Taking antibacterial drugs without a doctor's prescription in the Russian Federation

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ABSTRACT

Background. Antibiotic resistance is a global threat leading to ineffective treatment of many infectious diseases. One of the factors contributing to an increase in antibiotic resistance is over-the-counter sale of antibiotics.

The aim of this study was to establish the sources of antibiotic prescription and to determine the prevalence of self-medication and factors that cause it.

Materials and methods. The computer-assisted web interview (CAWI) methodology was used in the study. The questionnaire consisted of six blocks and 41 questions. For statistical analysis of the study results, Statistica for Windows version 10.0 and R-Studio software programs were used.

Results. The study involved 2,725 people. Only 50.9% of the respondents purchased antibiotics with a prescription or got them during hospitalization. Parameters associated with over-the-counter purchase of antibiotics included female gender (odds ratio (OR) = 1.4; 95% confidence interval (CI): 1.2–1.7), lack of higher education (OR = 1.6; 95% CI: 1.3–1.9), medical education (OR = 1.7; 95% CI: 1.2–2.5), lack of awareness of a ban on over-the-counter sale of antibiotics (OR = 1.6; 95% CI: 1.3–1.9), and relying on the knowledge (opinion) of family members or acquaintances as the main sources of information about the correct use of antibiotics (OR = 2.2; 95% CI: 1.7–2.9).

Conclusion. Antibiotic resistance can be reduced by propaganda and strict control over a ban on over-the-counter sale of antibiotics. It is also essential to update knowledge of medical professionals about antibacterial drugs and antibiotic resistance on a regular basis, also through raising their awareness of the development of antibiotic resistance in both patients and medical workers.

Keywords: antibiotics, antibacterial drugs, taking antibiotics without a doctor's prescription, antibiotic resistance, self-medication

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Прием антибактериальных препаратов без назначения врача в Российской Федерации

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РЕЗЮМЕ

Введение. Антибиотикорезистентность – глобальная угроза, приводящая к неэффективности лечения многих инфекционных заболеваний, причиной роста которой является ненадлежащее исполнение требований законодательства, а именно безрецептурная продажа антибиотиков.

Цель исследования. Установить источники назначения антибактериальных препаратов, распространенность самолечения и факторы, его обусловливающие.

Материалы и методы. В настоящей работе применялся метод онлайн-опроса (CAWI) с использованием анкеты, состоявшей из шести блоков и 41 вопроса. Статистический анализ данных проведен с использованием программ Statistica for Windows version 10.0 и R-studio.

Результаты. В исследовании приняли участие 2 725 человек. Только 50,9% респондентов приобретали (получали) антибактериальные препараты по рецепту врача. Параметрами, ассоциированными с приемом антибиотиков без назначения врача, являлись женский пол (отношение шансов (ОШ) = 1,4; 95%-й доверительный интервал (ДИ): 1,2–1,7), отсутствие высшего образования (ОШ = 1,6; 95%-й ДИ: 1,3–1,9), наличие медицинского образования (ОШ = 1,7; 95%-й ДИ: 1,2–2,5), отсутствие информации о запрете продажи антибиотиков без рецепта врача (ОШ = 1,6; 95%-й ДИ: 1,3–1,9) и применение знаний членов семьи или знакомых как основных источников информации о рациональном приеме антибактериальных препаратов (ОШ = 2,2; 95%-й ДИ: 1,7–2,9).

Заключение. Приоритетными направлениями по сдерживанию антибиотикорезистентности могут стать пропаганда и строгий контроль запрета продажи антибиотиков без рецепта врача. Кроме того, необходимо периодически актуализировать знания медицинских работников об антибактериальных препаратах и антибиотикорезистентности, в том числе для повышения настороженности специалистов сферы здравоохранения к развитию антибиотикорезистентности как у пациентов, так и самих работников.

Ключевые слова: антибиотики, антибактериальные препараты, прием без назначения врача, антибиотикорезистентность, самолечение

INTRODUCTION

Antibiotic resistance is a global threat leading to ineffective treatment, a rise in healthcare costs, and an increase in morbidity, mortality, and length of hospital stay [1, 2]. In the Russian Federation, the problem of antibiotic resistance is also relevant. According to O.Y. Kutsevalova et al. (2019), more than 50% of P. aeruginosa and K. pneumoniae strains and 90.9% of A. baumannii strains are resistant to carbapenems

[3]. V.V. Rafal'sky et al. (2018) found stable high resistance of E. coli strains to co-trimoxazole (19.3–26.2%) and ampicillin (33.1–41.5%) [4].

