

# Tuberculosis in a developing country – how much patients know about disease

Research Article

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**Abstract:** Introduction: Knowledge of tuberculosis among patients with the disease is crucial for early disease recognition, patients' full cooperation during the treatment, and prevention of future relapses. Our major aim was to evaluate knowledge about tuberculosis among patients and its correlation to their socioeconomic status (education level, employment status, monthly income, living conditions). Patients and methods: In this prospective study we interviewed 200 adult patients with newly diagnosed, active pulmonary tuberculosis treated at the Institute for Pulmonary Diseases of Vojvodina, Sremska Kamenica, Serbia (July, 2006-June, 2008). The information for analysis was obtained from two questionnaires and patients' medical records. Results: The majority of the patients, 158 (79%), were male, with a mean age of 49 years ( $\pm 15.4$ ). Most of the patients knew that tuberculosis is an infectious disease ( $n=188$ , 92%), but they were unaware of the cause ( $n=84$ , 42%). The patients with a higher education level (61.2% vs. 90%,  $p=0.03$ ), satisfactory living conditions (88.7% vs. 63.2%,  $p=0.02$ ), and higher economic status (78.4% vs. 100%,  $p=0.04$ ) demonstrated more knowledge about the disease. Half of the patients ( $n=98$ , 49%) believed that concomitant diseases (HIV, tumors) might contribute to the genesis of tuberculosis. Conclusions: Patients with tuberculosis demonstrated good knowledge of their disease. Patients with higher socioeconomic status and education level were more knowledgeable about their disease.

**Keywords:** Knowledge • Tuberculosis • Questionnaire • Socioeconomic status

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## 1. Introduction

Tuberculosis (TB) continues to be an important health and socioeconomic issue, especially in developing countries. The disease process itself produces no clear, typical clinical symptoms, making the infection more difficult to detect and enabling it to freely disseminate and affect those in contact with a diseased individual. The development of TB is affected by social and economic

factors more than any other disease. Epidemiological studies of these factors are fundamental, as they may influence TB frequency and distribution and interaction between people, as well as the course of treatment and its final outcome [1-4].

In the 1990s, the area of former Yugoslavia (the western Balkan countries: Serbia, Croatia, and Bosnia and Herzegovina) went through an exceptionally turbulent period characterized by wars, refugee migration, and economic sanctions. Unemployment rose from

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10.1% in 1993 to 14.8% in 2003 in most developed parts of the country [5,6]. At the same time, in Serbia, the incidence of TB increased from 28 per 100,000 to 37.6. A worsened epidemiological condition in Serbia was caused by wars and migrations of the population from their former places of residence (Croatia, Bosnia and Herzegovina, and Kosovo) [7-11].

Health promotion efforts concerning TB, in particular, were not adequately performed until mid-2004, when the “Board for Monitoring the Implementation of the Projects on HIV/AIDS and TB” was formed by the government of the Republic of Serbia. One of the aims of the Board was to carry out the project “Control of Tuberculosis in the Republic of Serbia through Implementation of the Directly Observed Therapy Strategy (DOTS) and Outreach Services for Vulnerable Populations”, with the support of the Global Fund to Fight AIDS, Tuberculosis, and Malaria. The program’s goal of reducing the TB incidence in Serbia from 37.6 per 100,000 in 2003 to 25 in a five-year period was achieved in 2009, when TB incidence was 23.2 per 100,000. In addition, one of the goals of this program was to improve knowledge about TB (symptoms, risk factors, ways of transmission, relationship to patients) in the general population [7,12-14].

The knowledge and attitudes about TB among patients with the disease are crucial for early disease recognition, patients’ full cooperation during treatment, and prevention of future relapses. So far, only a few studies have assessed patients’ knowledge about TB (symptoms, ways of spreading, and therapy) and its relation to socioeconomic status, with no data yet reported from the Balkan region, where TB continues to be an important health issue [15]. One of the major aims of our study was to evaluate patients’ knowledge about tuberculosis (symptoms, treatment modes, possible complications, and comorbidities that may contribute to the occurrence of tuberculosis) and its relation to the socioeconomic status of patients with TB on the basis of education level, employment status, monthly income, and living conditions.

