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Morbidity and mortality trends of the most common cancers in 1990–2019. Poland's position compared to other European countries

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Introduction. The purpose of the study was to evaluate the trends in morbidity and mortality of the selected cancer sites in Poland against other European countries.

Material and methods. Countries for analysis were selected based on geographical location. Estimates of age-adjusted incidence and mortality rates were calculated using the new European 2013 standard population. Lung, colorectal, breast, and prostate cancers were chosen. Time trends for age-standardized rates were analyzed using Joinpoint Regression software.

Results. Poland differed from other analyzed countries mainly in terms of cancer mortality. Poland is a country with one of the smallest amounts of current expenditures on health care per capita, which translates into one of the highest levels of cancer mortality in both women and men.

Conclusions. Compared to other countries, Poland's cancer outcomes on population level are unsatisfactory. The situation may improve with the introduction of educational and screening programs.

Key words: mortality, morbidity, Europe, neoplasms, Poland

Introduction

Poland is a country that differs from other European countries in terms of low morbidity (breast, prostate, and colorectal cancer) and higher mortality. In 1989, after decades of being a part of the so-called "Eastern bloc" influenced by the USSR, Poland was the very first country from Central and Southeastern Europe to adopt economic reforms and separate itself from the centrally planned economic system. In the Soviet model of health care (the so-called Semashko model – named after the first Minister of Health in the USSR [1]) every citizen was guaranteed universal access to healthcare and medical services, funded by the state budget. The model was replaced with a mandatory health insurance system (the National Health Fund [NFZ] – the payer in the system), complemented by financing from central and local budgets. In Poland and other countries of the region, the perception of health by an individual has changed since the end of dependence on the Soviet Union [2, 3].

Incidence and mortality rates are influenced by risk factors that vary not only by the type of cancer but also by geographi-

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cal location, ageing and growth of the population, sex and reproductive patterns, or factors associated with socioeconomic development [4]. In this paper, factors that may influence the different course of trends in morbidity and mortality have been evaluated, as well as, most importantly, national-level activities such as screening and preventive programs. For many years, lung, colorectal, prostate, and breast cancers have presented as the most common types of cancer in Poland (45.6% of all incident cases in 2019) and in Europe (49.5%) [5, 6].

The purpose of the analysis was to evaluate the trends in morbidity and mortality of the cancer sites mentioned above in Poland against European countries located in the same region and with a similar economic history, and, as a context, countries with a long history of democracy and a market-based economy.

Material and methods

Selection of countries

Countries for analysis were selected based on geographical location – Central and Western European Countries were chosen. An additional inclusion criterion was the existence of a national cancer registry. The final list of countries included in analysis is as follows: Austria, Czechia, Denmark, Estonia, Latvia, Lithuania, Poland, Slovakia, Slovenia, and Sweden.

Selection of sites

The neoplasms for analysis were selected based on the most common incidence and mortality in the Polish and European populations. Lung (ICD-10 C34), colorectal (C18–C21), breast (C50), and prostate (C61) cancers were chosen. Data for all cancer sites combined was also used in the analysis. For all sites, incidence data included C00–C97 neoplasms.

Data sources

Data was provided for all populations separately by sex. All data for the analysis presented was obtained from June to November 2022. The authors sent a request for data to institutions that oversee cancer data collection in the selected countries (see below for details).

Poland

Data on incidence was collected from the Polish National Cancer Registry [7] (1990–2019) and data on mortality from Statistics Poland [8] (1990–2019).

Austria

Data for Austria (1990–2019) was sent at the request of the Authors. Indicated data source was The National Statistical System of Austria [9].

Czechia

Incidence and mortality data (1990–2018) for single or grouped sites (C18–C21, C34, C50, C61) was retrieved from the official web portal on Epidemiology of Malignant Tumors in Czechia (SVOD) [10]. The SVOD project did not contain data about all cancer sites as a group. All cancer incidence data (1990–2016) was obtained from the European Cancer Information System (ECIS) [9], whereas mortality data (1990–2016) from the International Agency for Research on Cancer (WHO Cancer Mortality Database) [10].

Denmark

Incidence and mortality data in Denmark (1990–2019) was retrieved from the NORDCAN (Association of the Nordic Cancer Registries) database [11].

