



Knowledge, Attitudes and Practices of Parents Regarding Antibiotic use Among Children: Differences Between Urban and Rural Areas in the Republic of Srpska

Biljana Mijović,^{1, 2} Jela Aćimović,^{2, 4} Jelena Đaković Dević,^{2, 4} Julija Kralj,² Bojan Joksimović,¹ Vesna Lučić Samardžija,³ Mirjana Djermanović,^{2, 4} Vesna Vujić Aleksić,^{5, 4} Branislav Zeljković,² Snežana Perić Simić⁶

Abstract

Background/Aim: Antibiotic use and resistance represent a growing public health issue, with a specific risk of uncontrolled use of antibiotics in children. The aim of the study was to examine differences in parental knowledge, attitudes and practices about antibiotic use in children between urban and rural areas of the Republic of Srpska.

Methods: A cross-sectional study was conducted among 1459 parents of children under 6 years of age, out of which 1201 (82.3 %) lived in urban areas while 258 (17.7 %) lived in rural areas. The research is conducted among parents who brought their children to the selected primary healthcare centres and among parents of children in preschool institutions.

Results: The majority of respondents (98.4 %) state that doctors are their main source of information. Only 61.2 % of respondents precisely know which drug is an antibiotic when offered different drugs and respondents from rural areas (54.3 %) more often ($p = 0.012$) gave more accurate answers when compared to respondents from urban areas (37.3 %). Among parents, 86 % agree with the statement that improper use of antibiotics reduces their effectiveness and leads to bacterial resistance, regardless of groups. More than a half of respondents (52.4 %) do not think that children with flu or common cold symptoms recover faster when they receive antibiotics, significantly more respondents from urban areas ($p = 0.001$). Respondents from rural areas significantly more often believe that antibiotics can produce harmful effects compared to respondents from urban areas ($p = 0.049$). Respondents from rural areas significantly more often think that antibiotic use can prevent complications caused by inflammation of the upper respiratory tract ($p = 0.006$). Parents from rural areas give their children antibiotics without a paediatrician's recommendation significantly more often (4.3 %) compared to respondents from urban areas (0.6 %) ($p < 0.001$).

Conclusion: There are differences in parental knowledge, attitudes and practices regarding antibiotic use and antimicrobial resistance among parents in rural and urban areas. There is need for additional education of parents and for greater engagement of paediatricians in providing guidance and explanations regarding the use of antibiotics.

Key words: Antibiotic prescribing; Antimicrobial resistance; Parents; Attitudes; Knowledge; Practice.

1. Faculty of Medicine Foča, University of East Sarajevo, Foča, the Republic of Srpska, Bosnia and Herzegovina.
2. Public Health Institute of the Republic of Srpska, Banja Luka, the Republic of Srpska, Bosnia and Herzegovina.
3. Primary Healthcare Centre, Banja Luka, the Republic of Srpska, Bosnia and Herzegovina.
4. Faculty of Medicine, University of Banja Luka, Banja Luka, the Republic of Srpska, Bosnia and Herzegovina.
5. Agency for Certification, Accreditation and Quality Improvement in Health Care of the Republic of Srpska, Banja Luka, the Republic of Srpska, Bosnia and Herzegovina.
6. Primary Healthcare Centre, Bijeljina, the Republic of Srpska, Bosnia and Herzegovina.

Correspondence:
BILJANA MIJOVIĆ
E: biljana.mijovic@gmail.com

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Introduction

There is widespread public misconception on antibiotic use and antibiotic resistance. Preschool children are at particular risk of receiving unnecessary antibiotics.¹ Antibiotic abuse has become a global public health issue, especially due to the rapid development of antibiotic resistance, leading to high morbidity and mortality.² Over the last few years, there has been an increase in antimicrobial resistance across Europe, with extreme differences in knowledge, attitudes and beliefs, with the highest level of misconception leading to the inappropriate use of antibiotics in southern and eastern countries.³⁻⁵

In the Republic of Srpska, many activities are being undertaken in the field of prevention of antibiotic abuse and antimicrobial resistance. According to the regulation in the field of infectious diseases, there is the Committee for Antimicrobial Resistance Control in the Republic of Srpska. This Committee suggests adoption of the Antimicrobial Resistance Program in the Republic of Srpska. Based on data from healthcare institutions, the Public Health Institute of the Republic of Srpska monitors use of antimicrobial drugs in the Republic of Srpska and prepares an annual report on antimicrobials use for the territory of the Republic of Srpska.

