Inequalities in Mortality From Infectious Diseases and Tuberculosis by the Level of Education in Lithuania

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Key words: *infectious diseases; tuberculosis; education; inequalities; mortality.*

Summary. *The aim of this study was to evaluate changes in inequalities in mortality from infectious diseases and tuberculosis by educational level among men and women in Lithuania.*

Material and Methods. The data on mortality from infectious diseases in the Lithuanian population aged more than 30 years for the years 1989 and 2001 gathered from the Department of Statistics and censuses were used for the analysis. The relative and slope indices of inequality were calculated.

Results. Mortality from infectious diseases and tuberculosis among persons with primary education was higher than that among persons with university education, and these inequalities were found to be increased in 2000–2002 as compare with 1988–1990 due to declining mortality among persons with university education and increasing mortality among less educated persons. Similar tendencies were observed while evaluating the inequalities in mortality from tuberculosis. In 1988–1990, the relative indices of inequality for mortality from all infectious diseases and tuberculosis among men were 9 and 13, respectively. In 2000–2002, the relative indices of inequality increased significantly to 16.5 and 28.8, respectively. Inequalities in mortality from abovementioned causes for women with different educational levels were lower than those for men. The slope indices of inequality for mortality from infectious diseases among men with different educational levels were considerably higher than among their female counterparts, and in 2000–2002, they were greater compared with 1988–1990.

Conclusions. While implementing tuberculosis prevention and control program and planning prevention and control measures, greater attention should be paid to less educated Lithuanian population at highest risk of this disease.

Introduction

Differences in mortality among people with different educational levels are one of the key parameters of health, social, and economic inequalities (1). In Lithuania, education is considered as one of the most important factors differentiating the prevalence of social inequality and poverty (2). Higher educational level is associated with lower mortality indices and better health of the population. In Lithuania, as in other countries over the world, mortality rates in people with the lowest educational levels are highest (3). Earlier studies showed that differences in mortality among people with different education levels in Lithuania were considerable even at the end of the 1980s, and during the period of socioeconomic transition, differences increased even more (4, 5).

Infectious diseases continue to represent an epidemiologically important public health area (3). Death from infectious diseases in Lithuania ranked eight in 1989, but by 2001 had moved up to sixth place among other death causes and increased from 8.76 to 13.26 cases per 100 000 population (6). Moreover, this index in Lithuania was higher than in most other European Union countries (7, 8). Tuberculosis is a major and one of the most threatening causes of death from infectious diseases in Lithuania. It accounts for the overwhelming majority of deaths from infectious diseases (9). According to the data of the World Health Organization, tuberculosis is one of the most prevalent infectious diseases, affecting one-third of world's population. Over 9 million new cases of tuberculosis occur annually in the world (10). Within the period of 2003–2006, the State Tuberculosis Prevention and Control Program was implemented in Lithuania. Surveillance of mortality from tuberculosis revealed that in 1995, the mortality rate was 13.4 cases per 100 000 population and it decreased to 9 cases per 100 000 in 2004, rising up again to 10.8 cases per 100 000 in 2005 and 10.9 cases per 100 000 population in 2006. The State Tuberculosis Prevention and Control program 2007–2010 aimed to reduce the mortality rate from tuberculosis to 6.5 cases per 100 000 population by 2010 (11). Considerable sociodemographic inequal-

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ities in mortality from infectious diseases are typical of Lithuania (12); however, they have not been extensively studied yet.

The aim of this study was to evaluate changes in the inequalities in mortality from infectious diseases among Lithuanian men and women comparing the groups of different educational level.

