The role of public awareness in the structure of antibiotic resistance

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Abstract

Aim: The main factors that lead to antibiotic resistance are overuse and misuse of the antibiotics. The patients themselves have a considerable role on this, either by medical staff influence or self-use of antibiotics. Hence, the population awareness regarding this issue is of primary importance. This study assessed the level and determinants of patients' awareness in Vlora regional hospital, in South Albania, and the putative link with use of antibiotics and antibiotic resistance.
Methods: In a sample of 488 patients hospitalized at Vlora regional hospital, we gathered information about their knowledge on the use of antibiotics. Subsequently, in most of these patients we collected bacterial cultures (throat and urine cultures).
Results: Overall, 247 patients were antibiotic-resistant based on antibiograms' testing. The level of knowledge for a proper use of antibiotics was quite low in this population sample of Southern Albanians. Compared with the low-educated patients, individuals with middle and high levels of awareness relied on official sources and the authorized personnel regarding antibiotic use. Furthermore, highly-educated participants tended to use less antibiotics than their low-educated counterparts.
Conclusions: In our study, the low-educated patients had a higher probability to exhibit lower levels of awareness and this may lead to a higher level of antibiotic resistance. The information retrieved from non-authorized sources of information may explain the unsatisfactory levels of awareness among participants in our study.

Keywords: antibiotic resistance, bacterial cultures, use of antibiotics, awareness.

Introduction

Antibiotic resistance is an everyday problem in all hospitals across Europe. The spread of resistant bacteria in hospitals is a major issue for patients' safety (1).

Inappropriate use and prescribing of antibiotics is causing the development of resistance. Inappropriate use includes: not completing a course of antibiotics as prescribed, skipping doses of antibiotics, etc. Inappropriate prescribing includes: unnecessary prescription of antibiotics, unsuitable use of broad-spectrum antibiotics, etc (1).

In this context, as emphasized by the World Health Organization, it is necessary to promote informed decision-making about antibiotic consumption (1,2).

Furthermore, studies show that the general public remains unaware of basic aspects related to antibiotics' modes of action, and frequently engage in misinformed behaviours. This reinforces the importance of developing health education programs to promote appropriate antibiotic use and enhance public understanding about antibiotic drugs (3,4).

There is growing evidence suggesting that empowering patients through implementation of patient-centred health-care strategies, such as shared decision-making, in conjunction with educational initiatives help to change attitudes and behaviour, and improve access to and completion of appropriate antimicrobial therapy. This, in turn, may help to control the development and spread of resistance to antibiotics (5).

Aim of this study

The purpose of this study was to assess the level and determinants of patients' awareness in Vlora regional hospital, in South Albania, and the putative link with use of antibiotics and antibiotic resistance.

Methods

Study population of the study

Of all the admitted patients during the period of 2011-2012 in the regional hospital of Vlora in the wards of pathology, surgery, infectious diseases, and paediatrics, we selected a simple random sample of 488 individuals. Patients who were already taking antibiotics before being admitted or the ones who started the therapy before our study were excluded.

Ethical permission and informed consent

In order to conduct this study we asked for the ethical permission from the Director of the Hospital and the Director of Public Health Directorate in Vlora.

Furthermore, all participants gave their informed consent after being informed about the aims and procedures of the study. In case of the children, permission for participation in the study was obtained from their respective parents.

Instruments used for data collection

Determination of microbiological culture positivity was conducted through the following:

- Urine culture (uroculture) which deals with the collection of urine (collected in natural way in our patients) in food grounds to determine the bacteraemia in urinary tract infections;
- Culture of the throat, which has to do with cultivating the appropriate terrain (such as agar or blood) of the clinic material taken from the throat swabs, on an empty stomach in the morning, without mouth washing and always before starting antibiotic treatment.

Resistance to antibiotics is verified through the implementation of antibiogram. After the isolation and identification of the cause of the bacterial infection, the sensitivity to antibiotics of different groups is determined, which is realized through a common antibiogram's technique with diffusion of antibiotics by agar petri dishes.

The measurement of the other variables was done through a self-administered questionnaire consisting of 15 questions which test individual's level of knowledge on the appropriate or inappropriate use of antibiotics, as well as attitudes and behaviour related to the use of antibiotics. The questionnaire was previously tested in a pilot study including 38 participants, showing a satisfactory validity and reliability indices. This questionnaire was completed by patients and parents of the children.

