

EPIDEMIOLOGICAL STUDY

Cancer epidemiology in Slovakia

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ABSTRACT

Slovakia, in accordance with a global trend, is experiencing an increasing cancer burden. Development and assessment of preventive and healthcare interventions are informed by cancer epidemiology.

This study presents the current epidemiological situation and trends for three prevalent malignancies: breast, colorectal, and cervical cancer in the Slovakia. Population-based screening programs for these cancers have recently been reinforced.

Breast cancer is the most common newly diagnosed cancer and also the most common cause of death of all cancer in women. Cervical cancer is the second most common cancer in women with decreasing mortality. Colorectal cancer belongs to the cancer diseases with highest incidence and mortality in both the male and female populations, with the majority of cases diagnosed in later stages.

Despite progress in specific areas of cancer care, Slovakia acknowledges the need for further improvements. Enhancing cancer screening uptake presents a crucial area for advancement (*Fig. 7, Ref. 19*). Text in PDF www.elis.sk

KEY WORDS: epidemiology, Slovakia, breast cancer, colorectal cancer, cervical cancer.

Introduction

Cancer causes a significant and growing health and economic burden worldwide (1,2), the extent of which is monitored and assessed by cancer epidemiology (3). The information provided by cancer surveillance enables the establishing of appropriate preventive and health care interventions.

The trend of increasing cancer burden is not unique to Slovakia, a Central European country, that has observed a sharp increase in newly diagnosed cancer cases over the past half-century. In men, the most common malignancy is prostate cancer and in women breast cancer. Majority of newly diagnosed malignant tumors occur in individuals aged 65 and over (4). This age-related increase in cancer prevalence reflects the aging demographics of Slovakia and the cumulative effects of chronic lifestyle factors (5).

To stop the growing devastating impact of cancer on society, a reinforcement of cancer screening programs is important. Detecting cancer in early, most treatable stages, enhances patient prognosis, and, at the same time, alleviates the burden on the healthcare system (6). Cancer epidemiology is indispensable for establishing screening criteria, evaluating program effectiveness, and optimizing resource allocation (3).

In Slovakia, three national screening programs have recently been strengthened under the auspices of the Ministry of Health of the Slovakia and in collaboration with the National Cancer Institute: colorectal cancer, breast cancer, and cervical cancer screening (7).

The implementation of these national screening programs represents a significant step forward in Slovakia's efforts to combat cancer. By strengthening the early detection, these programs have the potential to improve patient outcomes, reduce healthcare costs, and enhance overall health outcomes.

This study describes the epidemiological situation and trends of these three cancer types that are under the population screening programs in Slovakia.

Methods

In the absence of a unified national cancer database to provide good quality data, we used multiple data sources for the study.

The national cancer incidence data are available for the period 1978–2012 from the National Cancer Registry (NCR), which is operated by the National Health Information Centre (NHIC).

Newly diagnosed cancer cases in years 2013 and 2014 are provided by NHIC, however, they were collected through accelerated data collection, are thus incomplete and as such they need to be interpreted with caution.

National hard data on cancer incidence for 2015 and 2016 are unavailable. NHIC provides predictions for this period based on the trends that include the 2013 and 2014 incomplete data.

Cancer incidence data for 2017–2021 are estimations based on the account of insured population of the Slovakia. The calculation utilizes healthcare claims data obtained through reimbursements

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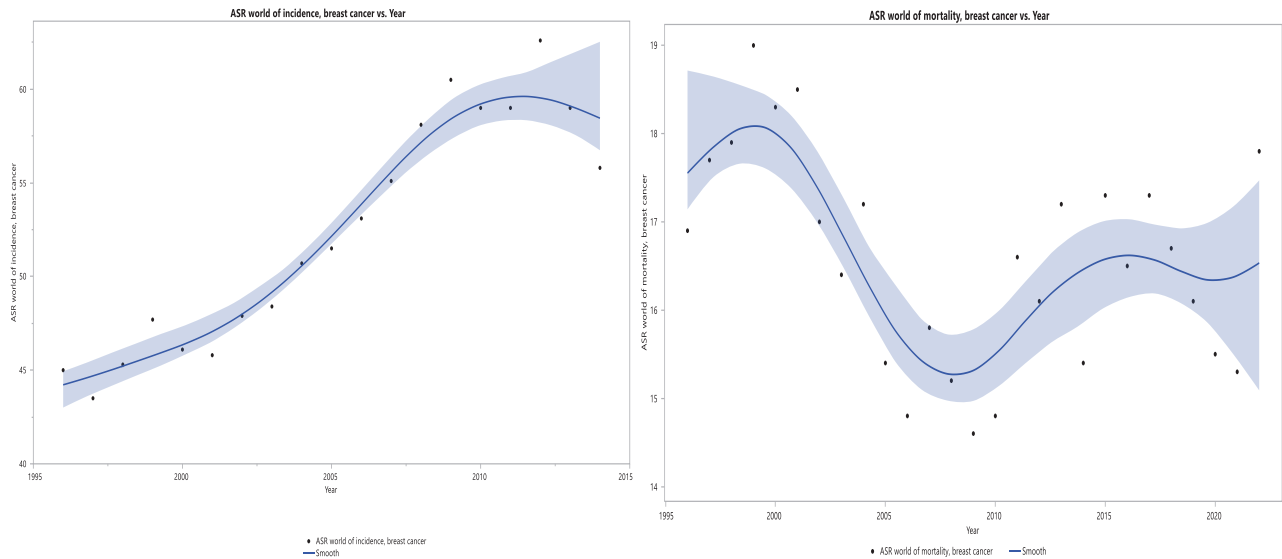