The studies about knowledge, attitudes and practices among parents were conducted in many surrounding countries. Baseline data in the former Yugoslav Republic of North Macedonia in September 2014 before their intervention programme show that 40 % of parents believed antibiotics could kill viruses while one third of parents expressed dissatisfaction with doctors who would not agree with them on antibiotic use.⁶ In Greece parents have a trusted relationship with their paediatrician and rarely give antibiotics without medical advice.⁷ In the Turkey study, which was held between 14 December 2020 and 1 April 2021, 37 % of parents believed that antibiotics could cure infections caused by viruses and 6.3 % of parents declared that they put pressure on paediatricians to prescribe antibiotics.⁸ In the Croatia, study from 2017 specifically compared parental knowledge and awareness between urban and rural areas and it was found that the knowledge about antibiotics was higher in urban parents, but it was not reflected on the level of antibiotic consumption.⁹ In Italian study families from

low-income settings or those born abroad have significantly more misconceptions about important antibiotic practices.¹⁰ In the countries which are geographically far from Republic of Srpska, such as China, low levels of knowledge on the use of antibiotics and a high prevalence of self-medicating children with antibiotics were observed among parents in rural areas of this country.¹¹ A total of 79.7 % of Palestinian parents were attentive to the truth that antibiotic misuse is responsible for bacterial resistance, but 70.1 % would still give antibiotics to their child because they thought this would lead to a faster recovery.¹²

The aim of the present study was to examine differences in knowledge, attitudes and practices among parents in urban and rural areas of the Republic of Srpska regarding antibiotic use in children and antimicrobial resistance.

Methods

The research was conducted in 2020 among 1459 parents of children under 6 years of age who brought their children to the selected primary healthcare centres and among parents of children under 6 years of age that attend preschool institutions in selected municipalities.

In Bosnia and Herzegovina, 40 to 60 percent of the population is living in rural areas according to the definition of the United Nations Development Programme (UNDP).¹³ There are several definitions of "rural" in common use. Some of them are "area-based approaches" that typically define a region, municipality or province as rural or urban according to the population density while others have "settlement-based approaches" and classify individual settlements as urban or rural according to their size or administrative classifications stipulated by state authority. According to 2020 estimates, there are 1.136.274 inhabitants in the Republic of Srpska. Regarding settlement-based approach in the Republic of Srpska, four cities with urban status (Banja Luka, Derventa, Bijeljina, Istočno Sarajevo) and four municipalities with rural status (Foča, Berkovići, Ljubinje and Bileća) were randomly selected.

The cross-sectional study was conducted at the same time in all selected cities and municipalities and included all parents (legal representatives or

guardians) who brought their children to public preschools or to the primary healthcare centres and agreed to participate in the study and signed informed consent. The study was approved by the Ethics Committee of the Public Health Institute of the Republic of Srpska. Participation was voluntary and all collected data were encrypted and thus entered into the database.

A structured questionnaire, specially designed for this research, was used as a research instrument. Questionnaires were distributed to parents upon picking up their children from preschools.

The questionnaire consisted of 44 questions given in four chapters and was developed after reviewing the similar published studies.^{6,7} It was pre-tested on 20 parents. The first chapter of the questionnaire included basic sociodemographic characteristics. The second chapter included questions about parental knowledge of antibiotics. The third chapter was related to the parental use of antibiotics, knowledge, attitudes and behaviour. The fourth chapter examined parental attitudes towards antibiotic prescribing in paediatric practice.

Statistical analysis was performed in SPSS software package version 21.0 (Statistical Package for Social Sciences SPSS 21.0 Inc, USA). Data were presented as frequencies and percentiles and the chi-square test was used to assess the statistically significant difference.

Results

Out of 1459 respondents, 1201 (82.3) lived in urban areas, while 258 lived in rural areas. The majority of parents were female parents (75.5 %) and significantly more women from rural areas were surveyed (80.6 %) compared to urban areas (74.4 %) ($p = 0.036$). The largest number of mothers had a university degree (49.3 %), degree in secondary school education (43.1 %), college degree (5.3 % of mothers) and 2.2 % of mothers completed the primary school only. Significantly larger number of mothers from urban areas had a university degree (52 %) compared to mothers from rural areas (37.2 %) ($p < 0.001$). The large percentage of fathers (54.1 %) had a degree in secondary school education, 1.9 % of them completed the primary school, 6.9 % a college degree and 37.1 % university degree; no significant dif-

ference was observed in the level of education of fathers among groups of respondents distributed by place of residence. From all respondents, 1.2 % assessed their financial income as very low, 9.8 % as low, 81.5 % as average, 7.5 % as high and only up to 0.1 % as very high. A significantly higher number of respondents from rural areas assessed their financial income as very poor (2.7 %) compared to respondents from urban areas (0.8 %) ($p = 0.023$). Sixty-four percent of respondents (63.7 %) had a professional relationship with their child's paediatrician, 34.3 % think they had a friendly relationship while 2 % of respondents state familiar relationship. Significantly ($p = 0.001$) larger number of respondents from rural areas (43.4 %) assessed relationship with their child's paediatrician as friendly compared to respondents from urban areas (32.3 %) (Table 1).