Statistical analysis was performed with Statistical Package for Social Sciences (SPSS, version 17.0, Inc., Chicago, Illinois).

Results and Discussion

Characteristics of the study sample

There were 488 patients in this study sample: 237 males and 251 females. Some characteristics of the final study sample are presented below: 488 patients

filled in the questionnaire, 460 had their cultures done, and 274 of them resulted positive in the microbiologic testing.

The highest number of the patients in our study (224) had a low level of education (elementary school), 184 had an intermediate level of education (high school) and 80 of them had a university degree. As for the children participating in our study, we took in consideration their mothers' level of education, since they filled in the questionnaire.

The highest percentage of the children admitted to the paediatric ward in the regional hospital of Vlora had low-educated parents (blue collar occupations). However, the highest percentage of the admitted patients in the adults' wards involved unemployed and retired/ disabled categories – according to the European socio-economic classification, E-SEC, 2011.

Awareness about the proper use of antibiotics

Tables 1.1 and 1.2 present the level of knowledge about antibiotics by patients and mothers of children who completed the questionnaire.

In the first group of patients, 22%-67% provided correct answers, 9%-57% of them provided wrong answers and 18%-24% of participants admitted that they had no information about the given questions.

About 41% of the patients were aware that people can become resistant to antibiotics and these antibiotics might not have an effect on them anymore. On the other hand, almost 60% of participants lacked this awareness.

About 67% of the patients correctly identified that bacteria, viruses and fungi cause diseases and 66% of them knew that antibiotic treatment should be completed as per medical prescription. The lowest level of correct knowledge in this bunch of questions involved the following item situation: *"It causes no problem to drink alcohol when taking antibiotics"*, where only 22% of the patients correctly reported that alcohol interferes with the metabolism of antibiotics.

The level of knowledge about the fact that antibiotics should not be used to treat viral infections was disturbing. About 70% of respondents thought they were, or were not informed about this issue. Around 49% of the patients did not know how to answer the question whether antibiotics only kill bacteria, or also viruses.

The main source of abusive use of antibiotics comes from the lack of information (or not being convinced enough) on this fact. Lack of information or uncertainty about this point induces people to exercise pressure to their doctors for prescribing antibiotics, or to pharmacists to provide antibiotics over the counter. These results converge with other studies conducted in this area by various researchers (3,6).

About 72% of the patients thought that antibiotics do not have side effects, or did not have any information on this matter. This percentage is really disturbing especially for the fact that the lack of knowledge leads people to neglect the use of antibiotics.

Only 50% of the respondents were sure that antibiotics for human use are used for animals too. A high percentage of uncertainty or insecurity (62%) was observed on the awareness on the use of antibiotics abroad.

A few patients were informed about the fact that in different countries there are used different generations of antibiotics and this can lead to absence of efficiency, or antibiotic resistance after coming back to the country of origin.

The second set of questions was designed to assess patients' opinions, attitudes and behaviours regarding antibiotic use and antibiotic resistance.

The highest percentage of correct reports was on antibiotics cure duration. About 48% of the patients were aware of the full implementation of treatments and interrupting the treatment of antibiotics before its full course. The lowest degree of correct reporting involved the issue of antibiotic use for treatment of viral infections.

Table 1.1. Level of knowledge on the use of antibiotics in study participants

	Knowledge on antibiotics	Correct answer		Incorrect answer		There is no information	
		N	%	N	%	N	%
1.	Bacteria, viruses, fungi cause diseases	326	67	42	9	120	24
2.	Antibiotics kill bacteria but not the viruses	186	38	62	13	240	49
3.	The same kinds of antibiotics are used in animals and humans	244	50	112	23	132	27
4.	Antibiotics treat the flu	144	30	188	39	156	32
5.	Antibiotics should always be taken with bronchitis	280	57	100	21	108	22
6.	It is not a problem to consume alcohol when you take antibiotics	106	22	280	57	102	21
7.	The treatment of antibiotics can be interrupted as soon as you feel better and you do not need to continue the treatment any more	324	66	64	13	100	21
8.	Antibiotics do not have side effects	136	28	250	51	102	21
9.	Humans can become resistant to antibiotics	200	41	92	19	196	40
10.	If you use antibiotics when you travel out of state this has no effect on how the antibiotics will effect you when you come back	120	38	144	45	56	18