## 2. Materials and methods

This prospective study included 200 patients with newly diagnosed, active pulmonary TB treated at the Institute for Pulmonary Diseases of Vojvodina in Sremska Kamenica, Serbia, between July, 2006 and June, 2008. The Institute is an academic tertiary health care centre and a major referral center in Vojvodina, a northern province of Serbia. There were 308 patients who had newly diagnosed, smear-positive pulmonary TB in the region of Vo-

jvodina during the study period (June 2006-July 2008). Of those, 200 (65%) met all the inclusion criteria for our study.

All the information needed for the investigation was obtained using two questionnaires, as well as patients’ hospital and medical records. The criteria included the requirement that the patients did not know that they had TB until they were informed by their doctors. Patients who were excluded included those with a previous TB diagnosis and patients who had been referred from other hospitals to our institution with newly confirmed TB but with the problems (allergic skin reaction, liver dysfunction) during the antituberculous therapy). The questionnaires were developed by the authors (TB specialists in a tertiary care center). The information provided by the patients was used exclusively for the purposes of this investigation. Institutional review and ethics boards approved the study protocol and waived the need for informed consent due to the observational study design.

### 2.1. Questionnaires

Questionnaire 1 consisted of 26 closed-ended questions about patients’ knowledge of their disease, including the cause of TB, ways of transmission, risk factors, clinical symptoms, and treatment (Figure 1).

Questionnaire 2 consisted of 19 closed-ended questions regarding basic demographic data and social history including sex, age, marital status, members of family, education level, occupation, employment status, monthly income, living conditions, refugee status, and social history such as smoking and alcoholism (Figure 2).

On the basis of the data obtained by the two questionnaires, the patients were classified into two groups for each parameter. The knowledge of the disease was “good” and “poor”. Patients were considered to have a good knowledge about TB if they correctly answered 16 questions (61%) from the first questionnaire. Patients who had a monthly income of 150 euros during the observation period were classified as financially poor, based on the minimum monthly income as defined by the National Bank of Serbia [16]. The patients’ living area was considered satisfactory if it measured over 20 m<sup>2</sup> per single family member, according to the national recommendation for daily living conditions [17]. We used the United Nations Human Settlements Programme (UN-HABITAT)’s general definition of poor human living conditions: buildings of poor quality or inadequate provision of infrastructure and service (one or more findings of lack of a water supply system, lack of a sewerage system, and moisture in houses/buildings) [18].

**Figure 1.** Questionnaire 1.

<b>1. How is tuberculosis caused?</b>		a. Virus	b. Bacteria	c. Fungus
<b>2. Is tuberculosis an infectious disease?</b>		Yes		No
<b>3. How is tuberculosis transmitted?</b>		a. Sex	b. Hands	c. Coughing
		d. Towel	e. Toilet bowl	
<b>4. What are the risk factors for the development of tuberculosis?</b>				
I Alcohol abuse		Yes	No	
II Smoking		Yes	No	
III Malnutrition		Yes	No	
IV Concomitant diseases (tumors,diabetes mellitus, HIV infection)		Yes	No	
<b>5. Have you some of diseases below?</b>				
I Diabetes mellitus		Yes	No	
II Arthritis reumatoides		Yes	No	
III Neoplasms (tumors),		Yes	No	
IV HIV infection		Yes	No	
<b>6. Had your doctors informed you about the possibility of developing tuberculosis in the future if you had one of these diagnosis?</b>		Yes		No
<b>7. What are the symptoms of tuberculosis of lung</b>				
I Dry cough		Yes	No	
II Productive cough		Yes	No	
III Chest pain		Yes	No	
IV Loss of appetite and body mass		Yes	No	
V Fever		Yes	No	
VI Overnight sweating		Yes	No	
VII Abdominal pains		Yes	No	
VIII Frequent urination		Yes	No	
IX Headache and vertigo		Yes	No	
<b>8. How long does the treatment of new tuberculosis take?</b>		a. 2 weeks	b. 2 months	c. 6 months
		d. 10months	e. 2 years	
<b>9. How many drugs do we use to cure the tuberculosis?</b>		a. None	b. One	c. More than one
<b>10. What is the reason for such a treatment?</b>				
I Completed cure the tuberculosis		Yes	No	
II Treatment is expensive.		Yes	No	
III. Prevent the complication		Yes	No	

