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A multi country comparison of the tuberculosis and endocrine related mortality in public health perspective

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Abstract

Aim: The aim of the study is to examine tuberculosis and endocrine-related deaths worldwide from WHO ICD-10 data with multi-country comparisons.

Materials and Methods: ICD-10 mortality data of WHO was used. Given mortality codes were examined, and mortality data records for 14 countries between 1996 and 2017 were used.

Results: For people over 60 ages, the most common mortality was reported for endocrine, nutritional and metabolic diseases, followed by respiratory related deaths. Respiratory related mortality is the most dominant mortality among other tuberculosis mortality and endocrine, nutrition and metabolic diseases related mortality. The most frequent mortality was reported in 2005, followed by 2004 and 2003. Infant deaths and 60 and above age mortality differences between gender groups were statistically insignificant for all mortality causes of the research ($p>0.05$). For under 60 ages, respiratory and other tuberculosis related mortalities were significantly higher in the male patients ($p<0.05$). Cause, year and country parameters were determinants of infant mortality with statistically significant rates ($p<0.05$). However, effect of gender on infant mortality for research causes was insignificant ($p>0.05$). For under 60 age group; cause, gender, year and country parameters had significant effect on mortality rates ($p<0.05$). Cause, gender, year and country parameters were not effective on mortalities above 60 ages ($p>0.05$).

Conclusion: Although there is no sufficient data to establish a direct relationship on TB-related deaths and endocrine-related deaths, the occurrence of both diseases in similar countries according to the World Bank development evaluation with same trends indicates the questioning of the relationship between these two disease groups.

Introduction

Tuberculosis, a disease caused by *Mycobacterium tuberculosis* mycrobacteria, is a public health problem with more than 10 million cases per year. The clinical features of the disease are characterized by chronic cough, loss of weight and appetite, fever, production of sputum, and hemoptysis [1-3]. While tuberculosis-related deaths have decreased by 42% until 2017, TB has become an increasingly threatening health threat today due to the increase in viral diseases such as HIV, which directly target the immune system, and resistance to antimicrobials used in the treatment process [4-7].

The word endocrine refers to specific stimuli, that is, the mixing of hormones produced from hormonal glands into the blood [8]. The basic glands of the endocrine system are listed as thyroid, pancreas, parathyroid, adrenals and gonals, testest and ovaries [9]. The biological role of the endocrine system is closely related to the nervous system, and these two systems coordinate organs and systems together [10]. There are many diseases related to the endocrine system and it can be stated that the majority of them are related to nutrition and metabolic errors. In the WHO ICD-10 mortality database, deaths related to the endocrine system are considered in the same category as nutrition and metabolic diseases [11].

The increase in mortality rates related to TB in recent years caused this disease to be the subject of research both in public health and clinical applications [12-14]. Similarly, endocrine-induced morality studies are conducted [15]. In recent years, the effect of the endocrine system on tuberculosis is increasingly being studied [16]. In this research, it was aimed to examine tuberculosis and endocrine-related deaths worldwide from WHO ICD-10 data with multi-country comparisons.

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Materials and Methods

In this comprehensive retrospective research, ICD-10 mortality data parameters of WHO were used. In ICD-10 mortality data, there are two tuberculosis and two endocrine related data category as "1005: A15-A16: Respiratory tuberculosis", "1006: A17-A19: Other tuberculosis", 1051: E00-E88: Endocrine, nutritional and metabolic diseases" and "1054: E00-E07, E15-E34, E50-E88: Remainder of endocrine, nutritional and metabolic diseases". Given mortality codes were examined, and mortality data records for 14 countries between 1996 and 2017 were used. The research was conducted in 2021. Since this is an observational study with anonymous data base of the WHO, the Yeditepe University Ethics Committee has confirmed that no ethical approval is required. Whole number sampling was done in the sampling. In this context, all countries and years in which deaths due to endocrine and tuberculosis were reported from WHO ICD-10 data were included in the study. The following hypothesis was tested in the research: H0: Cause, year, country and sex effects tuberculosis and endocrine related deaths.

Statistical analysis

In statistical analysis, SPSS 17.0 for windows was used. Nominal and ordinal parameters were described with frequency analysis whereas scale parameters were described by means and standard deviations. Kolmogorov Smirnov Test was used for normality of scale parameters. For non-normally distributed parameters, Mann Whitney U test was used. For normally distributed parameter differences, Independent Samples t-test was used. Multivariate regression analysis was used for relationship between mortality rates and covariates due to linearization deviations [17]. All analysis was performed at SPSS 17.0 for windows at 95% confidence interval.

