

ORIGINAL STUDY

Attitudes, perceptions and knowledge regarding antibiotic use for respiratory illness and antibiotic resistance in Romania: an observational, questionnaire-based study results

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BACKGROUND. Antibiotic resistance represents a public health threat worldwide, being a major cause of mortality due to resistant bacterial pathogens responsible for infections and colonisations. Worldwide, there is an inappropriate use of antibiotics in upper respiratory tract infections.

OBJECTIVE. To generate a quantitative snapshot of incidence of respiratory illnesses and symptoms, as well as behaviours and attitudes related to upper respiratory infections among Romanians; to understand the usage of antibiotics for respiratory symptoms and illnesses as well as sufferers' attitudes and beliefs.

MATERIAL AND METHODS. An observational, descriptive, questionnaire-based global study was conducted in 2022. Adults from 12 countries who had experienced respiratory symptoms in the past 6 months were included (n=1000 per country). Data was collected on antibiotic use and attitudes towards antibiotics, respiratory symptom counselling and bacterial resistance. Herein, we focus on the results of Romanian respondents.

RESULTS. 40.2% took antibiotics for respiratory conditions in the past 6 months, 46.05% of them for cough symptoms and 44.4% for sore throat. 55.72% of the respondents took antibiotics for flu/cold; the most users in 55-64y group. 64.4% obtained the antibiotic from a doctor or nurse. Furthermore, 72.9% of the respondents who took antibiotics had undergone a diagnostic test prior to treatment. Unfortunately, 51.8% believed antibiotics kill viruses and 46% that antibiotics are efficient in cold/flu. Regarding the antibiotic resistance, only 16.5% were very well informed.

CONCLUSION. There is a great number of Romanians who use leftover antibiotics from previous prescriptions, the most frequent reasons being sore throat and common cold. In upper respiratory tract infections, the symptomatic treatment, such as multi-symptom cold/flu medication associated with sore throat medication, should be the first-line treatment. Further interventions are needed to increase awareness of antibiotic resistance.

KEYWORDS: antibiotic resistance, sore throat, upper respiratory tract infections, flu, cold.

INTRODUCTION

Antibiotic resistance represents a public health threat worldwide, being described as a major cause of mortality due to resistant bacterial pathogens responsible for infections and colonisations¹⁻⁴.

The first alarm about antibiotic and antimicrobial resistance was given in the early 1950s by pharmacologists who advised the use of antibiotics in a rational manner and their

commercialization only by medical prescription⁵. During the last years, antibiotic resistance became a more intense concern among medical practitioners. The specialists estimate that by 2050 almost 10 million deaths every year will be due to incurable infections⁶.

The World Health Organization (WHO), the Centers of Disease Control and Prevention (CDC) and the European Medicines Agency (EMA) warned about this health problem over the last years. In 2021, WHO declared the antimicrobial

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resistance one of the top 10 global public health that humanity has to face¹. According to CDC, antimicrobial resistance kills at least 1,27 million people worldwide³. Almost 35,000 deaths in the United States and 33,000 deaths in the European Union are reported to be due to infections by multi-drug-resistant bacteria^{3,4}.

According to the European Antimicrobial Resistance Surveillance Network (EARS-Net) and the Surveillance Atlas of Infectious Diseases, Romania is among the EU countries with the highest level of antimicrobial resistance^{7,8}. Evaluating the “Antimicrobial resistance surveillance in Europe 2023-2021 data” report published jointly by the European Centre for Disease Prevention and Control (ECDC) and the WHO Regional Office for Europe⁹, in 2021 Romania was: on the first place for *Pseudomonas aeruginosa* resistance to a combination of more than three antimicrobial groups (piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides) with 42.1% (lower percentage compared to 2017 data, 58.7%); first place with 36% for the macrolide resistance of *Streptococcus pneumoniae* (with no statistically significant trend when compared to 2017); 2nd place when evaluating the resistance of *Methicillin-resistant Staphylococcus aureus* (MRSA) (41%). Statistically significant increasing trends are observed in the case of *Klebsiella pneumoniae* for third-generation cephalosporin resistance (from 62.5% in 2017 to 70.8% in 2021), for carbapenem resistance (22.5% in 2017 versus 54.5% in 2021), for fluoroquinolone resistance (64.1% in 2017, 67.2% in 2021) and *Acinetobacter spp.* for carbapenem resistance (87.4% in 2017, 93.3% in 2021), fluoroquinolone resistance (89.1% in 2017, 94.5% in 2021), aminoglycoside resistance (83.6% in 2017, 91.1% in 2021). The lowest results were reported in the case of *Escherichia coli* antibiotic resistance (5% for combined resistance, 10.6% for aminoglycoside resistance, 18.8% for third-generation cephalosporin).

There is a natural cycle in what the antibiotic resistance is concerned; this is why the pharmaceutical domain is in a permanent search and development of new antibiotics. But this natural process is accelerated by the misuse of antibiotics not only in humans but also in animals. And infections, such as pneumonia, tuberculosis, are harder to treat. The consequence is longer hospitalization, increased medical costs and increased mortality.

Most upper respiratory tract infections are caused by viruses; however, studies show that up to 10 million antibiotic prescriptions per year are inappropriately directed towards respiratory pathologies.^{10,11} Hersh et al.¹² concluded in their cohort study performed on 15,000 outpatients with acute upper respiratory tract infections that almost 41% of the patients who received an antibiotic prescription did not have an indication for them.

Starting from their own statement that “antibiotics are a precious resource that we cannot continue to take for granted and we must handle them with care”¹³, the Global Respiratory Infection Partnership (GRIP) conducted a global respiratory study in 2022. The study aimed to provide a quantitative snap-

shot of the incidence of respiratory illnesses and symptoms, behaviours and attitudes related to upper respiratory infections, and, most importantly, the usage of antibiotics for respiratory symptoms and illnesses. Additionally, it sought to understand consumers’ attitudes and beliefs in order to generate insights on driving behaviour change. For the present article we evaluated the results only for Romania, comparing the important data with the global ones.

MATERIAL AND METHODS

Study design

An observational, descriptive, questionnaire-based study was conducted in May 2022 and consisted in a 15-20-minute online interview. The questionnaire consisted in questions which evaluated the experience and treatments for different respiratory conditions, such as common cold, flu, sore throat, ear infections, bronchitis, pneumonia or allergies (hay fever), with associated symptoms in either ears, throat, nose or chest (headache, sneezing, sore throat, blocked/runny nose, cough, fever, sinus pressure/pain, hoarseness, earache, chest congestion, olfactory and/or gustatory disorders). Information about attitudes and perceptions on antibiotic usage and related variables were also collected.

Respondents’ selection

The study included adult respondents (>18 years of age) located in countries from Europe (United Kingdom, Germany, Spain, Italy, Poland, Romania), Middle East region (Saudi Arabia, South Africa), Asia-Pacific region (Philippines, Thailand), Latin America region (Brazil, Mexico).

The first two questions of the interview represented also the most important inclusion criteria of the study:

1. “Which, if any, of the following symptoms have you experienced over the last 6 months that you have treated (either over the counter, prescribed medicine, home remedies or other types of treatment)? This may be through self-care, or a healthcare professional (such as a doctor, nurse or pharmacist).”
2. “Thinking of the last occasion on which you experienced the symptom(s) that you mentioned at the previous question, what if anything, was the underlying respiratory condition for the symptoms that you experienced?”