**Figure 2.** Questionnaire 2.

<b>Sex</b>	a. Male	b. Female
<b>Age</b>		
<b>Education level</b>	a. Without school	b. Primary school
	c. Secondary school	d. College
	e. Faculty	
<b>Employed status</b>	a. Yes	b. No
<b>Financial status (monthly income)</b>	Under 150 €	150-450 €
	Above 450 €	
<b>Place of birth</b>	a. Serbia	b. Former Yug. republics
<b>Place of living</b>	Town	Village
<b>Living house</b>	House	Flat
<b>Living condition</b>		
Material structure of house*	a. Brick	b. Packed earth houses
	c. Wooden cottages	
Water supply system	Yes	No
Sewerage system	Yes	No
Moisture	Yes	No
<b>Members of family</b>	1	2
	3	4
	≥5	
<b>Living area (m<sup>2</sup>) per a single family member</b>	< 20	≥ 20
<b>Smoking</b>	Yes	No
<b>Alcohol abuse</b>	Yes	No

Depending on the radiologic and bacteriological parameters, all the patients were divided into groups according to evidence of caverns on chest radiographs, with or without smear-positive sputum. The diagnosis of tuberculosis was based on bacteriological confirmation of disease by a Lowenstein-Jensen culture for *Mycobacterium tuberculosis* (MT) from sputum, the presence of acid-alcohol resistant bacilli (MT) in sputum, or both. The diagnosis of TB was confirmed by Lowenstein-Jensen-based cultures [19-21]. All patients were closely followed over a period of 6 months while on antituberculous therapy. Patients were divided into two groups: one group had sputum conversion to MT in the initial phase of treatment (the first two months), and the other had conversion of sputum in the continuation phase (from the third month of therapy) [7,20-22].

The information was grouped, coded, and saved into a data base created specifically for the purpose of this study. All analyses were performed using SPSS for Windows version 13.0 (Chicago, Illinois).

Standard statistical methods for qualitative and quantitative evaluation of the results were applied, including the Mann-Whitney U test, Student's t-test and chi-square test as appropriate.

### 3. Results

The study included 200 patients, mostly men (n=158, 79%), mean age 49 ( $\pm 15.4$ ) years, with newly detected, active pulmonary TB. Most of the patients had a good knowledge of TB (158, 79%). The majority of patients knew that TB is an infectious disease (n=184, 92%), but were unsure about the cause (n=84, 42%). They were familiar with the forms of disease transmission (n=168, 84%). Half of all patients (n=98, 49%) were aware that concomitant diseases (HIV infection, tumors, diabetes mellitus, arthritis rheumatoid) might contribute to the genesis of TB. Diabetes mellitus was present in 20 (10%) patients, but only 50% of those received information from their doctor about the possibility of development of TB in the future. Most of the patients were well informed about the symptoms of TB. Almost everyone answered correctly regarding the reasons for the duration of TB treatment (Table 1).

Most of the patients (56%) had a high-school education, but 18% were without any education. The majority of patients 148 (74%) were considered poor, 76 (38%) had at least one criterion for poor living conditions, and 108 (54%) had an unsatisfactory size of living area. Among the patients, 36 (18%) were refugees (Table 2). Patients who were unemployed had a prolonged conversion of sputum (after the initial phase of therapy)

compared to those who were employed (p=0.06). There was a statistical significance between patients with a lower education level (below college) and a prolonged conversion of sputum (p=0.012). Also, a statistical significance was found between patients who were smokers (p=0.02) and a prolonged conversion of sputum. Similarly, a statistical significance existed between patients with unsatisfactory living conditions (p=0.005) and prolonged conversion of sputum (Table 3).

