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Prescribing Antibiotics to Preschool Children in Primary Health Care in Croatia

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ABSTRACT

The use of antibiotics depends on cultural and socioeconomic factors, physician's characteristics as well as on microbiological considerations. Aim of our study was to asses antibiotic prescription among preschool children in primary health care in Croatia in relation to socioeconomic factors, symptoms and diagnoses, and type of health care provider. Retrospective longitudinal survey was conducted in 7 teaching primary health care offices in the Croatian capital of Zagreb during 2004, among 1700 preschool children. Antibiotics were prescribed to 611 (46%) children. Significantly more antibiotics were prescribed to boys (66.7%, P=0.024) and to children whose parents had lower educational level. Most frequently antibiotics were prescribed for the symptoms such as fever (32%), cough (32.5%), nasal discharge (12%), and for the diagnoses such as respiratory diseases (J00-J99) (40%), infectious and parasitic diseases (A00-A99) (31%), and diseases of the middle ear and mastoid (H60-H95) (15%). Logistic regression analyses also predicted correlation of antibiotic prescriptions with socioeconomic factors, symptoms and diagnoses and health care of pediatrician. Prescription of antibiotics for preschool children in primary health care in Croatia related to socioeconomic factors, type of health care provider, certain symptoms and diagnosis groups which should be taken into account when assessing and planning primary health care for preschool children.

Key words: *antibiotics, preschool children, primary health care, socioeconomic factors, symptoms, diagnosis*

Introduction

After the introduction of antibiotics in the mid-20th century, clinicians soon witnessed clinical failures secondary to bacterial resistance mostly caused by inappropriate use of antibiotics. Option for solving this problem included development of new antibiotics to treat resistant organisms which increased health expenditures[1].

In poorer central and eastern Europe antibiotic resistance and nosocomial infection rates increased in comparison to western and northern Europe[2].

Croatia is undergoing an extensive health reform. Its government is concerned that Croatia appears to spend more money on medicinal drugs than most other countries in the region, and that the prescribing habits of some physicians are perceived to be unnecessarily expensive[3].

Understanding of determinants of antibiotics consumption is critical to explain current patterns of their use and to devise programs in order to reduce their inappropriate use. Physician behavior can be explained by such factors as lack of information, desire to satisfy patients' demand, and pressure from managed care organizations to speed throughput[4].

Patient complaints and pathological results in physical examination were strong predictors of antibiotic prescribing by GPs although they are non evidence based predictors[5].

Most antibiotics are prescribed only for few diagnoses, as was found in the Canadian prospective study of antibiotics prescribing for children in which three diagnoses accounted for 82% of antibiotic prescriptions: pha-

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ryngitis, bronchitis and acute otitis media[6]. Prescription of antibiotics at children initial visit for cough and cold symptoms is associated with higher parental satisfaction. Among those who did not receive antibiotics initially, receiving them subsequently was associated with significantly lower median parental satisfaction[7].

The most frequently prescribed drugs to frequent attenders are antibiotics[8] although mental health is recognized as a main factor associated with frequent attendance to primary health care[9].

Canadian study about child, household and physician factors predictive of no adherence to evidence-based antibiotic prescribing in children reveals that prediction for antibiotic prescription for a viral respiratory tract infections is higher for pediatricians and much higher for other specialists than for general practitioners. Pediatricians and other specialists were more likely to prescribe second-line antibiotics for initial therapy than general practitioners. Independent effect of household income indicates that parents also have an important role in antibiotic prescribing[10].

Different health care systems have different primary health care organization for preschool children. Primary health providers are either general practitioners or pediatricians or both[11]. Parents of preschool children in Croatia can choose pediatrician or family physician for health care providers of their children.

In our study we investigated antibiotic prescription to preschool children in primary health care in the Croatian capital of Zagreb, in relation to symptoms, diagnoses, socioeconomic status, and type of health care provider to enlighten characteristics of those factors as related to antibiotic prescriptions.

Subjects and Methods

The retrospective longitudinal study was conducted in six family physicians practices and one pediatrician practice during 2004, among 1700 preschool children being in their care one to six years. Only 4% of preschool children were in family physician's health care in Croatian capital of Zagreb. Therefore we chose family physician's practices that had preschool children in health care and one pediatric office from the same part of the city with a similar number of children in care as it is in those family practices. All seven practices were teaching practices so we could suppose to be specific and the best ones.

