

Pancreatic cancer in Poland: an analysis of incidence, mortality and years of life lost over a period of 22 years

Nowotwór trzustki w Polsce – analiza zapadalności, umieralności oraz utraconych lat życia w czasie 22 lat

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Key words: pancreatic cancer, incidence, burden of disease, years of life lost, mortality.

Słowa kluczowe: rak trzustki, zapadalność, obciążenie chorobą, utracone lata życia, umieralność.

Abstract

Introduction: Due to the late diagnosis and lack of standardized screening tests, pancreatic cancer is one of the world's most lethal neoplasms. Over the last 30 years incidence and mortality has more than doubled globally and the overall pancreatic cancer burden is thought to increase along with the increase of average life expectancy.

Aim of the research: To analyze countrywide trends, age patterns and burden of premature mortality due to pancreatic cancer in 1996–2018.

Material and methods: All calculations are based on publicly available data. Age-standardized incidence and mortality rates were used to present incidence and mortality statistics comparable across time. Years of potential life lost (YPLL) were calculated by applying the up-to-date reference life tables.

Results: During the analyzed period the overall pancreatic cancer incidence and mortality increased by 18% and 45%, respectively. Both standardized incidence and mortality rates, however, decreased among men and remained relatively stable among women. The number of YPLL increased by 23%, with the highest values being observed in the 65–69 age group. Meanwhile, a decrease in the mean YPLL value has been observed.

Conclusions: Our results indicate that the mean age of death due to pancreatic cancer has increased. Evidence of the change in incidence and mortality related to population ageing might be used by policymakers to improve the healthcare system in addressing the increasing health needs of the elderly population as well as to enhance primary preventive methods in the younger age.

Streszczenie

Wprowadzenie: Nowotwór trzustki jest obecnie jednym z najbardziej śmiertelnych nowotworów. Przyczynę stanowią przede wszystkim diagnoza stawiana w zaawansowanym stadium choroby oraz brak powszechnych i skutecznych badań przesiewowych. Przez ostatnie trzy dekady stwierdzono ponad dwukrotny wzrost zapadalności i umieralności na świecie. Uważa się, że obciążenie chorobą będzie wzrastać wraz ze wzrostem oczekiwanej długości życia.

Cel pracy: Analiza krajowych trendów, rozkładu wieku oraz obciążenia w wyniku zgonów spowodowanych nowotworem trzustki w Polsce w latach 1996–2018.

Materiał i metody: Przeprowadzone obliczenia oparte są na publicznie dostępnych danych. Standaryzowane współczynniki obliczono, by umożliwić porównanie wartości w czasie. Potencjalne utracone lata życia (YPLL) obliczono z wykorzystaniem aktualnych referencyjnych tabel przeżycia.

Wyniki: W analizowanym okresie całkowita zapadalność i umieralność na nowotwór trzustki wzrosła odpowiednio o 18% i 45%. Współczynniki standaryzowane zmniejszyły się u mężczyzn oraz pozostały stosunkowo stałe u kobiet. Suma utraconych lat życia wzrosła o 23%, z najwyższą wartością w grupie wiekowej 65–69 lat. Średnia wartość utraconych lat życia zmniejszyła się.

Wnioski: Przedstawione wyniki potwierdzają tezę, że w ostatnich dekadach średnia wieku zgonu na nowotwór trzustki wzrosła. Zmiany w zapadalności i umieralności spowodowane starzeniem się społeczeństwa mogą być pomocne dla ustawodawców w ustalaniu rosnących potrzeb osób starszych oraz skutecznych programów przesiewowych skierowanych do młodszej populacji.

Introduction

With a 5-year survival rate of only about 10%, pancreatic cancer is one of the world's most lethal neoplasms [1]. For comparison, prostate, stomach and liver cancers have 5-year survival rates of 99%, 32% and 20%, respectively [2]. Factors responsible for such unfortunate results may include: late diagnosis, due to the lack of standardized pancreatic cancer screening tests and the fact that symptoms typically occur when the disease reaches an advanced stage; quick progression and relatively low success rate of currently available treatment [3]. A recently published Global Burden of Disease Study demonstrates that the global number of cases, deaths and disability-adjusted life years caused by pancreatic cancer has more than doubled from 1990 to 2017 and suggests that the main reason for this increase is population growth and longevity, followed by changes in associated risk factors (mostly smoking, diabetes and obesity) [4]. Thus, the overall burden of pancreatic cancer is thought to increase along with the increase of global lifespans.