In the study, only those who had experienced symptoms caused by a respiratory condition in the 6 months preceding the study were included. Special attention was given to the respondents who answered that COVID (infection with SARS-CoV-2) was the cause of their symptoms. They were asked if they had experienced symptoms in the past 6 months caused by another respiratory condition. If the answer was “yes”, they were asked to respond to the survey on the other condition.

In this article, we will focus on the results found after interviewing the Romanian respondents.

Statistical analysis

The statistical analysis was performed by using Microsoft

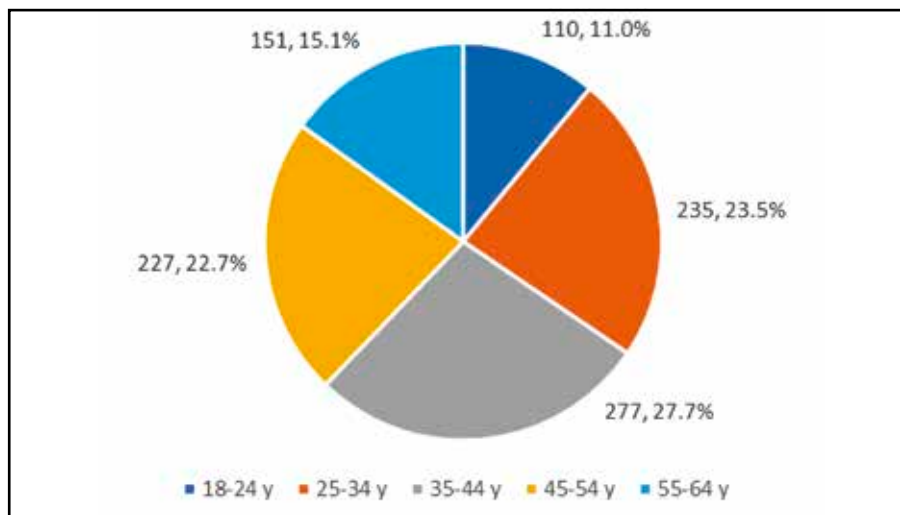


Chart 1. Age distribution of the respondents included in the study.

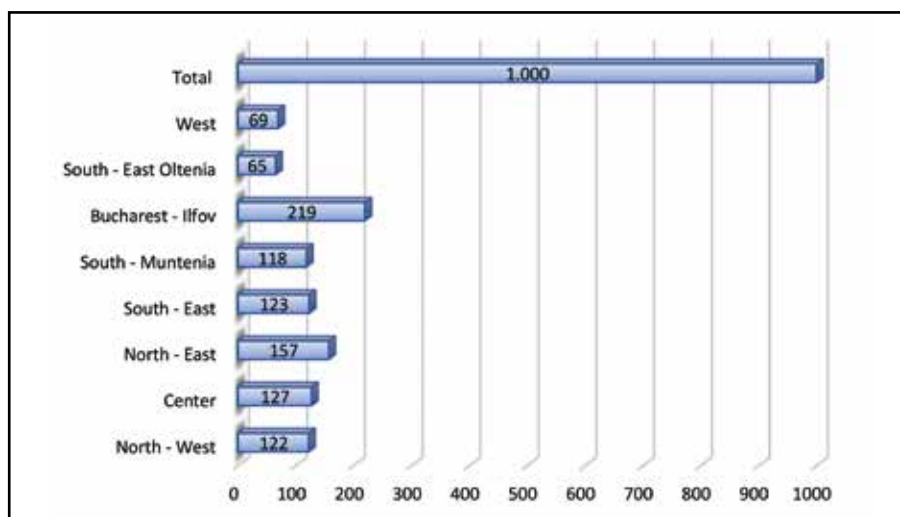


Chart 2. Distribution of the respondents according to the Romanian region they live in.

Excel. T-test for means and Z-test for percentages were used, a level of 95% confidence interval being considered statistically significant, with a p-value <0.05.

RESULTS

A total number of 18,564 adults from Europe, Middle East regions countries, Asia-Pacific countries and Latin America countries started the interview. After applying all inclusion and exclusion criteria, 12,000 respondents remained in the study, with a distribution of 1,000 for each evaluated country.

The results of the report focus only on the qualified sample of the respondents who suffered respiratory symptoms in the past 6 months and only on Romanian data (n=1,000).

1,528 Romanians were initially interviewed, but only 1,000 respected the inclusion criteria. From the demographic point

of view, 511 of the respondents included in the study were male (51.1%) and 489 were female (48.9%), with a male:female ratio of 1:1.04. Respondents' age was between 18 - 64 years (y) (mean of 40.85), the majority being included in the 25-54 age group (Chart 1).

Another important data we took into account when analysing the results was the region in which respondents lived: North-West 122 respondents (12.2%), Center 127 (12.7%), North-East 157 (15.7%), South-East 123 (12.3%), South-Muntenia 118 (11.8%), South-West Oltenia 65 (6.5%), West 69 (6.9%), Bucharest-Ilfov 219 (21.9%) (Chart 2). This aspect was a key in establishing the degree of antibiotic use, attitude and perception on antibiotics, knowing that some regions in Romania are less developed than others (North-East and South-East regions are considered the poorest regions; Bucharest-Ilfov area, North-West and West regions are the most prosperous).

Experience of respiratory symptoms and illnesses

Evaluating the answers of the 1,000 respondents, the symptoms most likely to be experienced in the previous 6 months were blocked nose (64.4%), sore throat (62.3%), sneezing (55.8%) and runny nose (55.2%) (Chart 3). On the most recent occasion when respondents experienced symptoms related to a respiratory condition, the most frequent were: blocked nose (52.4%), sore throat (49.6%), sneezing and runny nose (44.8% each), headache (44.4%), as seen in Chart 3.

Further, the interview reviewed the underlying respiratory condition for the symptoms the respondents said they experienced on the last occasion. As it can be seen in Chart 4, a cold was the most likely to be the cause for the related symptoms with 56.1%. Chest infection (1.1%), bronchitis (3.9%) or allergies (4.6%) were less likely to have been the cause.

Respondents who answered COVID were asked if they had experienced symptoms in the previous 6 months caused by

another condition. If yes, they were asked to respond to the survey on the other condition. Only 4.8% had experienced symptoms solely caused by COVID.

