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Title: **Antibiotic consumption and management at Kochani General Hospital – Annual report**

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Antibiotic consumption and management at Kocani General Hospital – Annual report

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Abstract

The aim of the study was to get detailed insight into the antibiotic consumption trends in the three year period (2016-2018) in Kocani Hospital, to identify the most often prescribed antibiotics and to determine whether the treatment of given diagnosis was in accordance with the official guidelines. The survey covered all pediatric and infant patients admitted to the pediatric ward. Patients' data included gender, age, diagnosis, antibiotic used and doses. The majority of admitted patients were in the age group of 0-1 (27.48%, 25.94% and 30.77% for 2016, 2017 and 2018, accordingly) followed by age group of 1-2 years (20.86%, 22,0% and 23.83% for 2016, 2017 and 2018, consequently) and 2-3 years (16.06%, 16.1% and 14.63% for 2016, 2017 and 2018, consequently) .The most frequent diagnosis was acute tonsillitis which was determined in ~21% of patients, pneumonia without complications in ~18% and acute bronchitis in ~16% of patients in the period 2016-2018. Results from conducted survey identified high prescription rate and use of antibiotics predominantly ceftriaxone (82.58%, 81.05% and 50.85% in 2016, 2017 and 2018, respectively) contrary to official recommendations and evidences based on clinical data for treatment of the diagnoses in question. So, it is foreseeable to conclude that there is urgent need for restrictive and educational measures i.e. to strength the surveillance and monitoring of antibiotic prescription and usage and hence to promote awareness for rational use of antibiotics on all health-care levels.

Key words: antibiotic prescription, antibiotic consumption, pediatric wards, annual report

Introduction

Antibiotics also known as antimicrobial drugs are commonly used for treatment of bacterial infections. Antibiotics are one of the most powerful medicines that have saved great number of people's life, despite the fact that in Greek, the translation of their name means anti bios (anti life). They inhibit or prevent the growth of bacteria, fungi and some parasites, but they cannot kill viruses. People misused antibiotics during the 20th century and this irrational consumption of antibiotics has resulted with occurrence of so called "resistant bacteria". Antimicrobial resistance occurs when bacteria and other microbes adapt and become less responsive to treatment. The rapid rise and replication of antimicrobial resistant organisms worldwide is a problem of huge dimensions. The antimicrobial resistance causes about 700,000 deaths annually around the world, and each country is potentially affected. The figure can rise to 10 million till 2051. The root causes of this problem are multifactorial. The emergence of antibiotic resistance is highly related to their inadequate use (Arnold et al., 2011; Laxminarayan et al., 2013; Leuthaner et al., 2013). Studies showed that 30-60% of the prescribed antibiotics in the hospital sector are unnecessary, inadequate, or suboptimal (Bergmans et al., 1997; Kollef, 2001; Kollef and Fraser, 2001; Roberts et al., 2011).

Prescribing antibiotics and antibiotics misuse, undoubtedly contribute to the growth of antibiotic resistant bacteria. Epidemiological studies demonstrate direct dependence between antibiotics consumption and the emergence and replication of the resistant hospital bacteria. The optimal use of antibiotics is crucial in the healthcare setting, especially in the era when antibiotic resistance increases and there is a lack of new antimicrobial development (Arnold et al., 2011; Laxminarayan et al., 2013; Leuthaner et al., 2013). Providing reliable and comparable national data about the consumption of antibiotics is a prerequisite for understanding of the epidemiology of antibiotic resistance in Europe since their inadequate use is one of the main factors responsible for resistance to antibiotics (Arnold-Lefevre et al., 2013; Goldman et al., 1996; Kollef and Fraser, 2001; Landman et al., 2002; Lipsitch et al., 2000; MacDougall and Polk, 2006; Malhota-Kumar et al., 2007; McGowan, 1983; Paterson, 2006; Ricel, 2008; Shalae et al., 1997; Sieve et al., 2013; Thomas et al., 1998; Zillich et al., 2006).

Having in mind previous, the aim of the study was to analyze the antibiotic consumption trends in the three year period (2016-2018) in Kocani Hospital, to identify the

most often prescribed antibiotics and to determine whether the treatment of given diagnosis was in accordance with the official guidelines.

