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The impact of tobacco-related cancers on excess mortality rates in Polish men

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Introduction. Since the latter half of the 20th century, Poland has witnessed increasing life expectancy inequalities between women and men. In 2012, women's life expectancy was over 8 years higher than for men. Such disparities mainly arise from differences in the prevalence of those lifestyle behaviours increasing the risk of premature death, such as tobacco smoking and alcohol consumption. This paper is mainly focused on estimating the impact of tobacco-related cancers on life expectancy inequalities between Polish women and men.

Material and methods. The database of the World Health Organization (WHO) was used to supply the statistics on tobacco-related cancer mortality in Poland during 1970–2012, including population size. Male excess mortality was expressed as the difference in life expectancy at birth between females and males. Such inequalities between genders were assessed by Arriaga's decomposition method. The Joinpoint Regression program was used to analyse time trends.

Results. After excluding gender-specific malignant neoplasms (cervical and ovarian cancers), tobacco-related cancers were found to be responsible for 22% of the differences in life expectancy between females and males for 2012. Male life expectancy at birth was on average shorter by 1.8 years because of cancer mortality being causatively associated with tobacco smoking when compared to females. After accounting for gender-specific cancers in the analysis, there were no significant changes in the observed differences. Tobacco-dependent cancers were found to be responsible for 18% of the difference in 2012, which is associated with 1.5 year shorter male life expectancy as compared to females.

Conclusions. Tobacco-related cancers significantly impact on life expectancy inequalities between females and males and significantly affect excess mortality rates in Polish men.

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Key words: Poland, male excess mortality rates, cancer, life expectancy, tobacco smoking

Introduction

In Poland, increasing gaps in life expectancy have been observed, which had begun in the second half of the 20th century. In 1991, such differences peaked where female life expectancy was on average 9.2 years longer than for males [1]. In the following decade, this gap became reduced by one year, but has started widening again since the beginning of the 21st century, reaching 8.3 years in 2012. At this time life expectancy at birth was 72.7 years for males and 81.0 years for females [1].

Differences in life expectancy between genders have been the subject of many studies [2, 3] where male excess mortality is commonly dealt with in relation to gender lifestyle differences (i.e. cigarette smoking, alcohol consumption, diet and physical activity levels, etc.) [4], and that varying lifestyle behaviour, such as tobacco smoking and alcohol consumption, are considered to be the main causes of an increased mortality risk [5]. According to McCartney et al., tobacco-use-dependent-mortality is responsible for 40–60% of mortality differences between men and women in 30 European countries. Tobacco smoking is one of the main risk factors of cardiovascular disease and cancer [6]. It is estimated that such behaviour is a direct cause of premature death in more than 50% long-term smokers, whilst the life expectancy of tobacco users is on average 10 years shorter compared to non-smokers [7].

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In Poland, male tobacco smoking is more prevalent than in females [8], as is the case for the majority of European countries [9]. This phenomenon impacts both on tobacco-related mortality and mortality inequalities between males and females [5, 10].

This paper aims to determine the magnitude of differences in life expectancy between Polish men and women as well as epidemiologically analysing the impact of tobacco-related cancers on male excess mortality and to propose policy recommendations for reducing this gap.

Materials and methods

The study results are based on the cancer mortality database in Poland taken from 1970–2012 according to age and gender. Mortality and population data were obtained from the official statistics of the World Health Organization's (WHO) database available from the WHO website [11]. Those cancers deaths attributable to tobacco use were analysed according to the classification proposed by the International Agency on Research on Cancer [12]; such cancer sites are listed in Table I.

Mortality data according to the cause of death during 1997–1998 were not available as Polish doctors were on strike at that time. Mortality rates from this time period were estimated and based on average mortality rates from years 1996 and 1999.

Male excess morality rates were expressed as the difference in life expectancy between males and females. Life expectancy was measured by life expectancy tables and analysed according to S.H. Prestin, P. Heuveline and M. Guillot in *Demography measuring and modelling population processes* [13]. Arriaga's decomposition method was applied to life expectancy differences [14] which allowed the share of chosen causes of death in the differences in life expectancy between two populations to be quantified. Data used for the decomposition was the cancer mortality that was causatively associated with tobacco smoking (see Tab. I).