Subjects

The sample included 964 preschool children being in health care of chosen practices one to six years, who visited their physicians during 2004.

Method

Symptoms and diagnoses were recorded in standardized children medical records for primary health care for every visit during 2004. Preventive check ups and vaccination were excluded.

TABLE 1
CHARACTERISTICS OF CHILDREN (N=964)

Characteristics	No (%). of children
Boys	517 (54)
Attending day care	621 (66)
Number of children in family	
one	321 (33)
two	432 (45)
three and more	212 (22)
Parents' marital status-married	950 (99)
Mothers' educational level	
primary school	61 (6)
secondary school	569 (59)
university degree	334 (34)
Fathers' educational level	
primary school	60 (6)
secondary school	545 (56)
university degree	359 (37)
Primary health care provider	
family physician	434 (45)
pediatrician	530 (55)

Standardized children medical records for primary health care consisted of socioeconomic data (parents – names, age, professions; living conditions – house or flat, electricity at home; brothers and sisters; day care center attendance), family history; preventive check ups and vaccination, visits (date, history, symptoms, findings, clinical examinations, diagnosis, therapy and referrals).

Because all involved practices were teaching practices their medical records were with previous agreement almost uniformly organized in standardized medical files. Data were collected by one person (physician) so bias was same for every practice.

Symptoms were classified according to ICD-10[12], Chapter XIII. Symptoms, signs, and ill-defined conditions (R00-R99).

Antibiotics were prescribed for five groups of diagnosis: diseases of the respiratory system (J00-J99), infectious and parasitic diseases (A00-A99), diseases of the middle ear and mastoid (H60-H95), diseases of the skin and subcutaneous tissue (L00-L99), and diseases of the genitourinary system (N00-N99).

Statistical analysis

Results were described by parameters of descriptive statistics: categorical data were presented in absolute and relative frequencies. Differences between investigated groups for categorical variables were tested with chi square test for independent samples. Correlation of

TABLE 2
GENDER, DAY CARE ATTENDANCE AND PARENTS' EDUCATIONAL LEVEL AMONG CHILDREN WHO DID OR DID NOT RECEIVE ANTIBIOTICS

Characteristics	No. (%) of children without antibiotics (n=353)	p*	No. (%) of children with antibiotics (n=611)
Boys	172 (33.3)		345 (66.7)
Girls	181 (40.5)	0.024	266 (59.5)
Attending day care	197 (31.7)		424 (68.3)
Not attending day care	145 (45.0)	<0.001	177 (55.0)
Mothers' educational level:			
primary school	26 (42.6)		35 (57.4)
secondary school	190 (33.4)		379 (66.6)
university degree	137 (41.0)	0.044	197 (59.0)
Fathers' educational level.			
primary school	26 (43.3)		34 (56.7)
secondary school	179 (32.8)		366 (67.2)
university degree	148 (41.2)	0.021	211 (48.8)

*χ^2 – test.

TABLE 3
LOGISTIC REGRESSION ANALYSIS OF ANTIBIOTIC PRESCRIPTION AS DEPENDENT VARIABLE RELATED ON SOCIOECONOMIC FACTORS, SYMPTOMS AND DIAGNOSIS

Parameters	OR	95% CI
Boys	0.7	0.5–0.97
Fever	1.4	1.1–1.7
Throat soreness	2.8	1.7–4.7
Earache	2.7	1.6–4.7
Cough	1.5	1.2–1.8
Group of ICD diagnosis		
Diseases of the Middle Ear and Mastoid (H60-H95)	1.6	1.0–2.4
Respiratory System Diseases (J00-J99)	1.6	1.4–1.8
Diseases of the Genitourinary System (N00-N99	1.6	1.0–2.5

logistic regression analysis

observed parameters on antibiotic prescription was investigated by logistic regression analysis.

Values $p<0.05$ were considered significant. Statistical analysis was performed on SPSS 9.0 software (SPSS Inc, Chicago, IL, USA).

Results

Antibiotics were prescribed to 611 (46%) children out of 1700.

Differences between group of children who received and did not receive antibiotics according to gender, age, number of children in the family, and parents' educational level

The mean age of children who did not receive antibiotics (n=353) was 4.2±0.1 years, compared with 4.1±0.1 years in children who received antibiotics (n=611) (p=0.563).

