



# Primary healthcare antibiotic therapy in Poland: a patient perspective – preliminary survey study

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## Abstract

**Introduction and Objective.** Growing resistance to commonly used antibiotics has challenged 21st-century medicine. To date, antibiotic policy has induced bacterial resistance and isolation of multi-drug resistant superbugs insensitive to known antibiotics. The aim of the study was to investigate the knowledge of primary healthcare patients about antibiotic usage, and to identify incorrect patient habits.

**Materials and method.** The research was based on a proprietary, anonymous Internet survey consisting of 21 questions, in which only adults could participate. The survey selected nine questions to assess the respondents' knowledge.

**Results.** 201 patients participated in the study. About 50% of participants based their knowledge about antibiotics on information obtained during a medical visit, 16.4% on consultations with a pharmacist, 24.9% on the Internet, and 11.4% exchanged experiences with friends. Every third respondent was not satisfied with the information obtained from a doctor. People with higher education reported this issue more often ( $p < 0.05$ ). Nearly 35% of people living in the countryside ( $p < 0.05$ ) admitted to using the part of a drug left after previous antibiotic therapy, and 10% administered antibiotics obtained from friends or relatives. Every fourth patient believed that antibiotics were effective against colds and flu. The average knowledge test result was 5.49 out of 9 points, and a positive score of 6 or more was obtained by nearly 60% of the respondents.

**Conclusions.** The results of this preliminary study indicate that more focus should be given to improving patients' education and compliance with treatment recommendations.

## Key words

antibiotics, patient education, medical overuse, anti-bacterial drug resistance, clinical pharmacy service

## INTRODUCTION

The growing bacterial resistance to the available antibiotics has become a real challenge to health systems worldwide and consumes vast amounts of money [1–3]. The definite cause of this problem is the inefficient use of antibiotics [4, 5]. Research shows that about 25% of antibiotics are prescribed unnecessarily, representing 10 million unneeded prescriptions in the United Kingdom [4, 6]. In contrast, according to a European Centre for Disease Prevention and Control Report, Poland's total consumption of antibiotics in 2021 was 20.2 defined daily doses (DDD) per 1,000 inhabitants per day. In comparison, the average for European countries was 18.1, and the lowest rate of only 8.3 was achieved in The Netherlands [7]. Abuses concern inpatient, outpatient, and primary treatment [8].

The majority of articles describing the discussed issue derive from data obtained from hospitals. The fewest studies concern primary healthcare, where patient knowledge and practices are important factors in influencing antibiotic resistance

[9–11]. Surveys show that nearly 50% of patients consider antibiotics effective against viral infections [10]. Only every fourth Polish patient knows that antibiotic therapy applies only to infections caused by bacterial pathogens [12]. It has become common practice to shorten the treatment duration due to symptom resolution or take antibiotics left over from previous therapy [6, 12]. Thus, many European countries established specialised units to combat bacterial resistance by educating patients and healthcare professionals on the rational use of antibiotics [8, 13]. The Polish representative of such an organisation is the National Antibiotic Protection Programme, which cooperates with national experts in microbiology, pharmacology, and diagnostics [12]. Rational antibiotic therapy is essential in the context of predictions for 2050, which estimated that up to 10 million deaths will be caused by the lack of therapeutic options against multi-drug resistant bacteria infections [3, 14].

Considering the still unsatisfactory public awareness and knowledge of antibiotic therapy, in 2015, the WHO established World Antibiotic Awareness Week, celebrated on 18–24 November each year [15]. As part of this information campaign, attention was drawn to the problem of the abuse of antibiotics in animal husbandry and the unreasonable prescription of antibiotics in primary healthcare. Likewise,

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the unauthorised modification of ordered pharmacotherapy resulting from insufficient knowledge of patients regarding the basic principles of proper antibiotic therapy was also emphasised. Moreover, it was found that antibiotic resistance is growing due to the irrational use of antibacterial agents in viral diseases, including the still ongoing COVID-19 pandemic, due to poorly understood prophylaxis and pharmacotherapy of this disease. The problem was one of the conclusions in the Polish report on the implementation of the campaign 'European Antibiotic Awareness Day 2020' [16].

Despite the above-mentioned information, data about the scale and reasons for overusing antibiotics in the primary healthcare sector is still lacking. Not enough is known about possible factors which may influence the unnecessary use of antibiotics, and sources of information that lead to misunderstanding of indications for antibiotic treatment. Despite the information campaign organised by different institutions, it is also not known what percentage of patients their message reaches.

