

## Aspects of monitoring a cohort of adult homeless people suffering from tuberculosis compared to the general population of Bucharest

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### ABSTRACT

*In the case of homeless adults (HA), there are high rates of TB- a public health issue in Romania- due to poor living conditions and to those conditions favouring the development of the disease. The aim of this study is to compare the cases reported with chemosensitive/ monoresistant TB, in 2013 at HA with those occurred in the general adult population (GAP), in terms of socio-demographic and clinical characteristics, and to evaluate the direct costs provided to such persons from both cohorts. Data were collected from the National Tuberculosis Programme. Have been taken into account the costs directly determined strictly for detection, monitoring and treatment of patients with TB, comparing the mean values for the 2 groups. The results showed that most patients are young men, representing new pulmonary TB cases, with associated conditions (HIV, drug addiction) and that there are significant statistical differences in terms of average costs determined per HA patient, due to the extended length of stay in their case. Most of the cases are pulmonary that can transmit the disease. The average length of stay in the case of HA is about 3.0 times higher than in GAP cases.*

**KEYWORDS:** *direct costs, general adult population, homeless adult people, tuberculosis.*

### 1. INTRODUCTION

In our country, tuberculosis is an endemic disease and a public health issue and, through its high incidence has placed us first among European Union countries in 2013 [1]. In vulnerable population groups that are at high risk for developing tuberculosis (TB), there are high rates of TB due to poor living conditions, to their poly-morbidity and to those conditions favouring the development of the disease, such as drug use, HIV infection and overcrowding in the shelters where they live [2, 3]. The vulnerable population groups also include the homeless adults - HA, a population group that has limited access to health care services, which makes the disease to not be early detected. WHO has claimed in 2009 that in many industrialized countries the TB rates in HA can be over 20 times higher than in the general population, that is perhaps due to the conditions of the economic crisis in recent years, and which has resulted in increased poverty [4]. Compliance with a long-term treatment (at least 6 months) is usually low, therefore, for a correct treatment under direct observation – DOT [5, 6], is preferred the hospitalization of HA for the whole duration thereof.

### 2. AIM and OBJECTIVES

Starting from the data gathered in the previous research, when was analysed the HA cohort for 2013 in Bucharest, the aim of this study was to review the same cohort of HA suffering from chemosensitive / monoresistant tuberculosis compared with a corresponding cohort of patients

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from the general population of Bucharest, and the proposed objectives were to analyse these people in terms of socio-demographic and clinical characteristics, as well as to assess the direct costs arising from the healthcare services provided to such persons from both cohorts, by comparing the average values thereof.

The hypothesis of this approach is that the cost of caring out for HA patients is higher than that of the cases of the general population.

### 3. METHODOLOGY

The methodology was a descriptive approach to HA and GAP suffering from chemosensitive / monoresistant TB, as they were reported in the year 2013, in Bucharest. The data were collected from the reporting sheets of HA kept by the TB outpatient care in the sectors of Bucharest, and from the electronic database of the National Programme for the Prevention, Surveillance and Control of Tuberculosis (NPPSCT), for both HA and the GAP.

In the calculation of costs, there have been taken into account the costs directly incurred strictly for detection, monitoring and treatment of patients with TB (Table 1) [7], and it was not taken into account the cost of epidemiological investigations carried out in each case, the cost of investigations conducted for persons who were in contact with cases of tuberculosis and the cost of other medical supplies used in such cases.

Table 1. Costs incurred for the detection and treatment of a case suffering from TB

Costs taken into account	Value	
the pulmonology clinical examination	RON 16	
pulmonary x-ray	RON 27	
the bacteriological examination	microscopy RON 17	= RON 71
	culture RON 54	
drug sensitivity test (DST)	for the short series (isoniazid, rifampicin) is of RON 102	
	for a long series (and second line drugs) is of RON 841	
the maximum cost of a day of hospitalization (for 2013)*	RON 231 for chemosensitive TB cases	
the average cost for a treated TB patient	per year is of RON 491 (regimen I- 6 months, II – 8 months, individualized, but not for MDR-TB)	

In the study have been excluded tuberculosis cases with multidrug-resistance (MDR-TB) due to their particularities: a special regimen of treatment that covers 24 months, with two phases (intensive and continuation), with a higher cost (of RON 11,180 for around 24 months) and also the hospitalization that could cover 90 days and over (the cost for a day of hospitalization in such case is of RON 1,900) [7].

