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Unemployment in TB Patients – Ten-Year Observation at Regional Center of Pulmonology in Bydgoszcz, Poland

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Background: Tuberculosis (TB) affects the poorest of the poor and is an example of a disease that can contribute to the “disease-poverty trap”. The variable epidemiological situation is associated with social risk factors, such as unemployment, which may favor the occurrence of this disease. The aim of this study was to analyze unemployment as a factor that can influence the incidence and course of the disease.

Material/Methods: We analyzed TB patients with confirmed status of employment or unemployment admitted to the Regional Center of Pulmonology in Bydgoszcz in during the years 2001 to 2010. Out of 1130 patients, 604 were unemployed and the other confirmed their employment.

Results: The unemployed patients were mostly single men over age 40, with a low level of education, and living in a city. We observed that the proportions of smokers and alcohol abusers were significantly higher among the unemployed patients. The advanced radiological lesions, smear-positive pulmonary TB, and extra-pulmonary sites were diagnosed significantly more often in this group. The rate of death in the course of hospitalization was significantly higher in the group of unemployed patients.

Conclusions: Unemployment among TB patients is a serious problem. We found that more advanced radiological lesions were associated with more frequent treatment interruptions and a higher rate of death in the course of hospitalization. Increased efforts are needed to reduce and eliminate the problem of unemployment among patients with TB. This may, indirectly, contribute to a decrease in notifications of TB cases and improve treatment outcomes.

MeSH Keywords: *Mycobacterium Tuberculosis • Risk Factors • Unemployment*

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Background

Although *Mycobacterium tuberculosis* was discovered over 130 years ago and the first antituberculous drugs were discovered over 60 years ago, and despite the creation of disease prevention and control strategies, tuberculosis is still one of the leading infectious causes of death [1–6]. Despite efforts to eliminate TB, the world-wide epidemiological situation at the end of the 20th century was so serious that the World Health Organization (WHO) acknowledged that it was necessary to take immediate actions [7] and estimates that each year 9 million new TB cases occur and 1.7 million people die from this disease [3,7]. The prevalence of TB reaches 10/100 000 in Western Europe, over 150/100 000 in Asia, and more than 300/100 000 in Africa [3].

Over the past 50 years, the incidence of tuberculosis in Poland has decreased 10-fold. For instance, in 1957 over 82 000 new cases were registered, while in 2010 there were only 7509 cases. In 2010, Poland joined the group of countries with low tuberculosis incidence, but it was still higher than the incidence in many other European countries; the incidence rate was 19.7/100 000 [3].

The variable epidemiological situation of tuberculosis is associated with social risk factors, such as unemployment, which may favor the occurrence of this disease [8]. In many studies it is not presented directly, but lack of income can lead to impoverishment of the society and, as a result, to pathological problems associated with poor living conditions [9,10].

The aim of this study was to analyze unemployment as a factor that can influence the incidence and course of TB on the basis of clinical and epidemiological data of patients with tuberculosis, admitted to the Regional Center of Pulmonology, Poland.

Material and Methods

The patients with tuberculosis (TB) were diagnosed and treated from January 2001 to December 2010 at the Regional Center of Pulmonology in Bydgoszcz. This retrospective study examined records of 2025 TB patients and 1130 patients were included in the research group: of these 1130 patients, 604 patients had a confirmed unemployment status and 526 patients were actively employed. Other patients, such as students and pensioners, were excluded from the analyzed group. The data were collected from the central database of the hospital. The study group included men ages 18–65 and women ages 18–60. The age provided is the age on the day of admission. The cut-off values of age correspond to the retirement age in Poland. We selected a group of patients whose employment status could be confirmed by patient records. Patients with

psychiatric conditions who were treated for TB were also included into study group if they had confirmed status as being employed or unemployed. All patients were in the directly observed treatment (DOT) programme.