Materials and methods

The retrospective survey for prescribing and consuming antibiotics for the period 2016-2018 (January-December) was conducted in May, 2019. The survey covered all pediatric and infant patients admitted to the pediatric ward. Patients' data included gender, age, diagnosis, antibiotic used and doses. The quantity of given antibiotic as treatment and prophylaxis was coded as a daily dose - DDD for 1 or more days of prophylactic treatment. Data were collected from software program "Moj termin" (My term) and official medical records from the Kocani Hospital database. The data covered all hospitalized pediatric patients in the above mentioned period. However, it has to be emphasized that all data were available as group data, and were not collected per patient admitted in pediatric ward of Kocani Hospital.

Obtained data were tabulated in Microsoft Excel® (Microsoft Corp. Redmond, WA, USA) and were computed and consequently evaluated using statistical software STATGRAPHICS Centurion XVI evaluation (StatPoint technologies Inc., USA).

Results and discussion

The overall number of patients admitted at the pediatric ward of Kocani Hospital in the study period 2016-2018 was 1696. Detailed data related to gender and age are given in Table 1.

Table 1

One-way ANOVA ($p < 0.05$) indicated that there was no statistical significant difference between total number of patients, as well as male and female patients in each year of studied period. However, it pointed that there is statistical difference between age groups. From results presented in Table 1, it can be clearly seen that the majority of admitted patients were in the age group of 0-1 (27.48%, 25.94% and 30.77% for 2016, 2017 and 2018, accordingly) followed by age group of 1-2 years (20.86%, 22.0% and 23.83% for 2016, 2017

and 2018, consequently) and 2-3 years (16.06%, 16.1% and 14.63% for 2016, 2017 and 2018, consequently). Overall results indicated that the number of patients decreased with age.

From detailed results presented in Table 2, it can be seen that the most frequent diagnosis was acute tonsillitis (code J03.9 according to ICD-10-CM (International Classification of Diseases, Tenth Revision, Clinical Modification)) which was determined in 21.03%, 20.93% and 20.08% of patients in 2016, 2017 and 2018, accordingly, followed by pneumonia without complications (ICD-10-CM code J18.0) in 18.38%, 17.89% and 18.39% and acute bronchitis (ICD-10-CM code J20.9) in 15.89%, 16.64% and 16.51% of patients in 2016, 2017 and 2018, consequently.

Table 2

Total quantity of antibiotics ordered from hospital pharmacy and used (2016-2018) in pediatric ward of Kocani Hospital is given in Table 3. Results pointed that ~97% of ordered antibiotics were used. The most common used antibiotic was ceftriaxone with a share of 82.58%, 81.05% and 50.85% in 2016, 2017 and 2018 year, accordingly. The lower share of ceftriaxone in 2018 is related to the significant increase of ampicillin usage compared to previous years (32.58% in 2018 vs 1.04% in 2017 and 0% in 2016 year). In accordance were the findings of Quaak et al. (2018) for the antibiotic use in secondary care urban teaching hospital in Rotterdam, the Netherlands. Namely, in the surveyed period 2010-2015 most commonly used antibiotics were cefotaxime and ceftriaxone, and hence their use showed a significant decrease during years due to the increase of amoxicillin and amoxicillin/clavulanic acid usage. The situation was similar in pediatric wards in hospitals in Latvia where a one-day cross-sectional point prevalence survey conducted in November, 2012 indicated that the third-generation cephalosporins were among the mostly used antibiotic groups for pediatric patients with share of cefazolin and ceftriaxone of 24.2% and 21%, respectively (Sviestina and Mozgis, 2014). In the study of Porta et al. (2012), conducted in 2009 in UK, Italy and Greece, 37% of all antibiotics were penicillin b-lactam antibacterials with type of b-lactam varied between hospitals. In UK hospitals use of co-amoxiclav prevailed, while in Italy and Greece hospitals ceftriaxone/cefotaxime and cefuroxime/ceftriaxone, respectively were dominantly used. Such high share of ceftriaxone use might be explained with social acceptance of the common believe that intravenous antibiotics are “stronger” than oral ones (Sviestina and Mozgis, 2014).