An important information the study evaluated was the treatment method used by the respondents during their most recent episode of respiratory symptoms. As Table 1 shows, the top method of treatment used was cold or flu medication (45%), followed by sore throat medication (36.7%), drinking fluids (36.6%). 21.1% of the sufferers turned to herbal supplements, probiotics or homeopathy. Those with flu/cold or infections or COVID were more likely to use cold/flu or cough medication, the difference when compared to allergies being statistically significant at a 95% confidence level ($p < 0.05$). Vitamins/minerals/immunity boosting supplements were more likely to have been used by those suffering from COVID (Table 1). 15.7% of the total respondents used antibiotics, COVID (39.58%) and chest/throat infections/sinusitis/bronchitis (24.1%) being

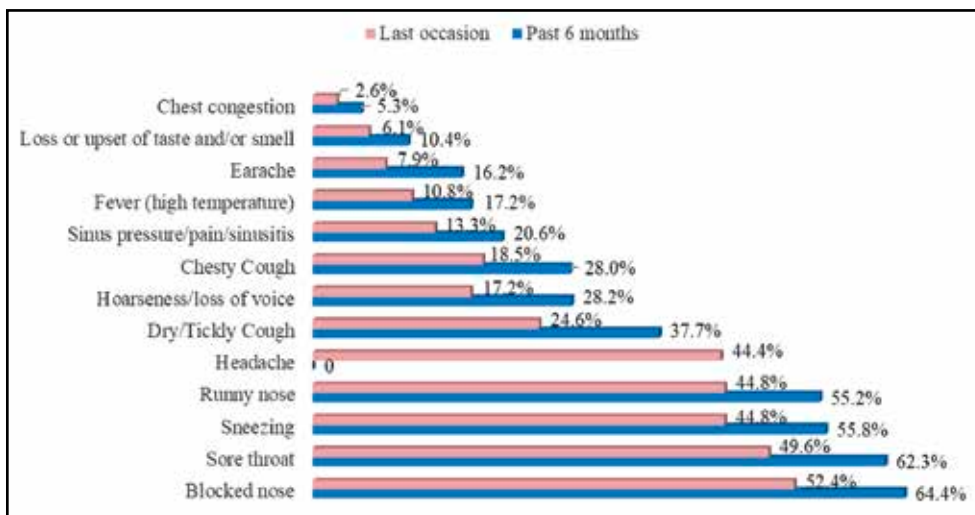


Chart 3. The symptoms experienced in the past 6 months and the most recent occasion related to respiratory pathology.

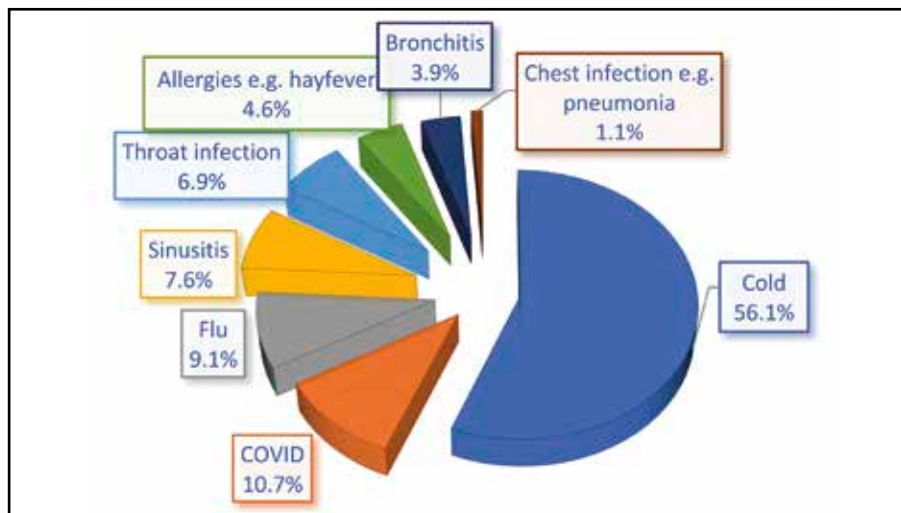


Chart 4. Respiratory conditions reported by the respondents.

Table 1. Method of treatment in the most recent occasion.

Method of treatment in the most recent occasion	N=1,000	Illness on the Last Occasion			
		Flu/ Cold (n=652)	Chest/throat infection/Sinusitis/Bronchitis (n=195)	Allergies (n=46)	COVID (n=48)
Multi-symptom cold or flu medication	45%	48.62% *	32.82% *	17.39%	47.92% *
Sore throat medication (e.g., lozenges, sprays, gargles, etc.)	36.7%	35.43%	36.41%	23.91%	47.92%
Drank fluids – either hot or cold drinks (e.g., water, tea, juices)	36.6%	36.96%	30.77%	34.78%	41.67%
Vitamins/minerals/immunity boosting supplements	34.2%	31%	31.79%	28.26%	68.75% *
Cough medication (e.g., syrups, gargles, tablets, lozenges, etc.)	33.9%	32.36% *	36.92% *	17.39%	39.58%
Took more rest	33.8%	33.59%	26.67%	30.43%	47.91% *
Sinus/nasal decongestant medication	31.9%	30.67%	34.87%	28.26%	22.91%
Painkillers or analgesic medication	30.6%	27.76%	34.36% *	17.39%	37.5%
Non-medicated nasal care products (e.g., inhalers/sprays)	22.2%	17.94%	28.21% *	28.26%	33.33%
Natural products (e.g., herbal supplements, probiotics, homeopa- thy)	21.1%	18.71%	24.62%	21.74%	29.17%
Antibiotics	15.7%	11.04% *	24.1% *	4.35%	39.58% *
Sweets, candies or drops	8.4%	6.60%	10.26%	8.70%	8.33%
Chest rubs	4.9%	4.75%	6.15%	2.17%	4.17%
None of these	1.2%	1.07%	0.51%	8.7%	-
Don't know	0.2%	0.31%	-	-	-

*statistical significance at a 95% confidence level when compared to other groups from the same category; Z-Test (p<0.05)

the most frequent reasons for this treatment type, the difference being statistically significant.

Antibiotic usage

Evaluating the answers the respondents gave in this section of the questionnaire, we observed that 40.2% of the Romanian respondents (n=402) had taken antibiotic for a

respiratory condition in the past 6 months, 32.3% having taken just one treatment and 7.9% with more than one antibiotic treatment (Chart 5). Still, there were 57.4% of the respondents who stated no antibiotic usage.

The antibiotic usage proved to be higher in the age groups 18-24y, 25-34y and 45-55y (51.8% [n=57], 44.7% [n=105],

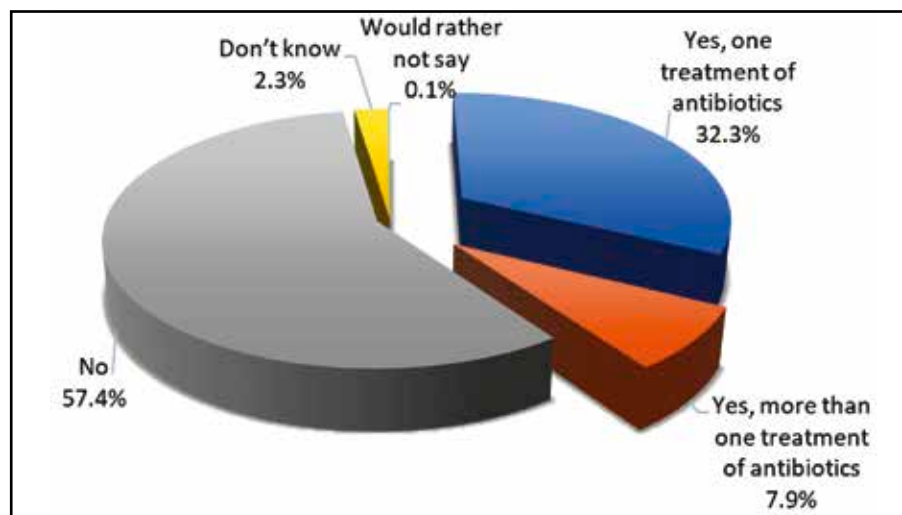


Chart 5. Romanian antibiotic usage for respiratory symptoms in the last 6 months.