Estonia

Incidence and mortality data in Estonia (1990–2019) was collected from the ANDMEBAAS Health Statistics [12] and the Health Research Database and from the International Agency for Research on Cancer (WHO Cancer Mortality Database) [13] (1990–2018).

Latvia

Incidence data in Latvia (1996–2017) was retrieved from the register of patients with particular diseases regarding patients with oncological diseases from The Centre for Disease Prevention and Control of Latvia. Mortality data (1996–2017) was calculated based on the number of deaths from the Database of Causes of Death of Inhabitants of Latvia, The Centre for Disease Prevention and Control of Latvia. Data for the Latvian population was sent on request (the Central Statistical Bureau of Latvia was indicated as the source).

Lithuania

Data for Lithuania was collected from the European Cancer Information System (ECIS) [14] (1993–2012) and the International Agency for Research on Cancer (WHO Cancer Mortality Database) database [13] (1996–2019). Morbidity was excluded from the rate of change comparisons due to the short observation period (1993–2012).

Slovakia

Morbidity data for Slovakia was retrieved from the National Health Information Centre (NHIC) [15] (1990–2010), European Cancer Information System (ECIS) [14] and the International Agency for Research on Cancer (WHO Cancer Mortality Database) [13] database for mortality rates (1996–2019). Morbidity was excluded from the rate of change comparisons due to the short observation period (1990–2010).

Slovenia

Incidence and mortality data in Slovenia were acquired using data from The Cancer Registry of the Republic of Slovenia (CRS) [16] (1990–2018).

Sweden

Incidence and mortality data for Sweden was taken from the NORDCAN (Association of the Nordic Cancer Registries) [11] database (1990–2019).

Statistical analysis

Estimates of age-adjusted incidence and mortality rates standardized using the new European standard population (ASR-European, new E-ASR) from 2013 were used for all countries [17]. If the rates with the European standardization of 2013 were not found in the databases of countries, the data were recalculated by the authors based on the epidemiological and demographic data contained in the databases (Estonia, Latvia, Lithuania). Time trends for age-standardized rates were analyzed using Joinpoint Regression software (version 4.9.1.0) [18]. Annual percent change (APC) and average annual percent change (AAPC) were calculated. The minimum number of observations between two joint points was set at 5. The minimum number of observations from a joint point to either end of the data was set at 3 or 5. It depended on the number of years taken for analysis. The models were restricted to a maximum of 3 joint points. The error option which has been chosen was constant variance (homoscendasticity). P values < 0.05 were considered statistically significant.

Results

A comparison of the morbidity and mortality trends of the sites analyzed in the selected countries is presented in figure 1. Dots represent a point in time at which a trend change (joinpoint) occurred. Figure 2 represents the annual per cent change (APC) of the latest identified linear segment (trend) in incidence and mortality by neoplasm location in the selected countries calculated with the joinpoint regression method. A detailed table with APC values for each period was included in the supplement to the paper.

All sites

Panel A in figure 1 presents morbidity and mortality time trends for all cancer sites. Most countries noted an increase in the incidence among women since the beginning of the observation period, except for Austria. Among men, decreasing trends in incidence of the last observed period were recorded in Austria, Estonia, and Slovenia, but none of them was statistically significant (fig. 2, panel A).

The following patterns of morbidity were observed. The first one is represented by Poland, Czechia, Latvia, Sweden in both sexes and among women in Estonia, Slovenia – raising trends with periodic pace changes. The second pattern applies to Austria (both sexes) and Estonia, Slovenia (men) – the most recent segment of the trend is decreasing, the previous periods show an upward trend. The last curve presenting data from Denmark for women and men remained without change for the last 10 years (fig. 1, panel A). In Poland, the APC for morbidity among men (0.27% annually – fig. 2, panel A) was lower than for women (1.01% annually – fig. 2, panel A).

Overall cancer mortality decreased in both sexes in almost all countries. Only in Latvia was there a statistically significant mortality increase among women (0.14% annually – fig. 2, panel A). The smallest gap between mortality rates among men and women occurred in Sweden and Denmark, where the rates were also the lowest. These countries also had the highest APC rates of mortality decline. In Poland, a greater mortality reduction was observed among men (–1.28% annually – fig. 2, panel A) than in women (–0.59% annually – fig. 2, panel A).