There are several causes of the rise in antibiotic resistance. One of them is non-compliance with legal regulations and over-the-counter sale of antibiotics. Foreign researchers report that this trend is observed in 51% of cases [5–7]. This results in overuse of antibacterial drugs, including self-medication, which ranges from 1 to 70% in some low- and middle-income countries [8, 9]: in Southeast Asia – 50%, in South America – 78%, in Italy – 32.3%, in Tanzania – 58% [10–13].

In the Russian Federation, sale of antibacterial drugs with a prescription and strict control over this process were introduced in 2017[1]. Unfortunately, in real practice, these recommendations are not always followed strictly. According to the results of the study by T.M. Klimova et al. (2017) that included 358 individuals, 73.4% took antibiotics without a doctor's prescription [14].

In order to better understand the sources of antibacterial drug prescription, the prevalence of self-medication with antibacterial drugs, and the factors that cause them, an observational study was carried out on a representative sample of the Russian Federation residents.

MATERIALS AND METHODS

The computer-assisted web interview (CAWI) methodology was used in the study. The questionnaire consisted of six blocks and 41 questions: characteristics of respondents, frequency and features of antibiotic intake, prescription and purchase, rationality of use, knowledge of the population and sources of information about antibacterial drugs and antibiotic resistance. To improve the questionnaire validity, the focus group method ($n = 10$ people) was used.

The statistical data analysis was carried out using the Statistica for Windows version 10.0 and R-Studio software. Qualitative variables were presented as absolute and relative frequencies. Quantitative variables were presented as the arithmetic mean and the standard deviation ($M \pm SD$).

The Shapiro – Wilk test was used to assess the distribution of the assessed variables. For non-normal distribution of the variables, the Mann – Whitney test was used to assess the significance of differences between two independent samples. For normal distribution of the variables, the Student's t-test was applied. The differences between the groups were considered statistically significant at $p < 0.05$. The odds ratio (OR) was used to assess the association of a particular outcome with its binary predictors. A logistic regression model was created to determine the probability of a certain event.

RESULTS

Characteristics of the respondents

The study included 2,725 people from all regions of the Russian Federation (45.6% men, $n = 1,242$; 54.4% women, $n = 1,483$). The average age of the participants was 42.4 years (± 14.4 years). More than 25% of the respondents were aged 25–34 years ($n = 683$), 22.7% of people were aged 35–44 years (22.7%, $n = 619$).

The respondents were asked a standard question for determining purchasing power: "How do you assess your financial situation?" According to the provided answers, the majority of the respondents (44.1%, $n = 1,200$) were attributed to the middle-income group, and 36.5% ($n = 995$) – to the upper middle group. Detailed socio-demographic characteristics of the participants are presented in Fig. 1–3.
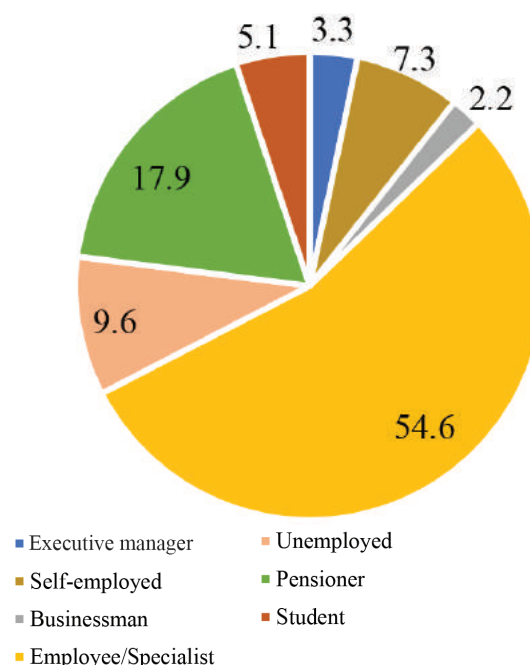