Table 1: Demographic characteristics of the study population

Demographic characteristics	Urban (n = 1201)		Rural (n = 258)		Total (n = 1459)		P (χ^2)
	n	%	n	%	n	%	
Responders	1201	82.3	258	17.7	1459	100.0	
Parental gender							
Male	307	25.6	50	19.4	357	24.5	0.036 ^a
Female	894	74.4	208	80.6	1102	75.5	
Mother's education							
Primary school	30	2.5	2	0.8	32	2.2	< 0.001 ^a
High school	485	40.4	144	55.8	629	43.1	
College	62	5.2	16	6.2	78	5.3	
University degree	624	52.0	96	37.2	720	49.3	
Father's education							
Primary school	24	2.0	3	1.2	27	1.9	0.080
High school	655	54.5	135	52.3	790	54.1	
College	74	6.2	27	10.5	101	6.9	
University degree	448	37.3	93	36.0	541	37.1	
Family income							
Very low	10	0.8	7	2.7	17	1.2	0.023 ^a
Low	126	10.5	17	6.6	143	9.8	
Average	979	81.5	210	81.4	1189	81.5	
High	85	7.1	24	9.3	109	7.5	
Very high	1	0.1	0.0	0.0	1	0.1	
Relationship with paediatrician							
Professional	792	65.9	138	53.5	930	63.7	0.001 ^a
Friendly	388	32.3	112	43.4	500	34.3	
Familiar	21	1.7	8	3.1	29	2.0	

χ^2 - Chi-square test; a - statistically significant

Ninety-eight percent (98.4 %) of surveyed parents stated that doctors are their main source of information when deciding on antibiotic treatment of their children, 2.7 % state TV as the main source of information, then 0.8 % newspapers, 4.3 % friends, 3.3 % cousins; no significant difference was observed in the main source of information according to place of residence. Four

percent of respondents state other sources of information not mentioned in the questionnaire. Respondents from rural areas more often (6.6 %) state this compared to urban areas (3.4 %) ($p = 0.018$) (Table 2).

Table 2: Main sources of information when deciding on the use of antibiotics

Statement about the main source of information	Urban (n = 1201)		Rural (n = 258)		Total (n = 1459)		p (χ^2)
	n	%	n	%	n	%	
Doctors							
No	22	1.8	1	0.4	23	1.6	0.091
Yes	1179	98.2	257	99.6	1436	98.4	
Television							
No	1171	97.5	249	96.5	1420	97.3	0.371
Yes	30	2.5	9	3.5	39	2.7	
Radio							
No	1195	99.5	258	100.0	1453	99.6	0.091
Yes	6	0.5	0	0.0	6	0.4	
Newspapers							
No	1190	99.1	257	99.6	1447	99.2	0.225
Yes	11	0.9	1	0.4	12	0.8	
Friends							
No	1153	96.0	243	94.2	1396	95.7	0.193
Yes	48	4.0	15	5.8	63	4.3	
Cousins							
No	1165	97.0	246	95.3	1411	96.7	0.177
Yes	36	3.0	12	4.7	48	3.3	
Other sources							
No	1160	96.6	241	93.4	1401	96.0	0.018 ^a
Yes	41	3.4	17	6.6	58	4.0	

χ^2 - Chi-square test; a - statistically significant

When asked which of the listed drugs are antibiotics, 80.7 % knew that *Panklav* (INN: amoxicillin and clavulanic acid) was an antibiotic while respondents from rural areas (88.8 %) showed significantly ($p < 0.001$) better knowledge compared to respondents from urban areas (78.9 %). Ninety-three percent of respondents knew that paracetamol was not an antibiotic and 93.6 % knew that ibuprofen was not an antibiotic. Also, 95.3 % knew about *Pulmicort* (INN: budesonide) and 96.2 % about *Flavamed* (INN: ambroxol hydrochloride) that they were not antibiotics while 91 % knew about amoxicillin and 52.5 % about *Pancef* (INN: cefixime) that they were antibiotics, with no significant difference in knowledge about paracetamol, ibuprofen, *Flavamed* and amoxicillin between respondents from rural and urban areas. However, it was noticed that respondents from rural areas significantly more often consider *Pulmicort* as an antibiotic (8.9 %) compared to respondents from urban areas (3.8 %) ($p < 0.001$) and respondents from rural areas know better that *Pancef* is an antibiotic (62 %)

compared to the urban respondents (50.5 %) ($p < 0.001$). By summarising the answers, it was noticed that a total of only 893 (61.2 %) respondents knew how to accurately identify the antibiotic out of the drugs offered, with more accurate answers given significantly more often ($p = 0.012$) by rural respondents (54.3 %) compared to urban respondents (37.3 %) (Table 3).

