SEASONAL TRENDS IN ANTIBIOTIC USAGE AMONG PAEDIATRIC OUTPATIENTS

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Abstract

The aim of this study was to analyze two aspects, the first one being the seasonal variations in antibiotic usage in different age groups and the seasonal prescription patterns of commonly used antibiotics in paediatric outpatients, the other one being the correlation of antibiotics with age and clinical diagnosis. Surveillance of antibiotic use was done during 01 January – 31 December, 2012 in the outpatient department of a paediatric hospital in Tetovo. Drug data and patient characteristics were computed using Ms. Excel 2007 and the SPSS (version 19.0) packages. Among the total number of 7956 patients analyzed during the period of one year, 3151 (39.6 %) of them were prescribed antibiotics. From the different age group, the study showed that special attention should be paid to toddlers (> 1 - ≤ 3 years)-those utilizing significant percentage of the antibiotic year's supply. Seasonal variation in antibiotic usage was strictly linked with the age of patients. Significant fluctuations of monthly use of antibiotics were observed for cephalosporins, combinations of antibiotics and macrolides. There was no significant seasonal fluctuation for penicillins. Respiratory tract infections were identified as a factor considerably elevating monthly drugs usage frequency. Usage of antibiotics was significantly correlated with group age. There was a correlation between the percentage of children given antibiotics for respiratory tract infections and the overall paediatric antibiotic prescribing rate. Results from our study have shown that a continuous surveillance of antibiotic use and resistance in the community are necessary to develop and implement guidelines for antibiotic use.

Keywords: Antibiotics, paediatric outpatients, seasonal trend

Introduction

The current worldwide increase in antimicrobial resistance (AMR) and, simultaneously, the downward trend in the development of new antibiotics have serious public health and economic implications. The increased resistance is a result of many factors, but the foremost cause is the overall volume of antibiotic consumption. About 80% of antibiotics are used in the community and the rest are used in hospitals (Wise R. et al., 1998)(Cars O. et al., 2001). The use of antimicrobial agents, especially antibiotics has become a routine practice for the treatment of paediatric illnesses. Although antibiotics are targeted to kill or inhibit the growth of bacteria and have no effect on viral agents (JETACAR 1999), it is often inappropriately used to treat viral infections. Antibiotic misuse was found to be significantly frequent in children, especially when presenting with viral upper respiratory tract infections (URTIs) (Cebotarenco N. et al., 2007). Detailed surveillance of antibiotic use in the community is one strategy to guide and control antibiotic overuse and misuse. In a number of developed countries, extensive surveillance programmes have been developed to

study patterns of antimicrobial resistance and antibiotic use (Moslstad S. et al., 2008)(Coenen S. et al., 2007)(Metz-Gereck S. et al., 2009).

Different publications provide information about the level of utilization of antibiotics, seasonal variations and long term trend in antibacterial pharmacotherapy. Available studies have been based on a few basic types of data of varying reliability: including survey data, data provided by companies analyzing the pharmaceutical market, insurance companies wholesale reports, as well as hospitals' and pharmacies' records (Ronning M., et al. 2003). Using the outpatient paediatric hospital records we achieved to analyze two aspects, the first one being the seasonal variations in antibiotic usage in different age groups and the seasonal prescription patterns of commonly used antibiotics in paediatric outpatients, the other one being the correlation of antibiotics with age and clinical diagnosis.

Materials and Methods

Surveillance of antibiotic usage was done by collecting data during 01 January – 31 December of 2012 from the outpatient department of a paediatric hospital in Tetovo, Republic of Macedonia. All patients' data at age group between 0 months and 14 years who were prescribed antibiotics were included in the study. A specially designed data entry form was used to collect data regarding demographics such as age, sex, diagnosis, drug details which included name of the drug, generic/brand name, dosage form, dose frequency and duration. The results were computed using Ms Excel 2007 and the SPSS (version 19.0) packages. Chi-square test was used for comparison between groups. Relationship between different parameters was measured using Pearson's correlation coefficient. $P<0.05$ was accepted as significant. The results were expressed as percentage/proportion either as pictorial representation in the form of line and bar diagram or in the tabular form.