Results

Respiratory tuberculosis related mortality was only reported in Syrian Arab Republic. Endocrine, nutritional and metabolic diseases related mortality was reported in Brunei Darussalam and Syrian Arab Republic, in which mean deaths in Syrian Arab Republic was significantly higher than Brunei Darussalam ($p<0.05$) (Table 1).

Deaths at under 60 ages mean were the highest in respiratory related tuberculosis, followed by endocrine, nutritional and metabolic diseases. Russian Federation was the country in which all death rates were the highest.

For people over 60 ages, the most common mortality was reported for endocrine, nutritional and metabolic diseases, followed by respiratory related deaths. Mortalities above 60 ages were only reported for Syrian Arab Republic and Russian Federation. According to Table 2, respiratory related mortality is the most dominant mortality among other tuberculosis mortality and endocrine, nutrition and metabolic diseases related mortality. The most frequent mortality was reported in 2005, followed by 2004 and 2003. For endocrine, nutritional and metabolic diseases related mortality, distribution was more stable than respiratory related deaths. In other words, dependency of respiratory related mortality to year was higher than endocrine related mortality rates.

Although respiratory related mortality was more common before 60 ages, endocrine, nutrition and metabolic diseases related mortality was more common after 60 ages (Table 2). Difference analysis results showed that infant deaths and 60 and above age mortality differences between gender groups were statistically insignificant for all mortality causes of the research ($p>0.05$). For under 60 ages, respiratory and other tuberculosis related mortalities were significantly higher in the male patients ($p<0.05$) (Table 3).

Regression analysis results showed that cause, year and country parameters were determinants of infant mortality with statistically significant rates ($p<0.05$). However, effect of gender on infant mortality for research causes was insignificant ($p>0.05$). For under 60 age group, cause, gender, year and country parameters had significant effect on mortality rates ($p<0.05$). Cause, gender, year and country parameters were not effective on mortalities above 60 ages ($p>0.05$) (Table 4).

Discussion

In this study, it was aimed to investigate TB and endocrine-related mortalities over the WHO ICD-10 mortality data set. In the study, mortality data of all countries in the ICD-10 data set between 1996 and 2017 were examined. The causes of mortality were examined in four categories as i. Respiratory tuberculosis, ii. other tuberculosis, iii. Endocrine, nutritional and metabolic diseases, and iv. Reminder of endocrine, nutritional and metabolic diseases, as in the ICD-10 report.

It is observed that the mortality values related to TB have increased in recent years due to various reasons, especially HIV. Other reasons for increasing TB mortality values can be listed as resistant bacteria and factors that cause weakening of the immune system [18-21]. In our study, TB deaths were common and high in certain regions, especially in Russia, Ukraine and Kazakhstan. This may be related to low health opportunities in the region and HIV prevalence.

Age is an important factor in TB deaths, and it is thought that immune system changes with age or immune system diseases are effective in TB deaths [22-25]. In our study, TB-related deaths are mostly seen in the population under 60 years of age. Considering that the HIV virus is mostly sexually transmitted and that sexual activity is higher under 60 years, the majority of these deaths may be related to HIV.

Deaths related to the endocrine system were given together with nutrition and metabolic diseases. This grouping by WHO shows that the endocrine system is practically associated with metabolism [7]. In our study, like TB deaths, endocrine-related deaths were seen in the same regions of the world, primarily the Russian Federation. On the other hand, deaths under 60 were predominant in endocrine-related deaths, whereas deaths under 60 were in majority in TB deaths.

According to deaths by years, TB deaths peaked between 2003 and 2005, while a relatively more stable change in endocrine-related deaths was observed. It is possible to think that TB-related deaths are more variable than endocrine-related deaths, and that they are associated

Table 1. Infant, under 60 ages, 60 and above ages death means according to country and cause (1996-2017).