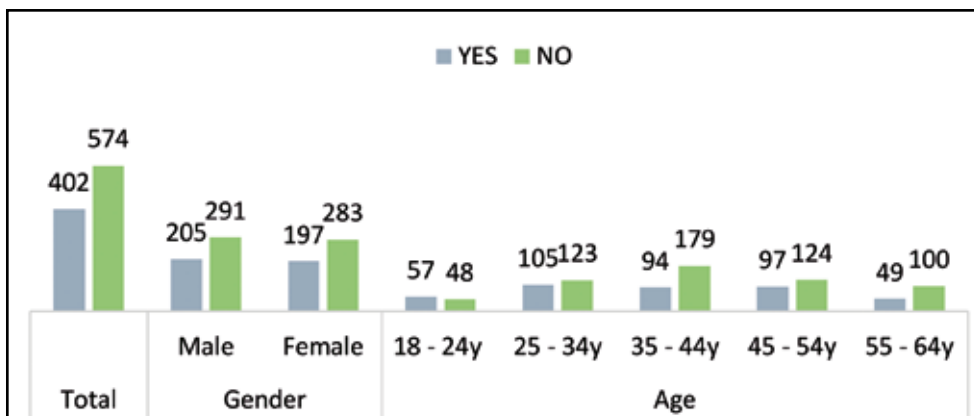


Chart 6. Distribution of antibiotic usage according to gender and age.

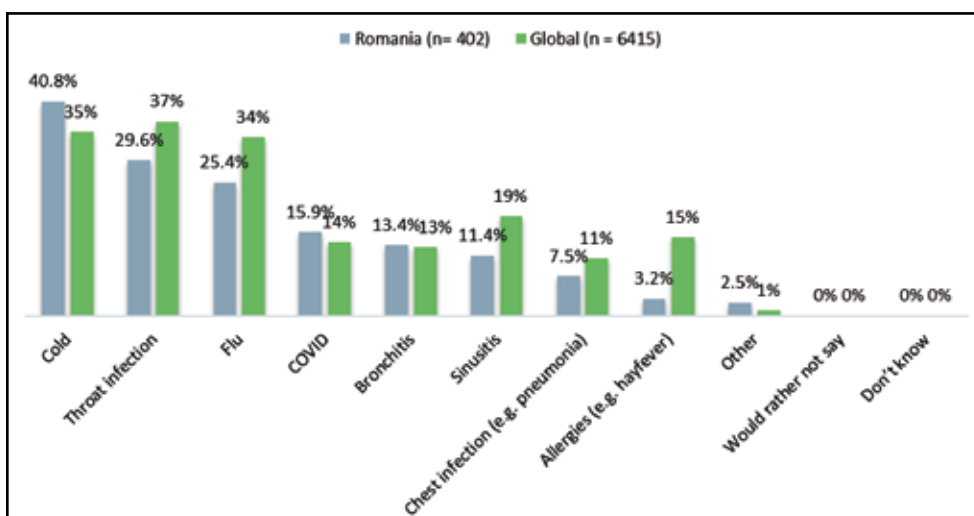


Chart 7. Reasons for taking antibiotics among "yes" respondents.

42.7% [n=97] respectively) as seen in Chart 6. Compared to the two other groups, the difference was statistically significant at a 95% confidence level ($p < 0.05$). The age group 18-24y seems to be the less likely to say "no" to antibiotic usage.

Amongst the 402 respondents with "yes" to antibiotic usage (40.2% of the respondents), there were a range of reasons for having taken antibiotics for respiratory conditions, the most common being a cold (40.8%), throat infection (29.6%) or flu (25.4%) (Chart 7). Considering the respiratory symptoms for which the patients took antibiotics over the past 6 months, 46.05% took them for cough symptoms, 44.4% for sore throat and only 39.38% for nasal symptoms. Of the patients who reported "sore throat" as a symptom for antibiotic usage, 40.53% were diagnosed with cold, 34.22% with throat infection and 27.91% with flu.

Overall, 55.72% (n=224) took antibiotics for flu or cold and 48.26% (n=194) for some type of infection (e.g., sinusitis, bronchitis, pneumonia, throat), no matter the gender or age.

Analysing in detail the reasons for taking antibiotics for a respiratory condition in the past 6 months according to age (Chart 8), the 35-44y respondents seem to be the less

likely to take antibiotics for cold (31.9%) while those included in the 55-64y group seem to be the most likely to have this habit (46.9%), the difference between male and female being statistically significant at a level of 95% confidence level ($p < 0.05$). By comparison, the "flu" reason had the lowest percentage reported among 55-64y respondents (12.2%) and the highest among 25-34y (34.3%), the difference between the two groups being statistically significant at a level of 95% confidence level ($p < 0.05$). The group 45-54y reported to take antibiotics the most frequently for cold and throat infections (40.2% each). An important piece of data is that 6.7% respondents in the 25-34-year-old group took antibiotics for allergies.

Amongst those who used antibiotics for a respiratory condition in the past 6 months, most of them (64.4%) obtained the antibiotic from the doctor or nurse by prescription for flu/cold (52.51%) or for some type of throat/nose/pulmonary infection (49.81%). However, 13.9% obtained the antibiotics directly from the pharmacist, the highest percentage (13.9%) being among those who took antibiotics for flu/cold (60.71%) or different respiratory infections (41.07%) (Chart

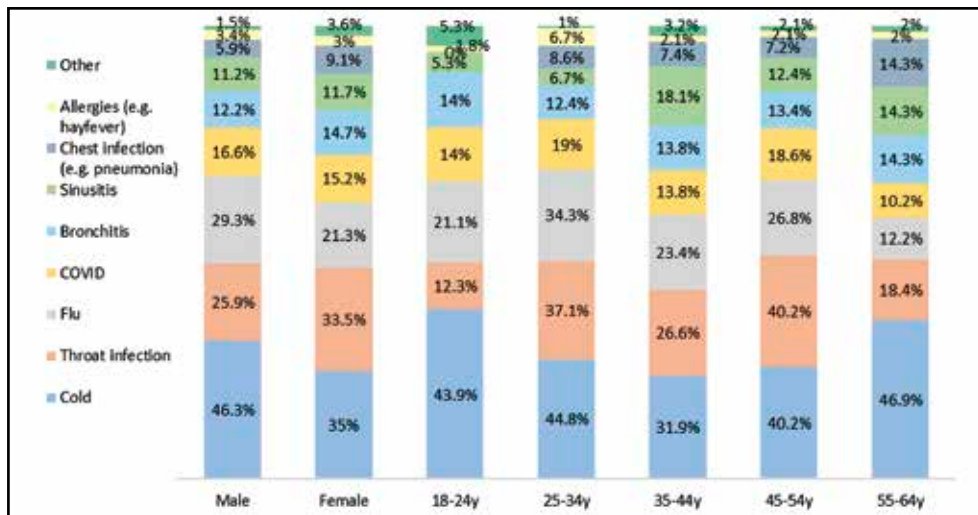


Chart 8. Distribution of reason for antibiotic usage according to gender and age.

