

The Inventory of Antibiotics in Russian Home Medicine Cabinets

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The objective of this study was to inventory the stock of antimicrobials in the home medicine cabinets (HMCs) of the general population in Russia and to find out for which indications people report that they would use antibiotics without a physician's recommendation. The research was performed in 9 Russian cities by physicians who visited households. An inventory of antibiotics in HMCs was made, and respondents were asked about instances in which they would choose automedication with antibiotics. We found that 83.6% of families had antibiotics for systemic use in HMCs. The most common antibiotics in HMCs were trimethoprim-sulfamethoxazole (46.3% of HMCs), ampicillin (45.1%), chloramphenicol (32.7%), erythromycin (25.5%), and tetracycline (21.8%). The major indications for automedication with antibiotics were acute viral respiratory tract infections (12.3% of total indications), cough (11.8%), intestinal disorders (11.3%), fever (9%), and sore throat (6.8%). According to this study, antibiotics are widely stocked among the general population in Russia, and people use antibiotics in an uncontrolled and imprudent manner.

The continuing emergence and spread of antimicrobial resistance is a major global public health problem. The main reasons for the observed increase in resistance are the high frequencies of uncontrolled and excessive antibiotic use [1, 2]. Antibiotic resistance disrupts the treatment of infectious diseases worldwide [3]. Disregarding the problem of antibiotic resistance leads not only to unfavorable medical consequences, but also to substantial ecological and economic consequences [3–7].

Worldwide data indicate that antibiotics are frequently used indiscriminately [8]. In the United States, 160 mil-

lion antibiotic prescriptions are written annually. There is evidence that inappropriate use of antimicrobials occurs for approximately one-half of all patients and is most frequently associated with the needless treatment of upper respiratory tract viral infections [9]. Overuse and/or inappropriate use of antibiotics by consumers [4], lack of knowledge about appropriate antibiotic use, and a lack of consideration about the importance of resistance by prescribers all combine to enhance the spread of antibiotic resistance [10].

It is worth noting that, for the first time, developing countries are reporting antibiotic resistance in some bacterial pathogens, such as *Neisseria gonorrhoeae*, *Streptococcus pneumoniae*, *Shigella* species, and *Salmonella enterica* serotype Typhi. In many of these countries, the distribution of antimicrobials is not regulated, and, therefore, antimicrobials are frequently available without a prescription [11]. In most European countries, the United States, and Japan, antibiotics cannot be purchased without a physician's prescription; antimicrobials are included in the category "prescription-

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The survey organizers are listed at the end of the text.

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Figure 1. Geographical location of the cities in this study

only medicine.” On the other hand, in Spain, Pakistan, Vietnam, India, Mexico, Argentina, and Africa and in many developing countries, it is possible to buy antibiotics over the counter (OTC) [12].

Physicians and scientists in these countries are aware of increasing antibiotic resistance and its relationship with the uncontrolled use, misuse, and self-medication with antimicrobials [13, 14]. Data from a variety of countries suggest that self-medication is rather common and often inappropriate. Antibiotics are frequently purchased without proper indication, in insufficient quantities, or when contraindicated [15]. Approximately two-thirds of all oral antibiotics worldwide are obtained without a prescription and are inappropriately used for diseases such as tuberculosis, malaria, and pneumonia and for mild childhood infections [16]. There is a complex relationship between the consumption of antimicrobials and the prevalence of drug-resistant bacteria [17].

In Russia, the list of OTC medications was officially approved by the Ministry of Health (Moscow) in 1997 and was amended in 1999. Antimicrobials are not officially included on this list. However, nationwide implementation of this regulation has faced some hurdles, and people can freely purchase antibiotics from most state-managed and commercial drug stores.

The aim of this study was to inventory the stock of antimicrobials in the home medicine cabinets (HMCs) of the “non-medical” population (i.e., families in which no members have medical education) in large Russian cities and to find out for which indications people report that they would use antibiotics on their own (without a prescription from a physician).