Fig. 1. Incidence ASR-W (left) and mortality ASR-W (right) of breast cancer in female population of the Slovakia in years 1997–2022 (data source: NCR SR, new cases in 2017–2021 are estimations based on insured population).

from health insurance companies. This strategy aims to include newly diagnosed cases only and exclude the recurrent cases. However, the possibility of misclassification remains (8, 9). The data were filtered according the International Classification of Diseases, 10th revision (ICD-10) (10).

Cancer incidence and mortality predictions were obtained from the Global Cancer Observatory (GLOBOCAN) estimates of cancer incidence and mortality produced by the International Agency for Research on Cancer (11).

We used the ICD-10 to classify the cancer types. We provide the data for all cancer types, for breast cancer (ICD-10 code C50), colorectal cancer (ICD-10 codes C18-20) and cervical

cancer (C53). Breast cancer is currently the most commonly diagnosed malignant tumor in women and an extremely rare disease in men (12). Therefore we describe the epidemiology of breast cancer only in the female population. Apart from describing the epidemiology of a broader group of colorectal cancer, we have also described the situation in colon cancer (ICD-10 code C18).

We used and calculated the following indicators: absolute number of new cases, crude incidence and age standardised incidence, absolute number of deaths, crude mortality and age standardised mortality, proportions of newly diagnosed cancers by age and clinical stage at diagnosis. The world population was used to calculate the age standardized rates (ASR-W) of incidence and mortality (13). To express trends we used standardized regression analysis. Data analyses were performed by Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC.

Mortality data were obtained from the Statistical Office of the Slovakia (14).

For the study we used the TNM classification system employed by the NHIC National Cancer Registry for the categorization of clinical stages.

Results

Epidemiologic situation of all cancer types

The number of new cancer cases diagnosed in Slovakia rose from 13,180 in 1978 to 18,043 in 1988, 21,699 in 1998 and 34,593 in 2014. The prediction of NHIC for

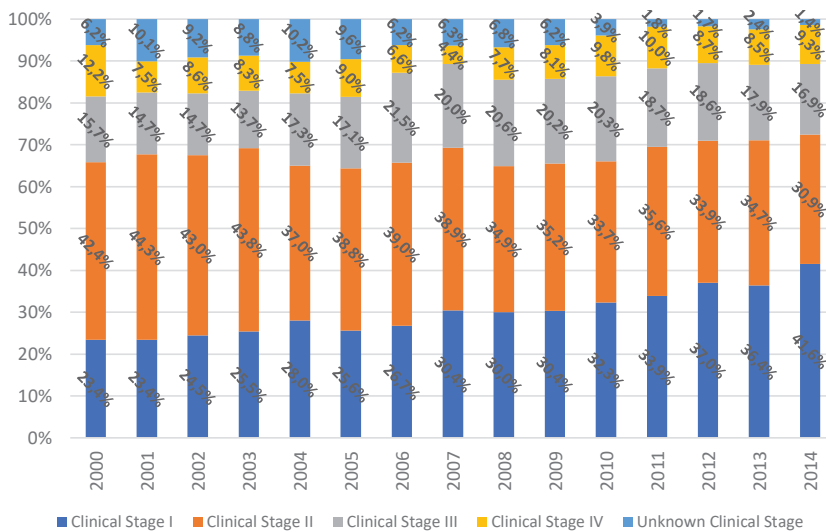


Fig. 2. Breast cancer clinical stages in the female population of the Slovakia in years 2000–2014 (data source: NHIC, NCR SR).