Table 1.2. Knowledge on antibiotic use among study participants

The knowledge on antibiotics	*Agree*		*I am not sure*		*Don't agree*		*Do not have an opinion*		*Correct answer*	
	N	%	N	%	N	%	N	%	N	%
In a child with viral infecsion (flu) should we usually give antibiotics	180	37	156	32	90	18	62	13	90	18
For the treatment of a common infection of the ear the 10 day cure is more effective than the shorter treatments	236	48	56	11	86	18	110	23	236	48
When you have the flu, should we teka antibiotics to prevent further infections?	200	41	146	30	56	11	86	18	56	11
Antibiotics will have no effects after 10 years if we keep using them in unnecessary situations	148	30	72	15	60	12	208	43	148	30
Giving antibiotics to the animals DOES NOT have any consequences in their effect on humans	76	16	76	16	86	18	250	50	86	18

Determinants of the level of awareness and its impact on the use of antibiotics

In the distribution of patients by level of awareness, the intermediate level (6-10 correct answers) predominated with 328 patients; 142 individuals had a low level of knowledge (0-5 correct answers); and only 18 patients had a high level of knowledge (11-15 correct answers). The low level of knowledge in this Albanian community is compatible with other reports at global level (1,2).

Table 2 shows that 69% of the patients with low levels of awareness belonged to the primary educational level (8-year education); on the other hand, 44% of the patients belonged to the secondary education category, and 44% of the patients with higher education had a higher awareness level.

Table 2. Association of level of awareness with the educational level						
Awareness	**Primary education**		**Intermediate education**		**University education**	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Low level	98	69%	42	30%	2	1%
Medium level	124	38%	134	41%	70	21%
High level	2	12%	8	44%	8	44%
	r = -0.98, P=0.01		r = 0.9, P=0.1		r = 0.99, P=0.01	
OR = 20.4, 95% CI = 5-84, P < 0.001						

The degree of correlation between education and awareness on the correct use of antibiotics was very high (r= 0.99, P= 0.01). Furthermore, individuals with a higher educational attainment were 20.4 times more likely to exhibit a higher level of awareness compared to patients with primary or secondary educational level (Table 3).

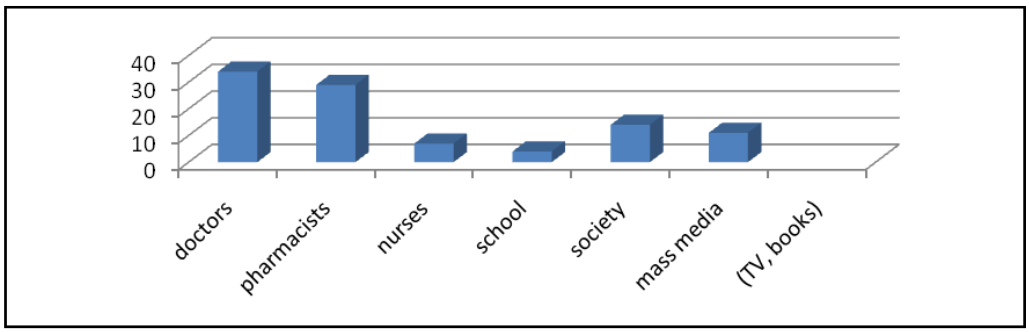
This phenomenon may be influenced by two factors: firstly, more years of education provide an opportunity to have more academic information and; secondly, the level of education, generally, determines the social status of an individual, which in turn affects the opportunities for the overall access to information.

Table 3. Distribution of antibiotic resistance by knowledge on the use of antibiotics						
		Total resistance in patients with correct answers		**Total resistance in patients with incorrect answers**		**OR**
		No. resistant	**No. non-resistant**	**No. resistant**	**No. non-resistant**	
1.	Bacteria, viruses, fungi cause diseases	144	44	62	24	OR = 0.8 95% CI = 0.4-1.5 P = 0.5
2.	Antibiotics kill bacteria but not the viruses	84	24	132	46	OR = 0.8 95% CI = 0.5-1.4 P = 0.4
3.	The same kinds of antibiotics are used in animals and humans	112	34	98	34	OR = 0.9 95% CI = 0.5-1.5 P = 0.6
4.	Antibiotics treat the flu	74	32	138	36	OR = 1.7 95% CI = 0.9-2.8 P = 0.05
5.	Antibiotics should always be taken with bronchitis	112	50	100	18	OR = 2.5 95% CI = 1.4-4.5 P = 0.003
6.	It is not a problem to consume alcohol when you take antibiotics	32	18	180	50	OR = 2 95% CI = 1-3.9 P = 0.03
7.	The treatment of antibiotics can be interrupted as soon as you feel better and you do not need to continue the treatment any more	138	40	72	28	OR = 0.7 95% CI = 0.4-1.3 P = 0.3
8.	Antibiotics do not have side effects	66	20	138	48	OR = 0.8 95% CI = 0.4-1.6 P = 0.6
9.	Humans can become resistant to antibiotics	92	28	120	40	OR = 0.9 95% CI = 0.5-1.6 P = 0.7
10.	If you use antibiotics when you travel out of state this has no effect on how the antibiotics will effect you when you come back			80	102	
11.	In a child with viral infecsion (flu) should we usually give antibiotics	40	18	168	50	OR = 1.5 95% CI = 0.7-2.8 P = 0.2
12.	For the treatment of a common infection of the ear the 10 day cure is more effective than the shorter treatments	86	28	130	40	OR = 1 95% CI = 0.6-1.8 P = 0.8