## OBJECTIVE

The aim of this study was to investigate the impact of demographic factors on antibiotic knowledge and treatment habits, which may lead to antibiotic overuse/misuse and resistant strain isolation. It is crucial to fill the knowledge gap concerning possible factors of improper practices regarding antibiotic therapy, and find a group of patients who need more attention during medical consultations and while designing future educational materials.

## MATERIALS AND METHOD

**Study design.** The preliminary survey study was designed for the European Antibiotic Awareness Day, celebrated throughout Europe on 18 November, which was established in 2008 by the European Commission at the request of the European Centre for Disease Prevention and Control. An online, anonymous survey was active from World Antibiotic Awareness Week, 18–24 November – 30 November, inclusive. Information about the possibility of participating in the study was provided to patients by pharmacy students who participated in the celebration of this event. Interested persons received a link with access to the survey. In addition, the link to the questionnaire was published on a social network. Survey participation was voluntary (simple random sampling), and the only inclusion criterion was the age of over 18. An e-mail address was required to access the survey to secure the questionnaire against multiple completion by one user. To exclude situations with missing data, participants were required to answer each question.

Because of the anonymous nature of the research, approval from the local Bioethics Committee was not required.

**Data collection.** The questionnaire consisted of 21 primarily closed questions in Polish. The first five questions concerned socio-demographic data such as gender, age, education, place of residence, and the current occupational situation. The next nine questions examined the habits and behaviours of the respondents. The following five questions assessed

**Table 1.** Questions assessing the knowledge and habits of the respondents

1. Do you always take all prescribed doses of antibiotics, even when your health is visibly improving?
2. Are antibiotics effective in flu and colds?
3. Are antibiotics effective in viral and/or fungal infections?
4. Does taking antibiotics at specific times with specific intervals between doses result in effective and efficient treatment?
5. Is it necessary to take pre- and probiotics during antibiotic treatment?
6. Have you ever used up the remainder of a pack from a previous antibiotic treatment on your own without consulting your doctor?
7. Is the increasing bacterial resistance to commonly used antibiotics related to their overuse in medical practice?
8. Have you ever used antibiotics that you received from a friend who had part of a pack left over?
9. Have you ever heard of European Antibiotic Awareness Day?

knowledge about antibiotic therapy. The last two asked for an opinion on the availability of over-the-counter antibiotics and prior contact with the European Antibiotic Awareness Day. Nine questions were selected from the questionnaire to evaluate the patients' knowledge and habits (Tab. 1). Based on the mean test value, giving at least six correct answers guaranteed the respondents a place in the group with a high understanding of antibiotic therapy.

**Statistical analysis.** The data collected during the study were subjected to descriptive statistics. The possibility of statistical relationships between the individual groups was assessed based on the obtained results. To compare most of the data meeting the requirements of the  $2 \times 2$  tables statistics, the  $\chi^2$  test was used. ROC curves were used to identify the age-related classifier. The basic version of the database was created in Excel in the MS Office 2019 package, while the statistical analysis was performed using PQStat version 1.8.2.

## RESULTS

**Patients characteristics.** A total of 201 respondents (139 women and 62 men) participated in the survey. The mean patient age was 30.2 years (SD = 11.2, range 19 – 68 years), with women averaging 31.3 years (SD = 11.6, range 19 – 68 years) and men averaging 27.7 years (SD = 9.7, range 19 – 58 years). Socio-demographic data are presented in Table 2.

**Habits of respondents.** The survey showed that most patients still base their knowledge of antibiotics on information obtained during a medical visit (47.3%) or a consultation with a pharmacist (16.4%). One in three respondents received this information from other sources such as the Internet (24.9%) and sharing experiences with friends (11.4%). Moreover, 33.8% of persons reported that the information about the therapy obtained during the visit was incomprehensible or unsatisfactory. Statistical analysis showed that women and higher-educated respondents often reported this problem. Only 9% of the participants stated that they took antibiotics more than once a year, 23.9% had taken an antibiotic once in the past 12 months, and the highest percentage (67.2%) were those who took antibiotics less than once a year. After starting treatment and noticing an improvement, every fifth responder skips the rest of the antibiotic doses. 34.8% of the subjects admitted that they used the remaining amount of antibiotics without consulting a doctor. This behaviour was statistically significantly more frequent in the group