Colorectum

Panel B in figure 1 shows data on colorectal cancer. In half of the countries, there was a downward trend of morbidity in men. An upward trend was observed in the Baltic States (Estonia, Latvia, and Lithuania), Slovakia, and Sweden, but at the same time, Sweden had the lowest incidence rate in men among all analyzed countries. In Poland, the decreasing incidence trend among men was observed from 2015, and APC was not statistically significant. An incidence decrease in women was observed only in 4 countries: Austria, Czechia, Slovenia, and Poland. The longest downward trend was noted in Austria (since 1998).

In all countries, except Poland and Estonia (only among men), a decreasing trend in cancer mortality was observed. The lowest mortality rates for both sexes were noted in Sweden. One of the highest values for the mortality rate in both sexes was observed in Poland compared to other analyzed countries. Similar values as in Poland were noticed in the Baltic States.

For both morbidity and mortality, higher values of standardized rates were observed among men than women.

Lung

In all analyzed countries, the morbidity and mortality rates have been decreasing among men over the years. The mortality trend shows the largest decrease. Among women, trends in morbidity and mortality tended to increase most of the time. Referring to the last observed period based on joinpoints, Denmark showed an outlier among women (decreasing curves for morbidity and mortality), also in Sweden the same tendency for mortality was observed (fig. 1, panel C). The highest APC rate of incidence increase in women was observed in Slovenia. Poland ranked second in terms of the increase in lung cancer mortality in women (2.46% annually – fig. 2, panel C) in the last observed period but had the highest standardized rate in the last analyzed year (38.9/100,000 – fig. 1, panel C). The trend line of morbidity and mortality within sex showed the same tendency – decreasing in men and increasing in women.

The values for morbidity and mortality rates were similar which distinguished them from other cancer trends, in which