9). From all respondents, 14.9% used the left-over drugs from previous treatments (7.7%) or from family/friends (7.2%). The results for Romanian respondents were almost similar to the global research results, as seen in Chart 9.

Amongst those respondents who used antibiotics obtained

through a healthcare professional (n=315), for 182 of them (57.8%) the doctor/nurse suggested they should take these drugs, but only in almost 3 cases of 10 the benefits and risks of antibiotics were discussed (27.9%) (Chart 10). Focusing on the information received from the healthcare profes-

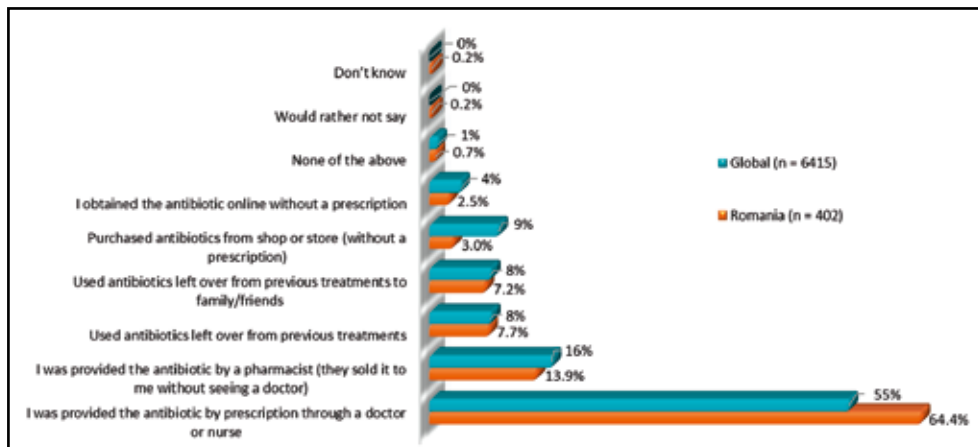


Chart 9. Method of obtaining antibiotic on the most recent occasion.

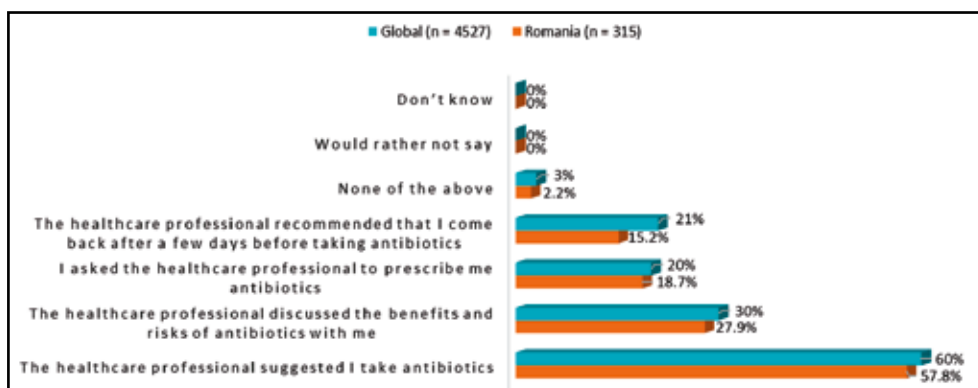


Chart 10. Last experience with a healthcare professional.

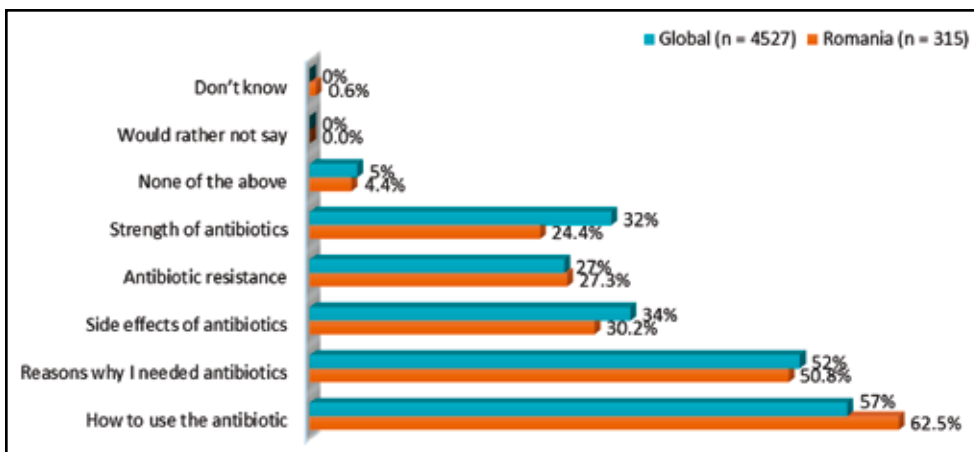


Chart 11. Information discussed when receiving the antibiotic.

Table 2. Level of understanding the explanation about antibiotic usage.

Grade	N = 382	18-24y (n=54)	25-34y (n=101)	35-44y (n=90)	45-54y (n=89)	55-64y (n=48)	Global (N=6078)
Understood completely	53.7%	55.6%	57.4%	50%	43.8%	68.8%	48%
Understood mostly	37.9%	29.6%	37.6%	37.8%	49.5%	27%	40%
Understood a little	6.3%	9.3%	3%	8.9%	6.7%	4.2%	11%
Did not understand at all	1.8%	3.7%	2%	3.3%	-	-	1%
Would rather not say	-	-	-	-	-	-	-
Don't know	0.3%	1.8%	-	-	-	-	-
Net: Understood	91.6%	85.2%	95%	87.8%	93.3%	95.8%	88%
Net: Did not understand	8.1%	13%	5%	12.2%	6.7%	4.2%	12%

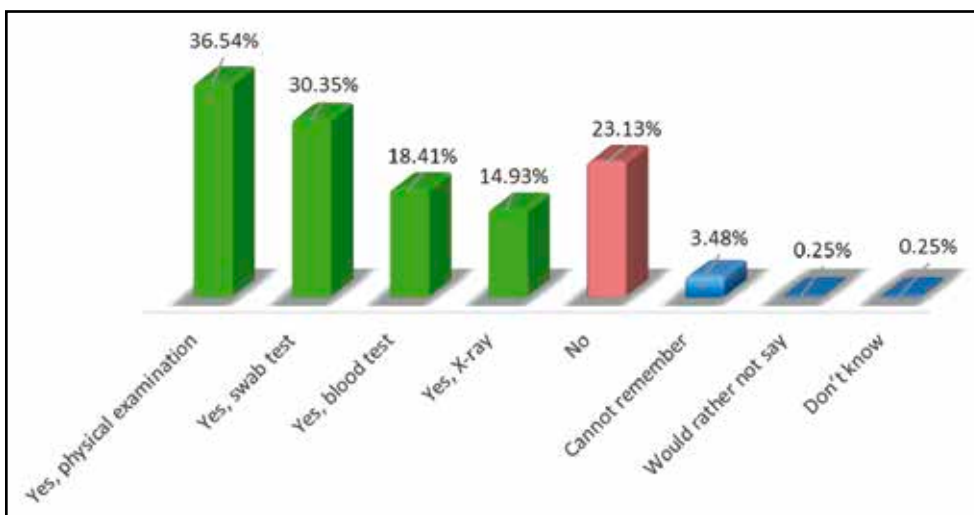


Chart 12. Diagnostic test to determine the cause of illness.