13.	When you have the flu, should we teka antibiotics to prevent further infections?	26	10	186	54	OR = 1.3 95% CI = 0.6-2.9 P = 0.4
14.	Antibiotics will have no effects after 10 years if we keep using them in unnecessary situations	42	10	164	56	OR = 0.7 95% CI = 0.3-1.5 P = 0.3
15.	Giving antibiotics to the animals DOES NOT have any consequences in their effect on humans	26	16	186	52	OR = 2.2 95% CI = 1-4.4 P = 0.02
	Total	**1074**	**372**	**1954**	**598**	OR = 1.1 95% CI = 0.9-1.3 P = 0.1

Another question in our study was about the sources of information about antibiotic use and antibiotic resistance. The findings suggested that, in most cases, the source of information was the health care personnel (doctors, pharmacists, nurses), which is positive, but the mass media and society accounted for a considerable share of the knowledge too. Conversely, the knowledge gained in school on antibiotics accounted for a very low percentage (Figure 1).

Figure 1. The impact of information source on the use of antibiotics



This findings raises two major problems: first, the academic programs provide little information, or the work done is not sufficient for health awareness raising; second, the school period when the children get the foundation of health education that will serve them later in life, is scarce and hence individuals have to get such information passively during life experiences, including the mass media and society at large. However, it cannot be assumed that the information obtained later in life (i.e. after the school period) will be accurate or complete. Researchers in other countries have concluded that mass media awareness campaigns can turn into powerful factors that can influence community decisions on getting appropriate health care (7), but this issue in our country is still much neglected.

In order to determine the impact of the source of information on the level of awareness about the proper or improper use of antibiotics, we compared two groups of information sources: health care personnel (doctors, pharmacists, nurses) and non-professional sources (school, society, mass media). This analysis showed that patients who received the antibiotic information from the health care personnel were 2.5 times more likely to have an intermediate or a high level of awareness compared to individuals who obtained information from other non-professional sources (OR=2.5, 95%CI=1.6-3.8, P<0.0001).

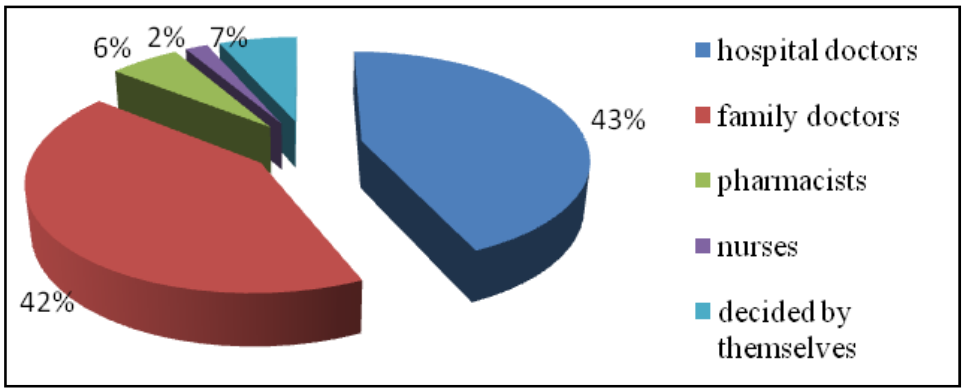
The group of patients with intermediate level of awareness presented a uniform distribution of the antibiotic use, with a slight predominance of rare use (59% vs. 41% frequent use). Meanwhile, the group of patients with a low level of awareness displayed a high percentage of antibiotic use several times per year (46%), and the group with a high awareness did not use the antibiotics for a long time (58%). Furthermore, patients with intermediate and high levels of awareness had 3.3 times higher odds of using the antibiotics more rarely than the other groups (OR=3.3, 95%CI=2-5, P<0.0001).

