An evaluation of laryngeal cancer morbidity time trends in Lithuania

Jasevičienė J[1], Gurevičius R[2], Juozulynas A[3], Cicėnas S[1]

[1] Institute of Oncology of Vilnius University, Lithuania
[2] Center of Social Medicine, Lithuania
[3] Center of Health Law and Economics, Lithuania

Abstract

Purpose: To make assessments of the rates of cases of larynx cancer in Lithuania in the years 1978-2001 as well as possible trends of changes in the future.

Material and methods: The data contained in the Lithuanian Cancer Register for the period 1978-2001 about new cases as well as the data compiled by the Lithuanian Department of Statistics on the average number of population of Lithuania within the same period in the same age groups have been used in the course of the study. The data have been standardized by age using direct method, in accordance with the European standard; a regression analysis of larynx cancer case rates was made.

Results: After standardization of data for the period 1978-2001, tendencies of increase have been registered both among men and women: in 1978 the case rate per 100 000 population was 10.73 among men and 0.26 among women, in 2001 the corresponding data were 11.6 among men and 0.7 among women. Throughout the period the investigated case rate for men was higher than for women. An increasing average age of men and women suffering from this disease has been noticed: average age for men is annually increasing by 0.1566 years and for women – 0.0602 years. The forecast for men in the year 2006 is 13.88 cases per 100 000 population and 0.54 for women.

Conclusions: The increase of larynx cancer case rates is growing more rapidly among women than among men, and also average age of the patients is increasing. The forecast is that in 2006 the case rate will be growing up, and both men and women will get ill at older age.

ADDRESS FOR CORRESPONDENCE:
Lilija Jasevičienė, PhD,
Thoracic Surgery Department, Head and Neck Division
Institute of Oncology of Vilnius University
Santariškių – 1, Vilnius, Lithuania
tel.: +370 687 95420   fax: +370 5278766
e-mail: irmantas.jasevicius@vuw.lt

Introduction

In Lithuania in 1995 larynx cancer accounted for 1,8 per cent of all malignant diseases, in 2000 – 1.5 percent. Within the period 1978-2001 average number of persons getting every year ill with larynx cancer was 179 men and 10 women. The index of cases for men per 100 000 population increased from 10.73 in 1978 to 11.6 in 2001, the corresponding figure for women has grown from 0.26 to 0.7.

The number of case rates in Lithuania, in comparison with case rates of such localization cancer in other European countries is not very high, however they are diagnosed late, stages III–IV predominating. According to data of Cancer Register – 2001 kept by the Institute of Oncology of the University of Vilnius (there under – IO VU), larynx cancer of stage III among men accounted for 38.5 per cent, stage IV – 21.3 per cent, among women – stage III – 50 per cent and stage IV – 18.8 per cent of cases [1-4].

Cancer of larynx is one of the most common malignancies in Europe, with about 52 000 new cases per year, of them 90% occurring in men. The yearly incidence rate for men in Southern and Northern Europe is between 18 per 100 000 and 6 per 100 000, respectively. For women incidence rate is not higher than 1.5 per 100 000 per year [5,6].
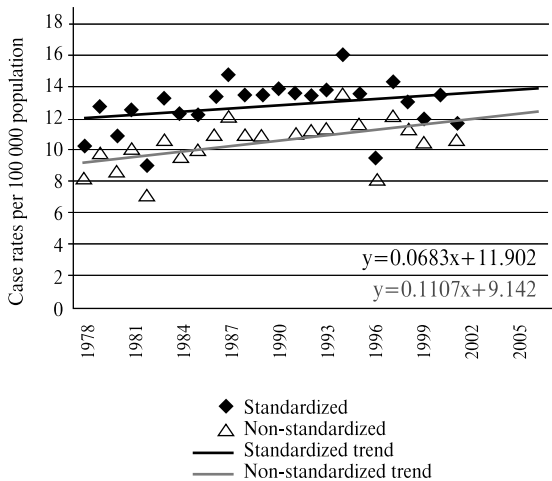
Increasing incidence has been reported from Canada, Italy, Denmark, the United States, Australia, especially among females. In Finland an overall decreasing incidence rate has taken place among males since early 1970s. This was caused exclusively by a decrease of supraglottic cancer cases. This is probably due to the strong decrease in the prevalence of smoking in Finland [7]. Among the European men population, the incidence of larynx cancer increases with age, with most carcinomas being diagnosed in individuals aged 65 or more (about 45% of all cases), and a peak incidence in the 6th and 7th decades with about 50 new cases per 100 000 per year [6].

Figure 1. Regression of larynx cancer case rates among men (comparison of standardized and non-standardized data).