In Poland, pancreatic cancer is the fifth leading cause of cancer-related deaths among women and the sixth among men, being responsible for 5% of all cancer-related deaths in 2018 [5].

Aim of the research

The aim of our study was to analyze countrywide trends, age patterns and years of life lost due to pancreatic cancer. Years 1996 to 2018 were included in our study to provide the longest possible analysis period. A comprehensive analysis of epidemiological indicators of pancreatic cancer as well as a comparison across both sexes and various age groups over such a long period of time might be valuable in exploring predictors of epidemiological trends and useful in allocating public health resources at a national level.

Material and methods

Absolute numbers of new cases and deaths due to pancreatic cancer in 1996 and 1999–2018 (1997–1998 have been omitted due to a national physicians strike and a following reduction in the database quality) classified by sex and five-year age groups were obtained from the annual "Cancer in Poland" reports published on the website of the Polish National Cancer Registry [6]. The structure of the Polish population by sex and five-year age groups was obtained from the Central Statistical Office [7] as of June 30th for each year from 1996 to 2018 according to permanent domicile. The population structure for 1996 and 2018 is presented in Figure 1.

The crude cancer incidence and mortality rates were used to inform about the number of cases and deaths per 100,000 population. This measure does not consider the age structure of the population. Frequency of pancreatic cancer occurrence in particular age groups was measured using age-specific incidence and mortality rates expressed per 100,000 population in the given age group. Age-standardized incidence and mortality rates were used to present incidence and mortality statistics comparable across time. We analyzed standardized coefficients provided by the National Cancer Registry. For 1996 the data source was data reported in Cancer in Poland 1996 [8], for 1999–2018 reports from an on-line database were generated [9]. In these reports a direct standardization was used and the standard world population was applied as the standard population.

Years of potential life lost (YPLL) in 1996 and 2018 were calculated by applying the up-to-date reference life tables proposed by the Institute for Health Metrics and Evaluation and recently used in the Global Burden of Disease study, with the normative standard life expectancy of 86.59 years at birth (not age-weighted)

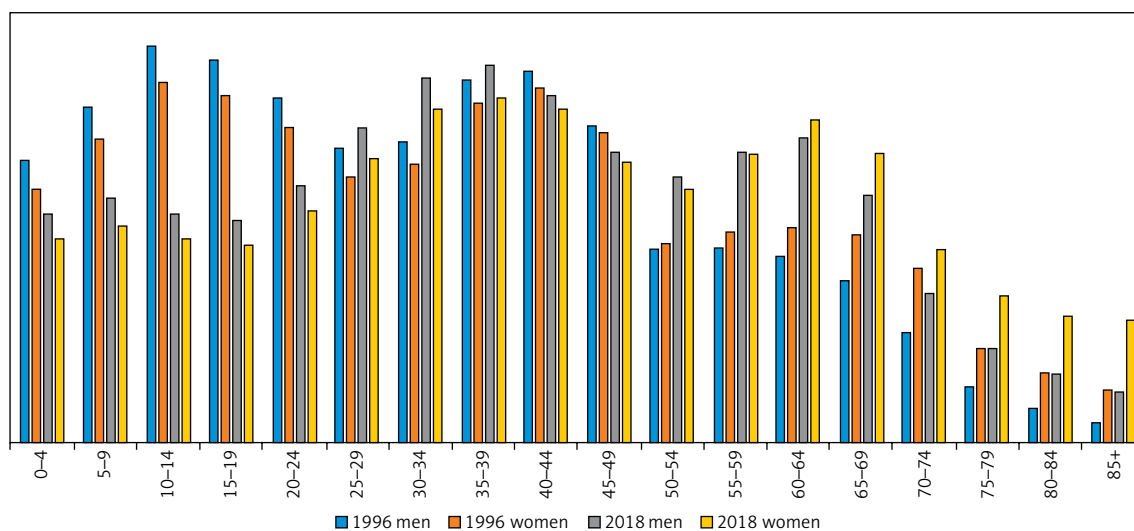


Figure 1. The structure of the Polish population by sex and 5-year age group for 1996 and 2018