Material and Methods

Data on Lithuanian inhabitants and deceased population due to infectious diseases in 1988–1990 and 2000–2002 were retrieved from the Department of Statistics to the Government of the Republic of Lithuania. Persons aged 30 years and more were enrolled into the study. By educational level, inhabitants were divided into four groups: primary (upper years of school or no diploma of graduation), lower secondary (5–10 grades), upper secondary (secondary education with 11–12 years of school) and professional college, and university education (diplomas or degrees from an institute or university). While evaluating the differences in mortality from infectious diseases according to the International Statistical Classification of Diseases and Related Health Problems (10th Revision), population was stratified into three groups: all infectious diseases (A00-B99), tuberculosis (A15-A19, B90), and other infectious diseases (A00-A14, A20-B89, B91-B99). Mortality rates were standardized according to age by the method of direct standardization using the age distribution of European standard population. The relative index of inequality was determined for evaluation of inequalities in mortality. The methodology proposed by Kunst and Machenbach was used (13). The relative index of inequality can be interpreted as the predicted mortality rate at the lower end of the hierarchy compared to the rate at the higher end of the hierarchy. While calculating this index, the ranking of the population by educational level was employed, i.e., a proportion of the population with higher educational level expressed in percentage. It ranged from 0 to 1, when 0 represented the mortality in the groups of highest education level, and 1 – the mortality in the groups of the lowest education level. The relative indices of inequality and its 95% confidence intervals (CI) were calculated using the Poisson regression model, including the age adjusted in 5-year intervals. Regression analysis was performed using the SAS 8.2 statistical package. In addition, the slope index of inequality was computed. It is an absolute difference in mortality rate between the groups of the lowest and highest education levels. When slope index of inequality equals 0, it indicates no inequality. The higher this index is, the greater are inequalities. Indices of inequalities in mortality from infectious diseases were determined for the periods 1988–1990 and 2000–2002.

Results

The distribution of Lithuanian population by educational level in 1989 and 2001 varied (Table). The proportion of men and women with primary and lower secondary education decreased, and the proportion of inhabitants with upper secondary or professional college and higher education increased. The proportion of men and women with primary education and women with lower secondary education decreased in the age group of more than 30 years, and the proportion of men with lower secondary education in the age group of more than 35 years. An increase in the number of men and women with upper secondary and higher education was documented in the age groups of more than 35 years.

Deaths from tuberculosis accounted for the overwhelming majority of deaths due to infectious diseases. In 1989, death from tuberculosis occurred in 70.4% of all the deceased from infectious diseases, and in 2001, this percentage increased to 76%.

Figs. 1 and 2 depicts the inequalities in mortality from infectious diseases in population of different educational level, and educational level is expressed as a rank from the highest educational group to the lowest one. This rank shows a proportion of population that has a higher educational level than a hypothetical person matching this rank. In 1988–1990, considerable inequalities in male and female mortality from infectious diseases in different educational groups were documented. Mortality from infectious diseases as well as that from tuberculosis increased with an increasing educational rank and decreasing education level. In 2000–2002, these inequalities increased even more due to increasing mortality

Table. The Distribution of Lithuanian Inhabitants Aged 30 Years and More by Educational Level in 1989 and 2001

Level of education	1989			2001		
	Men	Women	Total	Men	Women	Total
Primary	30.8	39.3	35.5	15.2	21.8	18.9
Lower secondary	18.5	13.3	15.6	14.3	9.8	11.8
Upper secondary or professional college	38.3	36.1	37.1	54.9	51.7	53.1
University	12.4	11.3	11.8	15.6	16.7	16.2

Values are percentages.

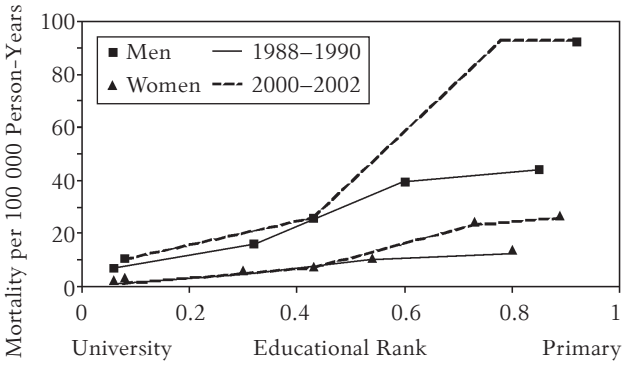

Fig. 1. Standardized indices of mortality from infectious diseases for men and women aged more than 30 years in 1988–1990 and 2000–2002 (per 100 000 person-years)