$y = 0.0683x + 11.902$
$y = 0.1107x + 9.142$

- ◆ Standardized
- △ Non-standardized
- — Standardized trend
- — Non-standardized trend

Figure 2. Regression of larynx cancer case rates among women (comparison of standardized and non-standardized data).

$y = 0.0082x + 0.4084$
$y = 0.0041x + 0.4191$

- ◆ Standardized
- △ Non-standardized
- — Standarized trend
- — Non-standarized tredn

Examining the dynamics of the cancer of larynx the trends of growth both among women and men can be observed. An evident growth in the context of case rates is not recorded (although throughout the years some fluctuation is noticed) but calculating the case rates this index is increasing because of the reduction of population.

Material and methods

To investigate the number of case rates in Lithuania primary data contained in the Lithuanian Cancer Register within the recent 24 years (1978-2001) had been used. The data were grouped by sex (men, women), five-year age groups (totally 18 groups) in accordance with recommendations of WHO, namely, 0-4, 5-5, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39... 70-74, 75-79, 80-84, 85+. The Department of Statistics has also collected data about the average number of population of Lithuania during the period under discussion in the age groups referred to above.

To assess the trends of development of case rates among men and women (the number of case rates per 100 000 population) a direct regression analysis was employed.

Y = a + bX, where
Y – case rates of larynx cancer (theoretical value)
a – constant
b – slope of regression line or average absolute annual change (the number of cases per 100 000 population)
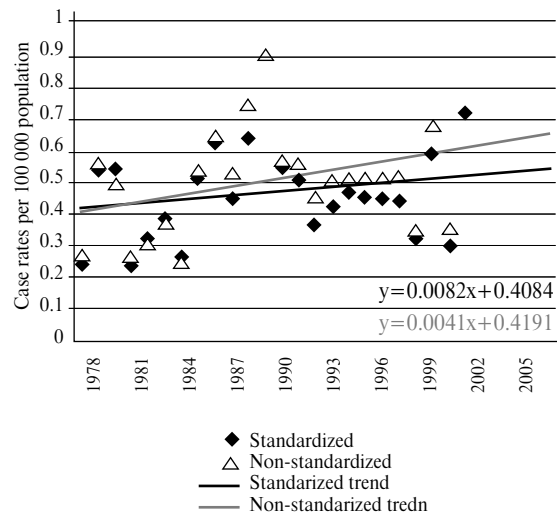X – time (year)

Statistical reliability of the slope rate of regression line has been checked using statistical hypotheses. To this end a calculation of probabilities (P_b) [8] was made.

$$P_b = 2P\left(\left|\frac{b-\beta}{S_b}\right| \geq Z_{P/2}|H_0:\beta = 0\right) \quad b$$

Probability P_b expresses the lowest level of significance where zero hypothesis ($H_0\beta = 0$) can still be rejected.

Making regression analysis both standardized and non-standardized data have been used. Linear regression equations obtained have been used to assess the forecast case rates trends. Confidence intervals of the forecasts have also been assessed (with 95 per cent of confidence level) [9]. Besides absolute changes in the case rates corresponding to the slope of regression curve average annual growth of larynx cancer case rates have also been calculated disclosing, in per cent, average annual increase of the number of cases. Average annual growth rates in per cent have been calculated using geometrical average employing data obtained by using regression equations [9]. To make graphical comparisons a logarithmic scale was used because larynx cancer case rates among men are much higher than between women.

Examining the dynamics of larynx cancer case rates in the average age groups direct regression and weighted average methods were employed. To calculate the weighted average medians of the age groups were employed taking the number of cases as weights. After calculating average weighted age of the persons with larynx cancer, for every year of the period studied on the basis of the data obtained, regression analysis was made.

Results

Changes in the larynx cancer case rates among men

Within the period 1978-2001 in the average 179 men were having larynx cancer in Lithuania. The index of case rates per 100 000 of population has increased from 8.16 person in 1978 to 10.7 person in 2001. The average case rate figure within the period under discussion was 10.5 persons per 100 000 population (*Fig. 1*). After standardizing the data corresponding data were as follows: in 1978 10.73 cases per 100 000 population, 11.6 persons in 2001, average case rate – 12.75. The fact that the average figure is higher than the data for both 1978 and 2001 evidences that, in comparison with actual data for the

Table 1. Parameters of regression analysis of larynx cancer case rates in Lithuania for the period 1978-2001 and the forecast for 2006.