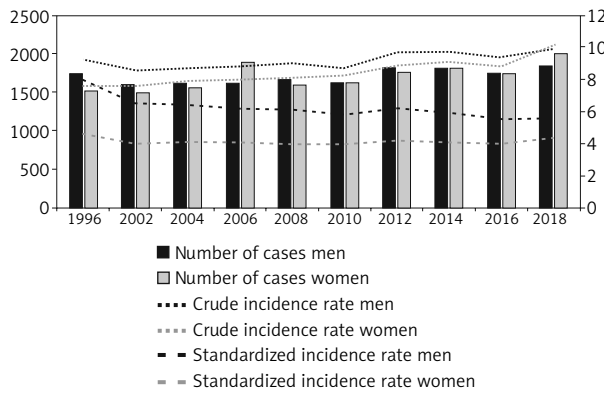


Figure 2. Pancreatic cancer incidence per year and sex. Crude and standardized incidence rates are presented as trend lines

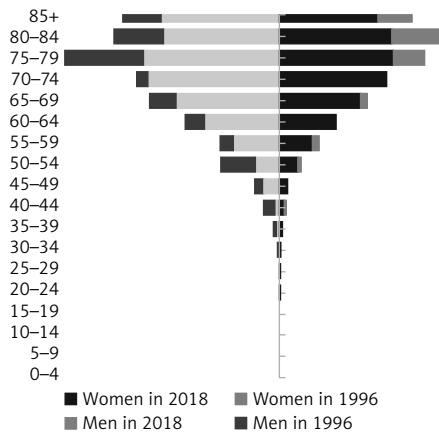


Figure 3. Age-specific incidence rates per 100,000 among men and women in 1996 and 2018

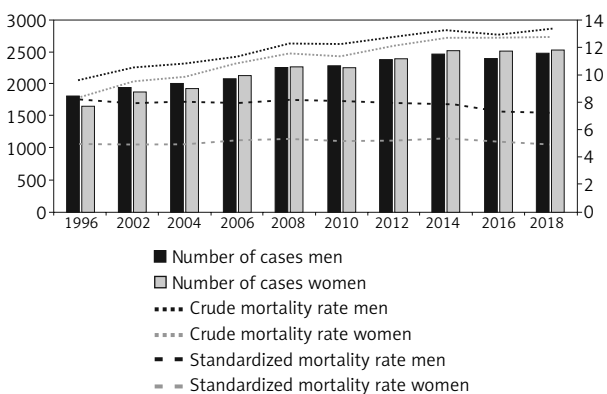


Figure 4. Pancreatic cancer mortality per year and sex. Crude and standardized mortality rates are presented as trend lines

nor discounted) [10]. YPLL were calculated by multiplying the number of deaths due to pancreatic cancer in the analyzed age group by the remaining life expectancy for each age category: $YPLL = N \times SLE$, where N is the number of deaths in a given age group,

and SLE is the standard life expectancy at death. Mean YPLL were determined by dividing YPLL by the actual number of deaths for a given cancer site over a defined period of time. Total and mean YPLL were computed for men, women and both sexes combined. In order to compare YPLL and mortality parameters, YPLL generated by pancreatic cancer were expressed as a percentage of total YPLL due to cancers and related to the number of deaths of pancreatic cancer expressed as a percentage of the total number of deaths of cancer. The results of these calculations indicate the relative difference between the burden of pancreatic cancer and mortality.

Results

Incidence

During the analyzed period of time the number of new cases of pancreatic cancer in both sexes increased by 18%, from 3245 cases in 1996 to 3837 cases in 2018. In 1996, 53% of all pancreatic cancer cases occurred in men, compared to 48% in 2018. The number of new cases was the highest among men aged 60–69, whereas among women it was mostly observed in the 65–74 age range. Additionally, the number of cases was lower among women aged < 70 than among men in the same age group, whereas an inverse proportion was observed when comparing population aged > 70.

The crude incidence rate among men was 9.2 per 100,000 in 1996 and increased to 9.9 per 100,000 in 2018. The equivalent findings for women were 7.9 per 100,000 in 1996 and 10.1 per 100,000 in 2018 (Figure 1). Standardized pancreatic cancer incidence rates among men generally decreased in the analyzed period of time; from 7.9 per 100,000 in 1996 to 5.6 per 100,000 in 2018, while among women relatively stable rates have been observed over the past two decades, with a slight increase in 2016–2018 (from 4.0 to 4.4 per 100,000, respectively) (Figure 2).