Results

Socio-Demographic data

During the study period from 01 January – 31 December of 2012, the total number of prescriptions surveyed was 7956; where antibiotics constitute 3151 (39.6%) out of prescriptions assessed. Demographic data of the patients are illustrated in (Table 1); where 3151 children who received antibiotics, were aged from 0 months to 14 years.

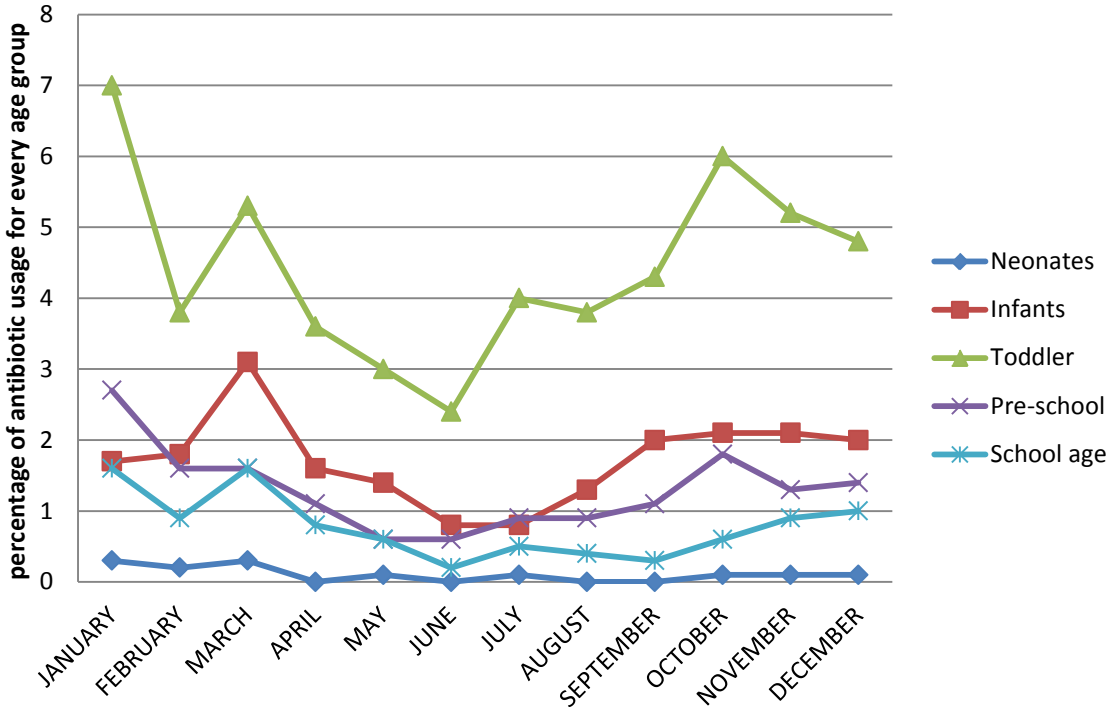
Table 1: Pediatric out patients socio-demographic data

Parameters	Number of patients	Percentage
Total prescriptions	7956	100
Antibiotics prescription	3151	39.6
Age		
Neonates (up to 4 weeks)	39	1.2
Infants (> 4weeks - ≤ 1 year)	652	20.7
Toddler (> 1 - ≤ 3 years)	1674	53.1
Pre-school (>4 - ≤ 6 years)	495	15.7
School age (>6 - ≤ 14 years)	291	9.2
Sex		
Female	1414	44.9
Male	1737	55.1

Seasonal variations of antibiotic usage in different age groups

The patient population was not homogenous in terms of the seasonal changes concerned. In age groups, the months of the largest usage were January and March, whilst the lowest level was recorded in June (Figure 1). There was tendency for two usage peaks for neonates and school age children in the months of January and March. It was 0.3% and 1.4%, respectively, higher than in the lowest usage months. Infants showed a significant peak in March (2.3% higher than in June and July). There was a significant peak of usage of antibiotics for toddlers in January, when the percentage of antibiotics usage was 4.5 % higher than in June, which was the month of the lowest usage of antibiotics. Pre-school age children had a single peak incidence in January, when the level of usage was 2.1% higher than in May and June (the lowest usage months during the year).