Fig. 1. Social and professional categories of the respondents, %

Complete secondary
Secondary vocational or technical
Incomplete higher education
Higher education
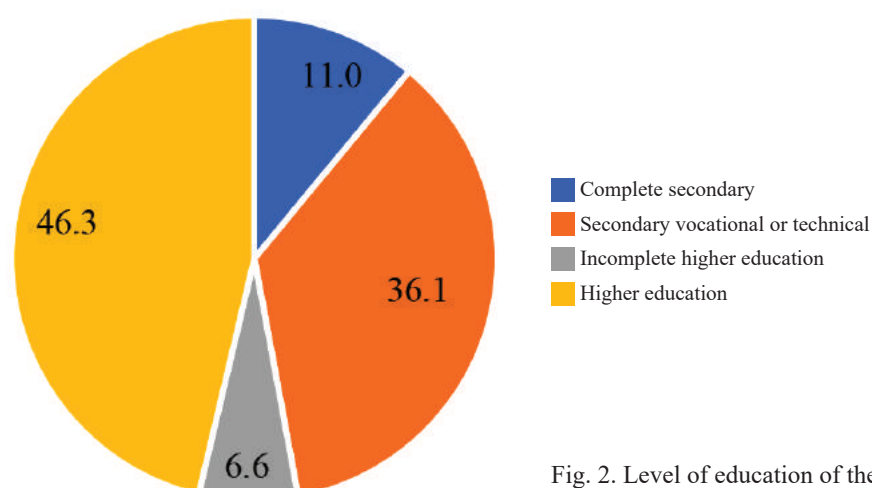
Fig. 2. Level of education of the respondents, %

There is not enough money even for food (extremelylow income)

There is enough money for food, but buying clothes andpaying for utilities causes difficulties (low income)

There is enough money for food and clothes, but buyinghousehold appliances causes difficulties (average income)

There is enough money for clothes, food and householdappliances, but buying a car, apartment or cottagecauses difficulties (above average income)

There are enough funds to buy everything you need (high income)

Fig. 3. Financial situation of the respondents, %

Prescription of antibacterial drugs

The study results indicate that 32.2% of the participants ($n = 479$) who took antibacterial drugs in the previous 12 months purchased them without a doctor's prescription. Of them, more than a third (34.0%, $n = 163$) decided to start taking antibiotics on their own, 33.2% did it following the advice of familiar medical professionals ($n = 159$), and 31.5% followed the advice of family members ($n = 151$) (Fig.4).

Fig. 4. Sources of prescription of antibacterial drugs other than the doctor

The percentage of the respondents who took antibacterial drugs prescribed by the doctor was the highest among people who had higher education (73.0%, $n = 514$) and the lowest among people wi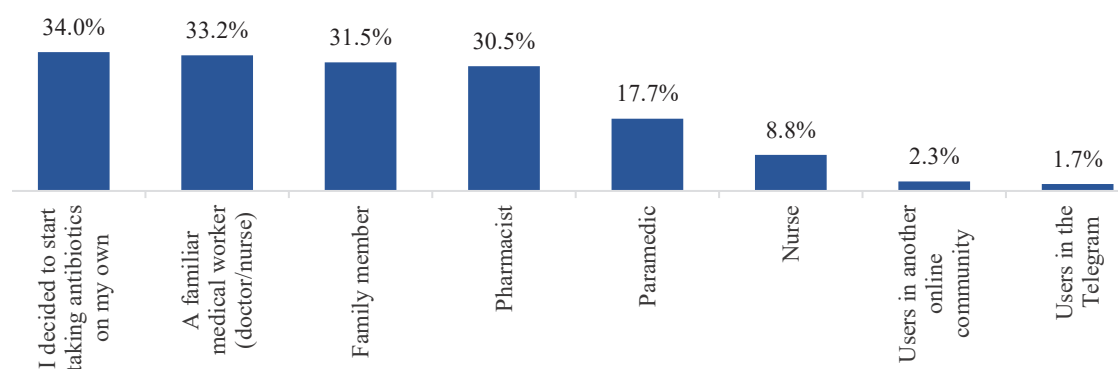th secondary vocational or technical education (63.6%, $n = 330$; $p = 0.004$). However, the analysis showed that social and professional groups and the financial situation of the respondents had no significant impact on taking antibiotics prescribed by the doctor ($p > 0.05$) (Fig. 5).
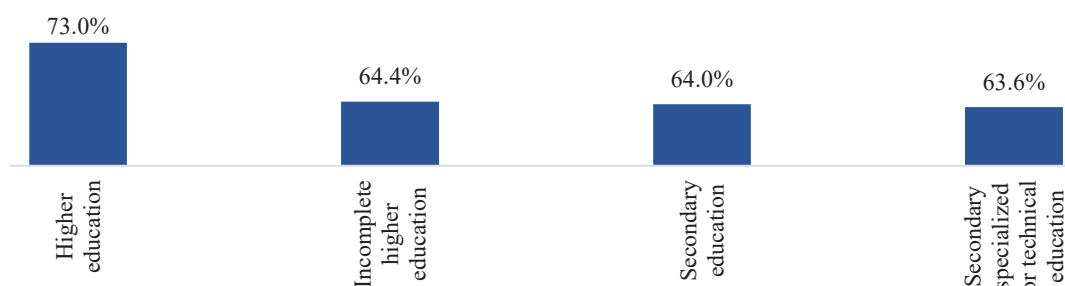