There was significant difference in number of children in the family between the group of children who did not receive antibiotics (38.6% families with one child, 40.1% families with two children and 21.3% families with three children) and the group of children who received antibiotics (29.9% families with one child, 47.6%families with two children, and 22.5% families with three children) (p=0.017).

Boys received significantly more antibiotics (p=0.024) and children attenders of day care (p<0.001, Table 2).

Significantly higher number of parents of children who were prescribed antibiotics were with secondary schooling than those with university degree ($p_{mothers}$=0.044, $p_{fathers}$=0.021, Table 2).

Symptoms correlated with antibiotics prescription

Frequency of fever with 560 episodes was almost equal as cough with 558 episodes, while the number of antibiotic prescriptions was slightly higher for cough (n=441) than for fever (n=433). Other symptoms: nasal discharge, earache and sore throat, GI disorders, rash and dyspnea corresponded with most frequent antibiotic prescriptions (Figure 1).

Diagnoses groups correlated with antibiotics prescription

Frequency of diagnosis groups (respiratory system J00-J99, infectious and parasitic diseases A00-A99, and

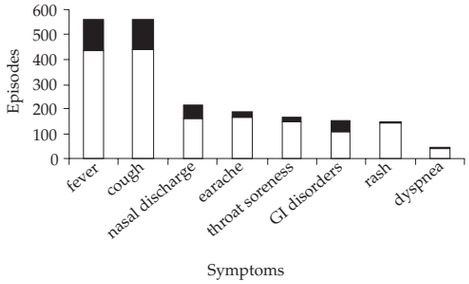

Fig. 1. Distribution of symptoms and antibiotics prescription.

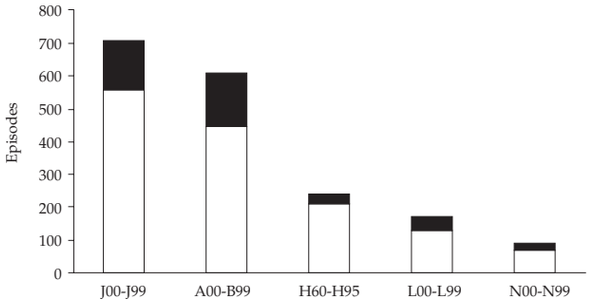

Fig. 2. Distribution of diagnoses groups and antibiotics prescription.

diseases of the middle ear and mastoid H60-H95, diseases of the skin and subcutaneous tissue L00-L99, diseases of the genitourinary system N00-N99) corresponded with frequency of antibiotic prescriptions (Figure 2).

Logistic regression analysis of antibiotic prescription as dependent variable related on socioeconomic factors, symptoms, and diagnosis

Logistic regression analysis predicted correlation of antibiotics prescriptions with boys, children with symptoms of fever, sore throat, earache, cough, children with diagnosis groups: diseases of respiratory system (J00-J99), diseases of the middle ear and mastoid (H60-H95), diseases of the genitourinary system (N00-N99) (Table 3.).

Logistic regression analysis did not predict correlation of antibiotics prescription with age, parents educational level and age, attending day care centers, with symptoms such as dyspnea, nasal discharge, digestive problems, loose of appetite, rash, unidentified symptoms, and injuries, with diseases groups infectious and parasitic diseases (A00-A99) and, diseases of the skin and subcutaneous tissue (L00-L99).

Logistic regression analysis of type of health care provider as dependent variable related to socioeconomic factors, symptoms, and diagnosis among children who received antibiotics

Logistic regression analysis was predicted correlation among children in health care of pediatritian with older mother and families with fewer children. Among symptoms, prediction of correlation was with cough, but not with nasal discharge and rash. Iinfectious and parasitic diseases (A00-A99) and diseases of the genitourinary system (N00-N99) correlated stronger with antibiotics prescriptions by pediatrician. Prediction of corelation among children in health care of pediatritian was connected with referrals to other specialists, referrals to therapy and hospital. Stronger predicton of correlation was with not only antibiotics prescirptions but also with prescriptions for other drugs among children in health care of pediatrician (Table 4.).