During the analyzed period age-specific incidence rates per 100,000 increased along with increasing age; this trend was similar between men and women. Age-specific incidence rates among men have declined in all age groups since 1996. In contrast, among women they were higher in 2018 than in 1996 in some age groups (20–39, 45–49, 60–64 and 70–74) (Figure 3).

Mortality

Pancreatic cancer mortality and crude and standardized incidence rates are presented in Figure 4. From 1996 to 2018 a noticeable 45% increase in the number of deaths caused by pancreatic cancer was reported; from 3451 (52% among men) to 5004 (49.5% among men). The number of deaths peaked in the 65–69 age group among men and among women aged > 70. The age pattern for the number of deaths showed a similar trend to the number of cases: the total mortality was

lower among women aged < 70 than among men in the same age group, whereas the numbers were higher among women aged > 70. Additionally, the number of deaths was significantly higher among men in all age groups younger than 84. In the population aged > 84 the mortality was higher among women. Crude and standardized mortality rates were higher among men than women in all years from 1996 to 2018. However, long-term trends show some differences. Crude mortality rates have increased from 9.6 per 100,000 in 1996 to 13.3 per 100,000 in 2018 among men and from 8.3 per 100,000 in 1996 to 12.7 per 100,000 in 2018 among women. Meanwhile, the standardized mortality rates have decreased among men (from 8.2 per 100,000 in 1996 to 7.2 per 100,000 in 2018) and remained stable among women (4.9 per 100,000). According to our results, age-specific mortality rates between 1996 and 2018 decreased among men until the age of 70 and increased in age groups older than 70 years. Among women, age-specific mortality rates in 2018 were higher than in 1996 in the following age groups: 30–39, 45–49, 60–64, 70–79 and 85+ (Figure 5).

Years of potential life lost

The number of YPLL due to pancreatic cancer deaths in 2018 was 23% higher than in 1996: 95466 in 2018 (54% among men) vs. 77888 in 1996 (58% among men). Similar to incidence and mortality, YPLL were much higher among men than among women in all age groups younger than 70. Highest YPLL values among both men and women were observed in the 65–69 age group. Between 1996 and 2018 mean YPLL declined from 24.91 to 20.95 among men, and from 20.01 to 17.7 among women. The share of pancreatic cancer in total cancer YPLL increased slightly from 4.1% and 4.2% in 1996 to 4.8% and 5.2% in 2018, among men and women, respectively. A similar trend was shown in the share of pancreatic cancer in total cancer mortality: 4.0% and 4.9% in 1996 vs. 5.0% and 5.0% in 2018, among men and women, respectively. Both in 1996 and 2018 the ratio of YPLL expressed as the percentage of total cancer YPLL to mortality expressed as the percentage of total cancer mortality was close to unity, indicating that the burden of pancreatic cancer does not exceed pancreatic cancer mortality.

Discussion

Our analysis of pancreatic cancer incidence in Poland in 1996–2018 demonstrates that although the number of new cases and crude incidence rates have increased, standardized and age-specific incidence rates, which reflect the absolute scale of the problem, presented a downward trend. It indicates that the overall incidence of pancreatic cancer is influenced mainly by the population's size and age structure. Taking into consideration that the sharp expansion of

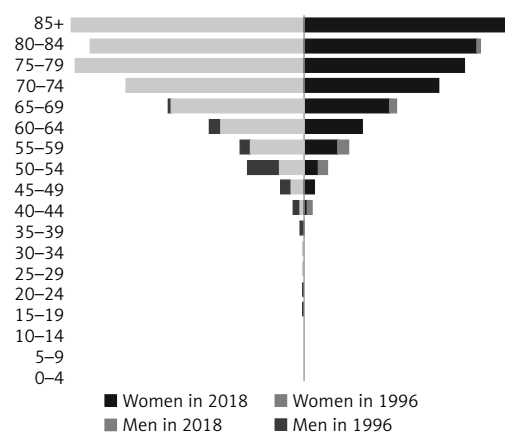


Figure 5. Age-specific mortality rates per 100,000 among men and women in 1996 and 2018

pancreatic cancer incidence occurs in the population aged > 50 and that the share of population at this age increased from 22% and 28% in 1996 to 34% and 40% in 2018 (among men and women, respectively) [11], such explanation seems to be reasonable.