MATERIALS AND METHODS

A nationwide, cross-sectional, observational, multicenter study of the inventory of antibiotics in HMCs was performed in 9 large cities in the Russia (Kaliningrad, Smolensk, Moscow, Volgograd, Nizjni Novgorod, Ekaterinburg, Tyumen, Novosibirsk, and Yakutsk) in 1999–2001 (figure 1). Electronic databases for the cities were used for random selection of 200 phone numbers. A specially trained doctor (interviewer) called a respondent and explained the main points of research and asked for a permission to visit the person at home. After that, the interviewer visited the household and performed the survey. One designated physician was responsible for performing the study in each particular city. During the visit, the presence or absence of antibiotics was checked in HMCs, and the respondent (the family member most informed about antibiotics) was interviewed. One hundred families were evaluated in each city. All data were recorded on a questionnaire. The study coordinator (I.V.A.) collected the data from all centers, which were later entered into a custom-designed database.

Confidentiality. The Ethics Committee of Smolensk State Medical Academy (Smolensk) approved this study. All information provided by the respondents was held in strict confidence, and the study eliminated the possibility of future identification of the respondents (only a few people were allowed access to the confidential information).

Statistical analysis. Descriptive statistical analyses were performed for all variables using SAS software (SAS Institute). Categorical variables were described by absolute frequencies and percentages. Statistical analysis was carried out for the total

population (all inspected families) and separately for each center (city). Ninety-five percent confidence intervals were calculated for the most prevalent antimicrobials in HMCs.

RESULTS

Quantitative and qualitative analyses. Nine hundred families were included in the study, 83.6% of which had antibiotics available for systemic use in their HMCs. Figure 2 shows the quantity of families that had antimicrobials in their HMCs. General information about the prevalence of antimicrobials in the nonmedical population in Russia is given in table 1. A total 62 different antibiotics were found in the HMCs. The maximum found in a single HMC was 9. The most common antibiotics in HMCs are indicated in table 2.

Respondents' opinions about indications for use of antibiotics. During the interview, subjects revealed that the most frequent indications for automedication with antibiotics were as follows: influenza, acute respiratory tract viral infections, or common cold, 284 (12.3%) of 2309 indications; cough, 272 indications (11.8%); intestinal disorders, 260 indications (11.3%); fever, 207 indications (9%); sore throat, 156 indications (6.8%); and acute tonsillitis, 131 indications (5.7%). The following "diseases" were also mentioned, but more seldom:

inflammation, headache, toothache, back pain, stomachache, dysuria, malaise, influenza (prophylaxis), edema, liver disease, conjunctivitis, and pharyngitis. The respondents stated that they used antibiotics from their HMCs without a physician's recommendation in 1990 (86.2%) of 2309 cases (from the total number of indications given by all respondents; table 1). Figure 3 shows the major indications (in the respondents' opinions) for use of the 5 most common antibiotics in HMCs.

Injectable antimicrobials. Injectable antimicrobials were found in 83 (9.2%) of all 900 HMCs. The most common injectable antibiotics were gentamicin (25 [30.1%] of 83 HMCs with injectable antimicrobials), ampicillin (23 [27.7%]), benzylpenicillin (20 [24.1%]), cefazolin (7 [8.4%]), benzathine benzylpenicillin (7 [8.4%]), and lincomycin (7 [8.4%]). Respondents stated that injectable antibiotics had been or were being used in accordance with the physician's instruction in 24 (23.1%) of 104 indications for use of injectable antibiotics. Injectable antibiotics had been or would be used for self-medication for the following indications: pneumonia (10 [9.6%] of 104 cases); acute tonsillitis (9 [8.7%]); fever (9 [8.7%]); bronchitis (8 [7.7%]); cough (8 [7.7%]); and influenza, acute respiratory tract viral infection, or common cold (8 [7.7%]). Other indications for self-medication included thoracic pain, gynecological disorders, headache, tooth-