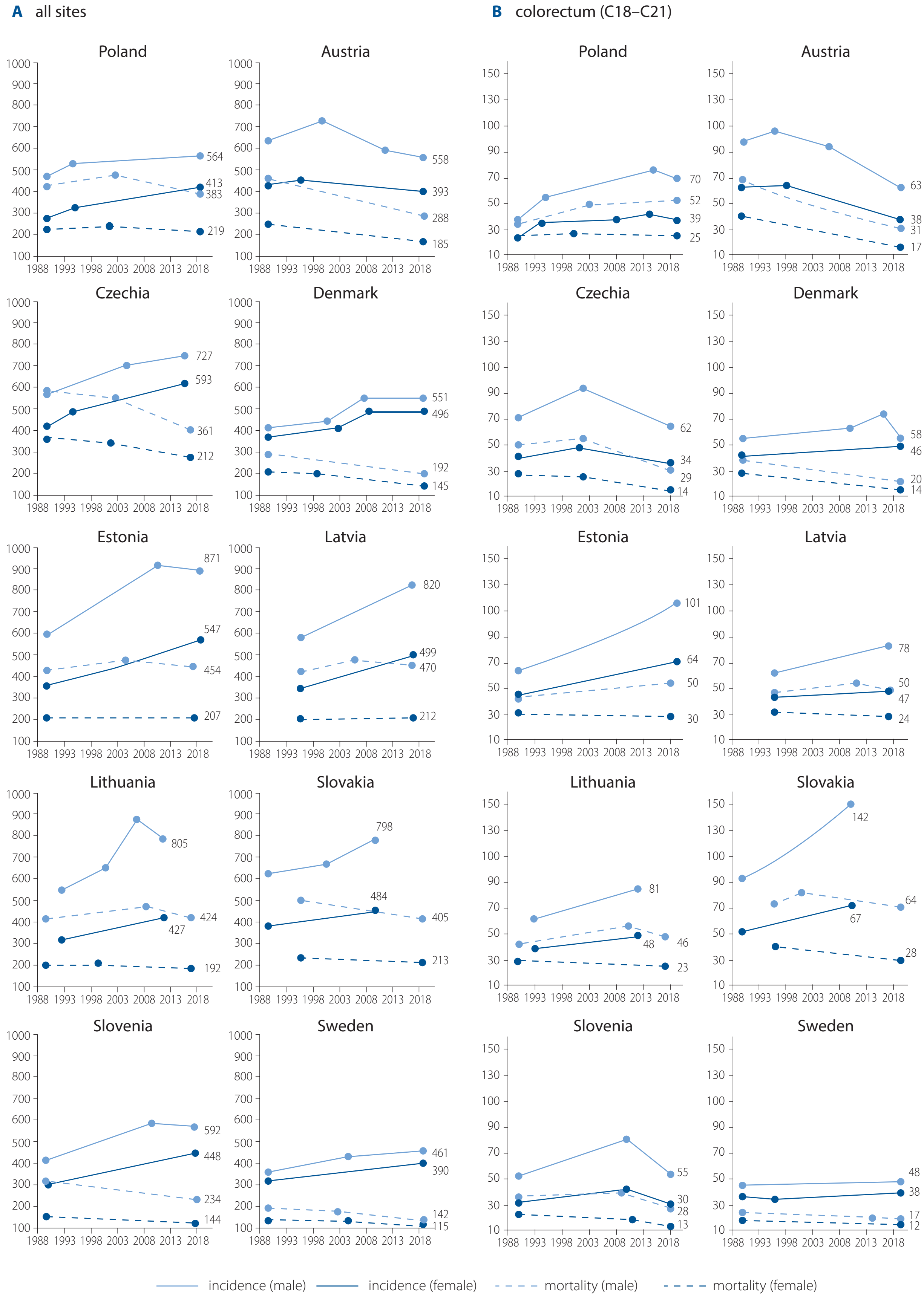

Figure 1. Joinpoint analysis of trends in incidence and mortality among men and women from 1990 to 2019 as per data availability

The values at the last point in the graph represent the actual age-standardized rate in the last observed year. Incidence and mortality in men (light blue) refer to C61 cancer, while incidence and mortality in women (dark blue) refer to C50 cancer