Patients with a higher level of education (college and faculty) (p=0.03), satisfactory living conditions (p=0.02) and a wealthier financial status (p=0.04) demonstrated better knowledge that was statistically significant. There was no statistical difference in knowledge about TB between patients who had a prolonged conversion of sputum (Table 4).

### 4. Discussion

The results of this study demonstrate that patients with TB in northern Serbia were well informed about their disease at the onset. Most of them knew that TB is an infectious disease and were knowledgeable about the ways of transmission, risk factors, symptoms, and treatment.

About 40% of patients did not know that bacteria is the cause of TB. The patient's level of education was associated with both knowledge about TB and delayed sputum conversion (after the initial phase of therapy). The study from Vukovic [12] in 2005 showed insufficient knowledge about ways of transmission of TB among the Gipsy population in the capital of Serbia (Belgrade). In a study by Khan [23], in Pakistan almost 30% of the subjects had never heard about tuberculosis; 15% did not know it was an infectious disease, and 40% of the patients had hidden the diagnosis from their family members. Similar results were obtained in a study in Malaysia and in another last year in Punjab, Pakistan [24,25]. Comparing these observations to the results of our study, we found that our patients were better informed and better educated. This can be explained by the fact that a large proportion of the population has a higher educational level in Serbia [13] compared to the population in Pakistan and Malaysia. People with a higher educational level can recognize symptoms of the disease earlier and contact their physicians. However, when discussing the differences in attitude and knowledge about TB between countries, the strong religious and cultural differences should be taken into account. In Serbia, there have been studies related to increasing the knowledge about TB among the population (Ilic, Vukovic), demonstrating the level of TB knowledge among the general population and Gipsies, as well as among

**Table 1.** Answers to the questionnaire no. 1 (n, %).

<b>1. How is tuberculosis caused?</b>			
Virus	70 (35)	Bacteria	116 (58)
		Fungus	14 (7)
<b>2. Is tuberculosis an infectious disease?</b>			
		Yes	188 (94)
		No	12 (6)
<b>3. How is tuberculosis transmitted?</b>			
Sex	6 (3)	Hands	12 (6)
		Coughing	168 (84)
		Towel	12 (6)
		Toilet bowl	2 (1)
<b>4. What are the risk factors for the development of tuberculosis?</b>			
I Alcohol abuse		Yes	134 (67)
		No	66 (33)
II Smoking		Yes	154 (77)
		No	46 (23)
III Malnutrition		Yes	182 (91)
		No	18 (9)
IV Concomitant diseases (tumors, diabetes mellitus, HIV infection)		Yes	102 (51)
		No	98 (49)
<b>5. Have you some of the diseases below?</b>			
I Diabetes mellitus		Yes	20 (10)
		No	180 (80)
II Arthritis reumatoides		Yes	0 (0)
		No	200(100)
III Neoplasms (tumors),		Yes	0 (0)
		No	200(100)
IV HIV infection		Yes	0 (0)
		No	200(100)
<b>6. Had your doctors informed you about the possibility of developing tuberculosis in the future if you had one of these diagnosis?</b>			
		Yes	10 (5)
		No	No
<b>7. What are the symptoms of tuberculosis of lung?</b>			
I Dry cough		Yes	142 (71)
		No	58 (29)
II Productive cough		Yes	170 (85)
		No	30 (15)
III Chest pain		Yes	158 (79)
		No	42 (21)
IV Loss of appetite and body mass		Yes	176 (88)
		No	24 (12)
V Fever		Yes	166 (83)
		No	34 (17)
VI Overnight sweating		Yes	172 (86)
		No	28 (14)
VII Abdominal pains		Yes	40 (20)
		No	160 (80)
VIII Frequent urination		Yes	104 (52)
		No	96 (48)
IX Headache and vertigo		Yes	90 (45)
		No	110 (55)
<b>8. How long does the treatment of new tuberculosis take?</b>			
2 weeks	2 (1)	2 months	40 (20)
		6 months	92 (46)
		10 months	54 (2)
		2 years	12 (6)
<b>9. How many drugs do we use to cure the tuberculosis?</b>			
a. None	0 (0)	b. One	0 (0)
		c. More than one	200 (100)
<b>10. What is the reason for such a treatment?</b>			
I Completed cure the tuberculosis		Yes	196 (98)
		No	4 (2)
II Treatment is expensive.		Yes	24 (12)
		No	176 (88)
III Prevent the complication		Yes	154 (77)
		No	46 (23)

Data are presented as n (%).