Table 3: Knowledge about antibiotics

Statement	Urban (n = 1201)		Rural (n = 258)		Total (n = 1459)		P (χ^2)
	n	%	n	%	n	%	
Panklav							
No	253	21.1	29	11.2	282	19.3	< 0.001 ^a
Yes	948	78.9	229	88.8	1177	80.7	
Paracetamol							
No	1111	92.5	246	95.3	1357	93.0	0.104
Yes	90	7.5	12	4.7	102	7.0	
Pulmicort							
No	1155	96.2	235	91.1	1399	95.3	< 0.001 ^a
Yes	46	3.8	23	8.9	69	4.7	
Pancef							
No	595	49.5	98	38.0	693	47.5	0.001 ^a
Yes	606	50.5	160	62.0	766	52.5	
Ibuprofen							
No	1128	93.9	238	92.2	1366	93.6	0.318
Yes	73	6.1	20	7.8	93	6.4	
Amoxicillin							
No	105	8.7	26	10.1	131	9.0	0.496
Yes	1096	91.3	232	89.9	1328	91.0	
Flavamed							
No	1153	96.0	250	96.9	1403	96.2	0.497
Yes	48	4.0	8	3.1	56	3.8	
Eritromicin							
No	468	39.0	70	27.1	538	36.9	< 0.001 ^a
Yes	733	61.0	188	72.9	921	63.1	
Summed answer							
No	448	37.3	118	45.7	566	38.8	0.012
Yes	753	62.7	140	54.3	893	61.2	

χ^2 - Chi-square test; a - statistically significant; *Panklav* - INN: amoxicillin and clavulanic acid; *Pulmicort* - INN: budesonide; *Pancef* - INN: cefixime; *Flavamed* - INN: ambroxol hydrochloride;

The majority of surveyed parents (82.4 %) disagreed with the statement that antibiotics should be given to every child with a fever, 10 % had a neutral attitude while 7 % of respondents agreed with this statement. Twenty-six percent of respondents disagreed that scientists can produce new antibiotics to destroy resistant bacteria, 39.5 % had a neutral attitude while 34.2 % of respondents agreed with this statement. Eighty-six percent of respondents agree with the statement that improper use of antibiotics reduces their effectiveness and leads to bacterial resistance. There was no significant difference in knowledge

Table 4: Knowledge about antibiotics

Statement	Urban (n = 1201)		Rural (n = 258)		Total (n = 1459)		p (χ^2)
	n	%	n	%	n	%	
An antibiotic should be given to every child who has a fever							
Disagree	1002	83.4	200	77.5	1202	82.4	0.074
Neutral	121	10.1	34	13.2	155	10.6	
Agree	78	6.5	24	9.3	102	7.0	
Since most inflammations of the upper RT are of viral origin, antibiotics should not be given							
Disagree	328	27.3	86	33.3	414	28.4	0.016
Neutral	439	36.6	102	39.5	541	37.1	
Agree	434	36.1	70	27.1	504	34.5	
Children who have flu or common cold symptoms recover faster if they receive antibiotics							
Disagree	657	54.7	107	41.5	764	52.4	0.001 ^a
Neutral	331	27.6	91	35.3	422	28.9	
Agree	213	17.7	60	23.3	273	18.7	
Scientists can produce new antibiotics that could destroy resistant bacteria							
Disagree	320	26.6	64	24.8	384	26.3	0.607
Neutral	477	39.7	99	38.4	576	39.5	
Agree	404	33.6	95	36.8	499	34.2	
Antibiotics can produce harmful effects							
Disagree	67	5.6	21	8.1	88	6.0	0.049 ^a
Neutral	243	20.2	38	14.7	281	19.3	
Agree	891	74.2	199	77.1	1090	74.7	
Improper use of antibiotics reduces their effectiveness and leads to bacterial resistance							
Disagree	47	3.9	7	2.7	54	3.7	0.500
Neutral	120	10.0	30	11.6	150	10.3	
Agree	1034	86.1	221	85.7	1255	86.0	
The use of antibiotics can prevent complications caused by inflammation of the upper RT							
Disagree	150	12.5	34	13.2	184	12.6	0.006 ^a
Neutral	445	37.1	69	26.7	514	35.2	
Agree	606	50.5	155	60.1	761	52.2	

RT – respiratory tract; χ^2 - Chi-square test; a - statistically significant

between the use of antibiotics for fever, the ability of scientists to produce better antibiotics or the effect of improper antibiotic use among groups of respondents according to place of residence.

However, 34.5 % of respondents believed that antibiotics should not be given since inflammation of the upper respiratory tract is most often of viral origin, with a significantly higher number of respondents from urban areas (36.1 %) than respondents from rural areas (27.1 %) ($p = 0.016$). Also, more than half of the respondents (52.4 %) did not think that children with flu or common cold symptoms recover faster if they receive antibiotics, significantly more urban respondents think so (54.7 %) compared to rural respondents (41.5 %) ($p = 0.001$). Seventy-five percent (74.7 %) of respondents believe that antibiotics can cause harmful effects, significantly more rural respondents believed so (77.1 %) compared to urban respondents (74.2 %) ($p = 0.049$). More than half of the respondents (52.2 %) believed that the use of antibiotics can prevent complications

caused by inflammation of the upper respiratory tract, significantly more often rural respondents believed so (60.1 %) compared to urban respondents (50.5 %) ($p = 0.006$) (Table 4).