2021 is 31,773 new cases. Incidence was higher in men in every reported year.

Non-melanoma skin cancer cases (NMSC) are included in these numbers.

When NMSC cases are excluded, in 2014 in male population the most common newly diagnosed cancer was prostate cancer (1,878 cases; 11.0% of newly diagnosed cancers in males). In the population of females, the most common newly diagnosed was breast cancer (2687; 19.4%).

Over 35% of newly diagnosed malignant tumors was in the third and fourth stage. In 2014 19.7% of all diagnosed tumors in men were diagnosed in Stage III and 32.2% in Stage IV. In

women, 19.6% cancer cases were diagnosed in Stage III and 22.6% in Stage IV.

Absolute number of cancer deaths and crude mortality rates decline in 2021 and 2022. While in 1950, in men 16.0% and in women 15.9% of the total number of all-cause deaths were due to cancer (15), in 2006, the proportion of cancer deaths was 24.3% of all deaths in men and 19.5% in women. In 2021, it was 19.0% in male population, and 16.4% in the female population.

In 2021, cancer hospitalizations accounted for 10.2% of all hospitalizations, The highest number of cancer hospitalisations was in the 65+ age group, representing 47.7% of all hospitalisations in this age group.

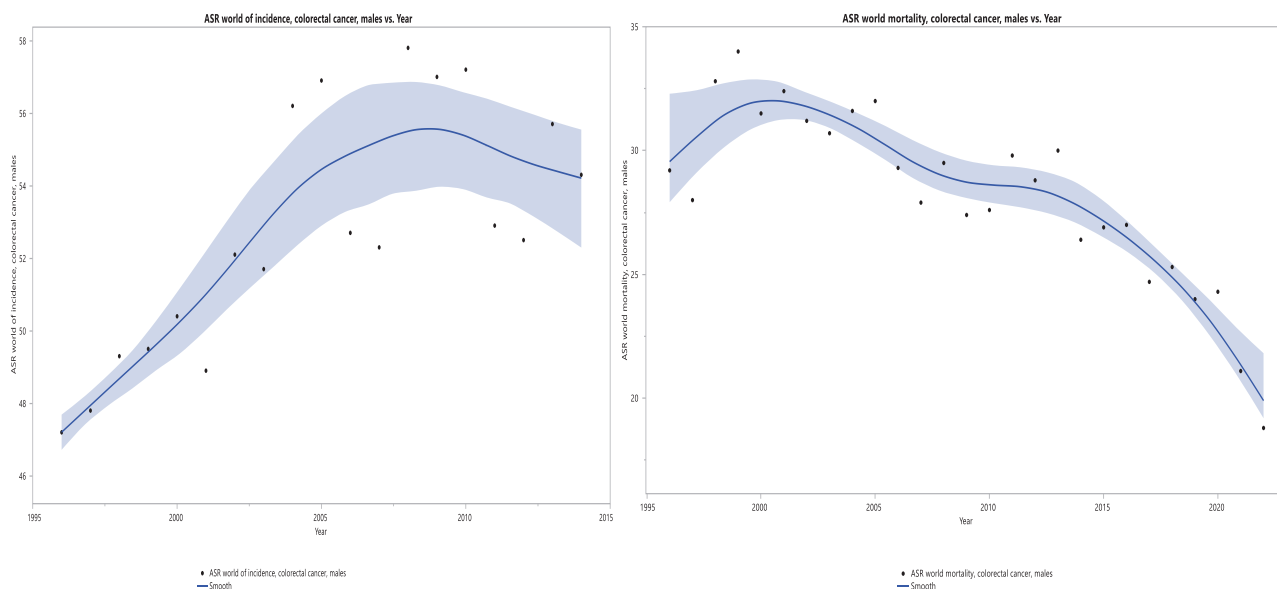


Fig. 3a. Incidence ASR-W (left) and mortality ASR-W (right) of colorectal cancer in men population of the Slovakia in years 1997–2022 (data source: NCR SR, new cases in 2017–2021 are estimations based on insured population).