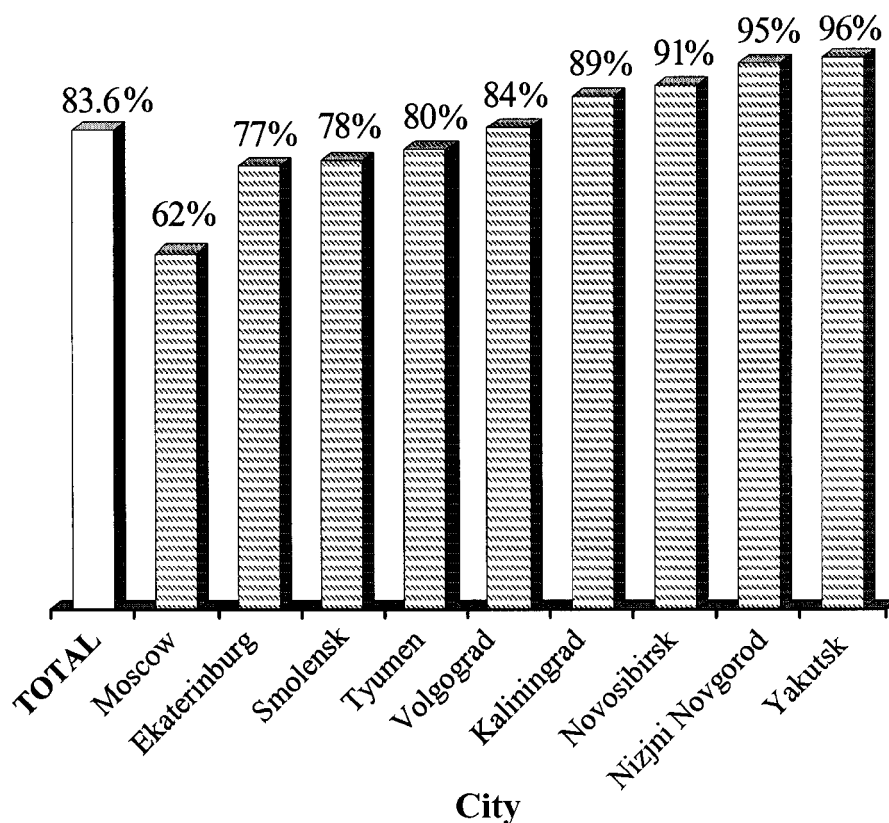


Figure 2. Percentage of families that had antimicrobials stocked in home medicine cabinets in 9 Russian cities

Table 1. General information about the distribution of antimicrobials among the nonmedical population in Russia.

City	Mean no. of antimicrobials per family	No. of different antimicrobials in HMCs	No. of families with ≥ 2 antimicrobials/ no. of families with antibiotics in HMCs (%)	No. of families with injectable antibiotics/ no. of interviewed families (%)	No. of families with expired antimicrobials/ no. of families with antibiotics in HMCs (%)	No. of expired antimicrobials/ total no. of antimicrobials (%)			No. of non-physician-approved indications for use/total no. of all indications for use ^a (%)
						Expired antimicrobials	Oral formulations	Injectable formulations	
Moscow	2.3	13	39/62 (62.9)	2/100 (2)	12/62 (19.4)	16/144 (11.1)	16/144 (11.1)	0	153/168 (91.1)
Ekaterinburg	1.9	23	46/77 (59.7)	9/100 (9)	19/77 (24.7)	20/147 (13.6)	18/138 (13)	2/9 (22.2)	144/171 (84.2)
Novosibirsk	2.2	20	65/91 (71.4)	7/100 (7)	4/91 (4.4)	6/203 (2.9)	6/203 (2.9)	0	297/298 (99.7)
Nizjni Novgorod	2.4	20	77/95 (81.1)	14/100 (14)	20/95 (21.1)	23/232 (9.9)	23/232 (9.9)	0	247/254 (97.2)
Smolensk	2.3	23	38/78 (48.7)	7/100 (7)	22/78 (28.2)	42/178 (23.6)	39/170 (22.9)	3/8 (37.5)	157/207 (75.8)
Tyumen	2.6	35	62/80 (77.5)	20/100 (20)	18/80 (22.5)	36/210 (17.1)	31/189 (16.4)	5/21 (23.8)	238/238 (100)
Volgograd	2.7	28	64/84 (76.2)	12/100 (12)	27/84 (32.1)	38/223 (17.0)	36/211 (17.1)	2/12 (16.7)	222/224 (99.1)
Kaliningrad	2.1	19	57/89 (64.0)	2/100 (2)	26/89 (29.2)	36/190 (18.9)	36/190 (18.9)	0	276/280 (98.6)
Yakutsk	4.3	49	90/96 (93.8)	10/100 (10)	63/96 (65.6)	121/412 (29.4)	114/397 (28.7)	7/15 (46.7)	256/469 (54.6)
Total	2.6	62	538/752 (71.5)	83/900 (9.2)	211/752 (28.1)	338/1939 (17.4)	319/1846 (17.3)	19/93 (20.4)	1990/2309 (86.2)