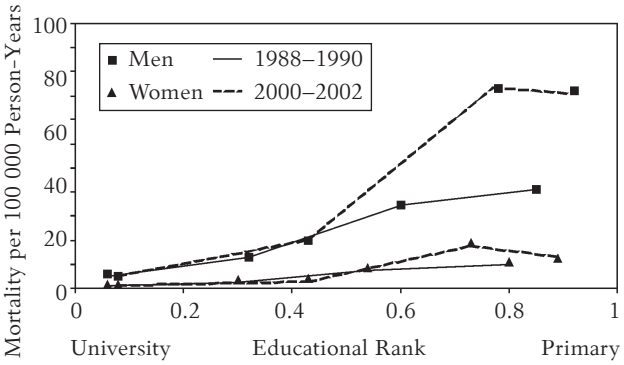

Fig. 2. Standardized indices of mortality from tuberculosis for men and women aged more than 30 years in 1988–1990 and 2000–2002 (per 100 000 person-years)

from abovementioned causes in the least educated and due to decreasing mortality in the most educated groups. Inequalities in mortality from infectious diseases among men were greater than women.

The evaluation of the relative indices of inequality for mortality from infectious diseases in men and women among the groups with different educational level showed that in 1988–1990, the mortality rate from all infectious diseases was 9-fold higher (95% CI, 5.9–13.6) and mortality from tuberculosis was 13-fold higher (95% CI, 8.2–20.5) in men with primary education than men with university education (Fig. 3). Afterward, an increasing trend in these inequalities was observed, and in 2000–2002, men with primary education were 16.5 times (95% CI, 12.0–22.7) and even 28.8 times (95% CI, 20.1–41.1) more likely to die from infectious diseases and tuberculosis, respectively, than their counterparts with university education. Among women, inequalities in mortality from the abovementioned causes were considerably lower than men (Fig. 4). Women with primary education in 1988–1990 died from infectious diseases and tuberculosis 2.8 (95% CI, 1.3–6.0) and 2.9 times (95% CI, 1.1–7.9), respectively, more frequently than those with university education, and in 2000–2002, these differences were even greater: death from the mentioned causes occurred 6.4 (95% CI, 3.6–11.4) and 15.1 times (95% CI, 6.7–34.2) more often among women with primary education than those with university education. Moreover, in 2000–2002, inequalities in mortality from other infectious diseases were observed: women with primary education were 2.5 times (95% CI, 1.13–5.36) more likely to die from these causes that those with university education.

The slope indices of inequality for mortality from infectious diseases were substantially greater among men in different educational groups than women and in 2000–2002 than 1988–1990. In 1988–1990, death from all infectious diseases occurred more frequently in men and women with primary education than those with university education (a difference of 38 men and 6 women per 100 000 person-years, respectively) (Fig. 5). Tuberculosis-related deaths contributed the most to these inequalities: in the same years, more persons died from tuber-

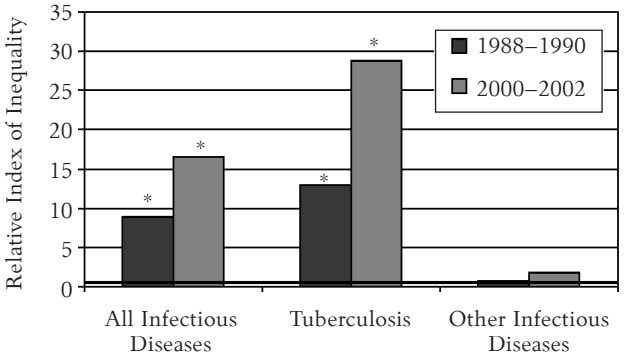

Fig. 3. The relative indices of inequality for mortality from infectious diseases for Lithuanian men with different educational levels and aged 30 years and more in 1988–1990 and 2000–2002

*$P<0.05$.