TABLE 4
LOGISTIC REGRESSION ANALYSIS OF TYPE OF HEALTH CARE PROVIDER* AS DEPENDENT VARIABLE RELATED ON SOCIOECONOMIC FACTORS, SYMPTOMS AND DIAGNOSIS

Parametars	OR	95% CI
Mathers' age	1.1	1.0–1.2
Number of children in family	0.7	1.0–1.1
Cough	1.3	1.1–1.5
Nasal discharge	0.65	0.5–0.8
Rash	0.6	0.5–0.8
Infectious and Parasitic Diseases (A00-B99)	1.4	1.2–1.6
Genitourinary System Diseases (N00-N99)	1.8	1.2–2.9
Referral to specialist	4.1	1.2–13.8
Referral to therapy	4.2	1.2–14.9
Referral to hospital	5.5	1.4–21.7
Other prescriptions	1.8	1.4–2.3
Antibiotic prescriptions	1.3	1.0–1.6

Dependent variable: physician (0=GP. 1=pediatrician) logistic regression analysis

Correlation was not predicted with children gender and age group, fathers' age, parents' educational level, number of visits, referrals to diagnostic procedures, symptoms of fever, throat sorrenes, earache, GI disoreders, unidentified symptoms and injuries, diagnoses groups of respiratory system (J00-J99) and diseases of the middle ear and mastoid (H65-H95).

Discussion

According to our results almost half of preschool children received antibiotics in primary health care. The same antibiotic prescribing rate is reported in so called antibiotic low prescribing country – Germany[13].

Dutch survey reports the highest antibiotic prescribing rate for respiratory tract infections among children under 2 years[14]. We did not find any effect of age to prescribing in our study.

In our study boys received significantly more antibiotics and also children who attended day care centers as in other settings[15]. It will be interesting for further qualitative research to explore differences by sex in prescribing antibiotics.

Our study showed that the parents (both – fathers and mothers) of children who received antibiotics had lower education (secondary school) comparing with university degree of parents of children who did not receive antibiotics, as in a Danish study, which connected except lower educational level, also lower social class, and lower household income with higher consummation of health care[16]. In literature it is recognized that children with a physician or a pharmacist as a parent are significantly less likely than other children to receive antibiotic prescriptions[17].

In our study, antibiotics were prescribed most frequently for diagnoses groups of respiratory diseases (J00-J99), infectious and parasitic diseases (A00-A99), and diseases of the middle ear and mastoid (H60-H95).

The most frequent symptoms for antibiotic prescription in our study were fever (body temperature over 37 °C), cough, nasal discharge, earache, and soreness of the throat. The most common symptoms recognized in literature as reasons for pre-school children to consult doctors are cough, high fever and/or earache[18]. The majority of febrile children in primary care settings are diagnosed with a bacterial infection and treated with an antibiotic[19].

Physicians prescribed antibiotics to 53% of children with sore throat, in excess of the maximum expected prevalence (15–36%) of pharyngitis caused by group A beta-hemolytic streptococci[20].

Physicians – frequent prescribers diagnosed bacterial infections according to symptoms in order to justify antibiotics prescription. Rinorrhea, sinus tenderness, and purulent secretion are the symptoms on which physicians based diagnose of sinusitis and prescribed antibiotics for 98.4% of patients vs. patients with diagnoses of upper respiratory tract infection to whom antibiotics were prescribed only in 13.1% of cases[21]. In Netherlands – low antibiotic prescribing country with tendency for further lowering increased disease-based prescription rates are observed for acute otitis media, acute bronchitis, acute upper airway infections, acute tonsillitis and cough, especially prescriptions of non-recommended broad-spectrum antibiotics[22].

When we consider disease based antibiotic prescriptions we also have to take in account tendency of decreased prevalence of respiratory tract infections and consequently lowering antibiotic prescriptions[23].

Our survey revealed higher antibiotics prescriptions by pediatrician and also higher prescriptions for other drugs, and more referrals. Stronger correlation with cough and diseases of Infectious and parasitic diseases (A00-A99) and diseases of the genitourinary system (N00-N99) and antibiotics prescription by pediatrician. Pediatrician also prescribed more antibiotics prescription to children with older mothers and from families with fewer children in family.