NOTE. HMCs, home medicine cabinets.

^a In the person's opinion.

Table 2. Prevalence of antibiotics in home medicine cabinets (HMCs) in 9 Russian cities.

City	Most common antibiotics in HMCs, by prevalence rank					
	1	2	3	4	5	6
Moscow						
Antibiotic	TMP-SMZ	Ampicillin	Chloramphenicol	Erythromycin	Doxycycline	Tetracycline
<i>n/N</i> ^a	46/62	30/62	24/62	15/62	14/62	6/62
Proportion (95% CI)	74.2 (61.5–84.5)	48.4 (35.5–61.4)	38.7 (26.6–51.9)	24.2 (14.2–36.2)	22.6 (12.9–34.9)	9.7 (3.6–19.9)
Ekaterinburg						
Antibiotic	Ampicillin	TMP-SMZ	Erythromycin	Chloramphenicol	Tetracycline	Spiramycin
<i>n/N</i> ^a	33/77	32/77	22/77	16/77	8/77	6/77
Proportion (95% CI)	42.9 (31.6–54.7)	41.6 (30.4–53.4)	28.6 (18.9–40.0)	20.8 (12.4–31.5)	10.4 (4.6–19.5)	7.8 (2.9–16.9)
Novosibirsk						
Antibiotic	Ampicillin	Chloramphenicol	Erythromycin	TMP-SMZ	Doxycycline	Tetracycline
<i>n/N</i> ^a	47/91	45/91	31/91	27/91	16/91	15/91
Proportion (95% CI)	51.6 (40.9–62.3)	49.5 (38.8–60.1)	34.1 (24.5–44.8)	29.7 (20.6–40.2)	17.9 (10.4–26.9)	16.5 (9.5–25.7)
Nizjni Novgorod						
Antibiotic	TMP-SMZ	Tetracycline	Ampicillin	Erythromycin	Chloramphenicol	Nystatin
<i>n/N</i> ^a	53/95	43/95	39/95	33/95	24/95	9/95
Proportion (95% CI)	55.8 (45.2–65.9)	45.3 (35.0–55.8)	41.1 (31.1–51.6)	34.7 (25.3–45.2)	25.3 (16.9–35.2)	9.5 (4.42–17.2)
Smolensk						
Antibiotic	Ampicillin	Chloramphenicol	TMP-SMZ	Doxycycline	Erythromycin	Sulfanilamide
<i>n/N</i> ^a	28/78	27/78	18/78	18/78	15/78	11/78
Proportion (95% CI)	35.9 (25.3–47.6)	34.6 (24.2–46.2)	23.1 (14.3–34)	23.1 (14.3–34)	19.2 (11.2–29.7)	14.1 (7.3–23.8)
Tyumen						
Antibiotic	Ampicillin	TMP-SMZ	Chloramphenicol	Erythromycin	Tetracycline	Doxycycline
<i>n/N</i> ^a	43/80	38/80	27/80	17/80	17/90	8/80
Proportion (95% CI)	53.8 (42.2–64.9)	47.5 (36.2–58.9)	33.8 (23.6–45.2)	21.2 (12.9–31.8)	21.2 (12.9–31.8)	10 (4.4–18.8)
Volgograd						
Antibiotic	TMP-SMZ	Ampicillin	Tetracycline	Chloramphenicol	Erythromycin	Doxycycline
<i>n/N</i> ^a	44/84	42/84	32/84	24/84	14/84	12/84
Proportion (95% CI)	52.4 (41.2–63.4)	50 (38.9–61.1)	38.1 (27.7–49.3)	28.6 (19.2–39.5)	16.7 (9.4–24.6)	14.3 (7.6–23.6)
Kaliningrad						
Antibiotic	TMP-SMZ	Amoxicillin	Ampicillin	Erythromycin	Furazolidone	Doxycycline
<i>n/N</i> ^a	31/89	25/89	25/89	23/89	21/89	16/89
Proportion (95% CI)	34.8 (0–45.7)	28.1 (19.1–38.6)	28.1 (19.1–38.6)	25.8 (17.1–36.2)	23.6 (15.2–33.8)	18 (10.6–27.6)
Yakutsk						
Antibiotic	TMP-SMZ	Ampicillin	Chloramphenicol	Sulfanilamide	Erythromycin	Tetracycline
<i>n/N</i> ^a	59/96	52/96	44/96	24/96	22/96	18/96
Proportion (95% CI)	61.5 (50.9–71.2)	54.2 (43.7–64.4)	45.8 (35.6–56.3)	25 (16.7–34.9)	22.9 (14.9–32.6)	18.8 (11.5–28)
All cities						
Antibiotic	TMP-SMZ	Ampicillin	Chloramphenicol	Erythromycin	Tetracycline	Doxycycline
<i>n/N</i> ^a	348/752	339/752	246/752	192/752	164/752	102/752
Proportion (95% CI)	46.3 (42.7–49.9)	45.1 (41.5–48.7)	32.7 (31.2–38.6)	25.5 (22.5–28.8)	21.8 (20.4–27.4)	13.6 (14.1–21.0)

