

# TRENDS IN LARYNGEAL CANCER INCIDENCE IN LITHUANIA: A FUTURE PERSPECTIVE

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## Abstract

**Objectives:** The aim of the present study was to assess the incidence of larynx cancer in Lithuania in the years 1978–2001 and to outline possible future trends. **Materials and Methods:** The number of new laryngeal cancer cases in 1978–2001 was obtained from the Lithuanian Cancer Registry. The Lithuanian Department of Statistics provided data on the population being at the same age in the same years. The data were adjusted for age, using the direct method in accordance with the European standard; a linear regression analysis of trends in the larynx cancer incidence was performed. **Results:** After standardization of data for the period of 1978–2001, an upward trend was registered for both men and women: in 1978 the incidence was 10.73 for men and 0.26 for women per 100 000 population, in 2001 the corresponding data were 11.6 and 0.7. Throughout the study period the incidence was higher in men than in women and the mean age of male and female larynx cancer patients was increasing: mean age for men was annually increasing by 0.1566 years and for women by 0.0602 years. The forecast for men in 2006 is 13.88 and for women 0.54 cases per 100 000 population. **Conclusions:** The increase in larynx cancer incidence is growing more rapidly among women than among men, and the mean age of the patients is also increasing. The forecast is that in 2006 the incidence rate will be increasing, and both men and women will get ill at an older age.

## Key words:

Incidence, Laryngeal cancer, Prediction of incidence, Time trends, Average age

## INTRODUCTION

In Lithuania, larynx cancer made only 1.8 percent of all malignant diseases in 1995 and 1.5 percent in 2000. In the years 1978–2001, 179 male and 10 female new larynx cancer cases were annually registered on average. The incidence for both men and women slightly increased from 10.73 and 0.26 per 100 000 population in 1978 to 11.6 and 0.7, respectively in 2001.

In comparison with other European countries, the incidence of larynx cancer in Lithuania is not high, however, this disease is diagnosed rather quite late, mostly at stage III or stage IV. In 2001, larynx cancer diagnosed at stages

III and IV accounted for 38.5 and 21.3 percent, among men, whereas among women the respective proportions were 50 and 18.8 percent of cases [1–4].

Cancer of larynx is quite common in Europe, especially in men. About 52 000 new cases are recorded per year, of them 90 percent occur in men. In the countries of southern and northern Europe the annual incidence rate for men is between 18 and 6 per 100 000, and for women it is not higher than 1.5 per 100 000 [5,6].

An increasing incidence has been reported in Canada, Italy, Denmark, the United States, Australia, especially among females. In Finland, an overall decreasing incidence rate

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has been observed among males since the early 1970s. This was caused exclusively by a decrease in supraglottic cancer cases, and probably due to the huge decrease in the prevalence of smoking in Finland [7]. Among the European male populations, the incidence of larynx cancer increases with age. In the age group over 65 years this malignancy constitutes about 45 percent of all cancer cases, with the peak incidence in the 6th and 7th decades of life: about 50 new cases per 100 000 detected annually [6].

Time trends of larynx cancer are on increase for both women and men.

## MATERIALS AND METHODS

To investigate the incidence of new larynx cancer cases in Lithuania, data covering the recent 24 years (1978–2001), stored in the Lithuanian Cancer Registry were used. The data were grouped by gender and five-year age categories (totally 18 categories) in accordance with recommendations of the World Health Organization (WHO) (0–4, 5–5, 10–14, 15–19, 20–24, 25–29, 30–34, 35–39... 70–74, 75–79, 80–84, 85+). The data on the population of Lithuania covering the period under study in the aforesaid age categories were obtained from the Department of Statistics. The data were age adjusted (standardized) using the direct method in accordance with the European standard.

To assess the time trends of incidence among men and women (incidence per 100 000 population) a linear regression analysis was employed.

$$Y = a + bx,$$

where:

Y – incidence 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 was checked, using statistical hypotheses. To this end, probabilities ( $P_b$ ) [8] were calculated, using the following formula:

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

$P_b$  that expresses the lowest level of significance and null hypothesis ( $H_0: \beta = 0$ ) can still be rejected. Regression analysis applied for both standardized and crude incidence data were used. Linear regression equations obtained were applied to predict incidence trends. Confidence intervals of the forecasts were assessed with 95 percent of confidence limits (95%CI) [9]. Besides absolute changes in the incidence corresponding to the slope of regression curve, average annual percentage change (AAPC), showing the rate of average annual increase in the incidence, was also calculated [9]. To make graphical comparisons, a logarithmic scale was used as the larynx cancer incidence among men is much higher than in women.

To examine the trends of larynx cancer incidence by age groups, linear regression and weighted average methods were employed. To calculate the weighted average, medians of age groups were used, taking the number of cases as weights. After calculating average weighted age of larynx cancer incidence for each year under study, the regression analysis was performed on the basis of the data obtained.