Sex	Average (b)	P_b	Average annual change, per cent	Determination coefficient (R^2)	Forecast (95% intervals of confidence)
Men					
Rough	0.11	0.0068	1.06%	0.29	12.36 (10.98 – 13.73)
Standardized	0.07	0.1648	0.54%	0.09	13.88 (12.12 – 15.64)
Women					
Rough	0.008	0.0914	1.64%	0.12	0.65 (0.47 – 0.82)
Standardized	0.004	0.3428	0.88%	0.04	0.54 (0.38 – 0.70)

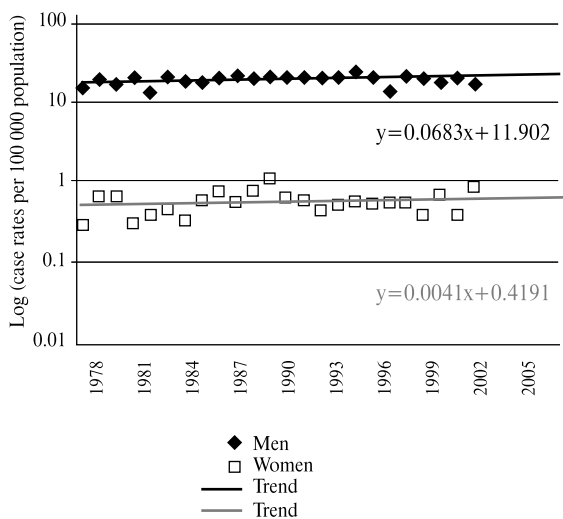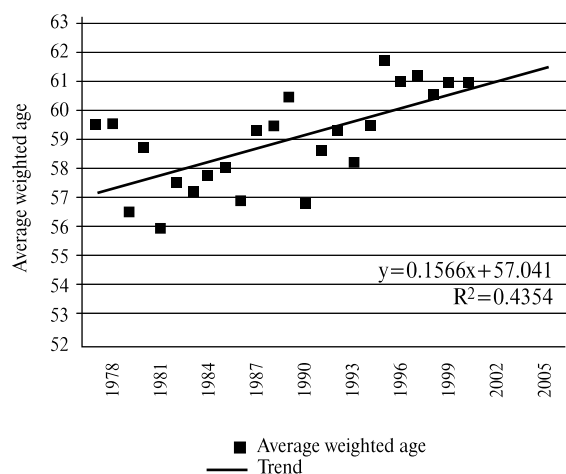*Figure 3.* Comparison of larynx cancer case rates for men and women (standardized data).

$$y = 0.0683x + 11.902$$

$$y = 0.0041x + 0.4191$$

◆ Men
◻ Women
— Trend
— Trend

Figure 4. Age regression of men (weights – larynx cancer case rates).

$$y = 0.1566x + 57.041$$
$$R^2 = 0.4354$$

■ Average weighted age
— Trend

period 1978-1994, beginning with 1995 a tendency of reduction of cases appeared (*Fig. 1*).

Changes in the larynx cancer case rates among women

Within the period under discussion (1978-2001) in the average almost 10 women, that is 18 times less than men, were suffering from the cancer of larynx every year. However, the case rate per 100 000 population increased from 0.28 persons in 1978 to 0.86 in 2001, that is, 3 times (actual non-standardized data) (*Fig. 2*). Average case rate for women within the period under discussion was 0.51 persons per 100 000 population. After standardizing the data the case rate per 100 000 population were as follows: 0.26 in 1978, 0.70 in 2001, average case rate – 0.47 (*Fig. 2*). Regression analysis of larynx cancer case rates for men and women is generalized in *Tab. 1*.

As can be judged by *Tab. 1*, after standardization of data average annual change, in per cent, in the case rates both for men and women has reduced by nearly 2 times. It shows that as people are getting older larynx cancer case rates are significantly influenced. Both for men and women quite low determination coefficients are observed showing that the models applied explain only a small part of the reasons for getting ill with the larynx cancer: in case of non-standardized data regres-

sion equation for men explains only 29 per cent of variation of larynx cancer case rates with time for men and only 12 per cent for women. After standardization of data preciseness and reliability of models reduces even more. Such conclusions are confirmed by the probabilities of the slope of regression line (P_b): after standardization of data the probabilities increase very much, that is, much doubts arise if the regression slope coefficient differs greatly from zero. Especially high probability (P_b) is observed investigating data for women because larynx cancer is not a very typical disease for women and therefore there are no such marked and reliable trends of case rates or morbidity trends. Judging by the data presented one can make a conclusion that in the future ceteris paribus larynx cancer case rates are expected to increase in 2006 with 95 reliability. Larynx cancer case rates per 100 000 men population are expected to be 10.98-13.73 and 0.47-0.82 for women (non-standardized data) (*Fig. 3*).

Analyzing larynx cancer case rates for men and women (*Fig. 3*) we have made a conclusion that larynx cancer case rates have a tendency to increase, yet the rates for men are faster. Average annual increase of absolute larynx cancer case rate for men is 0.0683 while for women it is only 0.0041. Comparison of annual average changes, in per cent, is somewhat complicated because the case rate for women is much less than for men,

Table 2. Parameters and forecasts of age of those having larynx cancer by 2006.