The majority of parents (90.6 %) believed that a paediatrician should not prescribe antibiotics to treat colds, significantly more often respondents from rural (96.1 %) compared to urban places (89.4 %) ($p = 0.004$). Ninety-three percent of respondents believed that antibiotics should not be prescribed for runny nose while 85.7 % believed that vomiting does not require the use of antibiotics, with no significant difference between respondents from urban and rural areas. However, 72.8 % of respondents did not think that a paediatrician should prescribe antibiotics for sore throat, significantly more often respondents from urban (74.6 %) compared to rural areas (64.3 %) ($p = 0.001$). Also, 80.3 % believed that the use of antibiotics is not necessary for children's cough, significantly more often this was urban respondents' opinion (81.8 %) compared

Table 5: Attitudes about how often parents would like a paediatrician to prescribe antibiotics to their child when he or she has symptoms such as common cold, runny nose, sore throat, a cough, vomiting, fever and ear pain

Symptoms	Urban (n = 1201)		Rural (n = 258)		Total (n = 1459)		P (χ^2)
	n	%	n	%	n	%	
Common cold							
Never	1074	89.4	248	96.1	1322	90.6	0.004 ^a
Frequently	48	4.0	4	1.6	52	3.6	
Always	79	6.6	6	2.3	85	5.8	
Runny nose							
Never	1109	92.3	247	95.7	1356	92.9	0.136
Frequently	41	3.4	6	2.3	47	3.2	
Always	51	4.2	5	1.9	56	3.8	
Sore throat							
Never	896	74.6	166	64.3	1062	72.8	0.001 ^a
Frequently	143	11.9	52	20.2	195	13.4	
Always	162	13.5	40	15.5	202	13.8	
A cough							
Never	983	81.8	189	73.3	1172	80.3	0.002 ^a
Frequently	97	8.1	38	14.7	135	9.3	
Always	121	10.1	31	12.0	152	10.4	
Vomiting							
Never	1032	85.9	218	84.5	1250	85.7	0.576
Frequently	68	5.7	19	7.4	87	6.0	
Always	101	8.4	21	8.1	122	8.4	
Fever							
Never	814	67.8	147	57.0	961	65.9	0.003 ^a
Frequently	157	13.1	41	15.9	198	13.6	
Always	230	19.2	70	27.1	300	20.6	
Ear pain							
Never	500	41.6	81	31.4	581	39.8	0.004 ^a
Frequently	206	17.2	43	16.7	249	17.1	
Always	495	41.2	134	51.9	629	43.1	

χ^2 - Chi-square test; a - statistically significant

to rural respondents' opinion (73.3 %) ($p = 0.002$). Twenty percent (20.6 %) of respondents believed that a paediatrician should always prescribe antibiotics in case of fever, significantly more often respondents from rural (27.1 %) compared to urban (19.2 %) ($p = 0.003$). Forty-three percent of respondents believed that a paediatrician should always prescribe an antibiotic to treat ear pain, significantly more often respondents from rural (51.9 %) compared to urban areas (41.2 %) ($p = 0.004$) (Table 5).

By examining the reasons why parents gave antibiotics to their children without a paediatrician's recommendation, 1.3 % of parents were found do it often and 0.9 % always. Respondents from rural areas (4.3 %) gave them significantly more often than respondents from urban areas (0.6 %) ($p < 0.001$). Almost two percent (1.9 %) of respondents often gave antibiotics to a child without a

Table 6: Parental reasons for administering antibiotics without a paediatrician's recommendation

Statement	Urban (n = 1201)		Rural (n = 258)		Total (n = 1459)		P (χ^2)
	n	%	n	%	n	%	
Lack of free time to visit a paediatrician or lack of enough money to pay for treatment							
Never	1159	98.3	246	95.7	1405	97.8	< 0.001 ^a
Frequently	7	0.6	11	4.3	18	1.3	
Allways	13	1.1	0	0.0	13	0.9	
Belief that child's health is not seriously endangered							
Never	1090	95.3	246	95.7	1336	95.4	0.060
Frequently	18	1.6	8	3.1	26	1.9	
Allways	36	3.1	3	1.2	39	2.8	
Paediatrician has previously prescribed the same antibiotic for the same symptoms							
Never	1064	94.2	244	94.9	308	94.3	0.428
Frequently	28	2.5	8	3.1	36	2.6	
Allways	38	3.4	5	1.9	43	3.1	
Pharmacist has recommended an antibiotic							
Never	1082	96.3	249	96.9	1331	96.4	0.866
Frequently	23	2.0	4	1.6	27	2.0	
Allways	19	1.7	4	1.6	23	1.7	
Friends / relatives recommended an antibiotic							
Never	1094	97.2	254	98.8	1348	97.5	0.272
Frequently	15	1.3	2	0.8	17	1.2	
Allways	17	1.5	1	0.4	18	1.3	

RT - respiratory tract; χ^2 - Chi-square test; a - statistically significant

paediatrician's recommendation because they think that the child's health condition is not seriously endangered while 2.8 % always do so. Almost three percent (2.6 %) often and 3.1 % always gave antibiotic to a child without a paediatrician's recommendation because the paediatrician has previously prescribed the same antibiotic for the same symptoms. Two percent of respondents often gave antibiotics to a child because the pharmacist recommended it and almost two percent (1.7 %) of respondents always do so. One percent (1.2 %) of respondents often and 1.3 % always give antibiotics to their child because a friend or relative recommended it. No significant difference was observed between the groups of respondents distributed by place of residence in these reasons for the use of antibiotics without a paediatrician's recommendation (Table 6).