In Poland, from the legal point of view, an unemployed person is a person who does not do any paid work and who is capable and ready to start a full-time job during normal working hours, who is not a full-time student, is registered at a district job center after the age of 18, and who has not attained retirement age as stipulated in article 24 1a and 1b of the act and in article 27 p. 2 and 3 of the act of 17 December 1998 – the Pensions from Health Insurance Fund Act (Journal of Laws 2009 No. 153, item 1227 as amended 2).

In this analysis of the period 2001–2010, we used an upper age limit of 60 years for women and 65 years for men, for unemployed people reaching retirement age (according to article 24 p. 1 of the act of 17 December 1998 Pensions from Health Insurance Fund Act (Journal of Laws 2013 item 1440).

TB can only be diagnosed if *Mycobacterium tuberculosis* bacteria are found in a clinical specimen taken from the patient. While other types of tests may strongly suggest tuberculosis as the diagnosis, they cannot confirm it. A complete medical evaluation for TB must include a medical history, a physical examination, a chest X-ray, and a microbiological examination (of sputum or some other appropriate sample). It may also include other scans and X-rays, and a surgical biopsy. TB is diagnosed if a patient: (1) has a positive culture for *M. tuberculosis*, (2) is culture-negative with clinico-radiological features and a response to treatment consistent with TB, or (3) has histological findings and response to treatment consistent with TB. The case definitions given in the 2007 WHO Report were used for the clinical classification of PTB [11].

A posterior-anterior (PA) chest X-ray is the standard view used; other views (lateral or lordotic) or CT scans may be necessary. These chest X-rays were evaluated independently by 2 pulmonologists and the final decision was established by consensus at the second reading. Radiological changes were all attributed to active pulmonary TB because infiltrates or consolidations and/or cavities are often seen in the upper lungs with or without mediastinal or hilar lymphadenopathy [12].

Excessive alcohol use is not defined quantitatively; instead, the U.S. Centers for Disease Control and Prevention provide general guidelines for public health staff to use when assessing alcohol consumption. The suggested criteria for identifying excessive alcohol use in the previous 12 months among tuberculosis patients include evidence of participation in an alcohol treatment program, documented medical conditions associated with excessive alcohol use (e.g., cirrhosis and pancreatitis),

and a diagnosis of alcoholism in medical records [13]. For the purposes of this analysis, TB patients were considered to abuse alcohol if they had a confirmed history of treatment for alcoholism or alcohol-related therapy or a confirmed diagnosis of alcohol dependence syndrome, or if they repeatedly showed signs of alcohol consumption during the course of their hospital stay. All patients meeting 1 or more of these criteria were classified into the alcohol-abusing group.

TB treatment outcome categories were defined according to WHO and International Union Against Tuberculosis and Lung Disease guidelines, with some modifications [14,15]. WHO defines successfully treated patients as all those who have both completed treatment and are cured. In keeping with these criteria, treatment outcomes were categorized as either: a) successful outcome, in which pulmonary TB (PTB) patients completed treatment and were cured (negative smear microscopy at the end of treatment and in at least 1 follow-up and resolution of symptoms) or b) unsuccessful outcome in which treatment ended in failure (remaining smear-positive after 5 months of treatment), default (interruption of treatment for 2 or more consecutive months after registration), or death [14].

An adverse drug reaction (ADR) was defined as an appreciably harmful or unpleasant reaction resulting from an intervention related to the use of a medicinal product, or from alteration of the dosage regimen or withdrawal of the product, which can be expected to recur upon future administration, alteration or withdrawal and which warrants prevention or specific treatment [16]. The cause of each ADR was evaluated according to the WHO Uppsala Monitoring Center System [17].

TB-ADR were classified as: 1) toxicity-like serious or potentially life-threatening reactions that may require treatment and/or hospitalization, dose changes, or stopping the drug; 2) adverse effects such as hepatitis, kidney failure, serious allergic reactions, vision changes, neurological problems, thrombocytopenia, neutropenia, or anaemia; or 3) unpleasant reactions that are not damaging to health and do not usually require changes in therapy, such as gas, bloating, discoloration of body fluids, sleeping problems, photosensitivity, or irritability [18].

