ESTIMATION OF THE BURDEN OF TUBERCULOSIS ON THE POPULATION HEALTH IN ROMANIA

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Abstract: *Romania is the first country in Europe regarding the incidence of tuberculosis. The study aims at assessing the burden of tuberculosis in Romania, expressed in DALY per total population and per counties, age groups and genders. 82.74% of the total potential years lost through premature death (YLL) that had tuberculosis as cause occurred in males, mostly between 30-59 years old. The same age groups determine the number of years of life lost by tuberculosis in women, about 63% of the total women YLL. For both genders, the large proportion of the disease burden was given by the premature deaths, 91% for men and 81% for women. Disease burden expressed in standardized rates of DALYs per 100,000 population by age is significantly higher in men than women (p <0.01). The counties with the highest burden of TB disease in men hold on the South and South-East of the country, and for women the West and South-West.*

Cuvinte cheie: *tuberculoză, DALY, ani de viaţă ajustaţi prin dizabilitate, YLL, YLD*

Rezumat: *România se află pe primul loc în Europa în ceea ce priveşte incidenţa prin tuberculoză. Studiul are ca scop evaluarea poverii tuberculozei în România, exprimată prin DALY, pe total populaţie, judeţe, grupe de vârstă şi sexe. 82,74% din totalul anilor potenţiali pierduţi prin decesele premature (YLL) care au avut ca şi cauză tuberculoza, au apărut la bărbaţi, cea mai mare parte între vârstele 30-59 de ani. Aceleaşi grupe de vârstă determină cei mai mulţi ani de viaţă pierduţi prin tuberculoză la femei, aproximativ 63% din totalul YLL la femei. Pentru ambele sexe, ponderea mare în povara bolii a fost dată de decesele premature, 91% pentru bărbaţi şi 81% pentru femei. Povara bolii exprimată prin rata DALY la 100.000 locuitori standardizată în funcţie de vârstă este semnificativ mai mare la bărbaţi faţă de femei (p<0,01). Judeţele cu cea mai mare povară a bolii dată de tuberculoză la bărbaţi ocupă partea de sud şi sud-est a ţării, iar la femei partea de vest şi sud-vest.*

INTRODUCTION

Tuberculosis has been, since 1990, among the top causes of death and burden of disease, expressed in DALYs.(2) In 2008, within the European Union (EU), 82,611 cases were reported of which 24,786 were reported in Romania. Of 65,094 new cases in the EU, 18,774 occurred in Romania. As a proportion of new cases of all new cases, Romania is the first country in the EU.

Tuberculosis is an important burden on population health because of the frequency of disease, because it affects relatively the young age and the decrease of the number of cases was not, in Romania, as large as in other EU countries, and therefore, it is necessary to evaluate it to the entire population and subgroups.

Efforts to develop indicators to measure the burden of the disease in a population have a long history, a growing interest can be noticed especially in the last two decades, given the fact that resources cannot meet the increasing demand of health care. The fundamental aim of developing various types of summative measurements is to identify the relative magnitude and to prioritize the health issues (diseases, accidents, risk factors). Disability adjusted life years (DALYs - Disability-Adjusted Life Years), developed by Murray and Lopez in 1996 to assess the burden of disease, is the most famous summative indicator of health. DALY extends the concept of potential years of life lost (PYLL - potential years of life lost, YLL) to include life years lost by disability (equivalent years of healthy life lost by having been spent in another state than in perfect health).

Therefore, the DALY is computed by adding the potential years of life lost (YLL) with years of life lost through disability (YLD) as:

$$DALY = YLL + YLD$$

The number of potential years of life lost is an estimate of the number of years that would have been lived if people had not died prematurely. As a method of analysis, it is an alternative to measure mortality by means of rates of mortality, an alternative that focuses on deaths occurring in younger ages. To calculate YLL, authors took as reference age, an upper limit against which to consider deaths as premature if they occurred before that.