Table 3

Usage of antibiotics per given diagnosis is presented in Tables 4, 5 and 6 for 2016, 2017 and 2018, accordingly.

Table 4

Table 5

Table 6

Having in mind that most commonly in the period 2016-2018 patients admitted in pediatric ward of Kocani Hospital were diagnosed with acute tonsillitis, pneumonia without a complications and acute bronchitis it is normally to expect that most of the prescribed DDD of antibiotics were related to these conditions. 36.55%, 39.56% and 23.6% of all DDD of prescribed antibiotics in 2016, 2017 and 2018 were related to pneumonia without complications and in case of acute tonsillitis 18.19%, 19.33% and 23.58% and acute bronchitis 15.06%, 11.2% and 14.36% of all DDD of antibiotics were prescribed in 2016, 2017 and 2018, accordingly. Respiratory infections were also most common diagnosis in pediatric wards in hospitals in Latvia, where 34.7% and 13.9% of pediatric patients were diagnosed with lower and upper respiratory tract infections (Sviestina and Mozgis, 2014). However, in the study of Patel et al. (2012) in UK, Italy and Greece hospitals, antibiotics were most commonly used for surgical prophylaxis (21%) with differences between surveyed hospitals (2% and 31% in two UK hospitals (Center 1 and 2), and 18% in Italy and 31% in Greece surveyed hospital. In UK Center 1 and Italy hospital the main indication for antibiotic treatment was lower respiratory tract infection in 17% and 37% of children, respectively.

It can be seen that patients diagnosed with Acute tonsillitis (ICD-10-CM code J03.9) in 2016 and 2017 were most frequently treated with Amp. Ceftriaxone á 1.0 g (93.06% in 2016 and 90.87% in 2017 of DDD of prescribed antibiotics for the J03.9). However, in 2018 only 37.14% of patients were treated with this antibiotic vs 58.54% which were treated with Amp. Ampicillin á 1.0 g. The treatment was prescribed empirically in all cases (no microbiology analysis were required and conducted). According to guidelines for medical

care of tonsillitis and pharyngitis in pediatric population issued by Ministry of healthcare of Republic of North Macedonia (<http://zdravstvo.gov.mk/wp-content/uploads/2015/08/Tonzilitis-i-faringitis-kaj-deca1.pdf>) if infection is caused by group A streptococci it should be treated with penicillin 70 mg/kg daily (100,000 d/kg/24h), or in patients allergic to penicillin with cephalexin 50 mg/kg/24h, in two doses for 10 days. Short-term cephalosporin therapy (2 to 6 days) may be effective but is associated with more side effects. Shorter therapy may be used if there is difficulty in prolonging a child's antibiotic treatment. Macrolides are used to treat tonsillitis only in patients with penicillin or cephalosporin allergy.

Patients diagnosed with pneumonia without complications (ICD-10-CM code J18.0) were treated with Amp. Ceftriaxone á 1.0 g in 79.37%, 81.88% and 74.76% of DDD of prescribed antibiotics in 2016, 2017 and 2018 year, accordingly. Similar was the situation for treatment of bronchopneumonia in Pediatric Clinic in Sarajevo where first (cefazolin in 40.4% of patients) and third generation of cephalosporins (31.7% of patients with most often used ceftazidime followed by ceftriaxone and cefixime) and penicillin antibiotics (25% of patients) were commonly used (Zec et al., 2016). According to the guidelines for medical care of pneumonia in childhood issued by the Ministry of healthcare of Republic of North Macedonia (<http://zdravstvo.gov.mk/wp-content/uploads/2015/08/Pnevmonii-vo-detstvoto.pdf>) medicine of choice in preschool children as first-line therapy is amoxicillin 40-50mg/kg/day in 3 doses for 7 days. The same recommendations are for treatment of pneumonia in school children, but having in mind that *Mycoplasma* and *Chlamydia* infections are very often in this group it might be considered that the treatment may be based on doxycycline (children older than 8 years, 200 mg as single dose in the first day, followed by 100 mg once a day during the next days). These guidelines are in accordance with recommendations published in Cochrane Database Systematic Reviews by Lodha et al. (2013) where amoxicillin as first-line therapy should be used, but with additional possibility to use cefpodoxime and cefuroxime as second-line therapies. Also, concomitant are recommendations of World Health Organization (Tong, 2013; WHO, 2012) for very severe pneumonia where parenteral ampicillin (or penicillin) and gentamicin are recommended as a first line treatment, while ceftriaxone should be used as a second line treatment when the first line treatment fails.