Used native language (Serbian) in questionnaire.

**Table 2.** Answers to the questionnaire no. 2 (n, %).

<b>Sex (n,%)</b>	Men	Women			
	158 (79)	42 (21)			
<b>Age (x±SD)</b>	47±12.4	57±11.5			
<b>Education level (n,%)</b>	a. Without school	b. Primary school	c. Secondary school	d. College	e. Faculty
	36 (18)	32 (16)	112 (56)	10 (5)	10 (5)
<b>Employed status (n,%)</b>	Yes	No			
	86 (43)	114 (57)			
<b>Financial status (monthly income) (n,%)</b>	Under 150 €	150-450 €	Above 450 €		
	148 (74)	48 (24)	4 (2)		
<b>Place of birth (n,%)</b>	Serbia	Former Yug. republics			
	164 (82)	36 (18)			
<b>Place of living (n,%)</b>	Town	Village			
	92 (46)	108 (54)			
<b>Living house (n,%)</b>	House	Flat			
	150 (75)	50 (25)			
<b>Living condition (n,%)</b>					
Material structure of house*	Good	Bad			
	160 (80)	40 (20)			
	Yes	No			
Water supply system	152 (76)	48 (24)			
Sewerage system	128 (64)	72 (36)			
Moisture	28 (14)	172 (86)			
<b>Members of family (n,%)</b>	1	2	3	4	≥5
	16 (8)	42 (21)	46 (23)	46 (23)	4 (2)
<b>Living area (m<sup>2</sup>) per a single family member (n,%)</b>	< 20	≥ 20			
	108 (54)	92 (46)			
<b>Smoking</b>	Yes	No			
	114 (57)	86 (43)			
<b>Alcohol abuse</b>	Yes	No			
	86 (43)	114 (57)			

\*Material structure of house: good (bricks), bad (packed earth houses, wooden cottages)

Used native language (Serbian) in questionnaire.

**Table 3.** Comparison between parameters (age group, education, financial, employment, living area and condition, place of birth, poor habits) to radiographic findings (caverns) and conversion of sputum (n, %, p)

Age groups		0-30 years	31-60 years	>60 years	p		
Caverns and/or M+	No	0 (0)	15 (9.2)	3 (12.5)	0.64		
	Yes	22 (100)	142 (90.8)	18 (87.5)			
Sputum conversion	After initial phase	9 (41.3)	85 (54.1)	9 (45.4)	0.76		
Level of education (n)*		a (36)	b (32)	c (112)	d (10)	e (10)	
Caverns and/or M+	No	4 (12)	0 (0)	10 (9)	0 (0)	2 (20)	0.54
	Yes	32 (88)	32 (100)	102 (91)	10 (100)	8 (80)	
Sputum conversion	After initial phase	4 (11)	4 (13)	28 (25)	1 (1)	0 (0)	0.012
Monthly income (%) <sup>£</sup>		Under 150 €	150-450 €	Above 450 €			
Caverns and/or M+	No	12 (8.1)	4 (8.3)	0 (0)			0.91
	Yes	136 (91.9)	44 (91.7)	4 (100.0)			
Sputum conversion	After initial phase	84 (56.8)	14 (30.4)	2 (50.0)			0.22
Employment		Yes	No				
Caverns and/or M+	No	8 (9.3)	8 (7.0)				0.96
	Yes	78 (90.7)	106 (93.0)				
Sputum conversion	After initial phase	36 (42.9)	64 (56.1)				0.06
Life size		Under 20 m <sup>2</sup>	Above 20 m <sup>2</sup>				
Caverns and/or M+	No	8 (7.3)	8 (8.9)				1.00
	Yes	100 (92.7)	82 (91.1)				
Sputum conversion	After initial phase	50 (46.3)	50 (55.6)				0.76
Living conditions		Good	Bad				
Caverns and/or M+	No	12 (9.7)	4 (5.3)				0.43
	Yes	112 (90.3)	72 (94.7)				
Sputum conversion	After initial phase	46 (37.1)	56 (73.0)				0.005
Place of birth		Serbia	Former Yugoslavia				
Caverns and/or M+	No	14 (8.5)	2 (5.6)				1.00
	Yes	150 (91.5)	34 (94.4)				
Sputum conversion	After initial phase	84 (51.9)	16 (44.4)				0.30
Smoking		Yes	No				
Caverns and/or M+	No	6 (5.3)	10 (11.6)				0.43
	Yes	108 (94.7)	76 (88.4)				
Sputum conversion	After initial phase	66 (58.9)	34 (39.5)				0.02
Alcohol abuse		Yes	No				
Caverns and/or M+	No	2 (2.3)	14 (12.3)				0.15
	Yes	84 (97.7)	100 (87.7)				
Sputum conversion	After initial phase	48 (57.1)	52 (45.6)				0.48