NOTE. TMP-SMZ, trimethoprim-sulfamethoxazole.

^a No. of families with particular antibiotic in their HMCs/no. of families with any antibiotics in their HMCs.

ache, inflammation, pain in spine, stomachache, and pyelonephritis.

Antibiotics used after the expiration date. One-quarter of respondents kept antibiotics that had passed the expiration

dates in their HMCs (table 1). Tetracyclines (i.e., tetracycline, doxycycline, and others) predominated among the expired medications and accounted for ~17% of these drugs.

“Discontinued” antimicrobials. “Discontinued” anti-

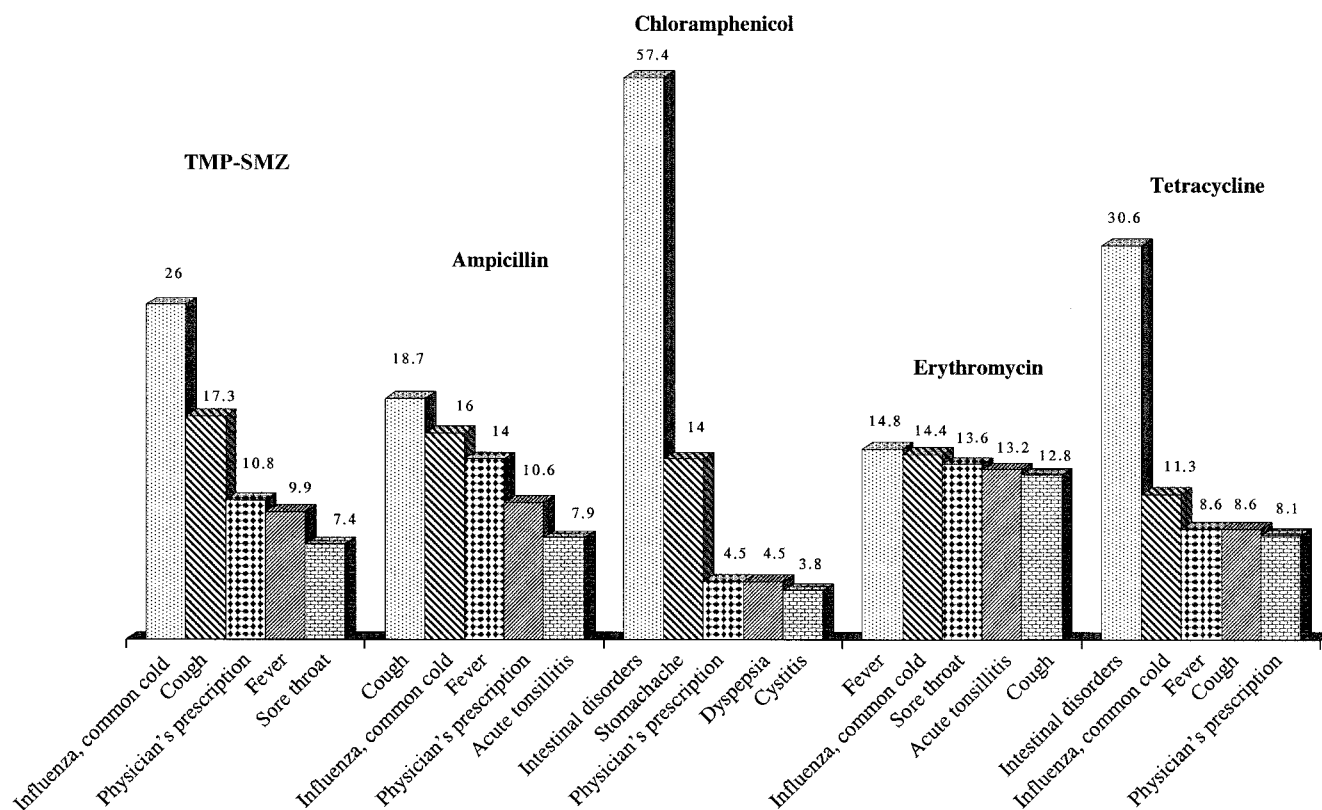


Figure 3. The major indications (in the respondents' opinions) for use of each of the 5 most common antibiotics in home medicine cabinets. Data are percentage of indications. TMP-SMZ, trimethoprim-sulfamethoxazole.

crobinas (including drugs that are no longer used in clinical practice worldwide) were kept in HMCs. Sulfonamides (streptocid) were found in 51 (6.8%) of 752 HMCs, and oletetrine (tetracycline plus oleandomycin) was found in 7 (0.9%). Of note, the "discontinued" antimicrobials were widely distributed in Yakutsk, Smolensk, Tyumen, and Volgograd: sulfonamides were present in 24 (25%) of 96 HMCs in Yakutsk, 11 (14.1%) of 78 in Smolensk, 7 (8.8%) of 80 in Tyumen, and 4 (4.8%) of 84 in Volgograd. The main indications for use of sulfonamides were sore throat (24 [43.6%] of 55), wound infection (17 [30.9%]), and acute tonsillitis (6 [10.9%]).

DISCUSSION

The results of this study demonstrate that there is a large stock of antibiotics in the HMCs of Russian inhabitants and that the uncontrolled and unsupervised use of antimicrobials is widespread among Russian families. Despite the fact that prevalence of antimicrobials in HMCs was different in different Russian cities, the most prevalent antimicrobials were similar in all centers. No considerable differences were revealed in the pattern of antibiotics in HMCs in large Russian cities. It is worth noting that "popular" antibiotics (e.g., trimethoprim-sulfamethoxazole

[TMP-SMZ], chloramphenicol, and tetracycline) may cause serious adverse drug reactions [18–23].