Discussion

So far, there have been no studies in the Republic of Srpska that investigated the parental knowledge, attitudes and behaviour regarding the use of antibiotics in children. Misconceptions and wrong attitudes lead to improper use of antibiot-

ics and encourage overuse, so understanding attitudes and behaviours can be a starting point for public health interventions.

Evidence-based literature review, which included studies from 20 countries published in the last 20 years, shows that parental knowledge still plays a major role in when and how to use antibiotics in children. The study also shows that parents are not disappointed if a doctor does not prescribe antibiotics to their children, provided they receive appropriate explanations.¹⁴

When deciding on the antibiotic treatment for their children, the main source of information for 89.4 % of our parents was doctors, with no differences in relation to place of residence. It is very similar result with Greek study where ninety percent of parents obtained information on judicious antibiotic use from paediatricians.⁷ It, however, is not in line with the results of a study in Croatia, where respondents state that they get informed on antimicrobial resistance through TV (60.4 %, the Internet (57.1 %) and newspapers (44.2 %).⁹ In this study, 4 % of respondents state that they use other sources of information more often in rural areas ($p = 0.018$). By summarising the correct answers about the knowledge on antibiotics, it was noticed that a total of only 893 (61.2 %) respondents know how to accurately identify the antibiotic from the drugs offered, with more accurate answers given significantly more often ($p = 0.012$) by rural respondents (54.3 %) compared to urban respondents (37.3 %). This is a higher percentage in comparison with Greek data where parents were given a list of drugs including antibiotics, antipyretics, bronchodilators and expectorants and were asked to distinguish antibiotic products from other drugs and 30.4 % of them made no mistakes at all, 42.1 % made one mistake and 27.5 % made two or more mistakes.⁷ In the Republic of Srpska the majority of surveyed parents (82.4 %) disagree with the statement that antibiotics should be given to every child with a fever, 10 % have a neutral attitude while 7 % agree with this statement. There were no differences in relation to place of residence. In prospective observational study that was conducted in Italy in 2020, 92.9 % knew that the antibiotic has no direct effect on fever.¹⁰ In a study conducted in Lebanon, 55.9 % of respondents still believe that antibiotics should be given to treat fever, 50 % were unaware of the consequences of antibiotic abuse, 58.4 % think it is OK to give a child antibiotics without a doctor's recommendation

and 66.7 % trust the pharmacist; parents earned a university degree have a better knowledge.¹⁵ The result are worse in Jordan where 72.4 % of parents believed that a child should be given an antibiotic if it develops fever, even though 60 % they were aware that most upper respiratory tract infections were viral in nature.¹⁶

Among respondents presented in this study, 86 % agree with the statement that improper use of antibiotics reduces their effectiveness and leads to bacterial resistance, regardless of place of residence. It is very similar with Greek result where a total of 88 % of the parents were aware of the fact that antibiotic misuse drives bacterial resistance.⁷ However, in the present study 34.5 % of respondents believe that antibiotics should not be given since inflammation of the upper respiratory tract is most often of viral origin, with a significantly higher number of respondents from urban areas (36.1 %) than respondents from rural areas (27.1 %) ($p = 0.016$). Also, more than half of the respondents (52.4 %) do not think that children with flu or common cold symptoms recover faster if they receive antibiotics, significantly more urban respondents think so (54.7 %) compared to rural respondents (41.5 %) ($p = 0.001$). In Greece 24.7 % parents would still give antibiotics to children with flu like symptoms because they thought that recovery would be quicker.⁷ In the Republic of Srpska this result is somewhat better where 18.7 % of parents think that children with these symptoms recover faster if they receive antibiotics.

Seventy-five percent (74.7 %) of respondents believe that antibiotics can cause harmful effects and significantly more often rural respondents (77.1 %) compared to urban respondents (74.2 %) ($p = 0.049$). More than half of the respondents (52.2 %) believe that the use of antibiotics can prevent complications caused by inflammation of the upper respiratory tract, significantly more rural respondents (60.1 %) compared to urban respondents (50.5 %) ($p = 0.006$). Greek authors have investigated the use of antibiotics in upper respiratory tract infections in children. Of the parents surveyed, 74 % expected to receive antibiotics for their children and ear pain was the most common symptom for which parents expected antibiotics. They rarely gave antibiotics to their children without a prescription (10 %) and the majority (88 %) believed that unnecessary use of antibiotics caused antibiotic resistance and were happy to receive symptomatic therapy

prescribed by a doctor.⁷ In the Turkey study, 85.6 % of the parents declared that they never gave their children antibiotics without a prescription when they had a fever.⁸