Multi-drug-resistant tuberculosis (MDR-TB) is defined as tuberculosis that is resistant to at least isoniazid (INH) and rifampicin (RMP) [1], which are the two most powerful first-line treatment anti-TB drugs [2]. Isolates that are multiply resistant to any other combination of anti-TB drugs but not to INH and RMP are not classed as MDR-TB [19].

Extensively drug-resistant tuberculosis (XDR-TB) is a form of TB which is resistant to at least 4 of the core anti-TB drugs. XDR-TB involves resistance to the 2 most powerful anti-TB drugs – isoniazid and rifampicin – also known as multidrug-resistance

(MDR-TB), in addition to resistance to any of the fluoroquinolones (such as ofloxacin or moxifloxacin) and to at least 1 of 3 injectable second-line drugs (amikacin, capreomycin, or kanamycin). MDR-TB and XDR-TB both take substantially longer to treat than ordinary (drug-susceptible) TB, and require the use of second-line anti-TB drugs, which are more expensive and have more adverse effects than the first-line drugs used for drug-susceptible TB [20].

Statistical analysis

Statistical analysis was performed using Statistica PL software, version 10.0. Comparisons between categorical variables made using the chi-square test. In order to check the difference between 2 sample means, the unpaired t-test was used. Standard deviations (SD) are reported. The results were considered as significant for P value lower than 0.05. The sample size for analysis ranged from 1067 to 1130 because of missing or incomplete data.

The analysis protocol was acknowledged by Committee on Ethics of Nicolaus Copernicus University in March 2013 (KB 168/2013).

Results

The study sample comprised 1130 patients. Most (811) of them were male, 721 were over age 40 years. Six hundred and four (about 54%) were unemployed, and the others confirmed their employment. The average age of the patients was 42.9 years (SD 11.1 years).

Table 1 shows comparisons between the groups of employed and unemployed patients, referring to their socio-demographic characteristics and habits. Significant differences were observed for gender, age, place of residence, education, smoking status, and alcohol abuse. The proportions of men, homeless, unmarried, smokers, and alcoholics were significantly higher among the unemployed patients. They also appeared to be less educated. The mean value of age was significantly higher in the unemployed group – 43.9 years (10.8) vs. 41.7 years (11.2), $P < 0.001$.

In the study group we had 142 (13%) patients with previously treated TB. The rate of patients suffering from TB adverse drug reaction during hospitalization was 36% and 1.4% of all patients had multi-drug-resistant tuberculosis (MDR-TB). Clinical characteristics of the study cases, with division into employed and unemployed groups, are shown in Table 2. There was no significant difference between the employed and unemployed groups in terms of re-activation, TB drug adverse reactions, or incidence of multi-drug-resistant tuberculosis

Table 1. Characteristic of the study population.

	Total	Employed	Unemployed	P
Gender (n=1130)				
Men	811 (71.8%)	348 (66.2%)	463 (76.7%)	<0.001
Age (n=1130)				
≥40 years	721 (63.8%)	308 (58.6%)	413 (68.4%)	<0.001
Residence (n=1130)				<0.001
Urban	678 (60.0%)	329 (62.5%)	349 (57.8%)	
Rural	351 (31.1%)	196 (37.3%)	155 (25.7%)	
Homeless	101 (8.9%)	1 (0.2%)	100 (16.5%)	
Education (n=1067)				<0.001
Elementary	171 (16.0%)	40 (7.6%)	131 (24.1%)	
Vocation	692 (64.9%)	304 (58.1%)	388 (71.3%)	
Secondary	152 (14.2%)	128 (24.5%)	24 (4.4%)	
Above secondary	52 (4.9%)	51 (9.8%)	1 (0.2%)	
Marital status (n=1112)				<0.001
Married	488 (43.9%)	310 (59.6%)	178 (30.1%)	
Widowed	26 (2.3%)	12 (2.3%)	14 (2.4%)	
Single	440 (39.6%)	151 (29.0%)	289 (48.8%)	
Divorced	158 (14.2%)	47 (9.0%)	111 (18.7%)	
Smoking status (n=1126)				<0.001
Smokers	886 (78.7%)	369 (70.3%)	517 (86.0%)	
Alcoholic abuse (n=1121)				<0.001
Alcoholics	375 (33.4%)	73 (13.9%)	302 (50.6%)	