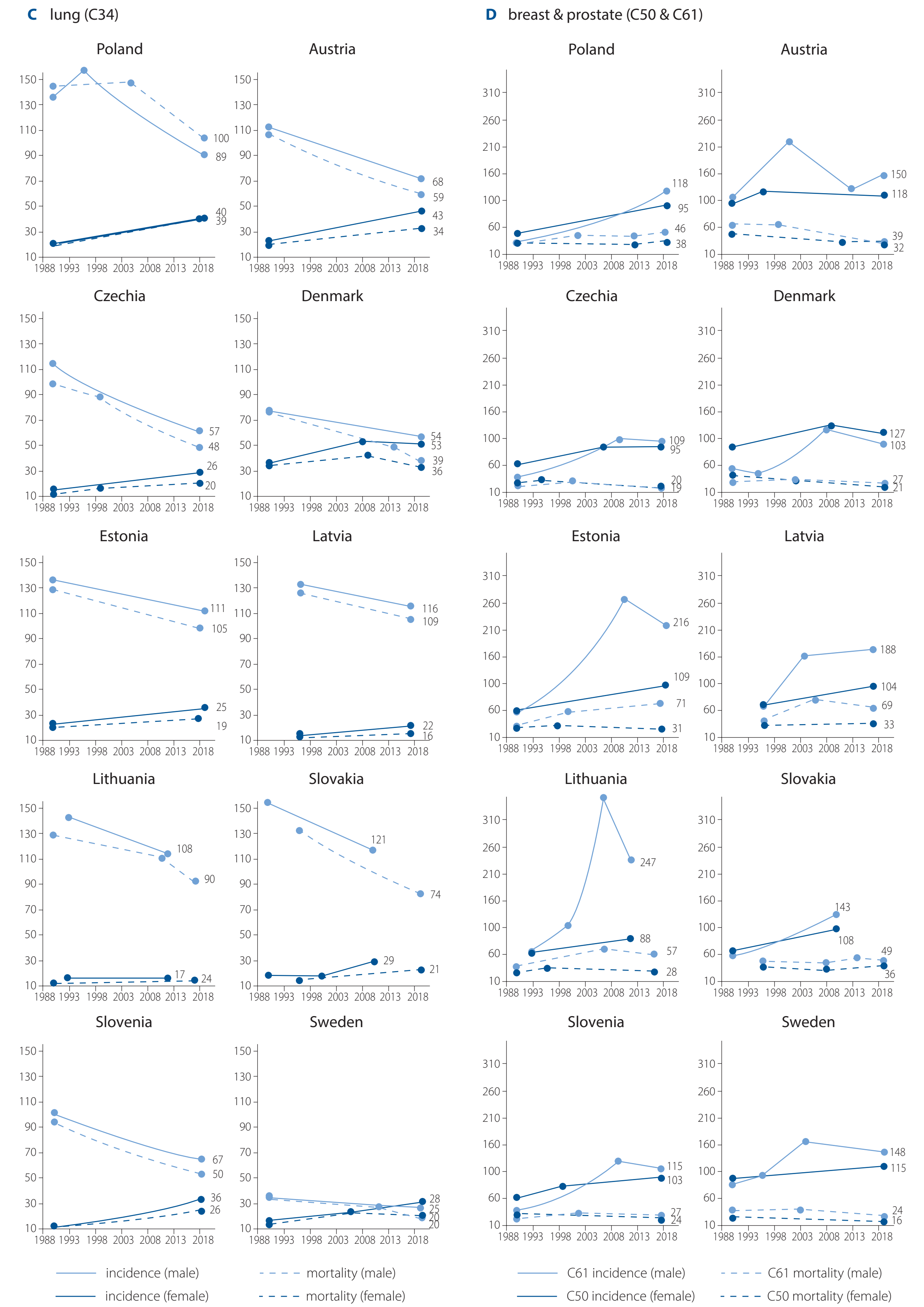

Figure 1. cont. Joinpoint analysis of trends in incidence and mortality among men and women from 1990 to 2019 as per data availability

The values at the last point in the graph represent the actual age-standardized rate in the last observed year. Incidence and mortality in men (light blue) refer to C61 cancer, while incidence and mortality in women (dark blue) refer to C50 cancer