Table 3. Diagnostic test according to symptoms and antibiotic usage.

Diagnostic test	Total	Symptoms P6M			Symptoms on the last occasion			Reason for taking antibiotics on the most recent occasion				p*
		Sore throat	Cough symptoms	Nasal symptoms	Sore throat	Cough symptoms	Nasal symptoms	Flu/ Cold	Chest/throat infection/Sinusitis/Bronchitis	Allergies	COVID	
No	93	72	52	75	55	36	66	59	42	1	4	<0.05
	23.13%	23.92%	22.32%	23.81%	22.63%	21.30%	23.66%	26.34%	21.65%	7.69%	6.25%	
Net Yes	293	218	173	229	179	127	204	156	145	12	60	<0.05
	72.89%	72.43%	74.25%	72.70%	73.66%	75.15%	73.12%	69.64%	74.74%	92.31%	93.75%	

*T-Test for means, Z-Test for percentages; significance at a 95% level; P6M – past 6 months

sional, as seen in Chart 11, more than half of the respondents were given information on how to use the antibiotics (62.5%) and half were told the reason for the prescribed antibiotic (50.8%). Globally, only 27% of the respondents confirmed they received some kind of information about the antibiotic resistance, the percentage among Romanian respondents being similar (27.3%).

Overall, the data received by those respondents who took antibiotic (n=402) included explanations about the reason for antibiotic prescription (39.8%), the importance of following instructions (37.6%), the cause of the condition (37.1%), and only 18.7% received details about the antibiotic resistance.

Of great importance was the degree of understanding of all explanations. And here we can see that, amongst those who received data about the antibiotic usage (n=382), 9 of 10 understood those explanations (53.7% completely, 38% mostly) (Table 2). If we evaluate the level of understanding in the age groups, the highest levels were in the 25-34-year-old and 45-54-year-old age groups (95%, 95.8% respectively) and the lowest in 18-24-year-old and 35-44-year-old age groups (13%, 12.2% respectively, did not understand at all).

At the question “Was some form of diagnostic test undertaken to determine what was causing your illness on this occasion?”, 72.9% (293 respondents) of those who took antibiotic for a respiratory condition responded “YES” (physical exam 36.57%, swab test 30.35%, blood test 18.41%, X-ray 14.93%) (Chart 12). As seen in Table 3, sufferers who experienced nasal symptoms or a sore throat in the past 6 months were more likely than those with other symptoms to have undergone a diagnostic test. When evaluating the relationship between undergoing a diagnostic test (Yes or No) and antibiotic usage, it was found that there was a higher likelihood of performing a test in cases of cold/flu and different types of infections compared to allergies and COVID (p<0.05). The same significant statistical difference can be observed when a diagnostic test is not performed before antibiotic administration (p<0.05).

Antibiotic perceptions and attitudes

In the last part of the questionnaire, the population attitudes and perceptions on antibiotics and their usage were surveyed. Evaluating the perception of antibiotic usage across Romania, 71.5% (n=715) of the respondents admitted they were quite knowledgeable about how antibiotics work on respiratory symptoms and 73.4% (n=734) about the antibiotics' side effects (Table 4). However, the answers received for other important questions revealed a great misunderstanding and false knowledge among Romanians. 51.8% (n=518) of the respondents agreed that antibiotics kill viruses, especially in the younger age groups (60% 18-24y, 60.85% 25-35y), with a significant statistical difference at a level of 95%CI when compared to the other age groups (p<0.05). 48.2% (n=482) believe that antibiotics relieve pain, in this group males being the most likely to think like this (p<0.05) and the 18-24-year-olds (71.82%); when compared to other age groups, the difference is significant from a statistical point of view. 46.7% (n=467) sustained that antibiotics can be effective for sore throat with no significant difference between male and female; with a statistically significant difference (p<0.05) between the age groups with higher percentages for the 18-24-year-olds (52.73%) and the 45-54-year-olds (50.66%) and the 35-44-year-olds having the lowest percentage (40.8%), as seen in Table 4. 46% (n=460) of the respondents admitted that antibiotics are effective for cold/flu, males and the 18-24-year-olds being the most likely to believe this (p<0.05; significant at a level of 95%CI).

73% of all the respondents stated that antibiotics should be available without prescription or on request, the most likely to sustain this statement being the 18-24y group (Table 4). Almost 6 of 10 sufferers were concerned about the resistance to antibiotics, especially those between 25 and 54 years of age.

When evaluating the moment an antibiotic treatment should be stopped, we also identified misconceptions about this subject. 53.6% of all respondents (n=536; with a range inside the age groups between 51.54% and 62.72%; the most

Table 4. Attitudes and perceptions on antibiotic use in Romania.

Attitudes/Perceptions	Net Agree	Gender		Group age				
		Male	Female	18-24y	25-34y	35-44y	45-54y	55-64y
Antibiotics relieve pain	48.2%	51.66%*	44.58%	71.82%*	57.45%	42.96%	40.97%	37.09%
Antibiotics are effective for sore throat	46.7%	48.73%	44.58%	52.73%	48.94%	40.8%	50.66%	43.71%
Antibiotics are effective for colds and the flu	46%	51.47%*	40.29%	70%*	53.62%	42.6%	42.73%	27.81%
Antibiotics kill viruses	51.8%	53.42%	50.1%	60%*	60.85%*	49.46%	49.34%	39.73%
Antibiotics quickly relieve symptoms	52.5%	54.8%	50.1%	66.36%*	54.04%	49.1%	53.3%	45.03%
Antibiotics should be available on request from the pharmacy	39.8%	40.9%	38.65%	48.2%*	42.13%	36.1%	39.65%	37.08%
Antibiotics should be available without a prescription	33.2%	33.46%	32.92%	42.72%*	34.47%	29.24%	34.36%	29.8%
People should have an examination before being offered antibiotics	86.2%	83.76%	88.75%*	90%	85.53%	84.11%	88.55%	84.77%
Unnecessary use of antibiotics makes them become ineffective	82%	80.82%	83.23%	72.72%	80%	84.11%*	81.94%	88.08%*
I am quite knowledgeable about how antibiotics work on respiratory symptoms/conditions	71.5%	67.9%	75.25%*	70.9%	69.36%	69.31%	73.12%	76.82%
I am quite knowledgeable about the side effects antibiotics can cause	73.4%	68.88%	78.12%*	65.45%	72.34%	71.48%	78.41%*	76.82%*
I would feel anxious about being treated for respiratory illnesses without antibiotics	22.6%	23.28%	21.88%	33.63%*	23.4%*	19.85%	25.11%*	14.6%
I do not have enough knowledge to know how to treat respiratory illnesses without antibiotics	33.9%	34.83%	32.92%	42.72%*	36.17%	30.68%	33.92%	29.8%
I'm concerned about resistance to antibiotics	59.5%	56.55%	62.57%	54.54%	62.55%*	61.73%	60.8%	52.31%

*T-Test for means, Z-Test for percentages; significance at a 95% level; P6M – past 6 months

likely to believe that being in the younger group) agreed that “You should stop taking antibiotics if you don't get better in a couple of days”, while 38.8% (n=388; with a range between 33.11% and 42.72% according to age groups) stated that “You should stop taking antibiotics when you feel better” (Table 5).