This finding is vital for us to understand the importance of the level of awareness on antibiotic use. Our findings indicate that a large share of individuals turn to pharmacists or use antibiotics without prescription. At the same time, a substantial share of study participants exert pressure on their respective doctors to start antibiotic therapies. This is a phenomenon also observed in previous studies conducted in other countries (8-10).

Figure 2 presents the distribution of medical personnel who had recommended to patients the use of antibiotics. The highest percentage of the patients reported that they received antibiotics on the recommendation of medical doctors, mainly from the doctors working in the hospital. However, there were cases in which participants reported that they had asked other people or have decided to take antibiotics by themselves, which is worrying. The main reason for this finding is considered the lack of confidence towards the doctors, or the shortage of medical personnel to provide information and patient counselling. Many researchers have reported that patients are not satisfied with the health care services and this satisfaction is affected by the information and the assurance given and subsequently by the recommendation of antibiotics (11-16).

In our study, compared to patients with a low level of awareness, individuals with an intermediate or a high level of awareness were 7.4 times more likely to get antibiotics from their medical doctors.

Figure 2. Distribution of personnel which recommended to patients the use of antibiotics



How does the awareness affect the structure of antibiotic resistance?

The majority of study participants underwent culture examination (urine and throat cultures) and 274 of 460 of the examined individuals resulted positive for different microorganisms. After the evaluation of distribution of antibiotic resistance according to the level of patients' knowledge on the use of antibiotics, patients with a higher level of knowledge were resistant to Amikacin (6-52 patients). Conversely, patients with a lower level of knowledge, besides Amikacin (10-58 patients), were also resistant to Augmentin (14-44 patients). In both groups, there was evidence of a lower degree of resistance from Norfloksacin (0-6 patients).

We also evaluated the distribution of the number of antibiotics to which participants were resistant to. Among patients with a satisfactory level of knowledge, 62%-81% of them were resistant to at least one antibiotic. Compared to participants with a satisfactory level of knowledge, patients with a lower level of knowledge had 2.7 times higher odds of developing resistance from antibiotics (OR=2.7, 95%CI=1.3-5.4, P=0.004). The lowest percentage of the antibiotic resistance was noticed in patients that answered correctly to the question *"Giving antibiotics to the animals DOES NOT have consequences on their effect on humans"*. On the other hand, the highest percentage of antibiotic resistance was noticed in patients who considered that: *"Antibiotics should always be taken when you have bronchitis"* (85% of them were resistant to at least one antibiotic).

As presented in Table 3, we calculated the odds of development of bacterial resistance in both groups for each of the questions and, in general, there was no statistically significant findings. The statistical significance between the level of knowledge for the

antibiotic use and the development of the resistance was reached ($P < 0.05$) only for four items. The statistical significance and the higher odds were again evident among patients who considered that: *"Antibiotics should always be taken when you have bronchitis"* (OR=2.5, P=0.003). This finding shows again that the main factor which leads to the development of the antibiotic resistance is the lack of the awareness in the general population.

Conclusion

Our findings, including a representative sample of the population residing in South Albania, indicate that the level of knowledge on the use of antibiotics and antibiotic resistance is rather insufficient. This is influenced by several factors including the low educational level and the lack of sources of information. In our study, the low-educated individuals were more likely to have low levels of awareness, and consequently a higher level of antibiotic resistance.

The source of information is also important in the transmission of proper knowledge on the use of antibiotics. Information received from unpro)-fessional sources (schools, mass media, society) may explain the pretty low awareness levels.

The influence of the individual' behaviour in the use of antibiotics is considerable. Patients with medium and high awareness levels were 3.3 times more likely to use antibiotics "rarely" than those with low levels of awareness. Also, individuals with a high awareness level were 7.4 times more likely to receive antibiotics by an authorized personnel (doctors). The distribution of antibiotic resistance according to the level of knowledge on the use of antibiotics indicated that patients with a satisfactory level of knowledge were resistant to Amikacine, whereas patients with a low level of awareness were resistant to Amikacine and Augmentine.

Conflicts of interest: None declared.

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