Patients diagnosed with acute bronchitis (ICD-10-CM code J20.9) were treated with Amp. Ceftriaxone á 1.0 g in 57.84%, 67.12% and 63.89% of DDD of prescribed antibiotics

in 2016, 2017 and 2018 year, accordingly. Amp. Cefotaxime á 500 mg were used in 28.65%, 18.84% and 20.49% of DDD of prescribed antibiotics in 2016, 2017 and 2018 year, accordingly. According to the guidelines for medical care of light form of respiratory pathways obstruction in children, issued by the Ministry of healthcare of Republic of North Macedonia (<http://zdravstvo.gov.mk/wp-content/uploads/2015/08/Tretman-na-opstruktiven-bronhitis-i-akutna-astma.pdf>) inhalation of salbutamol using metered-dose inhalers or nebulizer is first choice for treatment. Medium severe obstruction should be treated with repetitive application of salbutamol with spacer or nebulizer with 100% oxygen supplementation. Also, depending from symptoms systematic corticosteroid might be considered. Similar are recommendations for treatment of repetitive or prolonged obstruction as well as severe obstruction. In the case of severe obstruction additionally, use of anticholinergic such as ipratropium bromide is suggested. Antibiotic use is indicated in treatment of otitis, maxillary sinusitis and pneumonia. These guidelines are in line with clinical data that showed that antibiotics do not significantly change the course of acute bronchitis, and might provide only minimal benefit compared with the risk of antibiotic use itself (Albert, 2010). However, studies showed that almost 2/3 of patients in United States with acute bronchitis are treated with antibiotics with argument that they might decrease the risk of subsequent pneumonia as well as patient expectations for antibiotic prescription (Albert, 2010, Linder and Sim, 2002).

Conclusion

Results from conducted survey identified high prescription rate and use of antibiotics predominantly ceftriaxone, a third generation of cephalosporin, for pediatric and infant patients admitted in Kocani Hospital in the period 2016-2018. In the studied period decrease of cephalosporin usage was observed especially in 2018 and it was related to the increase of ampicillin use. The most frequent diagnoses were acute tonsillitis, pneumonia without complications and acute bronchitis. Treatment of patients diagnosed with acute tonsillitis in 2016-2017 was mostly based on ceftriaxone, while in 2018 ampicillin prevailed. In the case of pneumonia without complications ceftriaxone was also most commonly used antibiotic although WHO recommends it as a second line treatment when the first line treatment fails. When acute bronchitis was in question, ceftriaxone and cefotaxime were most used antibiotics contrary to official recommendations and evidences based on clinical data. So, it is

foreseeable to conclude that there is urgent need for restrictive and educational measures i.e. to strength the surveillance and monitoring of antibiotic prescription and usage and hence to promote awareness for rational use of antibiotics on all health-care levels.

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Резиме

Употреба и управување со антибиотици во Општа болница Кочани – годишен извештај

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Клучни зборови: пропишување на антибиотици, употреба на антибиотици, педијатарски оддели, годишен извештај