Figure 1: Comparison of seasonal variations in usage of antibiotics in different age groups



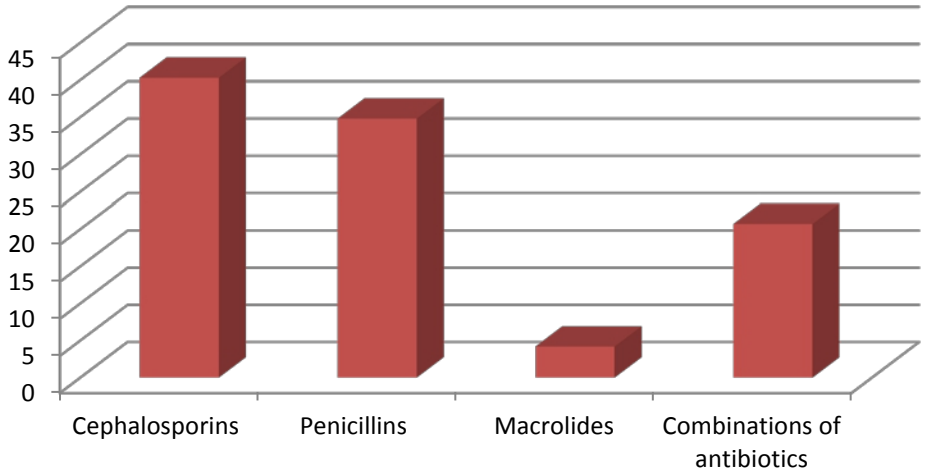
Monthly trends in the use of antibiotics

The frequency of prescriptions of antibiotics regarded as ‘single’ or in ‘group’ is shown in

Figure 2, where 40.3% out of the antibiotics prescribed belong to the cephalosporin class.

Penicillins constitute 34.8% of the antibiotics prescriptions; combinations of antibiotics presents 20.7%; macrolides, the least used antibiotics were prescribed in 4.2% out of the total antibiotics prescribed.

Figure 2: Percentage share of different classes of antibiotics



Figures 3, 4, 5 and 6 show the monthly trends in the percent of prescriptions containing various classes of antibiotics. There did appear to be an overall increased use of all classes of antibiotics (commonly used for respiratory tract infections) during the winter months January-March. For cephalosporins the highest prescription rates in winter (January-March) were around 4% greater than the minimum usage observed during summer (June as the lowest usage month during the year). Some seasonality was also observed for combinations of antibiotics with tendency for two peaks in January-November. It was 2.3% higher than in June the lowest usage month. Macrolides show a significant peak in January with 1.4% higher rate than the usage in June. There was no significant seasonal fluctuation for penicillins.