	Respiratory tuberculosis	Other tuberculosis	Endocrine, nutritional and metabolic diseases	Reminder of endocrine, nutritional and metabolic diseases
Infant deaths				
Brunei Darussalam	-	-	0.10±0.32	0.17±0.41
Syrian Arab Republic	0.25±0.50	-	30.75±7.41	21.50±5.57
Total	0.06±0.24	-	4.77±11.59	4.83±9.46
Under 60 ages				
Brunei Darussalam	1.55±1.01	1.14±0.69	7.90±3.25	1.00±0.89
Oman	3.50±3.53	1.00±0.01	95.50±40.30	25.00±8.48
Sri Lanka	264.07±135.06	3.78±2.26	370.21±96.18	33.36±12.99
Syrian Arab Republic	10.50±5.26	0.67±0.58	174.25±5.31	56.00±5.89
Azerbaijan	383.12±265.05	12.25±7.87	190.62±16.04	18.37±5.63
Belarus	277.50±236.28	34.11±26.99	87.89±18.07	27.61±6.17
Kazakhstan	1034.89±738.10	51.50±25.77	247.44±23.98	50.50±13.59
Russian Federation	9542.84±7306.10	1201.91±780.96	1862.75±281.39	333.97±41.17
Ukraine	2279.27±1916.37	1166.45±864.90	577.18±133.05	114.73±25.38
Total	3039.08±5360.83	535.17±787.41	672.01±726.96	125.09±130.12
60 and above ages				
Syrian Arab Republic	8.75±5.38	0.67±0.58	292.25±13.86	30.75±5.44
Russian Federation	1251.50±1028.84	223.50±89.80	3545.50±2522.25	138.00±73.54
Total	423.00±789.66	89.80±130.05	1376.67±2023.55	66.50±64.55

Table 2. Mean deaths under 60 ages distribution according to years

Year	Respiratory tuberculosis	Other tuberculosis	Endocrine, nutritional and metabolic diseases	Reminder of endocrine, nutritional and metabolic diseases
1996	1±0.01	1.00±0.01	11.50±3.54	2.00±0.01
1997	139.75±180.58	2.33±0.58	180.50±214.21	34.33±32.65
1998	174.67±192.09	5.33±3.79	163.25±190.32	22.00±25.18
1999	3775.00±7951.90	250.67±505.11	883.17±1102.96	170.00±206.24
2000	3777.83±7804.86	363.17±749.00	853.17±1045.27	167.60±204.68
2001	3806.50±7418.16	388.33±770.34	887.33±926.89	136.50±176.46
2002	3153.75±6915.66	309.88±700.01	684.25±833.32	107.75±154.98
2003	3225.38±6988.75	352.00±774.96	719.00±911.60	106.00±157.61
2004	4532.50±7734.89	474.50±851.61	836.83±967.70	143.83±176.70
2005	5901.83±7587.55	1044.83±1151.81	1015.00±807.52	187.83±136.35
2006	5170.17±6662.67	992.33±1095.55	976.67±758.64	172.67±127.43
2007	3670.63±5390.66	729.88±978.35	715.88±706.23	131.13±123.12
2008	2847.10±4882.69	671.44±983.11	574.30±641.97	112.60±110.51
2009	2075.58±4144.61	490.91±821.31	477.33±581.85	102.83±107.98
2010	2806.25±4341.27	624.63±836.36	614.00±594.37	125.75±115.63
2011	2536.50±4000.16	581.88±790.43	559.25±560.49	126.50±122.07
2012	2918.83±3832.82	712.83±757.24	733.33±587.27	147.50±108.11
2013	2943.75±4244.57	496.00±681.72	796.50±832.66	157.75±142.94
2014	2175.83±2982.05	589.33±644.62	811.33±882.61	139.00±124.31
2015	1178.50±1141.98	749.50±661.14	428.50±14.85	79.00±15.56
2017	938.50±883.18	597.00±555.79	392.50±51.62	70.00±1.41

with the emergence of the HIV virus and the fight process.

When the effect of gender on TB and endocrine-related deaths is analyzed, only a significant difference was noted in terms of gender in TB-related deaths under 60 years of age. This indicates that gender plays an important role in TB and endocrine-related deaths only in the values reported by the WHO.

According to the results of the regression analysis, while the cause of death, year and country variable had significant effects in under-60 and infant deaths; The effect of gender is not significant in infant deaths. From here, it

Table 3. Differences of mortality rates based on gender, mortality type and age group.