In studies published on DALYs, the reference age for women was 82.5 and 80 for men. The estimation of years of healthy life lost due to non-fatal condition requires estimates of their incidence or prevalence. For each new case, the number of years of healthy life lost is obtained by multiplying the average duration of that condition (to remission or death) with a relative value that expresses the degree to which health is lost during illness. The data required to estimate YLD are: the incidence of that conditions (I), the relative value of disability (DW), the age at which the disease occurred (to calculate the average duration of disability - L) and distribution by severity, all these disaggregated by age and gender, so the formula becomes:

$$YLD = I \times DW \times L$$

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PURPOSE

The aim of this study was to assess the burden on tuberculosis, expressed by DALY, of the total population of Romania, by county and gender.

METHODS

The study is descriptive and, to estimate the burden of disease, the following types of data were used: the number of new cases of tuberculosis, by gender and county, provided by the "Marius Nasta" Institute of Pneumology and the data on population and deaths occurred because of tuberculosis, by gender and county, provided by the National Institute of Public Health - National Centre for Public Health Statistics and Information.

DALY was estimated using the following formula:(1)

$$DALY = \frac{KDCe^{\beta a}}{(b+r)^2}\left[e^{-(b+r)L}(1+(b+r)(L+a))-(1+(b+r)a)\right]+\frac{(1-k)}{r}(1-e^{-rL})$$

where K is age-weight modulation factor, D is the disability weight (or 1 for premature mortality), r is the discount rate (0,03%), C is the age weighting correction constant (0,1658), β is the parameter from the age-weighting function (0,04), a is the age of onset, and L is the duration of disability or the time lost due to premature mortality. In the study, negative HIV new cases of tuberculosis were taken into account, as well as the deaths due to tuberculosis in HIV negative people. For the disability weight (D), the values used in the Global Burden of Disease 1990 study and subsequent ones were taken into account (table no. 1).

Table no. 1. Disability weight GBD 1990 for tuberculosis

Untreated forms					Treated forms				
Age groups (years)					*Age groups (years)*				
0-4	**5-14**	**15-44**	**45-59**	**60+**	**0-4**	**5-14**	**15-44**	**45-59**	**60+**
0.294	0.294	0.264	0.274	0.274	0.294	0.294	0.264	0.274	0.274

RESULTS

Since the disease burden on the population, expressed in DALY is given by the potential years of life lost and years lost through disability for the same disease, in this study these two categories of indicators were separately analyzed, each of them by age and gender.

82.74% of the total potential years lost through premature death (YLL) that had tuberculosis as cause occurred in males, mostly between the ages 30-59. The same age groups determine the number of years of life lost by tuberculosis in women, approximately 63% of all YLL in women (table no. 2).

The large number of years of life lost through disability in the age group of 15-29 years old without being accompanied by a large number of years lost through premature death and considering that no data were available about the rate of healing or disease form at the moment of diagnosis, we can assume that in this age group, most cases are cured and/or discovered in the early stages.

Table no. 2. Potential years of life lost by tuberculosis in Romania, 2008

Age groups	YLL in men	% from total YLL in men	YLL in women	% from total YLL in women	Total YLL	% from total YLL
0-4	68.28	0.33%	35.29	0.81%	103.57	0.41%
5-14	37.17	0.18%	-	0.00%	37.17	0.15%
15-29	1,133.66	5.45%	650.51	14.99%	1,784.17	7.10%
30-44	7,175.34	**34.49%**	1,634.07	**37.66%**	8,809.40	35.04%
45-59	9,898.67	**47.58%**	1,100.51	**25.36%**	10,999.18	43.74%
60-69	1,715.23	8.24%	506.90	11.68%	2,222.13	8.84%
70-79	702.80	3.38%	335.31	7.73%	1,038.11	4.13%
80+	73.57	0.35%	76.78	1.77%	150.35	0.60%
Total	**20,804.72**	**100.00%**	**4,339.37**	**100.00%**	**25,144.09**	**100.00%**

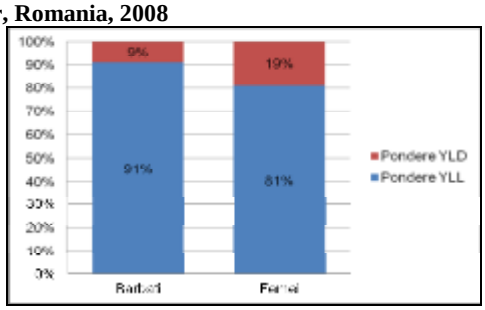
65.92% of all years of life lost through disability (YLD) on tuberculosis occurred in men. For both men and women, the large share of the burden of disease on disability occurs in the age group of 15-59 years old (table no. 3).