The data was summarized in a database in Excel and its processing was performed using SPSS version 19, and Microsoft Excel, including the descriptive statistics analysis of socio-demographic and clinical data, as well as concerning the assessment of direct costs.

#### 4. RESULTS

The number of persons reported as suffering from TB in Bucharest, in 2013, was of 1291, of which 45 were HA.

The cases of MDR-TB were eliminated: 3 among the 45 HA –remaining 42, and 46 among the GAP, as well as children under 18 years old reported during this period, so that the remaining people in the study from the latter category, suffering from chemosensitive / monoresistant TB, were 1,099 in number.

Most patients were men, i.e. 33 among HA and 660 among GAP (Fig. 1). There is a statistical significance between the two cohorts regarding their distribution by gender ( $p=0.015$ ).

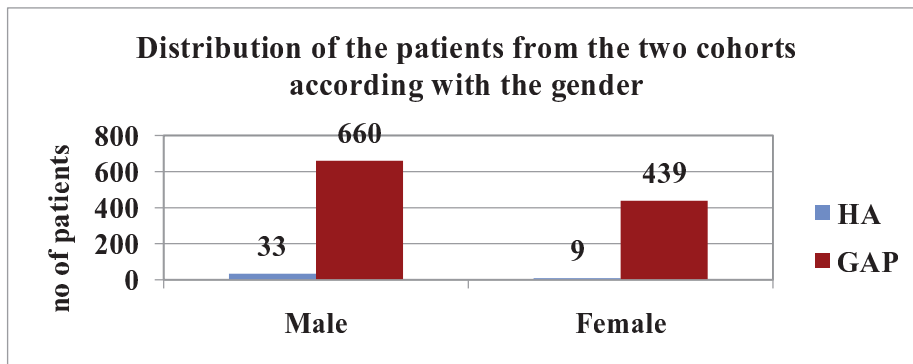


Fig. 1. Distribution of the two cohorts patients according their gender

Their average age is of  $43.74 \pm 12.26$  years old for HA and of  $43.94 \pm 17.38$  years old for GAP. The median among HA was of 44.00 years old and among GAP of 41.00 years old. Minimum age for HA was 19 and for GAP was 18, and the maximum age was 71 for HA, respectively 90 for GAP.

Depending on their location and classification at the time of reporting, most cases are pulmonary and new cases. Of the 42 cases of TB in HA, 40 of them are pulmonary cases, and of the 1,099 in GAP, 934 of them are pulmonary cases. Among the pulmonary cases in HA, 28 are new, 6 are relapses, 5 are defaults and 1 is failure, and out of the 934 pulmonary cases in GAP, 768 are new, 135 of them are relapses, 23 are defaults, 6 are failures and 2 are chronics. The 2 extrapulmonary cases in HA are new, and out of the 165 extrapulmonary cases in GAP, 153 are new, 11 of them are relapses and 1 is a failure.

The most common medical conditions associated with the TB patients reported in Bucharest, in 2013, were liver diseases - both for HA and GAP, namely 10 and 69 patients, as well as diabetes, alcoholism and drug addiction in GAP (56, 25, and respectively, 22 cases) and in HA, drug addiction and alcoholism, 7, respectively, 4 cases (Fig. 2).

