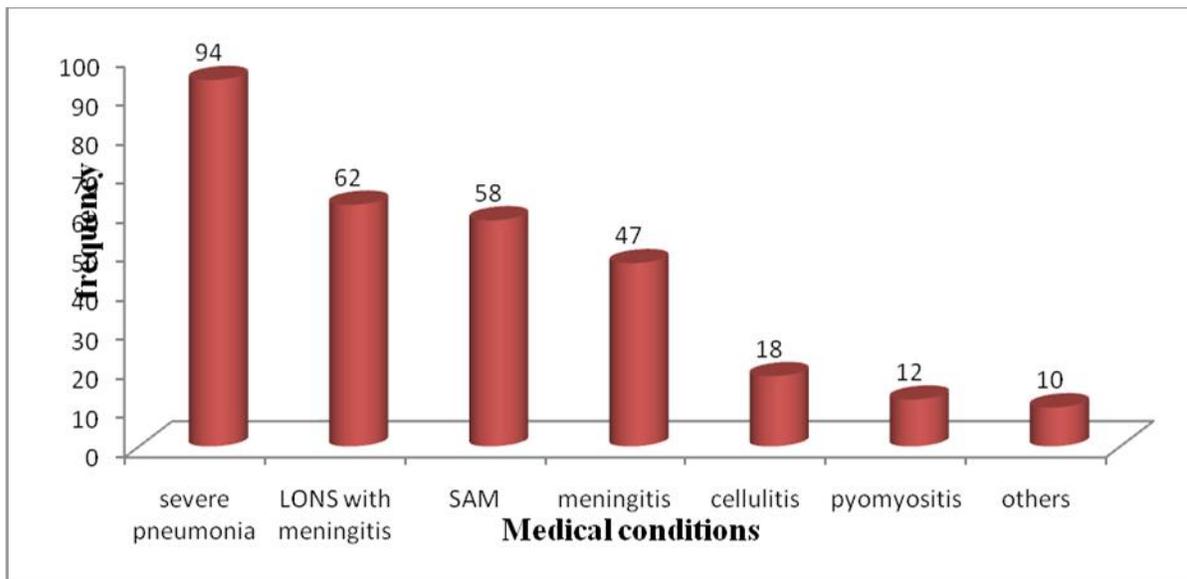
antibiotics prescribed, parenteral route was accounted for 532 (90.17 %) followed by oral (PO) 5.08%.



**Figure 1:** The percentage of antibiotics prescribed by different routes in pediatric ward of JUSH from January 27-February 07, 2014

In this study, the most common reasons for which antibiotics was prescribed were severe pneumonia followed by confirmed late onset neonatal sepsis (LONS) with meningitis and severe acute

malnutrition (SAM) which made up 94(31.23 %), 62(20.60) and 58(19.27%) of the indications respectively as stated on figure 2.



**Figure 2:** The medical conditions for which antibiotics prescribed in JUSH pediatric ward from January 27-February 07, 2014

The average number of antibiotics per patient was 2.17. Two hundred ten (77.20%) of the patients were exposed to at least two antibiotics. Only one antibiotic was prescribed in 22.80%, two

antibiotics in 51.47% (highest), three antibiotics in 16.91% & four or more than four antibiotics in 8.82% were prescribed (table 4).

**Table 4:** Antibiotics used per patient in JUSH pediatric ward from January 27-February 07, 2014

Antibiotics	Frequency	Percentage
One	62	22.80
Two	140	51.47
Three	46	16.91
Four or more	24	8.82

According to this study the maximum number of antibiotic prescribed per-prescription was 4. The

average number of antibiotic prescribed per prescription was 1.97.

**Table 5:** Antibiotics per prescription in JUSH pediatric ward from January 27-February 07, 2014

Antibiotics	Frequency	Percentage
One	74	24.67
Two	176	58.66
Three	38	12.67
Four	12	4.00

In analysis of types antibiotics prescribed, among the total of 590 antibiotics, the proportion antibiotics prescribed in generic name was high

which accounted for 585(99.15 %). The percentage of antibiotics prescribed from EDL of Ethiopia was 100%.