Long-time mortality trends presented a similar pattern as incidence trends, suggesting that increase in deaths due to pancreatic cancer is related to overall population ageing. According to our analysis, population burden of pancreatic cancer measured in YPLL was higher in 2018 compared to 1996. However, mean YPLL, which is a measure indicating the impact of pancreatic cancer on individual patients, have decreased. This may be interpreted as further evidence that the mean age of death due to pancreatic cancer has increased.

These findings are in line with other studies. A systematic analysis of the global burden of pancreatic cancer covering 195 countries and territories showed that globally the number of deaths, incident cases, and disability-adjusted life years caused by pancreatic cancer have more than doubled from 1990 to 2017 and the increase in incidence of pancreatic cancer is likely to continue with the ageing population [12]. It is predicted that by 2025 an almost 50% increase in the number of recorded deaths due to pancreatic cancer compared to 2010 will occur in the European region [12, 13] and that pancreatic cancer will escalate from fourth to second leading cause of cancer deaths in the USA by 2030 [14].

According to our findings, the overall incidence and mortality due to pancreatic cancer in 1996 was higher among men than among women (53% and 52%, respectively), whereas in 2018 the ratio has shifted – 52% of overall incidence and 50.5% of overall mortality was reported among women. However, when analysing crude and standardized incidence and mortality rates, men were more affected, which is consistent with other research [4, 15]. The cause of pancreatic cancer prevalence among men is not yet

fully explained. However, since smoking has been proved to be the main environmental risk factor for pancreatic cancer [16], one plausible reason may be less tobacco exposure among women. Furthermore, given that the estimated population fraction of pancreatic cancer deaths to tobacco smoking amounts to 11–35% [17, 18], a reduction in tobacco smoking might be attributable to the decline in standardized incidence rates. As compared to 2000, the percentage of smokers in 2019 decreased by over 19 percentage points among men (43.3% vs. 24%) and almost 5 percentage points among women (22.7% vs. 18%) [19, 20]. It is important to stress that this downward trend is seen only in the population younger than 60. The percentage of smokers increased by 35.94% in the 60–64 age group and by 9.68% in the population aged > 65 in 2000 to 2015 [21]. The GBD 2017 study found that the highest proportion of pancreatic cancer deaths attributable to smoking for both sexes was observed in the 55–84 age groups, which is consistent with both our and the International Pancreatic Cancer Case-Control Consortium findings [22].

It has been suggested that although not directly causing cancer, socioeconomic variables may impact the overall cancer risk indirectly by promoting access to environmental risk factors and limiting healthcare and treatment accessibility [23]. Considering that major pancreatic cancer environmental risk factors such as smoking, diabetes and obesity [4, 24, 25] might be significantly reduced by preventive measures, implementing such strategies on a national level constitutes a valuable and relatively accessible tool for healthcare policymakers.

This study is subject to limitations coming from the overall quality of epidemiological data. In Poland cancer incidence registry is based on malignant neoplasm notification forms and cancer mortality is based on data from death certificates registered by Statistics Poland. Our analysis is based on data collected by the Polish National Cancer Registry. The quality of data in this registry is still improving: the ratio of cancer mortality and incidence rates in the population, conventionally used as an indicator of the completeness of cancer registration, amounted to 0.8 in 1996 and 0.7 in 2018 and 91% of reported cases among men and 92% among women in 2018 were confirmed with the histopathological examination [26].

Mortality rates are in general a better indicator of progress against cancer than incidence rates because they are less affected by bias resulting from changes in detection practices. Nevertheless, mortality statistics alone cannot distinguish between the effects of primary prevention, earlier disease detection or various treatment possibilities. This is the reason why we analyzed both incidence and mortality data. Disability- and quality-adjusted life years may provide additional information complementing the population-based metrics such as YPLL. However, because of poor

availability of information about the period of disease before death, they have been not considered in the present study.

In conclusion, evidence on the change in incidence and mortality related to population ageing might be used by policymakers to improve the healthcare system in addressing the increasing health needs of the elderly population as well as to enhance primary preventive methods in the younger age.

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Conflict of interest

The authors declare no conflict of interest.

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