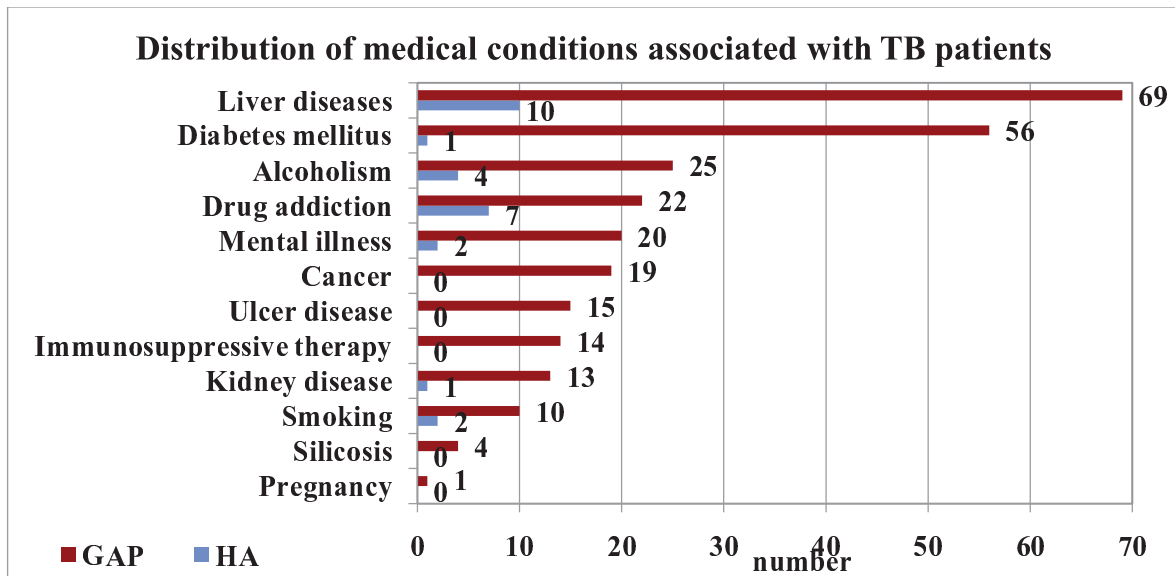


Fig. 2. Distribution of medical conditions associated with TB patients, HA versus GAP

In terms of HIV testing, 31 of the HA were tested and 740 of the GAP, and of these, 14 were positive in HA, respectively 40 in GPA, 13 of HA and 36 of GAP were receiving an antiretroviral treatment.

In terms of costs, all patients benefited from a pulmonology consult (RON 16) and X-rays (RON 27) - a total of 1,141 patients, meaning RON 1,806 for HA and RON 47,257 for GAP.

For the 42 HA patients, there were performed 210 bacteriological tests, with an average of  $5.00 \pm 2.34$ , minimum 0 and maximum 10 bacteriological tests per patient, a median, respectively a mode of 5, their cost being of RON 14,910. For the GAP patients, the number of bacteriological tests was of 4,350, with an average of  $3.95 \pm 2.41$ , minimum 0 and maximum 15 per patient, and a median, respectively a mode of 4. Their cost was of RON 321,900.

There have not been performed all drug sensitivity tests (DST) in patients with positive cultures, therefore, of the 37 culture-positive in HA patients, 7 DST have not been performed, and of the 681 culture-positive in GAP patients, 279 DST have not been performed. Of those performed for HA patients, the median, respectively the mode was 1, with a maximum of 2 DST, and of those performed for GAP patients, the median, respectively the mode was 0, with a maximum of 3 DST. In total, 35 DST were performed for HA patients, and 426 DST were performed for GAP patients. Only 18 DST were extended (long series), and among these, 2 of them were for HA patients. The total cost of such DST tests was of RON 5,048 (RON 3,366 + RON 1,682) for HA patients, and of RON 55,276 (RON 41,820 + RON 13,456) for GAP patients.

In terms of number of hospitalization days for patients with chemosensitive / monoresistant tuberculosis, they were of 5,320 for HA patients, with an average of  $126.66 \pm 81.49$  days, a median of 114 days, minimum 0 and maximum 331. For the GAP patients, the total number of hospitalization days for those suffering from chemosensitive / monoresistant tuberculosis, was of 46,470 days, with an average of  $42.24 \pm 39.43$  days, a median of 33 days, minimum 0 and maximum 356 (Table 2). The cost incurred with hospitalization days was of RON 1,228,920 for HA patients and of RON 10,734,570 for GAP patients.

Table 2. Number of hospitalization days for both HA and GAP

<b>Number of hospitalization days</b>		
	HA	GAP
Mean and Std. deviation	126.66±81.49	42.28±39.43
Median	114	33
Minimum- Maximum	5-331	0-356
Sum	5,320	46,470

Considering the average number of hospitalization days for HA and GAP (126.66±81.49 for HA versus 42.28±39.43 for PGA), the observed differences are statistically significant ( $p < 0.001$ ).