**Table 6:** Antibiotics prescribed by generic name versus brand name & antibiotics prescribed from EDL in JUSH pediatric ward from January 27-February 07, 2014

Type of Antibiotics	Frequency	Percentage
<b>Generic name</b>	585	99.15
<b>Brand name</b>	5	0.85
<b>EDL</b>	590	100

## Discussion

Antibiotics are powerful and effective drugs in the fight against infectious diseases caused by bacteria and have been frequently used for decades worldwide for effective treatment of a variety of bacterial infections. According to this study, the most frequent clinical indication for which antibiotics were prescribed was severe pneumonia followed by LONS with meningitis which was similar to the study done in pediatric wards of Bishoftu Hospital; East Ethiopia which revealed that pneumonia was the most frequent clinical indication for which antibiotics were prescribed in hospitalized children [13]. This study was also consistent with the previous study conducted in pediatric ward of JUSH in 2008 which showed that the most common diagnose was pneumonia [15]. This similarity might be due to the environmental condition of the study area. However, the study done in Palestine to assess pattern of parenteral antimicrobial prescription among pediatric patients explored that gastroenteritis was the most common cause of hospitalization [12]. This discrepancy might be due to the difference in the time period during which these studies were conducted. Besides to this the location of study area might be the matter. This study showed that Gentamicin was the most frequently prescribed antibiotic and crystalline penicillin G was the second most commonly prescribed antibiotic. This study was consistent with the study done in Nigeria, 2011 to assess the prescription pattern in the pediatric ward of a

tertiary health care facility in south Nigeria which showed that gentamicin was the most frequently used antibiotics [10]. But it opposed to the study conducted in Italy which indicated that the most frequently prescribed antibiotics was ceftazidime. The study done in pediatric wards of Bishoftu Hospital, East Ethiopia explored that ceftriaxone was the most commonly prescribed antibiotic [13]. Similar study done in Hawassa University Referral Hospital Pediatric Ward, Southern Ethiopia showed that the most commonly single antibiotic used was crystalline penicillin G [14]. The previous study done in JUSH pediatric ward in 2008 explored that Amoxicillin was the most prescribed antibiotic [15]. This difference might be due to availability of that drug in the facility. In addition to this, the difference in the indications between the present study and this similar study for which antibiotics prescribed as well as antibiotic selection based on the sensitivity of the responsible pathogens unlike in our case which was empiric might be contributed for the difference. In this study most common route of antibiotic administration was found to be parenteral route that accounted for 90.17% and followed by oral route which accounted for 5.08%.

This is because the largest percentages of the prescriptions in this study were made up of gentamicin and crystalline penicillin G which are both available as parenteral route only. The use of these medications is also appropriate since the

majority of the cases identified were severe pneumonia & LONS with meningitis which caused admission and hence need to be managed as soon as possible with parenteral antibiotics which is impossible with the oral ones. The other reason might be the study was conducted in admitted patient in which parenteral route of administration is common. The parenteral administration of antibiotics in this study was high as compared to similar studies conducted in Palestine which indicated parenteral administration accounted for 61.8% [12]& in Tamilnadu, India parenteral administration was 58.25% [9]. But it was somewhat consistent with the study done in pediatric ward of Bishoftu Hospital in which parenteral route was accounted for 83.1% [13]. The percentage of drugs prescribed by generic name should ideally be 100% according to world health organization (WHO) recommendation, and prescribing and dispensing of drugs by its generic name avoids confusion between prescribers and dispensers [16]. This study found that the pattern of generic prescribing was 99% which were considerably sufficient. This study was consistent with prescribing pattern by generic name in pediatric wards of Bishoftu Hospital, East Ethiopia which was 97.5% [13]. However, prescribing pattern by generic name indicated in this study was higher as compared to previous study done in the pediatric ward of JUSH which showed that 82% of drugs were prescribed by generic name. The difference might be because of that in the previous study not only antibiotics, but also other drugs were included, thus higher percentage of drugs prescribed by brand in previous study might be contributed by others drug rather than antibiotics. Our indicated that 77.20% of the patients have taken at least two antibiotics. Only one antibiotic was prescribed in 22.80%. It was consistent with the study conducted in pediatric hospital of Kathmandu Valley which indicated that the multiple antibiotics were 79% & only one antibiotic was prescribed in 21% [6]. However, multiple antibiotics use indicated in this study was higher as compared to study done in Palestine [12], Indonesia [11] & Hawassa University Referral Hospital [14]. In this study the average number of antibiotics prescribed per patient was 2.17. This result was high as compared to a study done in Tamilnadu, India in 2011 which showed

average number of antibiotics per patient was 1.54 [9]. The average number of antibiotics prescribed per prescription was 1.96 and the maximum number of antibiotic per prescription was 4.

This was comparable to the study done in Hawassa University Referral Hospital Pediatric Ward that indicated that the maximum number of antibiotic prescribed per-prescription was 3 [14].

## Conclusion

In general, in our study area Gentamicin and Crystalline Penicillin G were identified to be the most commonly prescribed medications followed by ampicillin and ceftriaxone, in this pediatric ward. Ampicillin + Gentamicin were the most frequently prescribed combined antibiotics. The parenteral administration of antibiotics in this study area was high. Overall there was good generic prescription as well as antibiotics prescriptions from EDL of Ethiopia in the study area as compared to other similar studies and the WHO guidelines.

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