**Table 2.** Sociodemographic respondents data

Factor	Category	Number of patients N=201	Percentage of patients (%)
Gender	Female	139	69.2
	Male	62	30.8
Education	Primary	2	1.0
	Vocational	2	1.0
	Secondary	87	43.3
	Higher	110	54.7
Place of residence	Country	55	27.4
	City	146	72.6
	Pupil/student	71	35.3
Vocational situation	Vocationally active	116	57.7
	Unemployed	11	5.5
	Retirement pensioner	2	1.0
	Disabled pensioner	1	0.5

of people living in the countryside ( $p < 0.01$ ). Additionally, 1 in 10 participants took an antibiotic gifted by a friend. Of the 10% who insist on a prescription for an antibiotic despite the doctor's contrary opinion, only 3% decided to see another specialist if such a prescription was not issued. As many as 14.4% of respondents chose not to fill an antibiotic prescription due to the high cost of the drugs prescribed. Despite the expected differences between patients living in rural and urban areas, no statistical significance was observed regarding fulfilment of prescriptions ( $p > 0.05$ ) (Tab. 3).

**Antibiotic therapy knowledge.** There is a belief among patients about the effectiveness of antibiotics taken during bouts of colds and flu, and as many as 26.9% of patients are convinced of the efficacy of such therapy. Moreover, 59.2% of respondents believe antibiotics are effective for viral and/or fungal infections. 96.0% of participants confirmed the importance of taking antibiotics at a strictly defined time,

**Table 3.** Answers and habits of the respondents (% of affirmative answers)

Question	Group		p-value
	Sex		
	Women	Men	
Is the information on antibiotic treatment obtained during the medical visit understandable and satisfactory for you?	61.87	75.81	0.0538
	Education		
	Other	Higher	
Is the information on antibiotic treatment obtained during the medical visit understandable and satisfactory for you?	73.63	60.00	0.0421
	Accommodation		
	Countryside	City	
Have you ever used the part of the package remaining after the previous antibiotic therapy on your own without consulting a doctor?	50.91	28.08	0.0024
Have you ever missed an antibiotic because the prescription filling cost was too high?	16.36	13.70	0.6317

with specific intervals between subsequent doses, on the therapy efficiency. 81.6% of respondents indicated the need for prebiotics and probiotics during antimicrobial treatment. Analysis showed that women and people over 25 years of age statistically significantly more often supported this practice ( $p < 0.01$ ). Most of the respondents (91.0%) correctly associated the abuse of antibiotics with increasing bacterial resistance. However, despite reports of multi-drug-resistant superbugs, 9.0% of respondents supported the accessibility of over-the-counter antibiotics.

For the reasons mentioned above, the National Antibiotic Protection Programme was created, preparing educational materials and organising events to educate patients under its patronage. Nevertheless, 181 respondents had never heard of the European Antibiotic Awareness Day, celebrated every year in Europe on 18 November. The results concerning the patients' knowledge of antibiotic therapy that achieved statistical significance are shown in Table 4.

**Table 4.** Responses regarding knowledge about antibiotic therapy (% of affirmative answers)

Question	Group		p-value
	Sex		
	Women	Men	
Is it necessary to take pre- and probiotics during antibiotic treatment?	87.05	69.35	0.0028
	Age		
	≤ 25 years old	> 25 years old	
Is it necessary to take pre- and probiotics during antibiotic treatment?	73.64	90.21	0.0014

**Test results.** Based on questions from the survey, a test was devised to check the respondents' knowledge and correctness of antibiotic-related habits. Based on the test, an attempt was made to characterise the knowledge of the principles of antibiotic therapy in the 'statistical respondent' to find difficult patient issues. Providing a correct answer to one of the questions gained one point. The mean test result obtained by the participants was 5.49 points (SD = 1.35). The obtained value, rounded-up to the whole number, was taken as the threshold, indicating passing a test. Based on the assumed criteria, 57.71% of the respondents passed the test. The  $\chi^2$  test showed that women and people aged 35 obtained a positive test result statistically significantly often ( $p < 0.05$ ). An interesting observation was the lack of significant differences in test passing depending on education ( $p > 0.05$ ). The results are summarised in Table 5.