Целта на студијата беше да се добие детален увид во трендовите на потрошувачка на антибиотици во тригодишниот период (2016-2018 година) во болницата во Кочани, да се идентификуваат најчесто пропишаните антибиотици и да се утврди дали третманот на дадената дијагноза е во согласност со официјалните упатства. Истражувањето ги опфати сите деца и новороденчиња примени на педијатриското одделение. Податоците на пациентите вклучуваат: пол, возраст, дијагноза, користен антибиотик и дозирање. Поголемиот дел од примените пациенти биле во возрастна група од 0-1 година (27,48%, 25,94% и 30,77% за 2016, 2017 и 2018 година, соодветно), потоа следува возрастната група од 1-2 години (20,86%, 22,0% и 23,83% за 2016, 2017 и 2018 година, последователно) и возрастната група 2-3 години (16,06%, 16,1% и 14,63% за 2016, 2017 и 2018 година, последователно). Во периодот од 2016-2018 година најчеста дијагноза била акутен тонзилитис, утврден кај ~21% од пациентите, потоа следува пневмонија без компликации, кај ~18% од пациентите и акутен бронхитис кај ~16% од пациентите. Резултатите од спроведеното истражување покажаа висока стапка на пропишување и употреба на антибиотици, претежно цефтриаксон (82,58%, 81,05% и 50,85% во 2016, 2017 и 2018 година, соодветно)

спротивно на официјалните препораки и докази засновани врз клиничките податоци за третман на соодветните дијагнози. Добиените резултати од истражувањето укажуваат дека постои итна потреба од примена на рестриктивни и едукативни мерки, т.е. да се зајакне надзорот и следењето на пропишувањето и употребата на антибиотици и да се зголеми свесноста за рационална употреба на антибиотици на сите нивоа на здравствената заштита.

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Table 1. Detailed data related to gender and age of patients admitted in Kocani Hospital pediatric ward for period 2016-2018 year

age	2016		2017		2018	
	male	female	male	female	male	female
0-1	78	88	75	70	73	91
1-2	67	59	64	59	58	69
2-3	57	40	48	42	28	50
3-4	25	22	23	27	20	24
4-5	17	12	14	13	8	14
5-6	14	16	12	8	10	12
6-7	7	10	6	9	4	9
7-8	15	9	13	8	11	10
8-9	8	4	9	6	2	2
9-10	7	8	6	7	5	6
10-11	3	4	8	3	5	2
11-12	8	3	5	2	6	3
12-13	2	5	2	4	1	4
13-14	4	2	3	3	2	1
14-15	3	0	3	1	1	0
15-16	4	0	2	1	2	0
16-17	2	1	3	0	0	0
Subtotal	321	283	296	263	236	297
Total	604		559		533	

Table 2. Number of patients by diagnosis admitted in pediatric ward in Kocani Hospital in the period 2016-2018 year

ICD-10-CM code	2016			2017			2018		
	female	male	total	female	male	total	female	male	total
1 J 00 Acute nasopharyngitis [common cold]	9	8	17	7	4	11	3	10	13
2 J 02 Acute pharyngitis	31	17	48	21	24	45	9	30	39
3 J 03.9 Acute tonsillitis, unspecified	54	73	127	60	57	117	49	58	107
4 J 04.0 Acute laryngitis	7	6	13	5	1	6	1	4	5
5 J 18.0 Bronchopneumonia, unspecified organism	59	52	111	53	47	100	56	42	98
6 J 18.9 Pneumonia, unspecified organism	18	9	27	9	11	20	10	12	22
7 J 20.9 Acute bronchitis, unspecified	47	49	96	49	44	93	32	56	88
8 J 21.8 Acute bronchiolitis due to other specified organisms		4	4		1	1		1	1
9 J 21.9 Acute bronchiolitis, unspecified	28	25	53	28	16	44	19	28	47
10 J 40 Bronchitis, not specified as acute or chronic (asthma)		2	2		3	3		1	1
11 J 44.1 Chronic obstructive pulmonary disease with (acute) exacerbation	1	4	5		2	2		1	1
12 N 39.0 Acute cystitis	4	2	6	9	1	10	7	1	8
13 N 39.9 Disorder of urinary system, unspecified	2		2	2		2	1		1
14 A 08.0 Rotaviral enteritis	3	1	4	7	2	9	3	3	6
15 A 09 Infectious gastroenteritis and colitis, unspecified	4	2	6	2	3	5	4	3	7
16 D 69.0 Allergic purpura	1	1	2	1		1	1	1	2
17 B 34.9 Viral infection, unspecified		2	2		1	1		1	1
18 F 31.7 Bipolar disorder, currently in remission	1		1	2		2	1		1
19 G 40.90 Epilepsy, unspecified, not intractable	2	1	3	1		1	1		1
20 G 80.03 Athetoid cerebral paralysis	1		1			0	1		1
21 H 65.9 Unspecified nonsuppurative otitis media	1	1	2	2	3	5	1	2	3
22 I 47.9 Paroxysmal tachycardia, unspecified	2		2			0	1		1
23 K 12.1 Other forms of stomatitis		1	1		1	1		1	1
24 K 29.9 Gastroduodenitis, unspecified	1		1	2		2	1		1
25 K 52.9 No infective gastroenteritis and colitis, unspecified	10	8	18	6	12	18	10	11	21
26 K 56.0 Paralytic ileus		1	1		1	1		1	1
27 L 04.0 Acute lymphadenitis of face, head and neck		3	3		1	1		2	2
28 L 20.9 Atopic dermatitis, unspecified		2	2	3		3		1	1