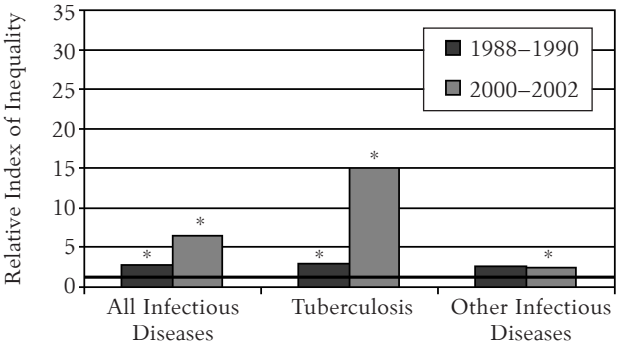

Fig. 4. The relative indices of inequality for mortality from infectious diseases for Lithuanian women with different educational levels and aged 30 years and more in 1988–1990 and 2000–2002

*$P<0.05$.

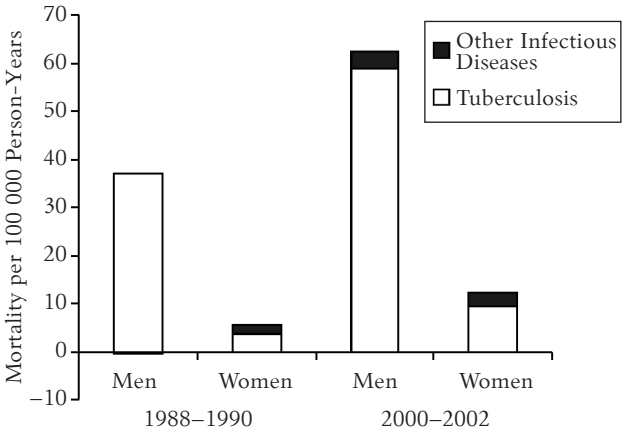

Fig. 5. The slope indices of inequality for mortality from infectious diseases per 100 000 person-years for Lithuanian men and women with various educational levels and aged 30 years and more in 1988–1990 and 2000–2002

culosis in the group of primary education than in the group of university education (by 37 men and 4 women per 100 000 person-years). In 2000–2002, deaths from all infectious diseases and tuberculosis occurred more frequently among the least educated persons than their counterparts with university education (a difference of 67 men and 13 women per 100 000 person-years and 59 men and 9 women per 100 000 person-years more, respectively).

Discussion

During this study, for the evaluation of inequalities in mortality from infectious diseases in Lithuania, the relative and slope indices of inequality were computed and employed. These indices are more informative than relative risk and absolute difference between different educational groups because the latter ones allow for comparison of only two educational groups. Meanwhile, while calculating the relative and slope indices of inequality, the whole population and all educational groups can be included in a regression model. However, this method also has some limitations. Firstly, the presumption that a direct dependence between mortality and educational level exists has to be accepted. Secondly, calculation of these indices and interpretation of the results are more complex (14).

The findings of the study showed that inequalities in mortality from infectious diseases from 1989 to 2001 had a tendency to increase. This gives a reason for concern if such results could not be affected by data reliability. In the evaluation of social inequalities in mortality, the problem of numerator/denominator bias often is encountered. Such possible biases may occur when social status of a deceased person is determined based not on documentation, but on reports of the relatives. Such distortions might be considerable while evaluating deceased persons by nationality, educational level, occupation, i.e. by characteristics that are not indicated in a passport or other document of a deceased person. Social characteristics of the population are gathered most precisely during population censuses; however, in this case, there is a high probability that during population census, a person indicated his/her social status differently than it was declared by his/her relatives after his/her death (15). Moreover, the change from ICD 9th revision to 10th revision could result in biased estimations; however, these discrepancies in all groups of different educational level had to be similar (16). An additional concern was the fact that during this study, we were able to evaluate inequalities in mortality from infectious diseases by different educational levels only 1989 and 2001, when population censuses were carried out. During other years, the distribution of the population by education level was not registered. In addition, in 1989 and 2001, the population was stratified by educational level slightly differently: in 1989, inhabitants were divided into 6 educational groups, and in 2001, into 4. Therefore, the groups of the year 1989 were adjusted to those of the year 2001 by merging the groups of uncompleted higher education, special secondary, and basic secondary education into one group of junior college and secondary education.