Figure 3: Monthly use of cephalosporins

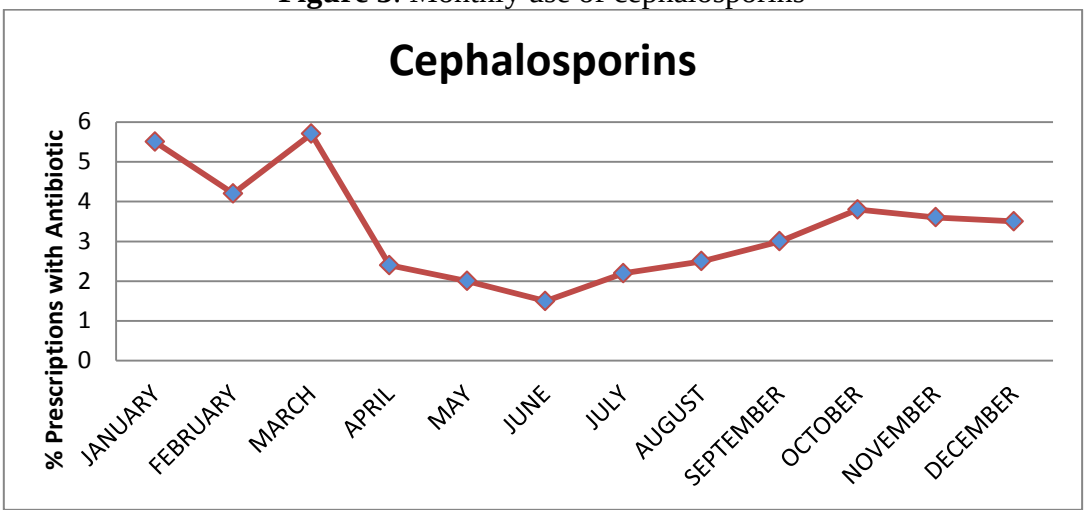


Figure 4: Monthly use of penicillins