Fig. 5. The proportion of the respondents who took antibacterial drugs prescribed by the doctor, depending on the level of education: $p = 0.004$ when comparing respondents who had higher and secondary education

The parameters associated with more frequent use of antibiotics without a doctor's prescription were female gender (OR = 1.4; 95% confidence interval (CI): 1.2–1.7), lack of higher education (OR = 1.6; 95%CI: 1.3–1.9), medical education (OR = 1.7; 95%CI: 1.2–2.5), unawareness of a ban on over-the-counter sale of antibiotics (OR = 1.6; 95%CI: 1.3–1.9), and relying on the knowledge of family members or friends as the main sources of information about the rational use of antibacterial drugs (OR = 2.2; 95%CI: 1.7–2.9) (Table 1).

T a b l e 1

Parameters associated with taking antibacterial drugs without a prescription	
Parameter	OR (95% CI)
Female gender	1.4 (1.2–1.7)
Lack of higher education	1.6 (1.3–1.9)
Medical education	1.7 (1.2–2.5)
Unawareness of a ban on over-the-counter sale of antibiotics	1.6 (1.3–1.9)
The main source of information about the rational use of antibacterial drugs is the knowledge (opinions) of family members or friends	2.2 (1.7–2.9)

Sources of buying (getting) antibacterial drugs

Almost half of the respondents (49.1%, $n = 732$) who took antibiotics in the previous 12 months took these without a prescription. Of these, the vast majority (86.3%, $n = 632$) bought antibiotics over the counter in a pharmacy and a fifth (22.8%, $n = 167$) took leftover antibiotics from a previous prescription (Fig. 6).

A significantly lower proportion of the respondents who bought antibiotics with a prescription was observed among self-employed (31.4%, $n = 38$; $p < 0.05$). During in-patient treatment, students and persons with extremely low income received antibacterial drugs less than other groups (19.1%, $n = 13$ and 3.8%, $n = 1$, respectively; $p < 0.01$).

Besides, the age group of 25–34 years old (28.1%), self-employed people (50.4%), and people with low income (53.8%) had the biggest proportion of the respondents who bought antibacterial drugs over the counter; the smallest proportion was noted for the age group of 18–24 years (13.3%), students (26.5%), and people with high income (18.9%).
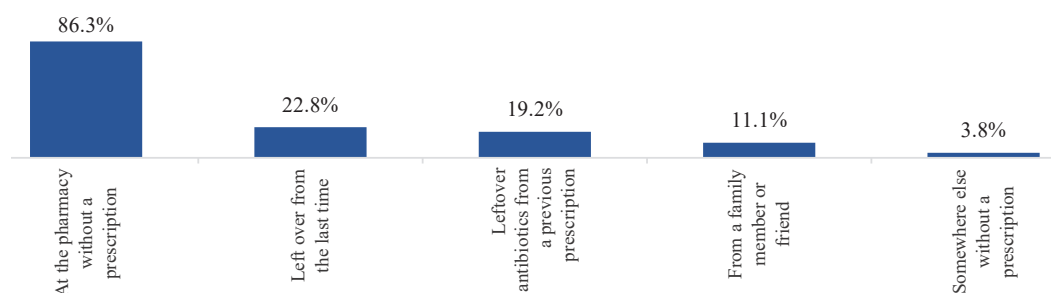