\* a - without school, b - primary school, c - secondary school, d - college, e - university  
<sup>£</sup> - mean value of the euros  
M+ - smear-positive sputum

**Table 4.** Comparison between knowledge about TB to parameters (severity of diseases, conversion of sputum, age groups, sex, education, financial, employment, living condition) to (n, %, p).

Knowledge about TB		Bad	Good	p
Caverns and/or M+	No	4 (9.5)	12 (7.6)	1.00
	Yes	38 (90.5)	146 (92.4)	
Sputum conversion	After initiation phase	24 (57.1)	76 (48.7)	0.38
Age groups	0-30 years	4 (18)	18 (81.9)	0.87
	31-60 years	33 (21)	124 (79)	
	Above 60 years	5 (23.8)	16 (76.2)	
Sex	Men	31 (19.6)	127 (80.4)	1.00
	Women	9 (21.4)	33 (78.6)	
Level of education	a	14 (38.8)	22 (61.2)	0.03
	b	10 (31.2)	22 (68.8)	
	c	16 (14.3)	96 (85.7)	
	d	1 (10)	9 (90)	
	e	1 (10)	9 (90)	
Employment	Yes	11 (12.8)	75 (88.2)	0.84
	No	21 (18.4)	93 (91.6)	
Living condition	Good	14 (11.3)	110 (88.7)	0.02
	Bad	28 (36.8)	48 (63.2)	
Monthly income	Under 150 €	32 (21.6)	116 (78.4)	0.04
	150-450 €	9 (18.7)	39 (81.3)	
	Above 450 €	0 (0)	4 (100)	

\* a - without school, b - primary school, c - secondary school, d - college, e - university

others [6,12,13,19,26]. The most recent study [7] was from 2004, when Serbia began the implementation of DOTS, and one of the goals was to improve knowledge among the general population. Among the gypsy population, denial of the disease has been common, but in the last decade that practice has decreased. All these studies show an improvement in the understanding of TB among the general population over decades. Every second patient in our study did not consider concomitant diseases (HIV infection, tumors, diabetes mellitus) to be risk factors for development of TB. Among patients with diabetes mellitus and TB, only half of them received information from their doctor about the possibility of the future development of TB. This data is very disturbing, since it demonstrates that general practitioners do not communicate the possibility of TB among those patients who are already at risk. Compared to the study of Ilic (Serbia) [26] from 2004, the understanding of the possibility of development of TB in people with diabetes has decreased (from 20 to 5% now). The period from 2004 to 2009 was marked by intensive implementation of a Project called "Control of Tuberculosis in the Republic of Serbia through Implementation of DOTS and Outreach Services for Vulnerable Populations", which helps to explain the good result. Savicevic (Croatia) [27] reported that among primary health care physicians, almost 30% showed deficient knowledge about TB particularly with regard to chest auscultation, predisposing conditions, and treatment regimens. This, in addition to our data, suggests that there is a need for intensive education among health care providers in primary health care. Improved understanding of TB for patients at risk may prevent a delay in symptom recognition and thus improve prevention and outcome of the disease.