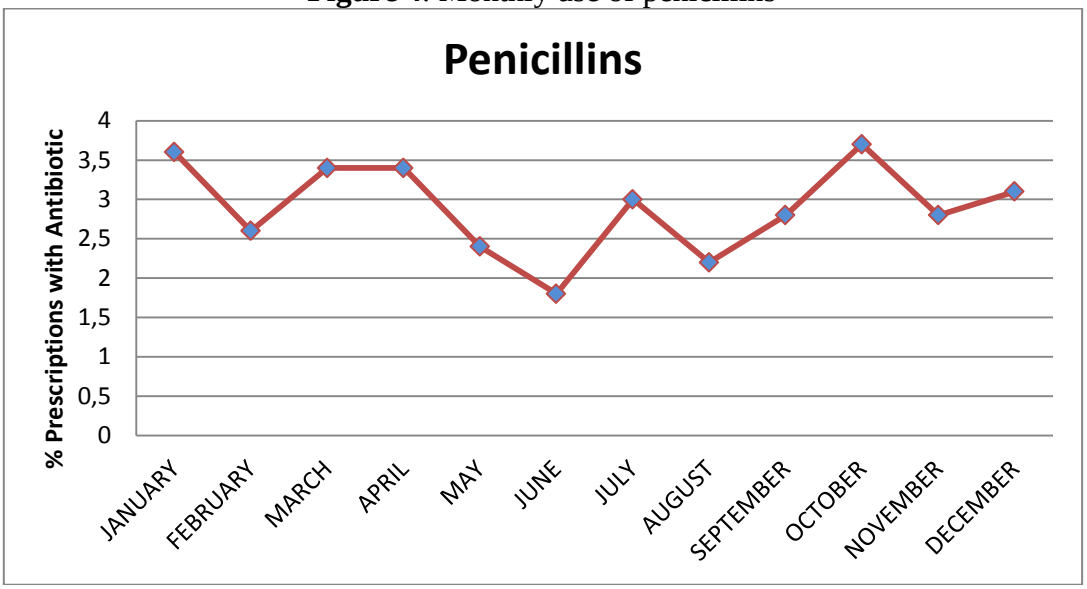


Figure 5: Monthly use of macrolides

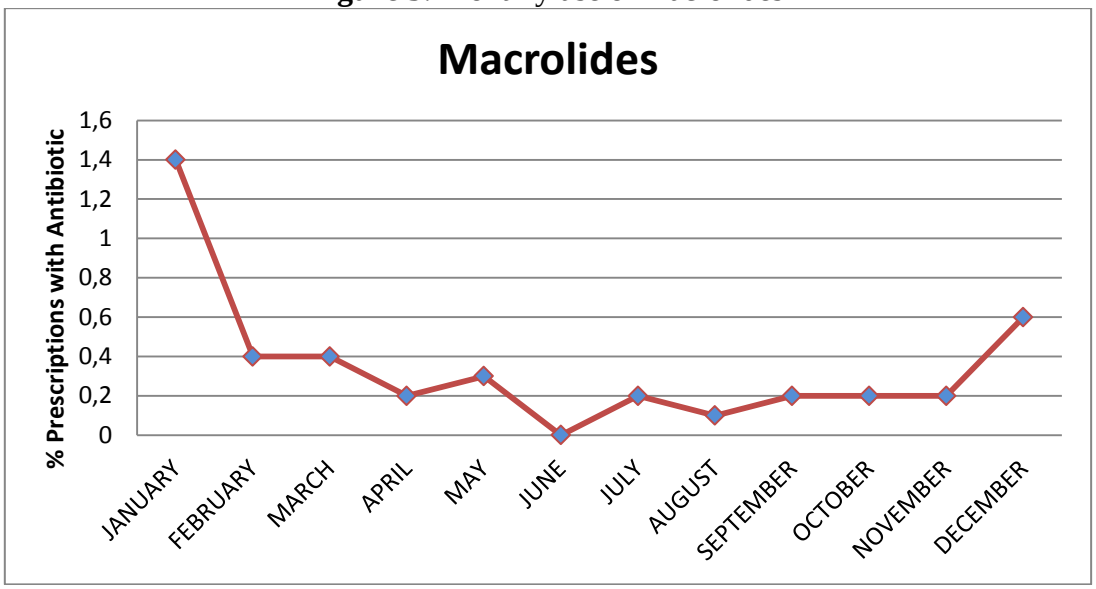
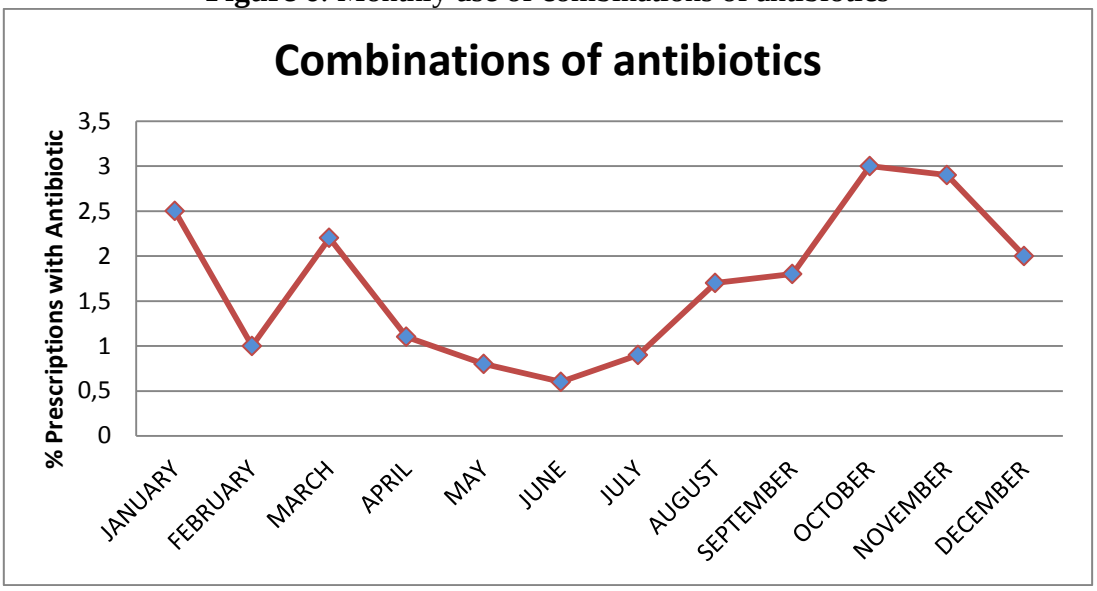