Fig. 6. Distribution of the respondents by sources of buying (getting) antibacterial drugs other than from the doctor

The proportion of the respondents who got antibacterial drugs from family members or friends was significantly bigger in the age group of 18–24 years (7.8%) and among students (20.6%), but it was significantly smaller in the age group of 55–64 years (1.3%) and among businessmen (0.0%) (Fig. 7).
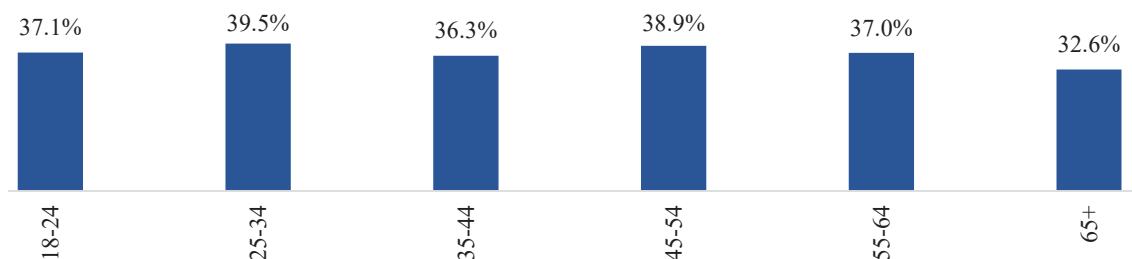

Fig. 7. Percentage of the respondents who took antibacterial drugs prescribed by the doctor depending on the age group, %, $p = 0.04$ when comparing the age group of 25–34 years and the group over 65 years

What is more, it was discovered that the respondents with a very poor financial situation were more likely than other people to buy antibiotics over the counter in a local pharmacy (53.8%) or in an online pharmacy (23.1%, $n = 6$). The level of education did not have a significant impact on the choice of a certain source of getting antibiotics (Table 2).

Among those who bought (got) antibacterial drugs over the counter, there were significantly fewer people who took drugs in the form of injections (11.1% vs. 19.4%; $p < 0.01$), completed a full course of antibiotics (71.1% vs. 85.8%; $p < 0.01$), underwent tests before the antibiotic therapy to identify the cause of the disease (25.6% vs. 53.3%; $p < 0.01$), and who were aware of and supported the ban on over-the-counter antibiotic sale (59.0% vs. 75.3% and 39.0% vs. 56.1%; $p < 0.01$). Besides, the abovementioned group used antibacterial drugs on average for fewer days (5.5 and 3.5 days vs. 6.7 and 3.6 days; $p < 0.01$) compared to people who bought (got) antibiotics with a prescription.

At the same time, there were significantly more people in this group who took antibiotics following the recommendation of family members and friends who were medical professionals (14.8% and 14.5% vs. 5.3% and 6.7%; $p < 0.01$), as well as those who relied on the knowledge (opinions) of family members or friends and the Internet as the main sources of information about antibacterial drugs (18.9% and 26.6% vs. 13.7% and 20.4%, respectively; $p = 0.004$ and $p = 0.02$) (Table 3).

Table 2

		With a prescription, % ($n = 657$, 44.1%[1])	During in-patient treatment, % ($n = 101$, 6.8%[1])	Without prescription, % ($n = 631$, 42.4%[1])	Leftover drugs from a previous prescription, % ($n = 167$, 11.2%[1])	Online pharmacy, % ($n = 140$, 9.4%[1])	Family or friends, % ($n = 81$, 5.4%[1])	Avito, Ozon and other platforms, % ($n = 28$, 1.9%[1])
	Parameter							
Age groups, years	18-24	24.7	6.2*	13,3*	7.5	5.2	7.8*	2.3
	25-34	27.7	3.2*	28.1*	6.1	4.8	2.9*	1.5
	35-44	24.9	3.5	23.9*	5.2	5.2	2.9*	0.6
	45-54	23.4	3.0	27.3	7.1	4.7	1.5*	0.9
	55-64	19.4	2.8	20.5*	6.7	6.2	1.3*	0.7
	65+	20.4	4.9	16.7	4.2	4.9	2.7*	0.0
Social and professional category	Executive manager	44.8	10.3	34.5	17.2	13.8	5.2*	5.2
	Self-employed	31.4*	5.8*	50.4*	14.9	9.1	4.9*	1.7
	Businessman	50.0	8.8	47.1	2.9	11.8	0.0*	2.9
	Employee/Specialist	46.8*	5.4*	43.1	9.9	4.7	2.8*	1.5
	Unemployed	32.1*	3.7*	50.0*	11.9	8.9	5.2*	2.2
	Pensioner	45.5	9.6	36.4	11.5	12.4	4.8*	1.0
	Student	48.5	19.1*	26.5*	17.6	11.8	20.6*	5.9