In this study, 43 % believe that a paediatrician should always prescribe antibiotic to treat ear pain, significantly more often respondents from rural (51.9 %) compared to urban areas (41.2 %). A survey of Lebanese parental knowledge, attitudes and behaviour found that 33.9 % of parents believe that antibiotics help in treating the common cold and 36.2 % believe that antibiotics speed up children recovery from a cold. Also, parents have no knowledge of antibiotic coverage, as 37.9 % believe that antibiotics cure viral infections. Also, 20 % believe that they can reduce the dose of antibiotics upon recovery.¹⁷

Examining parental reasons to give their children antibiotics without a paediatrician's recommendation led to the following results - 1.3 % do it often and 0.9 % always. Respondents from rural areas (4.3 %) are significantly more likely to do so than respondents from urban areas (0.6 %) ($p < 0.001$), which can be explained by less accessible healthcare in rural areas.

In researching knowledge and attitudes towards the antibiotic use and resistance in the Swedish population, respondents expressed confidence in doctors who decided not to prescribe antibiotic.¹⁸

The study has limitations in terms of sample selection in preschools. It is likely that some children from rural areas do not attend preschool so perhaps children from rural areas who attend them are not representative of all children from rural areas. In addition, parents filled out surveys at home, so the answers may have been influenced by information they found online or received from friends. Although the obtained results cannot be generalised to the population of parents of the Republic of Srpska, the obtained results can be applied to the improvement of public health activities aimed at reducing the abuse of antibiotics.

A number of public health interventions can be initiated. A study by Goggin et al showed that even short video promotional materials can help reduce parents' interest in taking antibiotics.¹⁹ This intervention could be used globally to promote the reduction of antibiotic use and could be part of a campaign in the Republic of Srpska and beyond.

Attention should also be paid to those who prescribe antibiotics. A study conducted in Denmark shows that interventions to optimise the use of antibiotics should primarily focus on those who prescribe drugs. The Danish legal framework prevents the over-the-counter dispensary of the antibiotics. The study showed that 97 % of the antibiotics used were obtained after a medical consultation.²⁰ This is supported by a survey in the rural population of Greece in which as many as 44.6 % of respondents reported that they had used over-the-counter antibiotics at least once. The largest source of purchasing over-the-counter antibiotics was the pharmacy, in as many as 76.2 % of self-medication cases.²¹

In the study conducted by Napolitan et al in Italy, self-medication by antibiotics was more often seen in people aged less than 40, who had a lower health status and who did not know that antibiotics were not indicated for flu, common cold and sore throat treatment.²² In the study conducted by Farkas et al, knowledge on antibiotic use between urban and rural population in Croatia was compared. Although knowledge of urban parents was better, it did not affect the antibiotic use. The authors think that healthcare workers should explain patients more about problems of antibiotic use and resistance.⁹

Conclusion

There are differences in parental knowledge, attitudes and behaviour about antibiotic use and resistance. It is necessary to work on additional education of parents. There is also a need for greater engagement of paediatricians in providing instructions and explanations regarding the antibiotic use.

Gratitude

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Conflict of interest

None.