Figure 6: Monthly use of combinations of antibiotics

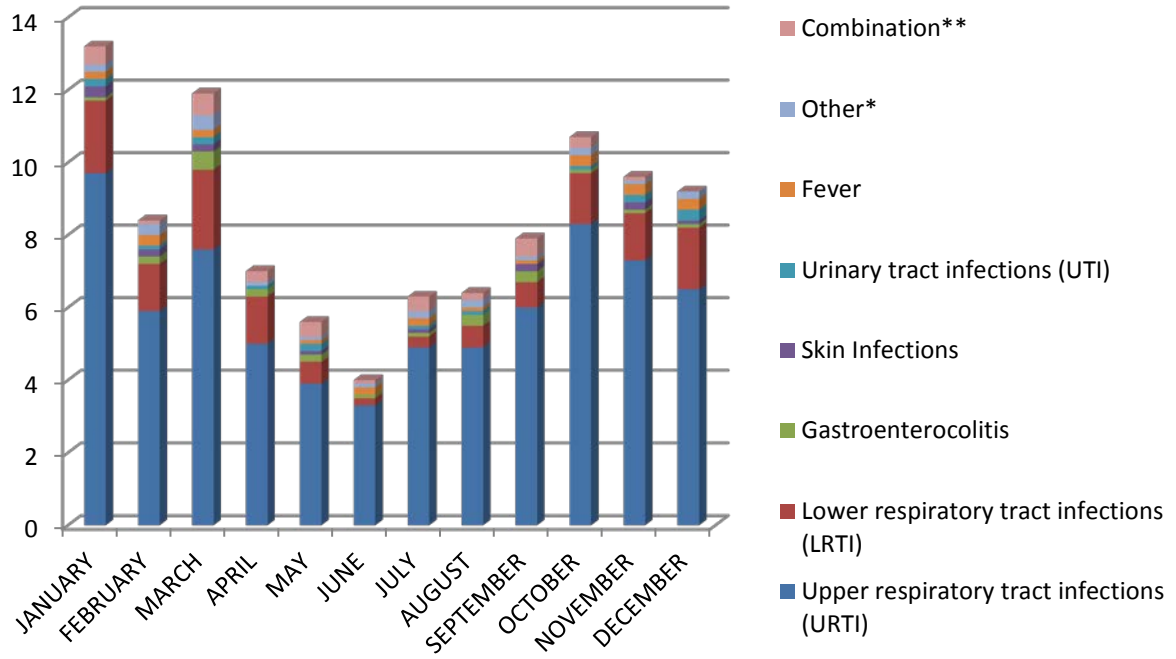


Seasonal variations of clinical diagnosis

Concerning the clinical diagnosis; out of 3151 patients for whom antibiotics were prescribed, 73.3% had an upper respiratory tract infections. Lower tract infection was present in 13.7% patients, gastroenterocolitis and fever in 2.1 %, skin infections in 1.5%, urinary tract infections in 1.7%. 2.5% had other diagnosis and in certain cases 3.5% prescriptions covered multiple diagnoses.

Upper respiratory tract infections had the highest frequency during all months with a significant percentage rate in January.

Figure 7: Frequency of clinical diagnosis



Correlation of antibiotics with age and clinical diagnosis

The treatment with antibiotics had a high significant relationship with upper and lower respiratory tract infections in all age groups as illustrated in Table 2.

Table 2: Correlation of antibiotics with age and clinical diagnosis

		Diagnosis	Antibiotic	Age
Diagnosis	Pearson Correlation	1	r=0.069*	r=0.050*
	Sig. (2-tailed)		P=1.114E-4 S	P=0.005 S
	N	3150	3150	3150
Antibiotic	Pearson Correlation	r =0.069*	1	r=0.180*
	Sig. (2-tailed)	P=1.114E-4		P=3.130E-24
	N	3150	3151	3151

**. Correlation is significant at the 0.01 level (2-tailed).

53.1 % of the total antibiotics prescribed to paediatric outpatients were used by toddlers (Figure 8). 73.1 % of the overall paediatric antibiotics were prescribed for upper respiratory tract infections and 13.8% were prescribed for lower respiratory tract infections (Figure 9).