29	L 23.9 Allergic contact dermatitis, unspecified cause	3	3	3		3		4	4	
30	L 27.9 Dermatitis due to unspecified substance taken internally	1	1			2	2	1	1	
31	L 50.0 Allergic urticaria	2	2			1	1	1	1	
32	L 50.9 Urticaria, unspecified	5		5	4	4	8	7	7	
33	M 60.9 Myositis, unspecified	1	1			1	1	1	1	
34	P 39 Other infections specific to the perinatal period	3		3		2	2	4	4	
35	R 10.0 Acute abdomen	1		1		3	3	1	1	
36	R 10.9 Unspecified abdominal pain	1		1		1	1	2	2	
37	R 11 Nausea and vomiting	21	2	23	20	10	30	20	8	28
38	R 55 Syncope and collapse	1		1		2	2	1	1	
39	R 56.9 Unspecified convulsions	2		2		1	1	1	1	
40	T 39.9 Poisoning by, adverse effect of and under dosing of unspecified no opioid analgesic, antipyretic and antirheumatic	1		1		1	1	1	1	
Total		321	283	604	296	263	559	236	297	533

Table 3. Quantity of ordered and used antibiotics in pediatric ward of Kocani Hospital 2016-2018 year

	2016		2017		2018	
	ordered	used	ordered	used	ordered	used
Amp. Ampicillin á 1.0 g	0	0	60	27	1650	1644
Amp. Ceftriaxone á 1.0 g	2080	2029	2129	2113	2640	2566
Sir. Cephalexin á 250 mg/5 ml	6	5	1	1	2	0
Caps. Cephalexin á 500 mg	48	48	70	60	192	192
Sir. Amoxicillin + clavulanic acid á 400 mg/ 57 mg/5 ml	37	35	65	59	55	53
Sir. Cefaclor á 250 mg/5 ml	19	15	30	30	27	25
Amp. Cefotaxime á 500 mg	270	270	220	210	325	306
Amp. Amikacin á 500 mg	30	30	73	64	130	130
Amp. Gentamicin á 40 mg/2 ml	10	0	50	43	80	80
Amp. Gentamicin á 20 mg/2 ml	30	25	5	0	50	50

Table 4. Usage of antibiotic per given diagnosis in pediatric ward of Kocani Hospital in 2016 year

ICD-10-CM code	Amp.	Amp.	Sir.	Caps.	Sir.	Sir.	Amp.	Amp.	Amp.	Amp.
	Ampicillin 1.0 g	Ceftriaxone 1.0 g	Cefalexine 250 mg/5 ml	Cefalexine 500 mg	Amoksicilline + clavulonic acid 400 mg / 57 mg/5 ml	Cefaclor 250 mg/5 ml	Cefotaxim 500 mg	Amp. Amikacin á 500 mg	Amp. Gentamicin 20 mg/2 ml	Amp. Gentamicin 40 mg/2 ml
1 J 00 Acute nasopharyngitis [common cold]		37								
2 J 02 Acute pharyngitis		223	5	16						
3 J 03.9 Acute tonsillitis, unspecified		416		16	7	8				
4 J 04.0 Acute laryngitis		40				3				
5 J 18.0 Bronchopneumonia, unspecified organism		746		16			136			
6 J 18.9 Pneumonia, unspecified organism		227				1	28	30		
7 J 20.9 Acute bronchitis, unspecified		214			25		106		25	
8 J 21.8 Acute bronchiolitis due to other specified organisms		8			2					
9 J 21.9 Acute bronchiolitis, unspecified		74								
10 J 40 Bronchitis, not specified as acute or chronic (asthma)		4								
11 N 39.0 Acute cystitis		16								
12 N 39.9 Disorder of urinary system, unspecified		4								
13 H 65.9 Unspecified nonsuppurative otitis media		20			1	3				
Total	0	2029	5	48	35	15	270	30	25	0