**Table 5.** Test results (% of positive results)

Group	Positive knowledge test %	p-value
Age	> 35 years old	73.91
	≤ 35 years old	52.90
Sex	Women	61.15
	Men	50.00
Education	Higher	55.45
	Others	60.44

## DISCUSSION

The study showed that an education plan for patients is crucial for reducing the risk of antibiotic resistance. It should include increasing patients' awareness and improving their habits and beliefs about antibiotic therapy. This could reduce the induction of bacterial resistance in primary healthcare.

The first part of the study assessed the patients' habits and behaviour related to taking antibiotics. Less than half of the respondents declared obtaining information about the usage of antibiotics from a physician, compared to about 70% of Polish patients described by Łoś-Rycharska et al. [12] and 64.5% of Lithuanian patients [17]. Almost every fourth patient considered the Internet the primary source of information. This is confirmed by the results obtained in other research papers which fluctuate from 15 to even 40% [12, 14, 17]. The 2018 Special Eurobarometer 478 report shows that 67% of patients expect more information on antibiotic therapy from healthcare professionals [18]. This is in line with the opinion obtained in the current study in which 33.8% of patients were dissatisfied with the information provided by their physicians. A similar percentage result (34%) was described in a study by Pavyde et al. [17].

In the light of the above-mentioned information, pharmacists who have been providing pharmaceutical care since 16 April 2021, under the long-awaited Profession Act, may contribute to improving the situation in Poland. With the validation of the profession, they were provided with new duties and tools to enable active counselling, care, and education of patients, including the possibility of participating in antibiotic therapy teams.

According to the 2018 'Special Eurobarometer 478' report, 24% of Poles have taken an antibiotic in the last 12 months. Compared to the data from 2016, Poland recorded a 4% decrease, which was below the average result obtained in other European countries, which in 2018 was 32% [18]. The finding of the current study is closer to the average result of European countries (32.8%). On the other hand, a study conducted in Lithuania shows that 24.9% of respondents confirmed antibiotic therapy in the last year [17]. In France, it was obtained from about 34 to 48% [19, 20], while in Kuwait, this percentage soared to 72.8% of participants [21].

Another problem is the interruption of the ordered treatment with a marked improvement in health and the disappearance of infection symptoms. This phenomenon may affect 22 – 65% of patients [4, 20–23], but this percentage was less than 20% in the study. Self-treatment with the remaining part of the drug package after the previous therapy becomes a significant problem (34.8% of respondents). The percentage observed in other studies fluctuates around 20% [14, 17, 19, 20], but during the COVID-19 pandemic, it might have affected up to 56% of patients [24]. A statistically significant greater frequency of this practice was observed in the group of people living in rural areas, which is also reflected in the results obtained in the study by Pavyde et al. [17]. Moreover, the uncontrolled use of drugs received from friends or family concerned 10% of respondents, and a close percentage was also presented in the Awad et al. study [21]. Prescription medication sharing among patients and self-medication are essential issues, which in the case of antibiotics, may lead to influences increasing bacterial resistance [25]. In addition to the risk of an uncontrolled increase in resistance, both phenomena lead to drug wastage and situations where

patients are exposed to ineffective therapy and serious side-effects [24, 26].

The final described observation is the lack of fulfilment of the prescription due to the high cost of the treatment. 14.4% of respondents confirmed the occurrence of such a situation, and a similar result (17.5%) was presented by Demore et al. [20]. On the other hand, another Polish study reported that the non-fulfilment of an antibiotic prescription for financial reasons may affect up to 38% of patients [27].

The second part of the questionnaire concerned primary healthcare patients' knowledge of antibiotic therapy. The results showed that just over a quarter of respondents believed that antibiotics are effective against colds and flu. According to the 'Special Eurobarometer 478' report, this represented 28% (43% Poles) of respondents [18], and 19% in a study by Napolitano et al. [14]. A high percentage of Poles is confirmed by other studies [17, 20–22, 28]. Additionally, participants were asked about antibiotic effectiveness in fungal and viral infections; almost 60% opted for activity in at least one of two cases. Precisely 21.9% selected both options, 27.9% chose activity against fungal infections and the least (9.9%) against viruses. Similar observations were described in the Mason et al. study, where nearly 30% of respondents believed in the effectiveness of antibiotics against fungi infections [6]. A Robert et al. study described a 10% greater number of respondents, confirming the validity of antibiotic therapy use in the case of fungal and viral infections [19].