Figure 8: Types of antibiotic prescriptions written in all age groups

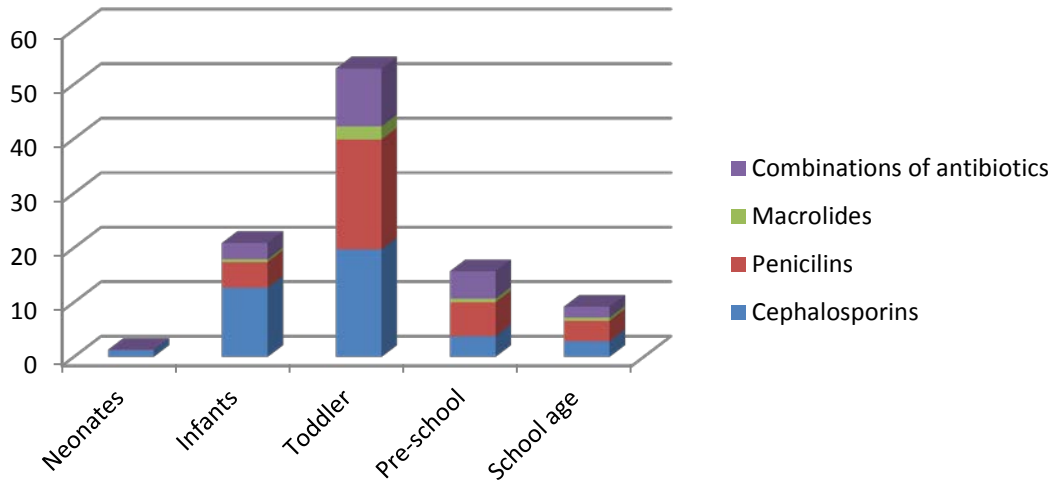
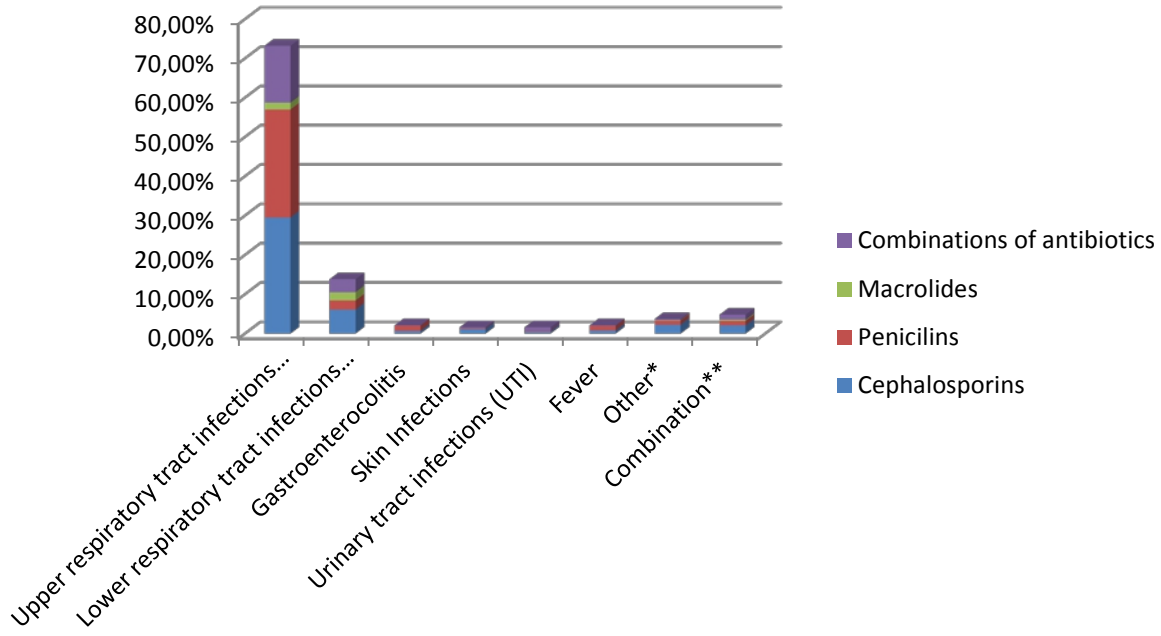


Figure 9: Antibiotic diagnosis relationship



Conclusion

Seasonality in antibiotic prescription rates is common and is more accentuated in countries with high antibiotic use (Goossens H. et al., 2005). The observations in the study were corroborated by the analysis of the monthly variations of antibiotic usage in different age groups. There was a significant correlation between the group age and seasonal usage of antibiotics. In all age groups, the months of the largest usage of antibiotics were January and March, whilst the lowest level was recorded in June. In our study, significant fluctuations of monthly use of antibiotics were observed for cephalosporins, combinations of antibiotics and macrolides. There was no significant seasonal fluctuation for penicillins. The antibiotics with high seasonality are mainly prescribed for respiratory tract infections during winter months. The European Surveillance of Antimicrobial Consumption (ESAC) study has shown a higher outpatient antibiotic use in the winter season in all countries. The authors explained that this seasonal variation could be related to an increased incidence of respiratory tract infections during the winter months in European countries, resulting in higher prescription rates during this period (Ferech M. et al., 2006). Respiratory infections are more likely in the winter months in Tetovo also, as showed in the results, and it is likely that the higher usage of antibiotics during the winter months in our study was due to this and could include inappropriate prescribing for coughs and colds. Our results revealed a positive correlation between the usage of antibiotics and age. 53.1 % of antibiotics were used by toddlers. There was a correlation between the percentage of children given antibiotics for respiratory tract infections (upper and lower) and the overall paediatric antibiotic prescribing rate. Results from our study have shown that a continuous surveillance of antibiotic use and resistance plus detailed knowledge of antibiotic use in the community are necessary to develop and implement guidelines for antibiotic use in a particular region. Efforts from the policy makers of R. of Macedonia to educate providers, mainly paediatric providers and patients to decrease the rate of irrational antibiotic use especially for viral infections are urgently needed to avoid development of resistance and to preserve the effectiveness of antibiotics.

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