	Males	Females	p
Infant deaths, median (Min-Max)			
Respiratory tuberculosis	0 (0-1)	-	0.743[a]
Other tuberculosis	-	-	N/A
Endocrine, nutritional and metabolic diseases	0 (0-39)	0 (0-32)	0.762[a]
Reminder of endocrine, nutritional and metabolic diseases	0 (0-27)	0 (0-21)	0.703[a]
Under 60 ages, median (Min-Max)			
Respiratory tuberculosis	1563 (1-20789)	351 (1-4134)	0.000[a]*
Other tuberculosis	82 (0-2595)	34 (0-627)	0.008[a]*
Endocrine, nutritional and metabolic diseases	423 (7-2233)	281 (3-2353)	0.759[a]
Reminder of endocrine, nutritional and metabolic diseases	47.5 (0-431)	64.5 (1-403)	0.645[a]
60 and above ages			
Respiratory tuberculosis	667.67±1135.65	178.33±299.37	0.537[b]
Other tuberculosis	96.33±165.12	80.00±113.14	0.912[b]
Endocrine, nutritional and metabolic diseases	780.00±850.57	1973.33±2906.10	0.532[b]
Reminder of endocrine, nutritional and metabolic diseases	51.67±29.94	81.33±94.13	0.630[b]

a. Mann Whitney U Test, b. Independent Samples T-Test, p<0.01.

Table 4. Regression analysis results for mortality, cause, year, country and sex.

	Unstandardized Coefficients		Standardized Coefficients	t	p	%95 Confidence Interval	
	B	Std. Error	Beta			Min	Max
Infant deaths							
(Constant)	-2005.772	293.578		-6.832	.000*	-2591.921	-1419.624
Cause	.142	.033	.375	4.281	.000*	.076	.208
Year	.917	.145	.723	6.304	.000*	.626	1.207
Sex	-.555	1.454	-.032	-.381	.704	-3.458	2.349
Country	.010	.001	.952	8.159	.000*	.007	.012
						R^2=0.515; df=4-70	
Under 60 ages							
(Constant)	260369.942	57493.092		4.529	.000*	147410.468	373329.415
Cause	-30.716	5.112	-.243	-6.009	.000*	-40.759	-20.673
Year	-117.734	28.953	-.200	-4.066	.000*	-174.619	-60.849
Sex	-1222.646	240.474	-.206	-5.084	.000*	-1695.118	-750.175
Country	2.600	.361	.354	7.196	.000*	1.890	3.310
						R^2=0.179; df=4-501	
60 and above ages							
(Constant)	-18621.854	1135438.835		-.016	.987	-2404090.328	2366846.621
Cause	9.149	9.718	.188	.941	.359	-11.268	29.566
Year	2.259	567.611	.002	.004	.997	-1190.248	1194.765
Sex	168.744	457.778	.073	.369	.717	-793.012	1130.500
Country	1.335	1.639	.500	.814	.426	-2.108	4.777
						R^2=0.132; df=4-22	

*p<0.01.

may be argued that the absence of sexual life in the infant period is effective. It may also be argued that due to low sexual activity over 60 years of age, HIV and similar causes have no effect. No significant relationship was observed in deaths over 60 years of age by country, year, cause and gender.

Limitations

Since the most updated data includes 2017 for all countries, 2017 was date limitation of the study. Another important limitation was that reliability of mortality rates and other parameters were related with WHO statistics. Although WHO is one of the most reliable data provider in the world on the health area, some bias due to country

reports to WHO may affect results.

Conclusion

According to results of the research, deaths caused by TB and endocrine are very common especially in certain regions of the world, in Russia and its surroundings. These rates, which are higher than other parts of the world, indicate that there are important deficiencies in these regions in terms of public health. Considering that health is a global public good, it is useful to conduct studies to decrease the mortality rates that are higher than other regions in these regions.

The fact that deaths caused by TB are more common under the age of 60 and that the sex is effective in the infant or not over the age of 60 but under the age of 60 suggests the sexual transmission status and HIV virus. However, the fact that gender, age, country and cause of death are not effective in patients over 60 shows that TB and endocrine related deaths are less in older ages. This situation can be explained by HIV and advanced follow-up. Although there is no sufficient data to establish a direct relationship on TB-related deaths and endocrine-related deaths, the occurrence of both diseases in similar countries according to the World Bank development evaluation with similar changing trends indicates the questioning of the relationship between these two disease groups.

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Ethical approval

It is a study that does not require an ethics committee decision.

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