Sources of buying (getting) antibacterial drugs for different groups of respondents

Table 2 (continued)

Parameter		With a prescription, % (n = 657, 44.1%[1])	During in-patient treatment, % (n = 101, 6.8%[1])	Without prescription, % (n = 631, 42.4%[1])	Leftover drugs from a previous prescription, % (n = 167, 11.2%[1])	Online pharmacy, % (n = 140, 9.4%[1])	Family or friends, % (n = 81, 5.4%[1])	Avito, Ozon and other platforms, % (n = 28, 1.9%[1])
Financial situation	Extremely low income	26.9	38.4	53.8*	15.4	23.1*	3.8	0.0
	Low income	37.9	6.4	44.8*	11.3	5.9*	4.4	1.5
	Middle income	46.9	6.3	41.3*	12.3	8.3	5.1	1.9
	Upper middle income	43.3	7.4	43.7*	10.0	11.2	6.1	1.9
	High income	54.1	10.8	18.9*	8.1	10.9	8.1	2.7

* $p < 0.01$ when comparing responses within a population group; [1] percentage of those who have taken antibiotics in the last 12 months

Table 3

Characteristics of the groups depending on the sources of buying (getting) antibacterial drugs			
Parameter	Buying (getting) antibiotics with a prescription	Buying (getting) antibiotics without a prescription	p
Form of taking antibacterial drugs – injections, %	19.4	11.1	<0.01
Source of prescribing (recommendations) about antibiotics – family members or friends, %	5.3	14.8	<0.01
The source of prescription (recommendations) of antibiotics – a friend who is a medical worker, %	6.7	14.5	<0.01
Duration of taking antibiotics, days	6.7 ± 3.6	5.5 ± 3.5	<0.01
Completed a course of antibiotics prescribed by the doctor, %	85.8	71.1	<0.01
Underwent tests before taking antibiotics to identify the cause of the disease, %	53.3	25.6	<0.01
Knowledge about the ban on the over-the-counter sale of antibiotics, %	75.3	59.0	<0.01
Considered it right to ban over-the-counter sale of antibiotics, %	56.1	39.0	<0.01
Source of information about antibiotics – family members or friends, %	13.7	18.9	0.006
Source of information about antibiotics – Internet, %	20.4	26.6	0.004
Source of information about antibiotics – radio, %	1.8	0.5	0.02

A larger percentage of the respondents who completed a full course of antibiotic therapy was noted among the group of people who took antibacterial drugs prescribed by the doctor (83.9%, $n = 847$) compared to the rest of the respondents (66.6%, $n = 319$; $p < 0.01$).

A logistic regression model was created according to the following equation to evaluate the probability of self-medication with antibacterial drugs for various groups of people:

The probability self-medication with antibiotics = $\beta_0 + \beta_1$*Female gender + β_2*Male gender + β_3*Source of information – doctor + β_4*Source of information – personal experience + β_5*Source of information – nursing staff or paramedic + β_6*Source of information – Internet

Thus, the probability that women will self–medicate with antibacterial drugs was 12.2% (95% CI: 10.2–14.8), while similar probability for men was 9.0% (95%CI: 7.0–11.5). The probability of self-medication decreased from 19 to 6.3% (95% CI: 1.3–23.0) when the Internet was the main source of knowledge about antibacterial drugs. If the doctor

was the main source of information, the probability decreased from 19 to 3.8% (95% CI: 2.5–5.9), whereas in case of personal (past) experience, it increased from 19 to 32.3% (95%CI: 22.6–42.5) (Table 4).