Table no. 3. Years of life lost due to disability given by tuberculosis, Romania, year 2008

Age group	YLD men	% from total YLD men	YLD women	% from total YLD women	Total YLD	% from total YLD
0-4	10.42	0.53%	10.78	1.07%	21.21	0.72%
5-14	43.93	2.25%	47.88	4.74%	91.81	3.10%
15-29	500.07	**25.58%**	400.82	**39.67%**	900.89	30.38%
30-44	651.05	**33.30%**	291.11	**28.81%**	942.16	31.77%
45-59	557.13	**28.49%**	152.98	**15.14%**	710.11	23.94%
60-69	121.05	6.19%	46.73	4.63%	167.78	5.66%
70-79	62.89	3.22%	48.75	4.83%	111.64	3.76%
80+	8.70	0.44%	11.37	1.13%	20.07	0.68%
Total	**1,955.25**	**100.00%**	**1,010.42**	**100.00%**	**2,965.67**	**100.00%**

For both genders, the large proportion of the disease burden was given by the premature deaths, 91% for men and 81% for women (figure no. 1).

Figure no. 1. Proportion of YLL from total DALY, by gender, Romania, 2008



The share of total DALY was 81% for men, the highest rate was in the age group of 45-59 years old. In women, the largest share of the disease burden is given by premature deaths and new cases of disease occurring in the age group of 30-44 years old (table no. 4).

Disease burden, expressed in rate of DALYs per 100,000 population standardized by age is significantly higher in men than women ($p < 0.01$).

On territorial profile, the disease burden was analyzed by comparing the standardized rates by age, region, counties and gender. For standardization, WHO standard population and the direct method were used.(4)

The development regions whose DALY rates per 1000.000 inhabitants standardized according to age, in men and for the total population are higher than the upper limit of the confidence interval (95%) are the South East and South West region and for women, the Western region (table no. 5).

Table no. 4. DALY from tuberculosis in Romania, 2008

Age group	DALY men	% from total DALY men	DALY women	% from total DALY women	Total DALY	% from total DALY
0-4	78.71	0.35%	46.07	0.86%	124.78	0.44%
5-14	81.11	0.36%	47.88	0.90%	128.99	0.46%
15-29	1,633.74	7.18%	1051.33	19.65%	2,685.06	9.55%
30-44	7,826.39	34.39%	1925.17	**35.99%**	9,751.57	34.69%
45-59	10,455.80	**45.94%**	1253.49	23.43%	11,709.29	41.66%
60-69	1,836.28	8.07%	553.63	10.35%	2,389.91	8.50%
70-79	765.69	3.36%	384.06	7.18%	1,149.75	4.09%
80+	82.27	0.36%	88.15	1.65%	170.42	0.61%
Total	**22,759.97**	**100.00%**	**5349.79**	**100.00%**	**28,109.76**	**100.00%**

Table no. 5. Standardized DALY per 100.000 inhabitants

Regions	Men	Women	Total
North-East development region - Bacău, Botoşani, Iaşi, Neamţ, Suceava,Vaslui	174.22	38.00	105.71
South-East development region - Brăila, Buzău, Constanţa, Galaţi, Vrancea, Tulcea	**222.28**	49.22	134.17
South-Muntenia development region - Argeş, Călăraşi, Dâmboviţa, Giurgiu, Ialomiţa, Prahova, Teleorman	215.40	40.27	126.71
South-West Oltenia development region - Dolj, Gorj, Mehedinţi, Olt, Vâlcea	**237.86**	51.89	144.36
Western development region - Arad, Caraş-Severin, Hunedoara,Timiş	186.41	**76.21**	128.56
North-West development region - Bihor, Bistriţa-Năsăud, Cluj, Sălaj, Satu Mare, Maramureş	129.71	40.58	83.92
Center development region - Alba, Braşov, Covasna, Harghita, Mureş, Sibiu	132.81	25.22	78.73
Bucureşti-Ilfov development region - Bucureşti and Ilfov county	179.94	39.18	104.84
Romania	**184,84**	**43,73**	**112,7**

Counties whose standardized DALY rates per 100,000 exceed the upper limit of the confidence interval (95%), both for men and women are: Galaţi, Covasna, Dolj, Bacău, Constanţa, Satu-Mare, Olt, Călăraşi, Caraş-Severin, Mehedinţi and Ilfov.