References

1. Van Hecke O, Butler CC, Wang K, Tonkin-Crine S. Parents' perceptions of antibiotic use and antibiotic resistance (PAUSE): a qualitative interview study. *J Antimicrob Chemother* 2019 Jun 1;74(6):1741-7.
2. Al-Shawi MM, Darwish MA, Abdel Wahab MM, Al-Shamlan NA. Misconceptions of parents about antibiotic use in upper respiratory tract infections: a survey in primary schools of the Eastern Province, KSA. *J Family Community Med* 2018 Jan-Apr;25(1):5-12.
3. European Centre for Disease Prevention and Control (ECDC) [Internet] 2015. Antimicrobial resistance surveillance in Europe 2014. Antimicrobial resistance surveillance in Europe. Annual report of the European Antimicrobial Resistance Surveillance Network (EARS-Net) 2014. Available at <http://ecdc.europa.eu/en/publications/Publications/antimicrobial-resistance-europe-2014.pdf>. [Cited: 2022-Jan-01]
4. Grigoryan L, Haaijer-Ruskamp FM, Burgerhof JG, Mechtler R, Deschepper R, Tambic-Andrasevic A, et al. Self-medication with antimicrobial drugs in Europe. *J Emerg Infect Dis* 2006 Mar;12(3):452-9.
5. Grigoryan L, Burgerhof JG, Degener JE, Deschepper R, Lundborg CS, Monnet DL, et al; SAR consortium. Attitudes, beliefs and knowledge concerning antibiotic use and self-medication: a comparative European study. *Pharmacoepidemiol Drug Saf* 2007 Nov;16(11):1234-43.
6. Ivanovska V, Angelovska B, van Dijk L, Zdravkovska M, Leufkens HG, Mantel-Teeuwisse AK. Change in parental knowledge, attitudes and practice of antibiotic use after a national intervention programme. *Eur J Public Health* 2018 Aug;28(4):724-9.
7. Panagakou GS, Spyridis N, Papaevangelou V, Theodoridou MK, Goutziana PG, Theodoridou NM, et al. Antibiotic use for upper respiratory tract infections in children: a cross-sectional survey of knowledge, attitudes and practices (KAP) of parents in Greece. *BMC Pediatr* 2011 Jul 5;11:60. doi: 10.1186/1471-2431-11-60.
8. Albayrak A, Karakaş NM, Karahalil B. Evaluation of parental knowledge, attitudes and practices regarding antibiotic use in acute upper respiratory tract infections in children under 18 years of age: a cross-sectional study in Turkey. *BMC Pediatr* 21, 554 (2021). <https://doi.org/10.1186/s12887-021-03020-4>.
9. Farkaš M, Glažar Ivče D, Stojanović S, Mavrinac M, Mićović V, Tambić Andrašević A. Parental knowledge and awareness linked to antibiotic use and resistance: comparison of urban and rural population in Croatia. *Microb Drug Resist* 2019 Dec;25(10):1430-6.
10. Pierantoni L, Lo Vecchio A, Lenzi J, Corsi V, Campana L, Luca Trobia G, et al. Parents' perspective of antibiotic usage in children: a nationwide survey in Italy. *Pediatr Infect Dis J* 2021;40(10):906-11.
11. Yu M, Zhao G, Stålsby Lundborg C, Zhu Y, Zhao Q, Xu B. Knowledge, attitudes and practices of parents in rural China on the use of antibiotics in children: a cross-sectional study. *BMC Infect Dis* 2014 Feb 27;14:112. doi: 10.1186/1471-2334-14-112.
12. Zyoud SH, Abu Taha A, Araj KF, Abahri IA, Sawalha AF, Sweileh WM, et al. Parental knowledge, attitudes and practices regarding antibiotic use for acute upper respiratory tract infections in children: a cross-sectional study in Palestine. *BMC Pediatr* 2015 Nov 11;15:176. doi: 10.1186/s12887-015-0494-5.
13. UNDP. National Human Development Report 2013. Rural development in Bosnia and Herzegovina: myth and reality. Sarajevo: UNDP; 2013.
14. Cantarero-Arévalo L, Hallas MP, Kaae S. Parental knowledge of antibiotic use in children with respiratory infections: a systematic review. *Int J Pharm Pract* 2017 Feb;25(1):31-49.
15. Zahreddine L, Hallit S, Shakaroun S, Al-Hajje A, Awada S. Knowledge of pharmacists and parents towards antibiotic use in pediatrics: a cross-sectional study in Lebanon. *Nathalie Lahoud Pharm Pract (Granada)* 2018 Jul-Sep;16(3):1194. doi: 10.18549/PharmPract.2018.03.1194. Epub 2018 Aug 12.
16. Hammour KA, Jalil MA, Hammour WA. An exploration of parents' knowledge, attitudes and practices towards the use of antibiotics in childhood upper respiratory tract infections in a tertiary Jordanian hospital. *Saudi Pharm J* 2018;26(6):780-5.
17. El Khoury G, Ramia E, Salameh P. Misconceptions and malpractices toward antibiotic use in childhood upper respiratory tract infections among a cohort of Lebanese parents. *Eval Health Prof* 2018 Dec;41(4):493-511.
18. Vallin M, Polyzoi M, Marrone G, Rosales-Klintz S, Tegmark Wisell K, Stålsby Lundborg C. Knowledge and attitudes towards antibiotic use and resistance—a latent class analysis of a Swedish population-based sample. *PLoS One* 11:e0152160. *PLoS One*. 2016 Apr 20;11(4):e0152160. doi: 10.1371/journal.pone.0152160. eCollection 2016.
19. Goggin K, Hurley AE, Bradley-Ewing A, Bickford C, Lee RB, Pina K, et al. Reductions in parent interest in receiving antibiotics following a 90-second video intervention in outpatient pediatric clinics. *J Pediatr* 2020 Oct;225:138-145.e1. doi: 10.1016/j.jpeds.2020.06.027.
20. Muscat M, Monnet DL, Klemmensen T, Grigoryan L, Jensen MH, Andersen M, et al. SAR patterns of antibiotic use in the community in Denmark. *Scand J Infect Dis* 2006;38(8):597-603.
21. Skliros E, Merkouris P, Papazafropoulou A, Gikas A, Matzouranis G, Papafragos C, et al. Self-medication with antibiotics in rural population in Greece: a cross-sectional multicenter study. *BMC Fam Pract* 2010 Aug 8;11:58. doi: 10.1186/1471-2296-11-58.
22. Napolitano F, Tereza Izzo M, Di Giuseppe G, Angelillo FI. Public knowledge, attitudes and experience regarding the use of antibiotics in Italy. *PLoS One* 2013 Dec 23;8(12):e84177. doi: 10.1371/journal.pone.0084177.