Sex	Average change (b)	P$_b$	Average annual change, per cent	Determination coefficient (R^2)	Forecast (95% intervals of confidence)
Men	0.16	0.00045	0.27%	0.44	61.58 (60.17 – 62.99)
Women	0.06	0.5925	0.10%	0.01	62.89 (58.78 – 67.00)

therefore the basis for making a comparison is less. Average annual larynx cancer case rate change for men is 0.54 per cent, while for women it is only 0.88 (standardized data). Thus, we can see that because of different basis for comparison (we have found that potential tempos of the case rate growth are bigger than absolute tempos of growth for men).

Regression analysis of larynx cancer case rates by age groups

Men   At the beginning of the period investigated average age of men having larynx cancer was about 59.5 years while at the end of the period – already about 61 years (actual data). As can be judged by *Fig. 4*, men of older age groups are more often getting ill with this disease. If such tendencies remain in the future in 2006 one may expect that the average age of ill men will be about 61.58 years.
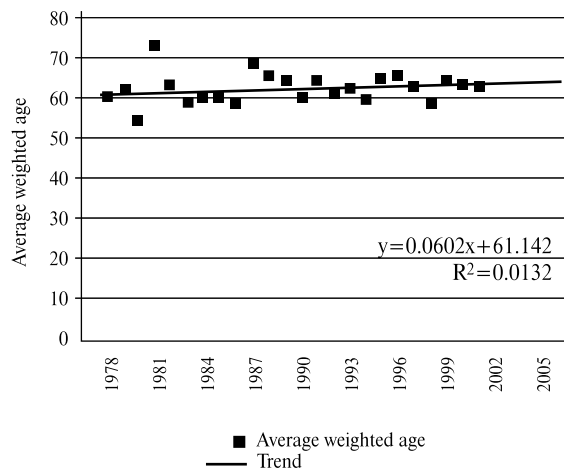
Women   As can be judged by *Fig. 5*, average age of women having larynx cancer has within the period investigated did not undergo essential changes – in 1978 average age was 60 years and in 2001 – 62.63 years. It is probable that in 2006 the figure will reach 62.89 years (*Tab. 2*).

Figure 5. Age regression of women (weights – larynx cancer case rates).

$$y = 0.0602x + 61.142$$
$$R^2 = 0.0132$$

■ Average weighted age
— Trend

Discussion

Analyzing larynx cancer case rates in Lithuania within the period 1978-2001 one may observe the tendencies of growth both among men and women (standardized actual data): in 1978 the case rate per 100 000 population was 10.73 for men and 0.26 for women, while in 2001 corresponding data were 11.6 and 0.7. thus, throughout the period analyzed the larynx cancer case rate among men was 12.75 cases per 100 000 population and 0.47 cases per 100 000 women, that is, 27 times less than among men. It may first of all be explained by less wide-spread consumption of alcohol and smoking among women. Results of calculations show that both in 1978 and in 2001 the ratio of case rates among men and women remained similar although the gap is slightly decreasing – in 1978 the case rate of men established by a calculated trend equation was 28.5 times and in 2001 – 26 times higher than between women (standardized values).

The tendencies all over the world show that the above proportions are decreasing but the reduction is conditioned by the growth of the case rates among women. Judging by the data of the above Society the highest number of the case rates per 100 000 population is in Spain (20 cases), slightly less in Poland, France and Italy. The data on the case rates in economically developed countries are generally 5-10 cases per 100 000 population. At the same time in Sweden this figure is exceptionally low [2,5,6,11].

Investigating the age of those having the larynx cancer a tendency of growth within the average age both of men and women was registered. It may be accounted by the fact that longer and longer time is needed for cancerogenes to have an influence and, on the other hand, the better quality of medical treatment had positive effect. Then, average duration of life of men having the larynx cancer is increasing faster than that of women: the age of men is increasing annually by 0.1566 years while that of women – only by 0.0602. One may forecast that in 2005 the average life of men having the larynx cancer will reach 61.58 years and of women – 62.89 years.

Having made prognostic calculations of the larynx cancer case rates negative tendencies in the case rates both for men and women have been established. It is forecast that the case rate for men in 2006 will be 13.88 per 100 000 population and for women – 0.54 cases (standardized data obtained using a calculated trend equation).

Conclusions

1. The average annual (at 1978-2001 period) increase in laryngeal cancer morbidity rates in Lithuania among males was 0.54%, among females – 0.88%. The age average of the sick persons had increased.

2. This analysis suggests that morbidity will rise until reaches 11.88 per 100 000 among males and 0.54 per 100 000

among females. The age average among the sick persons should increase if other conditions and previous trends continue.

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