Numerous studies have reported that less educated persons more frequently complain of worse health and die due to the major causes of death, such as diseases of the cardiovascular system, malignant tumors, accidents, and trauma (4). The results of our study indicate that deaths from infectious diseases occurred more frequently in persons with primary and lower education than those with higher education, and these inequalities had a tendency to increase. The main causes of the spread of infectious diseases, especially tuberculosis, in Lithuania are increasing poverty, unemployment, alcoholism, inadequate prevention, and delayed diagnosis (17). Aforementioned inequalities could be caused by the fact that less educated people could not adjust to the new political and economic system during the period of transition, after Lithuania regained its independence. Development of market economy, unemployment, poverty, and increasing social inequality were characteristic of this period (18). Graduates adjusted to changing conditions more easily both financially and psychologically; moreover, they had more knowledge about infectious diseases and their prevention. A considerable increase in mortality from infectious diseases and especially tuberculosis among the least educated persons from 1989 to 2001 also confirms the hypothesis that poverty was one of the major causes of these inequalities (16).

During 2001–2004, the Program for Increasing Employment was implemented (19), which reduced the level of unemployment considerably across the country. Recently, the problems of employment are being solved following the National Lisbon Strategy Implementation Program, which includes the chapter titled "Employment Policy Aiming to Stimulate Employment and Investment in Human Capital," approved by the resolution of the Republic of Lithuania, dated November 22, 2005 (20). However, due to unfavorable recent years' economic situation in Lithuania, unemployment increased again during 2008–2010 (21).

The loss of stable social status and poverty affect health through behavioral mechanisms as well. Numerous studies have suggested that the spread of infectious diseases and especially tuberculosis is associated with alcohol consumption (22–24). Due to rather liberal policy of alcohol consumption and distribution, its role could be significant in Lithuania too. The National Health Board described the current situation of alcohol consumption in Lithuania as critical in 2007 (25).

This study revealed that inequalities in mortality from infectious diseases were greater among men than women. It can be related to the fact that in Lithuania, as in other countries too, males consume more alcohol than females.

The State Alcohol Control Program 1999–2010, adopted by the resolution of the Government of the Republic of Lithuania in 1999, included the strategy employing a variety of measures, which obligated various ministries and institutions to change the situation substantially (25, 26). However, the National Health Board, after revision of implementation of the State Alcohol Control Program, has concluded that the program was not effective, many measures were not carried out or were carried out insufficiently, and the coordinating and leading role of the Ministry of Health was missing (25).

Only in the year 2008, which was announced as the year of abstinence, decisions important to reducing alcohol consumption were taken and started to execute: rise of alcohol costs by increasing the excise duty on alcoholic beverages, restrictions on alcohol advertising in the media, and goal-oriented activities of controlling institutions. The year 2008 became a turning point when for the first time alcohol consumption was considerably reduced during the latter 20-year period.

The Lithuanian Health Program aimed to reduce tuberculosis morbidity by 30% by the year 2010 (17). One of the tools for implementation of this goal is the execution of the National Tuberculosis Prevention and Control Program. In 2003–2006 while implementing this program, free treatment for all patients with tuberculosis regardless their social status was ensured (27). However, in 2006, the National Health Board, after the evaluation of implementation of this program, concluded that the epidemiologic situation of tuberculosis morbidity remained unfavorable. New tuberculosis cases in Lithuania still had been identified by means of passive prevention when a patient referred to a health care institution. Given that the majority of persons in the social risk group were not registered at health care institutions, it is thought that a considerable number of the disease cases remain unidentified. One more problem disclosed by the National Health Board was irresponsible behavior of persons with tuberculosis, treatment avoidance, or discontinuous treatment. Moreover, the Board reported that the coordination of activities among individual institutions, agencies, and specialists dealing with patients with tuberculosis is insufficient and there is a lack of greater attention and support from the Ministry of Social Security and Labor and municipalities for solving the social problems of these patients (11). In 2007–2010, a New National Tuberculosis Prevention and Control Program was prepared that aimed to reduce the tuberculosis morbidity and mortality rates to 45 new cases per 100 000 population and 6.5 cases per 100 000 population, respectively, by year 2010 (28). The goal was almost reached: morbidity and mortality rates were 47.9 and 6.7 cases per 100 000 population, respectively, in Lithuania in 2010 (29).