On the basis of the findings of this survey, it appears that a large segment of the general population in Russia is poorly informed about the indications for antibiotic use. There is clear medical consensus that antimicrobials should not be routinely used to treat the 5 diseases or conditions most frequently named by the respondents. Moreover, the respondents were convinced that TMP-SMZ or ampicillin should be used for the treatment of acute respiratory tract viral infections, cough, and fever, and that chloramphenicol or tetracycline should be the first line of treatment for intestinal disorders. The keeping of expired antibiotics in HMCs may be explained by the lack of attention that subjects paid to the contents of their HMCs.

We conclude that there are 3 main factors influencing the widespread presence of antibiotics in the HMCs of the general population in Russia. The first is excessive administration of antimicrobials by physicians in outpatient clinics in Russia. That the most frequently prescribed antibiotics in outpatient clinics are TMP-SMZ, ampicillin, and erythromycin is reflected by the findings of the examination of the HMCs in the present study [24].

The second factor is that patients can purchase antimicrobials

from drug stores without a physician's prescription. In addition, pharmacists may influence the choice of medications and the inappropriate selection of antibiotics. In Russian drug stores, pharmacists give advice on the purchase of prescription-only medicines (including antibiotics), and these medications are often actually available without a prescription.

The third factor that influences the widespread presence of antibiotics is the quantity of low-quality information about antibiotics in the mass media, popular print, and Internet. Russian consumers may see recommendations such as the following: "What medications should you keep in your home medicine cabinet? Antibiotics should be tetracycline, nystatin, erythromycin, or chloramphenicol" [25] or "Co-trimoxazole for cystitis, chloramphenicol or erythromycin for intestinal infections" [26]. Many more of such "recommendations" could be listed.

The problem of the self-medication with antibiotics is not exclusively a Russian issue. Despite the mandatory supervision over the purchase of antibiotics in the United States, 26% of Americans save "leftover" antibiotics—that is, unused medications that were obtained with a physician's prescription. US surveys show that one-half of these persons would take or had taken the "leftover" antibiotics without consulting with a health care provider [27]. In another study, 26% of respondents reported use of antibiotics for upper respiratory tract infections, even though the agents were not prescribed for these conditions. One-third of the respondents (31%) believed that antibiotics should be available OTC [15]. A prospective survey of emergency department patients established that 17% of patients had taken leftover antibiotics without consulting a physician, most commonly for a cough (11%) or sore throat (42%) and, much less frequently, for symptoms of urinary tract infection (0.7%) [28].

Informational and educational activities aimed at improving the public's knowledge about antimicrobials play the leading role in reducing imprudent use of antibiotics in the United States and Europe. Special educational leaflets have been distributed among the population [29, 30], consumer information offices have been established [31], and special sections for patients are created on medical Web sites (Alliance for Prudent Use of Antibiotics [<http://www.healthsci.tufts.edu/APUA/Patients/patient.html>], LIBRA [http://www.librainitiative.com/en/ap/li_ap.html], and Canada's National Information Program on Antibiotics [<http://www.antibiotics-info.org/anti01.html>]).

The uncontrolled and imprudent use of antibiotics not only harms the health of a particular patient because of the risk of adverse drug reactions, the masking of symptoms of infection [4], and the development of chronic disease and superinfection, but it is also an important problem for the population in general, because of the emergence and spread of antimicrobial resistance. Therefore, some authorities forecast the coming of

the "postantibiotic era" [32] (as opposed to the preantibiotic era, before the discovery of penicillin) in the near future, when many infectious diseases will once again become almost impossible to treat [33].

The cessation of the OTC purchase of antimicrobials, the strengthening of control over antibiotic consumption in clinical practice, and the creation of educational programs for physicians and patients in which information could be distributed by different means—these are the most simple and effective control measures to combat antimicrobial resistance, and they have been demonstrated to reduce the inappropriate use of antibiotics in other countries. Such activities are under way, and we hope that the results of such activities will become more and more prominent in the near future [30, 34–37].

SURVEY ORGANIZERS

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