Table 5. Usage of antibiotic per given diagnosis in pediatric ward of Kocani Hospital in 2017 year

ICD-10-CM code	Amp.	Amp.	Sir.	Caps.	Sir.	Sir.	Amp.	Amp.	Amp.	Amp.
	Ampicillin 1.0 g	Ceftriaxone 1.0 g	Cefalexine 250 mg/5 ml	Cefalexine 500 mg	Amoksicilline + clavulonic acid 400 mg / 57 mg/5 ml	Cefaclor 250 mg/5 ml	Cefotaxim 500 mg	Amikacin 500 mg	Gentamicin 20 mg/2 ml	Gentamicin 40 mg/2 ml
1 J 00 Acute nasopharyngitis [common cold]		40		16						
2 J 02 Acute pharyngitis	10	236		16						
3 J 03.9 Acute tonsillitis, unspecified	17	45		10	10	9				
4 J 04.0 Acute laryngitis		40				1				
5 J 18.0 Bronchopneumonia, unspecified organism		845		18			119	50		
6 J 18.9 Pneumonia, unspecified organism		148				9	36	14		
7 J 20.9 Acute bronchitis, unspecified		196			41		55			
8 J 21.8 Acute bronchiolitis due to other specified organisms		5			4					
9 J 21.9 Acute bronchiolitis, unspecified		65								43
10 J 40 Bronchitis, not specified as acute or chronic (asthma)		12	1							
11 N 39.0 Acute cystitis		38								
12 N 39.9 Disorder of urinary system, unspecified		6								
13 H 65.9 Unspecified nonsuppurative otitis media		24			4	11				
Total	27	2113	1	60	59	30	210	64	0	43

Table 6. Usage of antibiotic per given diagnosis in pediatric ward of Kocani Hospital in 2018 year

ICD-10-CM code	Amp.	Amp.	Sir.	Caps.	Sir.	Sir.	Amp.	Amp.	Amp.	Amp.
	Ampicillin á 1.0 g	Ceftriaxone á 1.0 g	Cefalexine á 250 mg/5 ml	Cefalexine á 500 mg	Amoksicilline + clavulonic acid á 400 mg / 57 mg/5 ml	Cefaclor á 250 mg/5 ml	Cefotaxim á 500 mg	Amikacin á 500 mg	Gentamicin á 20 mg/2 ml	Gentamicin á 40 mg/2 ml
1 J 00 Acute nasopharyngitis [common cold]	304	50	32							50
2 J 02 Acute pharyngitis	428	260	32							260
3 J 03.9 Acute tonsillitis, unspecified	692	439	32	10	9					439
4 J 04.0 Acute laryngitis	220	40			2					40
5 J 18.0 Bronchopneumonia, unspecified organism		883	96			124	80			883
6 J 18.9 Pneumonia, unspecified organism		220			10	64	50			220
7 J 20.9 Acute bronchitis, unspecified		368		40		118		50		368
8 J 21.8 Acute bronchiolitis due to other specified organisms		10		2						10
9 J 21.9 Acute bronchiolitis, unspecified		178							80	178
10 J 40 Bronchitis, not specified as acute or chronic (asthma)		10								10
11 N 39.0 Acute cystitis		68								68
12 N 39.9 Disorder of urinary system, unspecified		12								12
13 H 65.9 Unspecified nonsuppurative otitis media		28		1	4					28
Total	1644	2566	192	53	25	306	130	50	80	2566