Table 2. Selected clinical elements in division into employed and unemployed groups.

	Total	Employed	Unemployed	P
Bilateral and/or cavitary lesions in chest X-ray findings (n=1096)	799 (72.9%)	320 (63.4%)	479 (81.1%)	<0.001
Re-activation (n=1130)	142 (12.6%)	55 (10.5%)	87 (14.4%)	0.05
Smear positive pulmonary TB (n=1067)	750 (70.3%)	309 (63.6%)	441 (75.9%)	<0.001
Clinical form of tuberculosis extra-pulmonary (n=1130)	63 (5.6%)	40 (7.6%)	23 (3.8%)	0.006
Treatment interruption (n=1130)	222 (19.6%)	46 (8.7%)	176 (29.1%)	<0.001
Tb drug adverse reaction (n=1130)	406 (35.9%)	177 (33.7%)	229 (37.9%)	0.17
Multi-drug resistant tuberculosis MDR-TB (n=1130)	16 (1.4%)	6 (1.1%)	10 (1.7%)	0.46
Deaths (n=1130)	55 (4.9%)	11 (2.1%)	44 (7.3%)	<0.001

MDR-TB. Radiological findings revealed bilateral and/or cavitary lesions for 799 cases. The proportion of patients with lesions was significantly higher among the unemployed group. Smear-positive pulmonary TB was diagnosed significantly less frequently in the employed group. The proportion with extra-pulmonary sites was significantly higher among the unemployed patients. We found that the unemployed group had more treatment interruptions. Finally, the risk of death in the course of hospitalization was also significantly higher in unemployed patients.

Discussion

The TB incidence rate is a vital population health parameter as regards the relationship with poverty. Pulmonary tuberculosis is a social disease in our country, which means that the incidence rate is high, and triggering factors make it necessary to employ social forces to eliminate them. The social determinants of tuberculosis in the study population are related to unemployment. Poverty undoubtedly contributes to the incidence of tuberculosis through increased progression from infection to disease due to poor diet or stress, and greater difficulties in using health services [21]. There were 2 083 100 unemployed persons registered at job centers in Poland at the end of September 2013. The unemployed registered at job centers at the end of September 2013 constituted 13.0% of professionally active persons. In the Kuyavian-Pomeranian region, the unemployment rate is high (17.5%), and is the second worst in the country after the Warmian-Mazurian region (20.4%) [22]. The above-mentioned parameters are high for the general population, but still significantly lower than in our study population of tuberculosis patients, in which, during the 10-year observation period, the percentage was as high as 31%.

In the 1980s and 1990s in Poland, most TB patients were employed [23, 24]. In 1992, Miller et al. recorded only 8.5% unemployment among all patients in Poland [25]. In the beginning of the 21st century, the unemployment rate was 23–37% of the patients [8, 26]. Jagodziński et al. reported that during the last 2 years the problem of unemployment was still rising, especially among men (57% unemployed) compared to women (25% unemployed [26,27]. In our study, only one-fourth of the patients had a permanent job. Among people from countries with varying degrees of TB cases, a several-fold increase in incidence of tuberculosis was noted among the unemployed compared to the employed [9,28–30].