The most frequently asked question about the effectiveness of antibiotics in other studies was their effectiveness against viruses. The differentiation of the answers provided is perfectly illustrated by the 'Special Eurobarometer 478' data in which the percentage of correct responses ranged from only 23% in Greece to 74% in Sweden [18]. 96% of respondents agreed that using antibiotics with an interval between consecutive doses, allows maintaining the concentration at the desired level, directly translating into the effectiveness of therapy, which correlates with the Mason et al. study from the United Kingdom [6].

Although the Cochrane analysis from 2011 on the benefits of using probiotics during antibiotic therapy suggests suppressing excessive enthusiasm [29], 81.6% of respondents were convinced of the need to use them. In addition, in the current study it was observed that women statistically significantly more often agreed with that ( $p < 0.01$ ). This regularity was also observed in the Draper et al. study, in which nearly 80% of patients mentioned using probiotics several times a week [30]. In the current study, a 91% agreement was observed among participants on the impact of antibiotic overuse on increasing bacterial resistance. A similar opinion was expressed by slightly over 90% of French citizens participating in the Demore et al. study [20] and 86% of Poles participating in the 'Special Eurobarometer' report from 2018. Among European countries, this percentage ranges between 70% (Italy) and 97% (Greece) [18]. Despite educational campaigns and promotion of the 'European Antibiotic Protection Day' by the National Antibiotic Protection Programme and organizations with similar functionality created in individual European countries [8], only 20 out of 201 participants had heard about its celebration on 18 November each year.

Many questionnaires regarding patients' knowledge about the use of antibiotics included a test that allowed the participants to assess and compare their results quickly.

According to the assumed pass criteria in the current study, 57.7% of the respondents obtained a positive outcome. Awad et al. presented a similar percentage in which 53.4% of the respondents received a result above the average for the entire group [21]. In the current study, people over 35 more often achieved a score greater than or equal to six ( $p < 0.01$ ). The Demore et al. study confirms this relationship carried out in France [20], the Kim et al. assessing the knowledge of South Korean patients [22], and the 'Special Eurobarometer 478' report for Europe [18].

It was not possible to link patients' knowledge about antibiotics with the level of their education ( $p > 0.05$ ), despite many studies confirming such a relationship [17, 18, 20, 22, 31].

## CONCLUSIONS

The study has several limitations, including the small group of respondents and the relatively short duration of the questionnaire's activity. Additionally, in treating the survey as a preliminary study, no attempt was made to validate the survey questions and calculate the minimum number of respondents. However, ignoring any imperfections, the results obtained from the survey shed light on the often underestimated and neglected problem. It turns out that this is an area that leaves a great deal of scope for doctors, pharmacists, healthcare workers and specialists, national consultants, and the Ministry of Health.

Despite the facilities of the 21st century enabling the easy and quick transfer of important information, the basic knowledge of patients about their antibiotic therapy leaves much to be desired. The current state of affairs requires everyone to mobilise to improve this phenomenon, thus limiting the induction of bacterial resistance. According to the results of this preliminary study, efforts should be made to increase the level of confidence in the information provided to patients to exclude the use of uncertain knowledge from the Internet, or discussions among friends and family. Moreover, medical specialists must focus on providing all necessary information regarding the therapy which should increase patient satisfaction. This, in turn, can translate into a better understanding of treatment and avoidance of behaviours that influence the development of bacterial resistance.

With many respondents (181/201) unaware of the existence of European Antibiotic Awareness Day, information campaigns organised in the future should try to expand their reach and focus on underlying rules of proper use of antibiotics and the spectrum of their activity. Previous studies confirm the need to educate patients to enable them to understand the basic mechanisms for controlling bacterial infections, resulting in higher adherence rates and minimising the failure of antibiotic therapy.

In the light of these conclusions, it appears that mere instruction on how to take the antibiotic correctly is clearly insufficient for patients. It is worth emphasising the fact that in this day and age, direct contact with medical staff should not be the only form of information for patients. Evolving e-healthcare offers almost unlimited opportunities to reach patients, including the possibility of providing personalised and comprehensive treatment and prevention materials. We believe that further research should focus on identifying the most effective sources of messages to improve patient

awareness and describing factors influencing patients' treatment motivation, as well as risk behaviour, such as self-medication or treatment discontinuation.

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