When asked “In the last 6 months, how much information, if any, have you seen about the unnecessary use of antibiotics?”, 22.7% (n=227) responded “Not seen any”, 26.9% (n=269) “A fair amount” and 35.3% (n=353) “A small amount”. Only 8.9% (n=89) reported they received “A great deal” of information. Evaluating the general knowledge about antibiotics, 24.9% of all the respondents included in this study (n=249) received

information about antibiotic use for respiratory conditions in the past 6 months from a doctor, followed by a pharmacist (22%) and internet (19.9%). Another source of information related by 16.4% was the TV. Still, 317 of the respondents, representing 31.7%, stated that they have not seen any kind of information about this topic.

When asked about the type of information they would be interested in hearing about, 493 of those interviewed (49.3%) said they would want to know how to manage their symptoms without antibiotic, 47.5% were interested in information about the medical condition, and 43.3% were interested in learning how to use antibiotics. There were 460 respondents

Table 5. Attitudes to stopping antibiotics across Romania.

	Agree strongly	Agree somewhat	Neither agree nor disagree	Disagree somewhat	Disagree strongly	Would rather not say	Don't know
You should stop taking antibiotics when you feel better	17.4%	21.4%	21.5%	20.1%	15.4%	0.3%	3.9%
You should stop taking antibiotics as quickly as possible	15.7%	26.4%	27.4%	13.9%	11.4%	0.6%	4.6%
You should stop taking antibiotics if you get side effects	63.1%	22.9%	7.0%	2.4%	2.8%	0.6%	1.2%
You should stop taking antibiotics if you don't get better in a couple of days	25.8%	27.8%	18.8%	14.8%	8.1%	0.2%	4.5%
You should keep leftover antibiotics for the next time you or your family get sick	15.5%	29.6%	23.6%	13.4%	14.8%	0.6%	2.5%

(representing 46%) who stated that antibiotic resistance would be a topic of interest.

“Before today, how informed or uninformed did you feel about antibiotic resistance? By antibiotic resistance we mean the way in which bacteria can overcome the effectiveness of these medicines.” represented a very important question in the present survey. 49.4% of all the respondents included in the study (n=494) were “somewhat informed” and only 16.5% (n=165) were “very informed” (Chart 13). There was a similar distribution across all evaluated categories (gender, age), with no statistical differences.

“To what extent do you agree or disagree with this statement: People are contributing to antibiotic resistance every time they take an antibiotic?” revealed that 73% of the respondents (n=730) agree that people are contributing to antibiotic resistance; of them, 29.2% strongly agreed, while 44.1% somewhat agreed. There is no difference between the age groups. When considering the gender, in the “Net: Agree” group, males were more likely

to confirm this statement (77.1% versus 69.32% of females), while in the “Net: Disagree” group, the difference was significant in favour of women (7.56% versus 4.3%) (Chart 14).

DISCUSSIONS

Antimicrobial resistance (AMR) and the inappropriate use of antibiotics are, in most cases, the results of a poor knowledge and a misconduct of the population, but also due to healthcare professionals. Globally, many studies have been performed in order to evaluate the population knowledge and attitude towards antibiotic usage and campaigns developed to rise the general awareness upon antibiotic misuse risks and resistance. The European Antibiotic Awareness Day set up in 2008 by ECDC (on November 18th each year) and the World Antibiotic Awareness Week celebrated from November 18th to November 24th each year (initiated in 2015 by

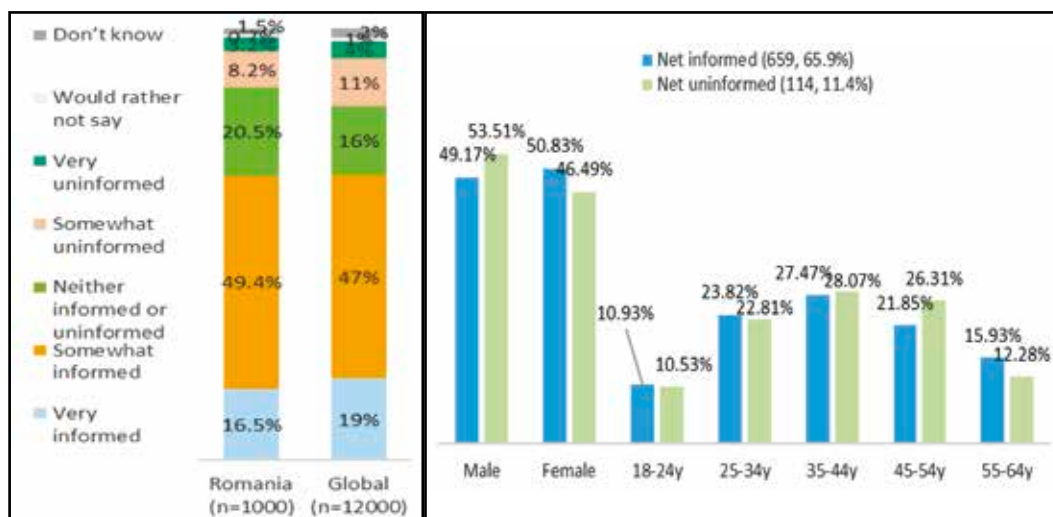


Chart 13. The degree of information about antibiotic resistance.

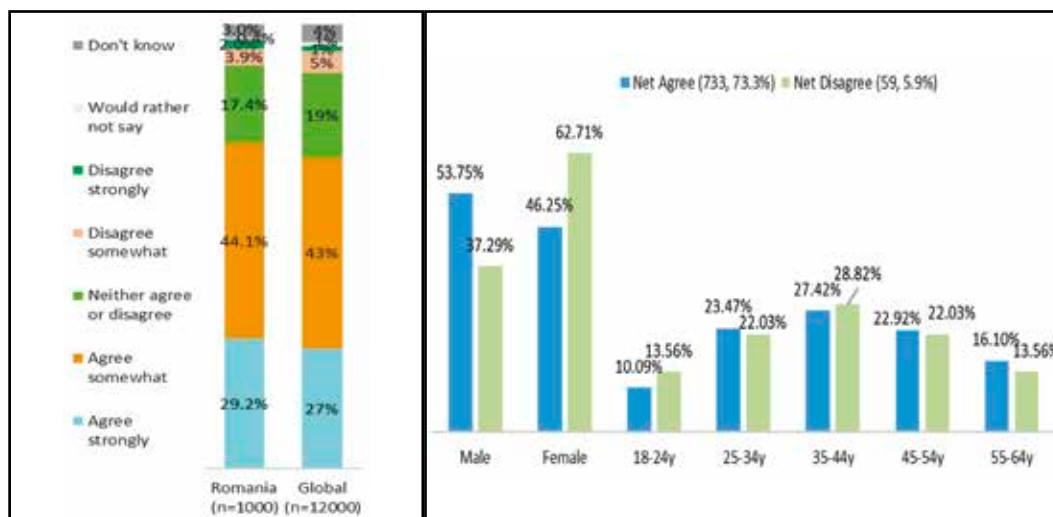


Chart 14. Are people contributing to antibiotic resistance every time they take an antibiotic?