Temporal trends analysis was performed by the Joinpoint Regression Program version 4.3.1.0, in order to fit trend lines that were statistically significant to the analysed data. The type of variable was suitably defined (percentage or other) and data were log transformed and a homogeneity of variance was assumed for the weighted least square method. A Permutation Test was performed to determine the minimum number of the so-called change points (up to 3). The statistical significance level was set at $\alpha = 0.05$. Annual Average Percentage Change (AAPC) was calculated according to time period models and their statistical significance was determined.

Results

Life expectancy at birth has been increasing in Poland for the last 40 years for both genders, however this increase has become more pronounced in last two decades of the observation period (Fig. 1).

In the 1970s, female life expectancy at birth increased from 73 years in 1970, to 75 years in 1979. In the following decade, this rising trend was maintained, albeit at a slower rate. Male life expectancy remained at a constant level in the same time period, oscillating between 66 and 68 years. Due to such contrasting trends, differences in life expectancy between males and females rose significantly, reaching 9 years at the end of 1980s when at the beginning of the 1970s it had been 6.6 years. This difference peaked in 1991, where female life expectancy at 75.3 years was 9.2 years higher than for males; being at 66.1 years. Hitherto this time, life expectancy rose for both males and females, however

Table I. Codes of tobacco-attributable causes of cancer deaths according to ICD revisions

ICD-8 A	ICD-9 BTL	ICD-10	Cancer causes of death
A045	B08	C00–C14	Malignant neoplasms, lip, oral cavity and pharynx
A046	B090	C15	Malignant neoplasm of esophagus
A047	B091	C16	Malignant neoplasm of stomach
[153–154]	B093–B094	C18–C21	Malignant neoplasm of colon and rectum
[155]	B095	C22	Malignant neoplasms of liver and intrahepatic bile ducts
[157]	B096	C25	Malignant neoplasm of pancreas
[160]	[160]	C30–C31	Malignant neoplasm of nasal cavity, middle ear and accessory sinuses*
A050	B100	C32	Malignant neoplasm of larynx
A051	B101	C33-C34	Malignant neoplasm of trachea, bronchus and lung
A055	B120	C53	Malignant neoplasm of cervix uteri
[183]	B123	C56	Malignant neoplasm of ovary (mucinous)
[188–189]	B126, [189]	C64–C68	Malignant neoplasms of urinary organs
[205]	[205]	C92	Myeloid leukemia

*The codes also embrace malignant neoplasms of the inner ear — these were included as the analysis was possible in such a configuration, however mortality from this cause was negligible; in 2012 there were 13 registered deaths from this cause.

Source: Authors' analysis; in square brackets there numbers are presented from detailed lists of codes — this concerns all causes of cancer deaths, that were not present in the aggregated lists of the ICD codes

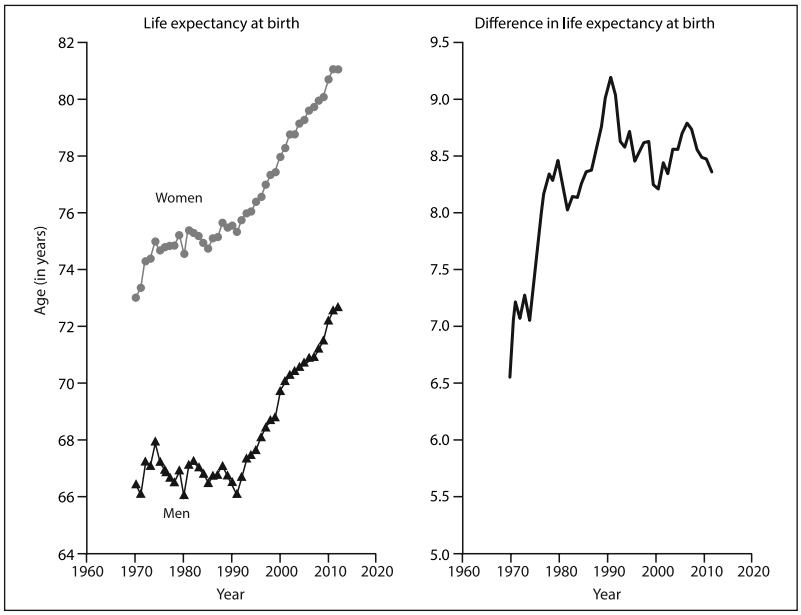

Figure 1. Differences in life expectancy between men and women in Poland. Source: Authors' analysis

the rate of increase was higher for males; consequently, differences in mortality rates between the sexes started to decrease. This trend became shortly reversed during 2002–2007, where female life expectancy started to rise faster compared to males. Since 2007 onwards, a reduction in gender differences for life-expectancy was observed. In 2012, life expectancy was 81.0 years for females and 72.7 years for males; an 8.3 years difference.