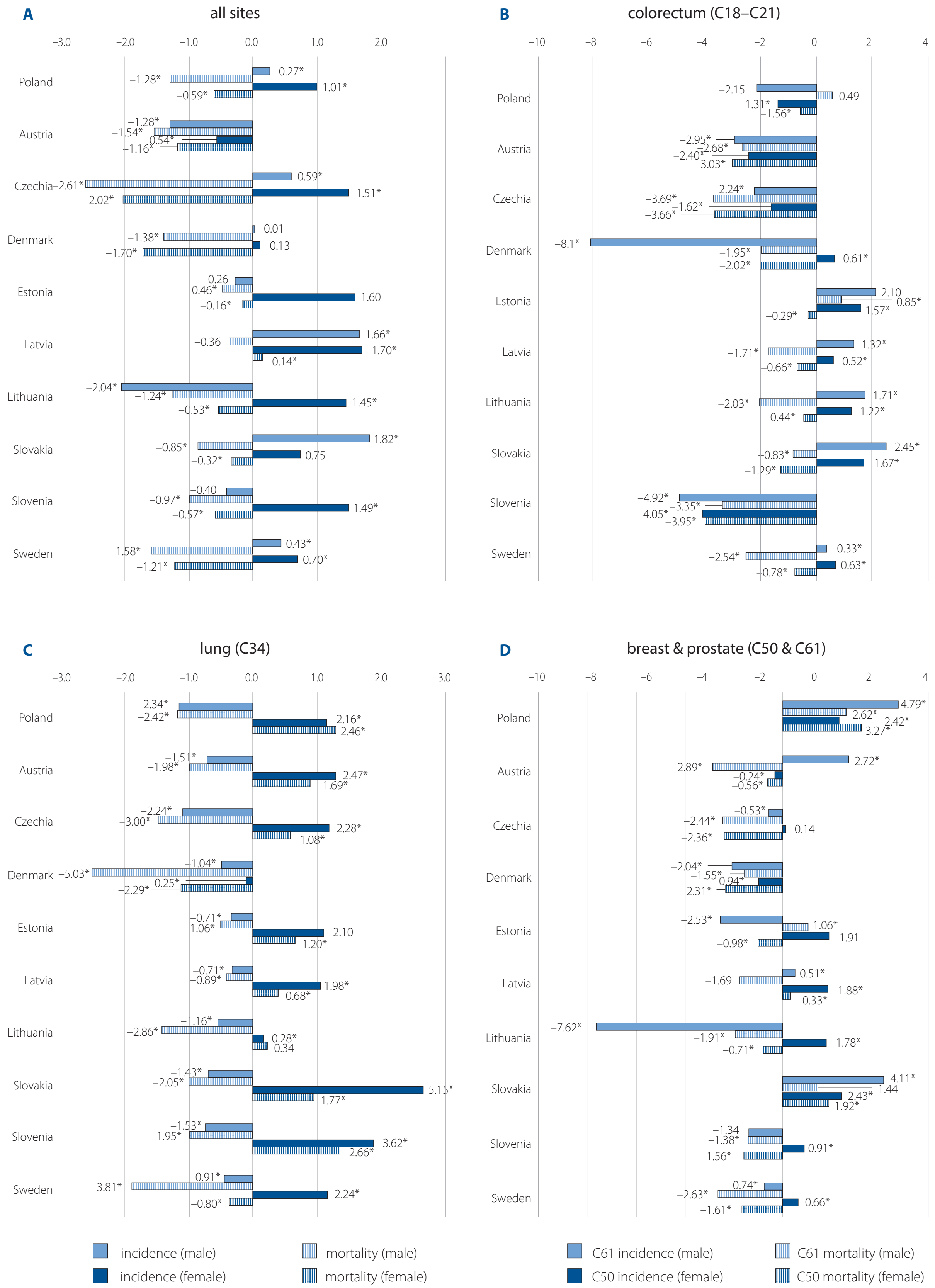

Figure 2. The annual percent change (APC) of the last linear segment identified (trend) in incidence and mortality by neoplasm location in selected countries calculated with the Joinpoint Regression method*

* – indicates that the APC is significantly different from zero at the alpha = 0.05 level. Incidence and mortality in men (light blue) refer to C61 cancer, while incidence and mortality in women (dark blue) refer to C50 cancer

Table I. Comparison of GDP and current healthcare expenditure [20] with mortality in selected countries in 2019

	% of gross domestic product (GDP)	PPS per inhabitant	Mortality, males [E-ASR]	Mortality, females [E-ASR]
Sweden	10.9	3968	142	115
Austria	10.4	4078	288	185
Denmark	10.0	3915	192	145
EU	9.9	3207	–	–
Slovenia	8.5	2361	234[b]	144[b]
Czechia	7.8	2443	361[a]	212[a]
Lithuania	7.0	1949	424[a]	192[a]
Slovakia	7.0	1565	405	213
Estonia	6.7	1792	454[b]	209[b]
Latvia	6.6	1457	470[a]	212[a]
Poland	6.5	1636	383	219

a – 2017; b – 2018

the mortality in both sexes tended to be lower than the morbidity. The unique case was Poland where mortality was higher than morbidity among men since 1999.

Breast and prostate

Breast

All countries, except Austria and Denmark, experienced an increase in breast cancer incidence during the period covered by the analysis. The fastest statistically significant increase of the APC was in Poland (2.42% annually). At the same time, Poland, Slovakia, and Latvia were the only countries where an increase in mortality was observed. Moreover, the highest statistically significant increase in mortality was observed in Poland (3.27% annually).

Prostate

The largest significant increase in the incidence of prostate cancer was observed in Poland (4.79% annually – fig. 2, panel A) with the greatest increase in mortality (2.62% annually). In other analyzed countries, except Latvia, a pattern was noticed in which a rapid increase in the incidence was followed by a sharp decrease.

All countries except Poland, Estonia, and Slovakia recorded a reduction in prostate cancer mortality. The lowest prostate cancer mortality rates in the last analyzed year were in Czechia (26.6 per 100 000) and the highest in the Baltics.

Discussion

Compared to other countries, Poland's cancer outcomes on population level are unsatisfactory. With lower morbidity (except for lung cancer), it had higher mortality.

The gross domestic product (GDP) level has been a factor that has differentiated the health status of societies in the world for many years [19]. This dependence is also visible in Europe, especially in the countries of Central and Eastern Europe when compared with the "old" European Union.