French study also revealed differences between pediatricians and general practitioners in care of children. Management by pediatricians was associated with 25% fewer consultations and 6% fewer hospitalizations. Pediatricians also wrote 25% fewer prescriptions for drugs, 17% fewer for laboratory tests. Children seen by pediatricians took antibiotics less frequently[24].

Even among general practitioners, antibiotic prescribing rate is influenced by physicians' characteristics and by the environment in which they practice[25].

In the group of children who received antibiotics we could not identify children who really had to receive antibiotics what represented a limitation in our study. Same problems existed in interpretation of received antibiotics for certain symptoms. This is partly because of the International Classification of Diseases, which is probably not the best way for interpretation of antibiotic prescriptions especially for the group of infectious and parasitic diseases (A00-B99) which consisted of both bacterial diseases and viral infections.

Practices in our survey were teaching what is in literature recognized as lower antibiotic prescribing practices[26] so we could not generalized our findings for other practices and another limitation is that. only one pediatrician practice was included in our survey.

The use of antibiotics is heavily shaped by cultural and economic factors as well as by microbiological considerations. Those non pharmacological factors are relevant to clinicians and policymakers because of the clinical and fiscal toll of inappropriate antibiotic prescribing, including excessive use, preventable adverse effects, and the increasing prevalence of resistant organisms[27].

Comparison of utilization of antibiotics in young children shows opposite relationships to adult educational levels in Danish and Swedish countries and warn that relationships between socio-economic position (educational level) and drug utilization should not be generalized from one area to another[28] and need for further reserches.

Antibiotic resistance is a serious problem worldwide. In order to develop guidelines for appropriate antibiotic use it is necessary to understand the present prescribing patterns of physicians who manage children.

Our results: prevalence of almost half preschool children who received antibiotics, lower educational level of children's parents, male gender, the most frequent symptoms correlated with antibiotics prescription: fever, cough, nasal discharge and the most frequent diagnoses correlated with antibiotics prescription: respiratory diseases (J00-J99) (40%), infectious and parasitic diseases (A00-A99) (31%), and diseases of the middle ear and mastoid (H60-H95) (15%) should be considered as a pilot research for more extensive epidemiological research.

Socioeconomic factors, symptoms, and diagnoses that correlate with antibiotic prescription to preschool children in primary health care in Croatia should be a small piece of puzzle of improving antibiotic use in intensive restructuring of health care in Croatia, country in transition and post war period.

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PROPISIVANJE ANTIBIOTIKA DJECI PREDŠKOLSKE DOBI U PRIMARNOJ ZDRAVSTVENOJ ZAŠTITI U HRVATSKOJ

SAŽETAK

Propisivanje antibiotika ovisi o kulturološkim i socioekonomskim čimbenicima, karakteristikama liječnika kao i o mikrobiološkim uzročnicima. Cilj rada je bio procjeniti propisivanje antibiotika djeci predškolske dobi u primarnoj zdravstvenoj zaštiti u Hrvatskoj u odnosu na socioekonomske čimbenike, simptome i dijagnoze te vrsti liječnika. Retrospektivno longitudinalno istraživanje je provedeno u sedam nastavnih ordinacija u primarnoj zdravstvenoj zaštiti, u glavnom gradu Hrvatske – Zagrebu, tijekom 2004, obuhvativši 1700 predškolske djece. Antibiotici su propisani 611 (46%) djetetu. Značajno više antibiotika je propisano dječacima (66,7%, p=0.024) i djeci čiji roditelji imaju niže obrazovanje. Najčešće su propisivani kod simptoma povišene temperature (32%), kašlja (32,5%), curenja nosa (12%) te za dijagnoze skupina bolesti: dišnog sustava (J00-J99) (40%), zarazne i parazitarne bolesti (A00-A99) (31%) te bolesti srednjeg uha i mastoida (H60-H95) (15%). Logistička regresijska analiza je također predvidjela povezanost propisivanja antibiotika sa socioekonomskim čimbenicima, simptomima, dijagnozama i skrbi pedijatra. Propisivanje antibiotika djeci predškolske dobi u primarnoj zdravstvenoj zaštiti u Hrvatskoj ovisi o socioekonomskim čimbenicima, određenim simptomima i dijagnozama te o vrsti liječnika što bi trebalo uzeti u obzir pri procjenjivanju i planiranju primarne zdravstvene zaštite predškolske djece.