Some of the tobacco-linked cancers, such as cervical and ovarian cancer, are specific only to females. As our study aim was to describe male excess-mortality in relation to female mortality rates, the gender differences in life expectancy that can be linked to tobacco use were both analysed, including and excluding those cancers occurring only in females.

After excluding the female-specific cancers, tobacco-linked cancers were responsible for approximately 17–18% of the differences in life-expectancy at birth between males and females at the beginning of the 1970s. Our calculations have demonstrated that tobacco-linked cancers resulted in males losing on average 1.2 years in the mortality rate difference as compared to females (Fig. 2).

Up to the beginning of the 21st century, the contribution of tobacco-related cancers to this difference had been increasing, where in 2002 this accounted for 23–24% of the total difference in life expectancy between males and females with males having, on average, 2 years less life expectancy than females. After 2004, the effect of tobacco-related cancers in these differences started to diminish, where the gap in life expectancy between genders was 1.8 years in 2012; accounting for 22% of this difference (Fig. 2). Female-specific cancers that *per se* reduce the life expectancy gap between males and females did not significantly affect the total tobacco-related differences in life expectancy.

In 2002, when taken together, tobacco-linked cancers at first had increased to approximately 20%, which represented a 1.7 year shorter male life expectancy at birth than in females. In 2012, tobacco-related cancers showed a decreased (18%) contribution to this difference in life expectancy, representing a reduced 1.5 year gender gap (Fig. 3).

Discussion

Mortality due to tobacco-attributable cancers significantly contributes to the high levels of total mortality observed from cancer disease in Poland. In 2012, tobacco-related cancers represented 73% of all cancer deaths in males and 58% in females. In terms of mortality from all causes, then tobacco-linked cancer mortality was 20% for males and 13% for females.

In Poland, male excess mortality is observed not only for cancer disease and tobacco-linked cancers, but also for cardiovascular disease and deaths due to external causes [15, 16]. These three factors are the main cause for the gender gap in life expectancy which should be treated as one of the most important public health issues in this country [17].

Increased life expectancy should be the same for both genders, as they are under the same healthcare system and experience the same socio-economic conditions. Nevertheless, because of such risk factors as tobacco smoking and alcohol consumption, gender similarities became divergent as early as at the beginning of 1970s. This increase of female life expectancy was attributed to reduced perinatal mortality and the increase of gender

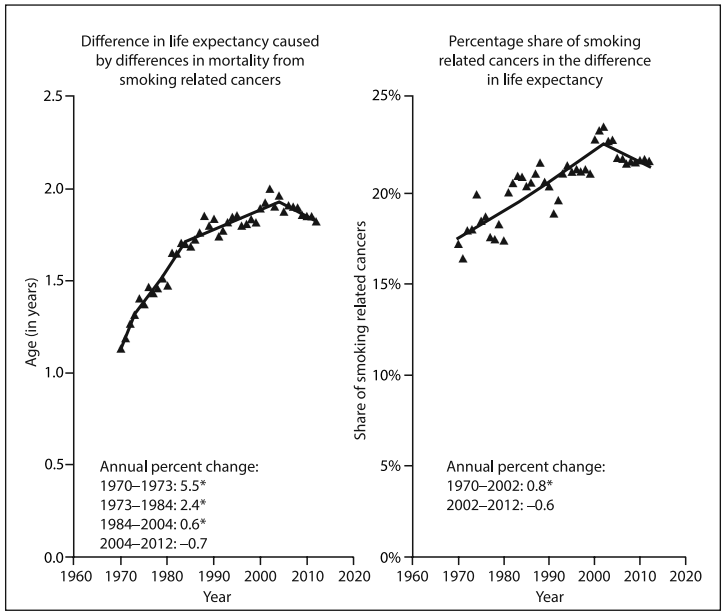

Figure 2. Share of tobacco-attributable cancer deaths in life expectancy differences between men and women in Poland (gender-specific cancers not taken into account). Source: Authors' analysis
*average annual percent change for given time periods being significantly different from zero ($\alpha = 0.05$)