The county with the highest standardized DALY rate per 100,000 population is the Galaţi County. The counties with the highest burden of TB disease in men hold the South and the South-East of the country, and for women the West and South-West (figure no. 2 and 3).

Figure no. 2. Territorial distribution of standardized DALY rates per 100,000 population in men, Romania, 2008

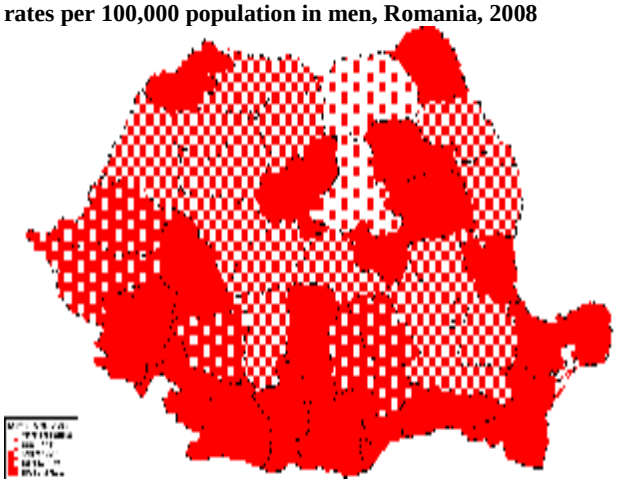
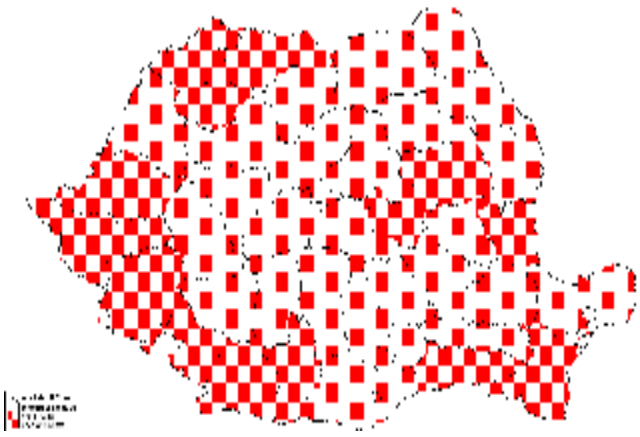


Figure no. 3. Territorial distribution of standardized DALY rates per 100,000 population in women, Romania, 2008



DISCUSSIONS AND CONCLUSIONS

The results presented above are based on the analysis of data collected routinely by the Ministry of Health, respectively, at the time of the study, data were not available for detailed analysis on recurrent disease burden, treatment resistant cases or disaggregated burden by disease stage of new cases of tuberculosis.

The advantage of estimating the disease burden in DALYs by comparison with the traditional evaluation methods, based on the analysis of mortality is that it explicitly brings into question the notion of disability as a factor for evaluation. The statistical epidemiological studies conducted within the Global Burden of Disease study were very large and have generated many discussions about the social and economic importance of this disease in certain ages.

In the current study, the adjustment factors were those used in GBD studies and published by Murray and Lopez, similar to other studies to estimate the burden of disease, an aspect of the discussion is the question of whether to use the adjustment factors resulting from studies conducted in other populations or to develop specific adjustment factors of studied population. Besides the fact that specific adjustment factors were not developed for the Romanian population, one advantage of using the GBD adjustment factors is related to the comparability of similar studies conducted on different populations.

Special attention in monitoring and control of tuberculosis should be given to Southern and South-East counties, because of significantly higher burden of tuberculosis in men in these areas and in the West and South-West counties for women.

Since most affected ages, both for men and women, are the ages of 30-59 years old, which are active ages, additional measures are needed to assess the health status in these ages at community level and probably, measures to improve the environmental conditions and nutrition.

In terms of the type of the disease causing death and disability, tuberculosis is a preventable and treatable disease and, as a result, tuberculosis burden could be almost entirely avoidable.

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