The average duration of treatment for the HA suffering from TB was of  $7.57 \pm 3.49$  months, with a minimum of 0.75 and a maximum of 15.00 months, and the median of 6.75 months. The average duration of treatment for the GAP suffering from TB was of  $6.95 \pm 2.47$  months, with a minimum of 0.00 and a maximum of 22.00 months, and the median of 6.25 months (Table 3). In total, the number of months of treatment for HA was of 318.00 months, the cost incurred being of RON 13,011.50, and the number of months of treatment for GAP patients was of 7,642.25 months, incurring a cost of RON 312,695.39.

Table 3. Duration of treatment for both HA and GAP patients suffering from sensitive / monoresistant TB (months)

<b>Duration of treatment for both HA and GAP patients suffering from sensitive / monoresistant TB (months)</b>		
	HA	GAP
Mean and Std. deviation	7.57±3.49	6.95±2.47
Median	6.75	6.25
Mode	8.00	6.00
Minimum-Maximum	0.75-15.00	0.00-22.00
Sum	318.00	7,642.25

The total average cost per HA patient was of RON 30,087.98 and the average cost per GAP patient was of RON 10,426.43, the differences being statistically significant ( $p < 0.001$ ), the increased costs for HA patients being determined by their long length of stay. The total cost for HA patients was of RON 1,263,695.50 and for GAP patients was of RON 11,458,648.39, whereas the total amount spent for treating these patients was of RON 12,722,343.89.

Regarding the outcomes of the treatment of patients suffering from sensitive / monoresistant TB, most of them are a therapeutic success, for both HA and GAP patients. Thus, of the 42 TB cases in HA, 20 were cured and 8 of them have completed the treatment, whereas in GAP, of the 1,099 cases, 553 patients were cured and 406 of them have completed the treatment. Among the HA patients, there were 5 defaults, 4 died, 3 were failure and 2 patients were lost of follow-up. For GAP patients, there was a total of 58 deaths, 37 defaults, 17 cases were considered as treatment failure and 10 were lost of follow up. Also, 6 of them are continuing treatment, and 12 patients have not been evaluated.

## 5. CONCLUSIONS

The characteristics of the patients suffering from TB in Bucharest show that they are young adults, men, associated with liver diseases, diabetes, drugs and alcohol consumption, mental illness, and with co-infection HIV. In terms of location, most of them are pulmonary cases (those that can transmit the disease).

The optimal length of stay for a TB case without multidrug-resistance, was set at 37 days, at the country level, in 2013. The average length of stay for HA patients is about 3.4 times higher than the average length of stay for TB cases at the country level, so that the costs of hospitalization are also higher (for GAP patients are 1.1 times higher) [8]. The average number of hospitalization days is about 3.0 times higher for HA patients than for GAP patients, as well as the average cost per patient, precisely because of the large number of hospitalization days for HA patients.

The duration of treatment for chemosensitive / monoresistant TB is about 7.6 months for HA patients and 6.9 months for GAP patients, but the incomplete treatments must also be considered (i.e. default, lost of follow up, died!).

## 6. DISCUSSIONS

There are still not evaluated people in the GAP group of patients and some who are still undergoing treatment, a fact which may influence to some extent the final results. As in the electronic database of NPPSCT are not passed information regarding radiological monitoring and biological examinations carried out on patients during treatment, the total cost could be undervalued.

For a proper monitoring and a comprehensive treatment, due to the particularities of the HA patients (unable to follow an appropriate hygienic-dietary regime, lack of minimum living conditions, high mobility, etc.), is preferred a treatment under direct observation – DOT [5] - administered in the hospital, thus leading to increased costs of hospitalization for these patients, otherwise, there is a higher risk of abandoning treatment and the danger of contracting resistant strains.

The difficulty lies in finding optimal solutions for a proper monitoring and a correct and complete treatment of these people, with the possibility to reduce cost, that means it would be necessary a collaboration between health services and social services, by addressing the HA problem in an interdisciplinary manner.

Perhaps the best solution to reduce these costs in the future should be regularly screening of HA [5], not just for TB, but also for hepatitis B and C, and HIV.

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