## RESULTS

### Changes in the larynx cancer incidence among men

In 1978–2001, 179 new cases of larynx cancer on average were annually diagnosed in Lithuania. The incidence rate per 100 000 population increased from 8.16 in 1978 to 10.7 in 2001. The average crude incidence rate in those years was 10.5 per 100 000 population (Fig. 1). After age adjustment the following data were noted: 10.73 cases per 100 000 population in 1978, and 11.6 cases in 2001; the mean incidence rate = 12.75.

The time trends were on increase (Fig. 1).

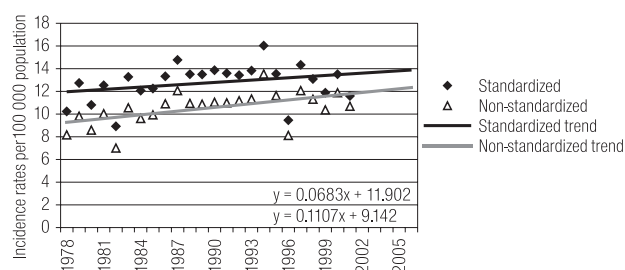
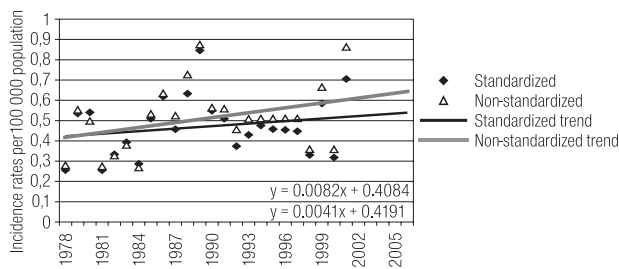


Fig. 1. Regression analysis of larynx cancer incidence among men (comparison between standardized and non-standardized data).



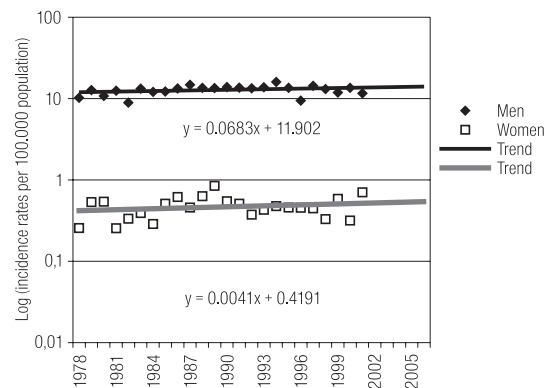
**Fig. 2.** Regression analysis of larynx cancer incidence among women (comparison of standardized and non-standardized data).

### Changes in the larynx cancer incidence among women

In the study period (1978–2001), 10 new cases of larynx cancer developed in women per year, on average (18 times less than in men). However, the crude incidence rate per 100 000 population increased from 0.28 in 1978 to 0.86 in 2001 (a three-fold increase) (Fig. 2). The incidence rate for women was 0.51 per 100 000 population. After age adjustment the incidence rates per 100 000 population were: 0.26 in 1978, and 0.70 in 2001, the mean incidence rate = 0.47.

Regression analysis of larynx cancer incidence in men and women is summarized in Table 1.

As depicted by Table 1, after age adjustment average annual percentage change in the incidence for both men and women declined by nearly 2 times. It indirectly shows the significant effect of aging on larynx cancer incidence. For both men and women quite low determination coefficients were observed showing that the models applied explain only a small part of the reasons for developing larynx cancer: as to the crude incidence data the regression equation explains only 29 percent of time-variation in the larynx cancer incidence for men and only 12 percent for women. After age adjustment, the preciseness and reliability of



**Fig. 3.** Comparison of larynx cancer incidence in men and in women (standardized data).

models are reduced even more. Such conclusions are confirmed by the probabilities of the slope of regression line: after adjustment of data the probabilities highly increased. This gives rise to much doubt whether the regression slope coefficient differs greatly from null. Especially high  $P_b$  was observed when investigating data for women, because larynx cancer is quite rare in the female populations and thus the trends of incidence are not clearly marked and may be not reliable. Judging by the data presented, one can draw a conclusion with the assumption “*caeteris paribus*” (if no change in conditions in the period of coverage) that in the future larynx cancer incidence can be expected to increase in 2006 with 95% statistical significance. Larynx cancer incidence is expected to be 10.98–13.73 for men and 0.47–0.82 for women per 100 000 population (crude incidence data).

Having analyzed the larynx cancer incidence in men and women (Fig. 3) we found that it shows an upward tendency, yet the rates for men increase faster than those for women. Average annual increase in the absolute larynx

**Table 1.** Parameters of regression analysis of larynx cancer incidence in Lithuania, 1978–2001, and the forecast for 2006

Gender	Average (b)	$P_b$	Average annual change (%)	Determination coefficient ( $R^2$ )	Forecast (95% CI)
Men					
Crude	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					
Crude	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)

cancer incidence rate for men is 0.0683 while for women it is only 0.0041. Comparisons of annual average percentage changes are somewhat complicated because of much lower incidence in women than in men, hence a weaker basis for comparisons. The average annual change in larynx cancer incidence rate is 0.54 percent for men, and 0.88 for women (standardized data).