Table 4

Probability of self- medication		
Parameter	Probability of self-medication, % (95% CI)	p
Female gender	12.2 (10.2–14.8)	< 0.001
Male gender	9.0 (7.0–11.5)	< 0.001
Source of information – a doctor	3.8 (2.5–5.9)	< 0.001
Source of information – personal (past) experience	32.3 (22.6–42.5)	< 0.001
Source of information – nursing staff or a paramedic	11.5 (6.3–19.0)	< 0.001
Source of information – Internet	6.3 (1.3–23.0)	< 0.001

The parameters associated with self–medication with antibacterial drugs were female gender (OR = 1.4; 95%CI: 1.0–1.9), medical education (OR = 2.1; 95%CI: 1.3–3.5), and unawareness of a ban on over-the-counter sale of antibiotics (OR = 8.4; 95%CI: 5.3–13.3) (Table 5).

Table 5

Parameters associated with self-medication with antibacterial drugs	
Parameter	OR (95% CI)
Female gender	1.4 (1.0–1.9)
Medical education	2.1 (1.3–3.5)
Unawareness of a ban on over-the-counter sale of antibiotics	8.4 (5.3–13.3)

DISCUSSION

The results obtained in this work are comparable with other foreign studies. So, in Saudi Arabia, almost 51% of respondents took antibiotics without a doctor's prescription, including for the prevention of infections, 37.5% bought them at a pharmacy without a prescription and 42% of the participants discontinued taking drugs after symptoms had been relieved [15]. In China, the percentage of respondents who bought antibacterial drugs in the pharmacy without a doctor's prescription reached 47%, in Ethiopia – 67.3%, in the USA – 66%, and in Brazil – 19.0% [8,16–18].

The parameters associated with taking antibacterial drugs without a doctor's prescription in the Russian Federation differ from other countries. Thus, in a Chinese study by X. Yin et al. (2022), a multifactorial logistic regression analysis showed that people aged 30–44 years with higher education and low self-evaluation of health were more likely to take antibiotics without a doctor's prescription [19]. In studies from Lebanon and Ethiopia, age, financial status, level of education, and awareness of antibiotics and antibiotic resistance were significantly correlated with self-medication practices [17, 20].

Similar data were obtained in the work by Y. Ateshim et al. (2019), where the results of the multivariate logistic regression analysis showed that the factors associated with self-medication were gender ($p = 0.046$), education level ($p = 0.019$), and the attitude of citizens to the problem of antibiotic resistance ($p < 0.001$) [21]. Also in the Cameroon study, male gender (OR = 2.32, 95%CI: 1.24–4.34) and higher education (OR = 2.05, 95%CI: 1.08–3.89) were significantly associated with self-medication [5].

CONCLUSION

The results obtained both in the present and other domestic and foreign studies demonstrate the importance and relevance of the problem of self-medication with antibacterial drugs. Moreover, the fact that self-medication is associated with irrational medication intake (since the patient is not aware of the principles of rational antibiotic therapy) doubles the

severity of this phenomenon. Since the main source of buying (getting) antibiotics was a pharmacy without a doctor's prescription, the propaganda and strict control over the ban on over-the-counter purchase of antibiotics can become a priority measure to curb antibiotic resistance, which in particular should be directed to the following categories of the population:

– medical and pharmaceutical workers (access channels: professional websites, medical journals, websites of medical organizations and regional executive authorities in the field of healthcare, professional communities);

– citizens without higher education (access channels: general education institutions, educational institutions of primary vocational education, social networks, television, metro, other types of public transport);

– self-employed, entrepreneurs, unemployed, citizens with a poor financial situation (access channels: social networks and Telegram channels, television, public transport).

At the same time, first of all, it is necessary to concentrate on the age group of 25–34 years. This age is the beginning of economic activity of citizens, when they do not want or do not have the opportunity to visit a doctor and get a sick leave, so they independently begin taking the most common and well-known antibacterial drugs for diseases not always caused by bacteria.

A special category characterized by an increased risk of self-medication is medical workers. So, according to the results of the study, the presence of medical education increased the chances of self-treatment twice. In this regard, it is necessary to regularly update the knowledge of medical workers about antibacterial drugs and antibiotic resistance, for example, by holding the "Global Week of Rational Consumption of Antibiotics" in medical organizations and pharmacies on a regular basis. It will help, among others, to increase awareness of healthcare professionals about the development of antibiotic resistance in both patients and medical workers themselves.

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