Many studies have reported that unemployment is an important risk factor for TB. A 2006–2008 study from Croatia reported that 23% of unemployed people have TB [31]. In Russia, a 2001 study found that the TB infection rate varied from 6% to 11% [28]. Greenland has a high incidence of tuberculosis,

and the risk of TB is more than 4 times higher among the unemployed [30]. Brazilian authors reported that unemployment was a risk factor for tuberculosis and that unemployed people had significantly delayed treatment [29].

A recently published meta-analysis evaluating the impact of the economic crisis on the transmission and control of TB contains 8 studies and reveals the effect of recession on TB [32]. The financial crisis may increase the size of the groups with a high risk of incidence of tuberculosis. An example is unemployment, where job insecurity seems to lead to behavior that increases the risk of tuberculosis, such as higher alcohol consumption. To make matters worse, the economic decline caused unemployment and an increase in the homeless population, both of which are risk factors for tuberculosis [30,33–35].

Nearly all homeless people in our study were unemployed. Only 1 patient with TB among the homeless had a job. The lack of employment as a symptom of impoverishment of the society is often connected with alcohol consumption and smoking. To sum up, it should be noted that unlike those obeying the hospital regimen, the patients who did not follow the regimen were statistically more frequently alcohol abusers, single, unemployed, and homeless. Risk of failure to complete therapy among alcoholics is seven times higher than among other patients [36,37]. According to the data cited in 1 of the studies, it appears that as many as 50% of patients in this group discontinue anti-TB treatment [38]. In our research, nearly 80% of those who stopped the treatment were unemployed.

The inappropriate treatment and the lack of mechanisms enabling more rigorous therapies cause the development of drug-resistant tuberculosis, including multi-drug resistant type TB (MDR-TB) and extensively drug-resistant tuberculosis (XDR-TB). In our group of patients with these difficult and costly to treat forms of tuberculosis, more than 60% were unemployed. Statistically, employed people are more likely to have extra-pulmonary TB. In the available literature there are no conclusive data regarding an association between pulmonary TB and unemployment, but if you combine other social factors with unemployment, there is more pulmonary TB in these social groups [39,40].

Among the unemployed patients, radiological changes were often characterized by a bilaterally abnormal radiogram with numerous cavities. Such results are confirmed by other studies [26,41]. This creates an erroneous therapeutic downward spiral. Since they do not want to be treated, the patients provoke the deepening TB changes, make the treatment harder, and have even more complications. It often entails long treatment and the use of more drugs. The low level of education and training, as well as unemployment, all are risk factors of poverty and social exclusion. This aspect is represented by our

unemployed patients who tend to stop the treatment more often and who are indisciplined, which may result in an increased drug resistance, re-treatment, or disease reactivation [8].

Most people dying from TB live in developing countries. And yet, in order to compare it with Poland, one should recall regularities observed in economically developed societies. Sterling pointed out that, among many social and clinical causes, unemployment may be considered an independent risk factor of death for patients with TB [8,42]. In a Japanese review of 12 articles published in English language and 7 articles published in Japanese, unemployment is a risk factor for death due to TB, and research from China emphasizes an increased risk of death during TB therapy [43,44].

Our analysis confirms the conclusion drawn from the above-mentioned studies. Nearly 80% of patients who died during treatment were unemployed. The Kuyavian-Pomeranian region has one of the highest rates of unemployment [22]. Persistent unemployment increases poverty and its accompanying social pathologies, and keeps TB rates high. This can be prevented

by accelerated economic growth and investment, which are required to reduce unemployment.

Conclusions

Employment creation is a key to eradicating poverty and reducing inequality. Unemployment among TB patients constitutes a serious problem. The anti-health behavior noted in this group of patients includes smoking, alcohol abuse, and homelessness. The problem of unemployment as an element impoverishing the society calls for more action from all government departments toward its reduction and elimination. Therefore, all programs, of both state and non-governmental organizations, by reducing unemployment on a national and global scale, contribute to the elimination of one of the oldest infectious diseases in the world, which is tuberculosis.

Competing interests

The authors declare that they have no competing interests.

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