### Regression analysis of larynx cancer incidence by age groups in both genders

#### Men

At the beginning of the study period the mean age of men with larynx cancer was about 59.5 years whereas by the end of that period, it increased to about 61 years (current data). As shown in Fig. 4, men of the older age groups develop this disease more often. If this tendency persists in the future one may expect that in 2006 the mean age of men who have developed larynx cancer will be about 61.58 years.

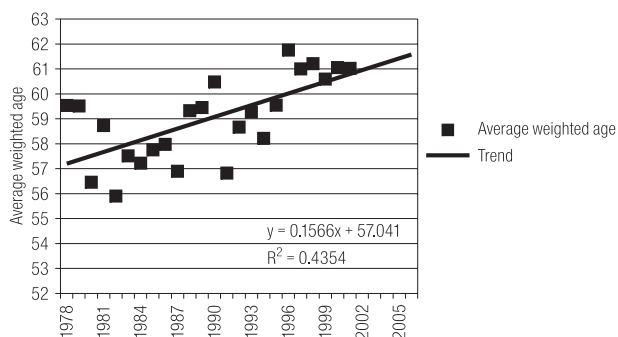


Fig. 4. Regression analysis of larynx cancer incidence by male age groups.

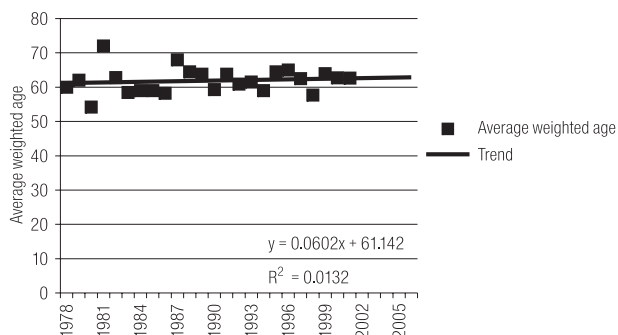


Fig. 5. Regression analysis of larynx cancer incidence by female age groups.

#### Women

As shown in Fig. 5, no essential changes were observed in the mean age of women with developed larynx cancer in the study period; the mean age of 60 years in 1978 and 62.63 years in 2001. It is likely that in 2006 this figure will increase to 62.89 years (Table 2).

Table 2. Parameters and forecasts of mean age in persons with new cases of larynx cancer diagnosed by 2006

Gender	Average change (b)	P <sub>b</sub>	Average annual change (%)	Determination coefficient (R <sup>2</sup> )	Forecast (95% CI)
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)

### DISCUSSION

Having analyzed the larynx cancer incidence in Lithuania in the years 1978–2001 an upward trend can be observed for both men and women (adjusted incidence data): in 1978 the incidence rate per 100 000 population was 10.73 for men and 0.26 for women, while in 2001 the rates increased to 11.6 and 0.7, respectively. Thus, over the study period the larynx cancer incidence rate was 12.75 cases per 100 000 population for men and 0.47 cases per 100 000 for women, that is 27 times lower than in men. This may primarily be explained by less widespread consumption of alcohol and smoking among women. The results of our analysis show that in both 1978 and 2001, the ratio of incidence among men and women remained almost similar although the gap is slightly decreasing. In 1978, the incidence rate for men established by a calculated trend equation was 28.5 times and in 2001 – 26 times higher than among women (standardized rates).

The worldwide tendencies show that the above proportions are decreasing, however, their reduction is conditioned by the increase in the incidence among women. Judging by the data of the American Cancer Society, the highest incidence rate per 100 000 population is registered in Spain (20 cases), slightly lower in Poland, France and Italy. The

incidence in economically developed countries is generally 5–10 cases per 100 000 population. At the same time in Sweden this figure is exceptionally low [2,5,6,11].

Having investigated the age of persons developing new cases of larynx cancer, a tendency of the increased mean age in both men and women was observed. It may be accounted for still longer period of time needed for cancer to develop and better quality of medical treatment. Moreover, the average number of survival years in men with larynx cancer is increasing faster than that in women: the age of men is increasing annually by 0.1566 years while that of women only by 0.0602. According to our forecast in 2005 the mean age of male larynx cancer patients will reach 61.58 years and of female patients – 62. 89 years.

Having made prognostic calculations of the larynx cancer incidence its upward tendencies in both men and women were established. It is predicted that in 2006, the incidence rate for men will be 13.88 and for women 0.54 per 100 000 population (adjusted data obtained using a calculated trend equation).

## CONCLUSIONS

1. Laryngeal cancer incidence in Lithuania is quite low, especially in women.
2. In Lithuania in the years 1978–2001, the average annual increase in laryngeal cancer incidence rates was 0.54 percent for men and 0.88 percent for women.
3. The mean age of persons with new cases of larynx cancer increased in both genders.
4. According to our study, morbidity will increase to 11.88 among men and to 0.54 among women per 100 000 population.

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