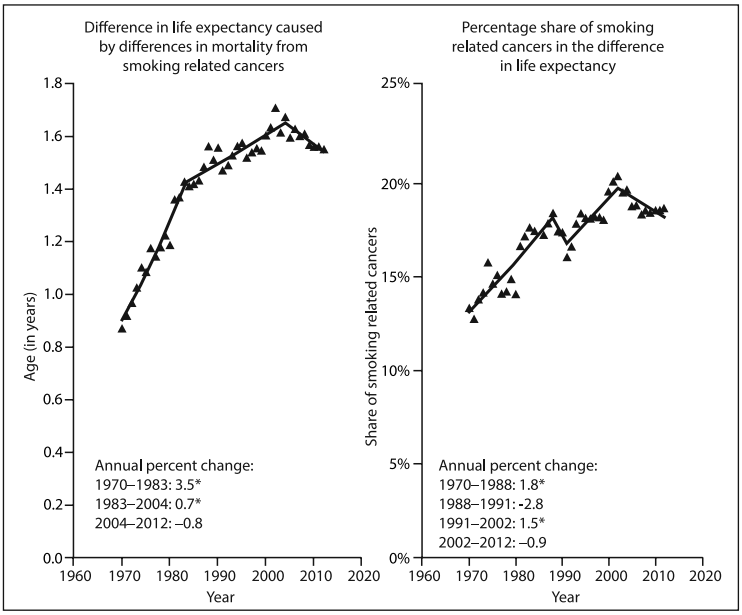

Figure 3. Share of tobacco-attributable cancer deaths in life expectancy differences between men and women in Poland (gender-specific cancers taken into account). Source: Authors' analysis
*average annual percent change for given time periods being significantly different from zero ($\alpha = 0.05$)

equality [15]. Contemporaneously, increased prevalence of tobacco smoking in males contributed to opening the gap between female and male mortality rates and life expectancy in 1970s and 1980s [18].

An increased prevalence of smoking by females and a simultaneous rise of smoking cessation rates in males are considered to be the reason for a closing gap in life expectancy rates after 1991 [18]. This process reversed a decade later where female life expectancy started to increase more rapidly than males during 2002–2007, which was explained by increasing male alcohol consumption related to a 30% reduction of excise duty for spirit drinks [20, 21].

The presented analyses confirms that during last four decades, those cancers attributable to tobacco use contributed to significant differences between male and female life expectancy in Poland. Limiting exposure to tobacco smoke could prevent a large proportion of deaths [22] and decrease the morbidity and mortality rates of tobacco-linked cancers, as suggested by Doll and Peto in 1981 [23]. In 2005, it was estimated that more than one third of all cancer deaths worldwide were caused by potentially modifiable risk factors, amongst which tobacco smoking and alcohol consumption are critical [22]. As in Poland, males more often engage in risky behaviour than females [24, 25], and smoking prevalence has always been higher for Polish males than females [8, 26]. Reducing such risk factors could thereby increase male life expectancy and contribute to closing inequalities in gender life expectancy.

Measures aimed at effectively treating tobacco dependence, undertaking large-scale educational initiatives and promoting primary cancer prevention, (especially targeted at males) thereby appear to be vital for diminishing the existing differences in life expectancy between genders in Poland and other countries.

Limitations

Deaths from tobacco-attributable cancers were analysed in this study. Not all these deaths were exclusively caused by tobacco smoking. Some deaths were due to cancers of the lip, oral cavity, throat, oesophagus, larynx, liver and colon and thus could have been caused by alcohol consumption or by the combined effect of alcohol consumption and tobacco smoking. Our analysis was based on population data, where information on past health behaviour of individuals was not available. Differences in mortality were calculated based on total mortality rates for selected cancers.

Because the histological distinction between different subtypes of ovarian cancer in the ICD classification is lacking, all types of this tumour were included in our analyses; and not only mucinous cancer, which is causally related to tobacco use.

Conclusion

Tobacco-attributable cancers are a cause of significant differences in life expectancy between males and females and contribute to male excess mortality rates in Poland. Actions aimed at limiting the influence of risk factors, mainly tobacco use, appear necessary in order to close the gap in male and female life expectancy in Poland.

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Conflicts of interest: none declared

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