The educational level of the patients in our study correlates with that of the general population in the northern province of Serbia, Vojvodina, according to the census of 2002 [28]. A study from Thailand [29] and Punjab, Pakistan [25] have shown that patients with lower educational levels and a decreased knowledge of TB had delayed sputum conversion. It is likely that educated patients can recognize their symptoms early, so their disease is milder at the time of diagnosis, and it is easier and faster to cure. But of course, the speed of sputum conversion is primarily connected to the spread of the disease. There were 100 patients who had sputum conversion after the initial phase, and we did not find a statistical significance between "good" and "poor" knowledge of TB among this group.

Most of the patients had a monthly income under 150€ (minimum average of the Republic of Serbia). The level of monthly income was associated with knowledge about TB, but not with the chest radio-

graphic findings and duration of sputum conversion. The employed patients achieved sputum conversion faster than the unemployed ones, suggesting that the subjects with a regular monthly income could provide for normal living conditions and regular and healthy nutrition. This is consistent with formerly reported results from Serbia [6], Russia [30,31] and Estonia [32]. These studies reported that employed patients with stable income who had TB were exposed to fewer stress factors in their living environment. That fact positively reflects rapid and safe adherence to antituberculous drug regimens and subsequent recuperation.

Living conditions were associated with both knowledge about TB and delayed sputum conversion (after the initial phase of therapy). More than half of our patients had a living area under 20 m<sup>2</sup>, which suggests that they generally lacked the living space needed for a healthy life by the standards of UN-HABITAT and national laws [17,18].

The smokers were more likely to have delayed sputum conversion. These results are not surprising, when the impact of smoking and abuse alcohol on the occurrence of tuberculosis is kept in mind, as confirmed by numerous studies [31-38]. This suggests another point for intensive education of a population at risk. Continuing medical education of general practitioners should be aimed at giving more attention to TB patients who are smokers or have a history of alcohol abuse.

This study has several important limitations. First, the data collected from the patients were based on their personal beliefs and memory, which is not always exact, and the patients could be prone to recall bias. However, since data were collected at the onset of the patients' disease, before they had been informed that they had TB, we believe that this is likely to be minimized. Although we cannot exclude the fact that some patients may have been informed by their physicians that TB was suspected, this is unlikely to be the case in most patients, since the final diagnosis was made at our institution; thus, the risk of including patients with a previous knowledge of their TB was minimized. Second, the data are representative of patients seen at a tertiary care center, with the majority of patients being male with severe forms of the disease, thus limiting the generalizability of the data. Nevertheless, it represents 65% of all patients with new smear-positive TB who were treated during that period in Vojvodina. Finally, we used a questionnaire that was originally developed by the authors, so comparison of our results to other published studies may be difficult. Despite these limitations, this is one of the first studies assessing the knowledge of patients with TB about their disease and its relation to socioeconomic status in this part of the world (Balkan region).

## 5. Conclusion

Patients with TB in our study demonstrated a good understanding of the disease. The major gaps in patients' knowledge were detected in those with chronic comorbidities who did not consider themselves at increased risk of TB. In addition, patients with a higher socioeconomic status and education level were more knowledgeable about their disease. Strict adherence to DOTS and the national program on TB should be encouraged, giv-

ing priority to professional improvement of the engaged medical staff to obtain the earliest diagnosis and to further the education of the general population and especially the at-risk population, including socially endangered and unemployed persons and those with chronic conditions, to help them recognize the disease as early as possible and seek medical attention.

Also, an important part of a future strategy in the fight against TB will be the education of patients and their relatives regarding the possible development of multi-resistant and extensively resistant forms of TB.

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