WHO) are global action plans taken in order to increase the understanding of AMR and encourage best practice among both general population and healthcare workers. Unfortunately, there are not so many articles covering this problem performed on Romanian consumers by native researchers^{14,17}. Most of the surveys performed by WHO and ECDC include also Romania.

Analysing the results of the present research, the investigators observed that there is a lack of clarity in the general population regarding how antibiotics work among Romanians. 40.2% of the interviewed have taken antibiotics for a respiratory condition in the last 6 months, 40.8% of them doing it to treat a cold and 44.4% for sore throat. These results can be compared to those reported by other studies. According to the European Union Eurobarometer survey on antimicrobial resistance from 2022, 26% of the Romanian respondents took antibiotics for a cold¹⁸, their number being lower if we look at the results of the same survey performed in 2013 (35%)¹⁹. The global results of our study showed that 35% of all sufferers were likely to use antibiotics for a common cold, 37% for throat infection (versus 29.6% Romanians) and 34% for flu (versus 25.4% Romanians) (as seen in Chart 7).

Unfortunately, 51.8% of all respondents consider antibiotics efficient in killing viruses, especially the younger age groups (60% 18-24y, 60.85% 25-34y). 46% believe that antibiotic therapies are the answer when having a cold/flu, with a higher prevalence among men (51.47%) and 18-24y respondents (70%). The global results of the present study revealed that 51% of worldwide sufferers believe that viruses can be killed by antibiotics. Voidazau et al.¹⁴ reported that 22.98% of their respondents considered antibiotic treatment efficient in case of a viral infection, while Pogurschi et al.¹⁵ (2022) had 37.51%. The Eurobarometer survey from 2022 revealed a lower percentage when compared with 2013 results (35% versus 70%)^{18,19}. A study performed in Egypt in 2023 reported that 22% of the Egyptian respondents believe that common cold can be treated with antibiotics²⁰. “Antibiotics kill viruses” is a *false* statement. Comparing to other European countries, Waaseth et al.²¹ reported that more than 30% of the Norwegians erroneously believe that antibiotics are effective against viruses, cold or influenza. In a study published in 2017, Mazinska et al.²² showed that 60% of the Polish people have the same belief.

Another important information was that 64.4% of those who used antibiotics received them from a doctor or nurse by prescription, a higher percentage when compared to the global result (55%) (see Chart 9). Similar results were reported by other studies^{15,17,18}. Self-medication (20.4% in Romania versus 29% globally) seems to be another factor leading to antimicrobial resistance. Of the 20.4% of the respondents who reported antibiotic self-medication, 5.5% obtained it without a medical prescription (online or shop) and 14.9% used the leftovers. The same observation was made in the last years^{14,17,18,23-25}.

Even if most people worldwide use antibiotics only if pre-

scribed by a healthcare professional, there are still many cases of self-medication and many opportunities of obtaining the drugs freely without a prescription, even if this practice is illegal. This behaviour is a result of both people's poor medical education, especially in poorly developed countries or areas, and pharmacists' behaviour. More campaigns focused on this subject might help to understand the risks of self-medication.

The misconceptions about antibiotic usage and mechanisms of action reside also from the fact that 38.8% of the Romanian respondents agreed with the statement “*You should stop taking antibiotics when you feel better*” no matter the treatment duration and 45.1% agreed that you should “*keep leftover antibiotics for the next time you or your family get sick*”. Various other studies reported the same behaviour^{15,17,22,23,26-28}. One of the best examples on this matter is Sweden, where only 4.5% of people use to stop the antibiotic therapy if they feel better²⁹.

Regarding the use of antibiotics according to gender and age, there was a significant difference between the younger population, adults and the elderly ($p < 0.05$ at a 95% level of confidence). The age group 18-24y seems to be the most likely to say “yes” to antibiotic usage, while the elderly are the less likely to do so: 51.8% for 18-24y, 44.7% for 25-34y, 34.43% for 35-44y, 42.7% for 45-55y, 32.88% for 54-65y. The same data is confirmed by Voidazan et al.¹⁴ and Pogurschi et al.¹⁵. There was not a significant difference between males (41.33%) and females (41.04%). When analysing the level of understanding of the explanation received about antibiotic usage, the highest levels were in the 25-34-years-old (95%) and the 45-54-years-old age groups (95.8%) and the lowest in the 18-24-year-old and the 35-44-year-old age groups (13%, 12.2% respectively, did not understand at all).

The attitudes toward antibiotic usage differed also according to the country residence region. Analysing the data according to the number of respondents from each Romanian geographic region, the highest number of antibiotics users were from South-East with 55.28%, South Muntenia with 50.32% and North-East with 50.32%, while the lowest percentages were found in North-West with 45.08% and Center with 45.67%. For the Bucharest-Ilfov region, the capital city and the most developed region of the country, with one of the highest levels of education, the usage was of 48.86%. Considering that the poorest geographical regions of Romania are South-East and North-East, the high percentages of antibiotic usage exactly in these two regions show that poverty and a lower education level can be two favourable factors for antibiotic abuse and its consequences.

Even if 71.5% of the Romanian respondents seem to be knowledgeable about how antibiotics work and 73.4% have knowledge about their side effects, with no significant statistical differences when referring to gender and age groups, there are many wrong attitudes and beliefs, which can lead to antibiotics misuse and antimicrobial resistance.

When directly analysing the level of information upon antibiotic use, action mechanisms, we see that only 3 out of 10 sufferers who saw a doctor for their respiratory pathology

received information about the antibiotic benefits and risks. 24.9% of the respondents declared they received information from a doctor, 22% from a pharmacist, 19.9% from the internet and 16.4% from the TV.

Antibiotics side effects and the antibiotic resistance was a subject of discussion in 30.2%, respectively 27.3% of the cases. The results for Romania are similar to the global ones (Chart 11). These findings correspond to those reported in the medical literature^{14,15,22,30-32}.

Regarding how informed or uninformed Romanians are about antibiotic resistance, we found that 49.4% have some information, 16.5% are very informed and 11.4% have no data. Unfortunately, no matter the gender or the age, the differences between informed and uninformed were not statistically significant. When compared to the global level of knowledge, the results were similar (they can be seen in Chart 13). Also, 73% of the respondents believe that *“People are contributing to antibiotic resistance every time they take an antibiotic”*.

CONCLUSIONS

The present study results show that, despite a high degree of knowledge regarding the antibiotic usage and side effects among the Romanian population, there are still higher percentages of inappropriate usage. There is still a great number of Romanians who use leftover antibiotics from previous treatments or purchase the antibiotic without prescription, and the most frequent reasons are sore throat and common cold. Also, we identified a range of medical, populational and demographic risk factors which can increase the antibiotic misuse (e.g., young people and poorly developed countries).

In upper respiratory tract infections, the symptomatic treatment, such as multi-symptom cold or flu medication associated with sore throat medication (e.g., lozenges, sprays, gargles, etc.), should be the first-line treatment. Antibiotics should only be recommended if the patient has clear signs of bacterial infection or in case of worsening symptoms after 3-4 days of symptomatic treatment.

The results of this study are worrying not only in the case of Romania, but also at the European and global level, and once again show that antibiotic resistance represents a threatening public health problem. Further written and online campaigns are needed in order to raise the awareness on antibiotic usage, antimicrobial resistance among Romanians.

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