Table I presents the GDP and current healthcare expenditure of the analyzed countries for the year 2019, compared to data on cancer mortality for the same year. There was a considerable difference between the Nordic countries and Austria and the rest of the analyzed countries. Compared to other European countries and the European average, the current expenditure on health care in Poland was comparatively low and the percentage of GDP spent on health was the lowest. The presented data showed negative correlations between GDP and mortality in both sexes.

The funds allocated to health care translate beyond current healthcare expenditure into ways and possibilities of planning long-term healthcare costs expenditure (such as preventive, curative, rehabilitative and long-term care) [21]. The way these funds are allocated is of utmost importance for the health of citizens. The cheapest and most effective action to reduce the health burden of societies is disease prevention. It has been estimated that up to half of the cancer burden is preventable [22, 23]. Two strategies – disease prevention and prevention of premature death – should form the basis of cancer health policy. Health education brings the greatest benefits, as exemplified by the implementation of the European Code Against Cancer (in Western Europe, the first edition of ECAC was presented in 1987) [24].

The spectacular success of primary prevention is demonstrated by the reduction of tobacco smoking and, consequently, a decrease in lung cancer incidence. The introduction of primary prevention in the form of educational campaigns informing about the harmful effects of smoking had a huge impact on the number of lung cancer cases and deaths among men in developed countries [25, 26]. Throughout the observed periods, morbidity and mortality in women have been increasing in most countries – the only exception is Denmark.

An interesting case is Sweden, where, due to the decreasing incidence trend among men and increasing among women, in the last observed year the incidence rate was higher among women than among men. The phenomenon of the lack of success in reducing smoking among women is mainly psychological [27]. There are no population screening programs introduced for lung cancer, although attempts are being made to implement them [28]. It seems that the greatest emphasis should be placed on supporting women in quitting smoking.

The second type of cancer prevention is early detection of precancerous conditions (secondary prevention), which is possible thanks to the introduction of the policy of preventive examinations. The observed changes in morbidity and mortality in Central European countries are likely the result of different health policies, which is apparent in the timing of the implementation of screening programs. In most countries, screenings for colorectal and breast were implemented, except for Slovakia where such programs have not been introduced at all. PSA screening towards prostate cancer is controversial because of low specificity for prostate cancer detection in symptomatic patients [29].

Many studies have shown that healthy lifestyle factors are associated with a lower risk of developing colorectal cancer [30]. This observation has been implemented in the recommendations of the European Code Against Cancer (ECAC). Simultaneously, ECAC recommends a second form of prevention for this neoplasm – screening for the early detection of polyps in the intestine, which reduces the risk of both subsequent cancer development and death [31]. Colorectal cancer screening was introduced at the earliest in Czechia – In 2000 [32]. The time trends showed a shift in the trend from ascending to descending in the incidence (men and women) and mortality (men) already in 2002, which suggests that there may have been educational campaigns undertaken earlier. A clear effect of the screening implementation could be seen in Austria (introduction date 2002), Slovenia (2009), and Denmark (2014) [32], where there was a reduction in mortality after the introduction of screening. In Sweden, no clear differences in morbidity and mortality trends were observed after the introduction of screening (2008) [32], however, in this country, mortality from the beginning of the observed period had a downward trend and the mortality rate value in the last year of observation was the lowest among all the countries surveyed. Poland introduced a screening test policy in 2012 [32]. Poland and Estonia were the only ones in the analyzed group to have growing trends in colorectal cancer mortality, while in Estonia the screening program was introduced only in 2016. The European Union study in 2019 showed that Denmark, Austria, Slovenia, and Czechia reported the highest percentage of people (in the 50–74 age group) ever screened for colorectal cancer [33]. In these countries, more than two-thirds of respondents took part in preventive examinations. In Poland, about 80% of respondents reported that they had never taken part in such a program [33]. It was the worst result among the countries analyzed in this paper. The low level of health literacy has a direct impact on colorectal cancer in Poland. In January 2022, screening for colorectal cancer was abandoned in Poland – the effects of this decision may be observed in the following years, but it can be expected that it will contribute to an increase in mortality among Poles.