Therefore, inequalities in mortality from infectious diseases have been recognized as an important public health issue in Lithuania. In 2007 Mackenbach emphasized that inequalities are one of the main challenges for public health, and there is a great potential for improving average population health by eliminating or reducing the health disadvantage of lower socioeconomic groups. This requires an active engagement of many policy sectors, not only of the public health and health care systems, but also of education, social security, working life, city planning, etc. (30).

Conclusions

The relative and slope indices of inequality allowed for better evaluation of inequalities in mortality from infectious diseases, including into analysis all the educational groups. Lithuanian population with primary and lower education level was found to have higher mortality rates due to infectious diseases and tuberculosis than those with higher education. In 2000–2002, as compared with 1988–1990, inequalities in mortality increased due to growing mortality from infectious diseases and tuberculosis in primary and lower educational groups and due to

decreasing mortality in higher educational groups. Inequalities in mortality from infectious diseases were greater among men of different educational level than their female counterparts. In the implementation of tuberculosis prevention and control programs and planning other prevention and control measures of infectious diseases, special attention should be given to the population at highest risk for this disease, i.e., those with the lowest education.

Statement of Conflict of Interest
The authors state no conflict of interest.

Įvairaus išsimokslinimo Lietuvos gyventojų mirtingumo nuo infekcinių ligų ir tuberkuliozės netolygumai

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Raktažodžiai: infekcinės ligos, tuberkuliozė, išsimokslinimas, netolygumai, mirtingumas.

Santrauka. *Tyrimo tikslas.* Įvertinti Lietuvos vyrų ir moterų mirtingumo nuo infekcinių ligų netolygumų pokyčius įvairaus išsimokslinimo grupėse.

Tyrimo medžiaga ir metodai. Analizei naudoti 1988–1990 ir 2000–2002 metų Lietuvos gyventojų mirtingumo nuo infekcinių ligų ir surašymų duomenys apie 30 metų ir vyresnių gyventojų skaičių skirtingose išsimokslinimo grupėse. Netolygumai vertinti santykiniu ir absoliučiu netolygumo indeksu.

Rezultatai. Lietuvos gyventojų, turinčių pradinį ir žemesnį išsimokslinimą, mirtingumas nuo infekcinių ligų buvo didesnis nei turinčių aukštąjį išsimokslinimą. 2000–2002 m. mirtingumo netolygumai padidėjo lyginant su 1988–1990 m. dėl mirtingumo nuo minėtų priežasčių mažėjimo aukštojo ir didėjimo pradinio ir žemesnio išsimokslinimo grupėse. Panašios tendencijos pastebėtos vertinant mirtingumo nuo tuberkuliozės netolygumus. 1988–1990 m. vyrų mirtingumo nuo visų infekcinių ligų santykinis netolygumo indeksas, rodantis, kiek kartų pradinio ir žemesnio išsimokslinimo grupėje mirtingumas buvo didesnis nei aukštojo, buvo 9, o mirtingumo nuo tuberkuliozės – 13. 2000–2002 m. santykiniai netolygumo indeksai žymiai išaugo – atitinkamai iki 16,5 ir 28,8. Įvairaus išsimokslinimo moterų grupėse netolygumai dėl minėtų mirties priežasčių buvo žymiai mažesni nei vyrų grupėse: 1988–1990 m. moterų mirtingumo nuo visų infekcinių ligų santykinis netolygumo indeksas buvo 2,8, nuo tuberkuliozės – 2,9; 2000–2002 m. - atitinkamai 6,4 ir 15,1. Mirtingumo nuo infekcinių ligų ir tuberkuliozės absoliutūs netolygumo įvairiose vyrų išsimokslinimo grupėse indeksai taip pat buvo žymiai didesni nei moterų ir 2000–2002 m. viršijo 1988–1990 m. indeksus.

Išvados. Įgyvendinant tuberkuliozės profilaktikos ir kontrolės programas bei planuojant infekcinių ligų prevencijos ir kontrolės priemones, būtina atkreipti dėmesį į didžiausią šių ligų riziką turinčią žemo išsimokslinimo Lietuvos gyventojų grupę.

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