Screening with mammography and breast self-examination can help detect breast cancer at an early stage and reduce mortality [34]. The earliest screening program was introduced in Sweden in 1986 [32]. The morbidity and mortality trends in Sweden since this year did not change over time, remaining at the same level, and Sweden had the lowest mortality rate from breast cancer in the last observed year. The second country with a low mortality rate was Czechia, which introduced screening in 2002 [32]. Even by 2001 a decline in mortality rates began, maintaining that trend throughout all subsequent years of observation. In the following year, an increase in morbidity was observed, which persisted for the next 5 years. Subsequently, the incidence rate stabilized at around $100/10^5$. Screening programs have also been introduced in Estonia (2003), Slovenia (2008), Denmark (2008), and Austria (2014) [32]. In these countries, a reduction in mortality caused by breast cancer was noted, although in the case of Austria, due to the short time that had passed since the start of the intervention, this effect cannot be linked to the introduction of screening. A particularly substantial increase in incidence was noted in Denmark, where the rates increased from $137/10^5$ in 2008 (start of screening) to $166/10^5$ in 2009. In Poland, screening was introduced in 2006, but despite the increase in morbidity, a decrease in mortality was not observed. The increase in the mortality rate was the highest in the entire study group (3.27% annually). The other two countries where an increase in mortality was observed were Latvia and Slovakia, but in these countries, the APC was at a much lower level (fig. 2, panel D). Among the countries analyzed in 2019, Poland, Slovakia, and the Baltic countries were below the average European proportion of women having mammography, but at the same time, over 80% of women reported having taken part in screening examinations at least in the last 2 years [33]. In 2016 in Poland, paper invitations to breast and cervical cancer screening stopped being shipped, and an important communication channel with women was lost. The effect of this action has not yet been considered in this analysis.

In the last decade of the 20th century, in some developed countries prostate cancer screening was introduced through the PSA test. The analysis of trends in the discussed countries indicates that the introduction of the PSA test is reflected in the growing incidence rate. The clearest peak of growth could be seen in the incidence in Lithuania, where in 2006 a program of preventive examinations was started [35]. Large increases in incidence were also noted in Estonia (no population-based program but increased PSA testing [36]) and Austria (intensive screening program in 1990–2002 [37]). In Sweden, Slovakia, and Czechia a population program was conducted until 2003 [38, 39] and in Denmark until 2009 [40].

Currently, doubts are raised that conducting population studies using PSA tests is unjustified and can lead to overdiagnosis [41, 42]. In Poland, there were no population-based screening programs using the PSA test. However, a study was conducted on participation in PSA levels in men participating in the PolSenior population study. It has been shown that about 60% of older men have never had a PSA test. Among younger men (55–59 years), the percentage was 72.2%, and the respondents were more often functionally independent, better educated and married with higher than average personal income and a healthy lifestyle (nonsmoker) [43]. Considering that Poland was the only country with a significant increase in prostate cancer mortality among the analyzed countries, it can be concluded that the effectiveness of treatment is lower in Poland than in other countries. In 2021 the European Commission presented Europe's Beating Cancer Plan focused on four key action areas: prevention, early detection, diagnosis and treatment, and improving quality of life. The European plan assumes that by 2025, 90% of the European Union population that is affected by breast, cervical, and colon cancer will have access to breast, cervical, and colon cancer screening programs co-financed by EU funds [44].

Conclusions

The challenge for Europe is to provide equal access to health care for all citizens. Wide disparities in cancer screening exist across European countries and even between specific regions within a country. One of the fundamental recommendations proposed by The Lancet Oncology European Groundshot Commission is the implementation of screening programs, which has real effects in reducing the burden of cancer and in slowing down or reversing the upward trend in cancer mortality [45]. Screening programs do not include lung cancer, but in this case, due to primary prevention, the rates among men are decreasing through the years.

Compared to Western countries, Poland fares worse both in terms of morbidity and mortality. Poland is a country that has one of the smallest amounts of current expenditures on health care, which translates into one of the highest mortality rates in both women and men. Screening and educational programs in Poland should be supported. On the whole, European education on lung cancer among women should be promoted.

Limitations

A limitation of the study is the unequal amount of available data, especially in the case of Latvia, Lithuania, and Slovakia. Not all data comes from national institutions. Some were taken from the European and WHO databases. Therefore, it was difficult to assess to what extent the analyzed data represented the continuing trend in the following years.

Conflict of Interest: none declared

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