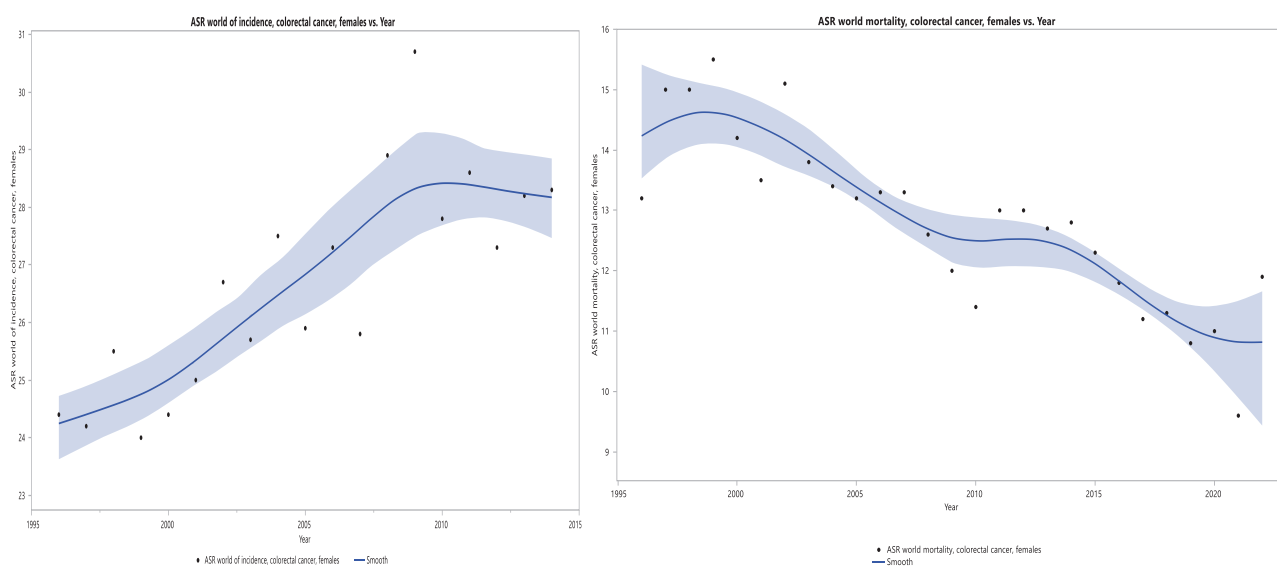


Fig. 3b. Incidence ASR-W (left) and mortality ASR-W (right) of colorectal cancer in women population of the Slovakia in years 1997–2022 (data source: NCR SR, new cases in 2017–2021 are estimations based on insured population).

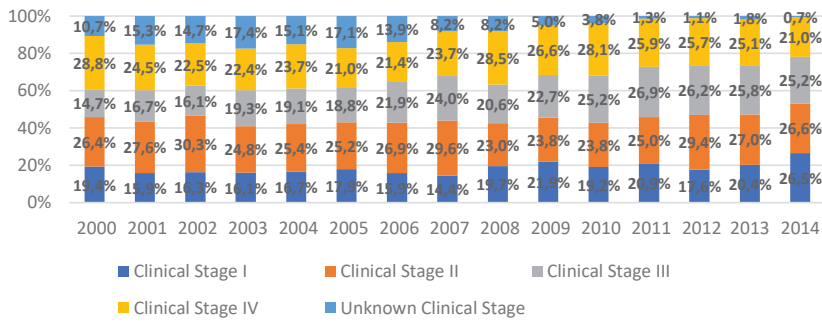


Fig. 4a. Colon cancer clinical stages in men in the Slovakia in years 2000–2014 (data source: NHIC, NCR SR).

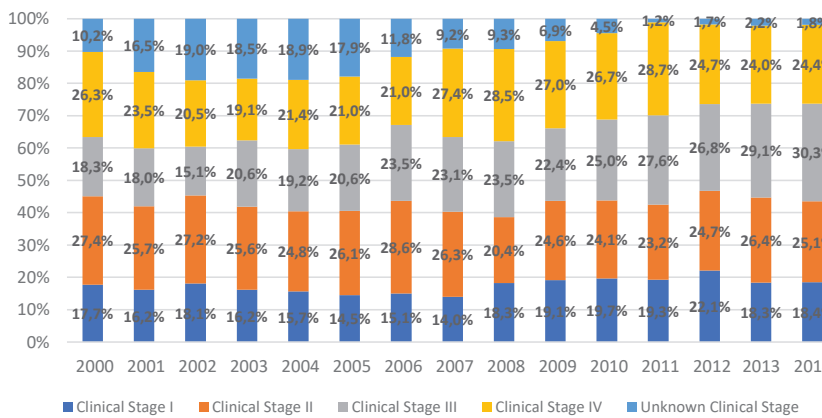


Fig. 4b. Colon cancer clinical stages in women in the Slovakia in years 2000–2014 (data source: NHIC, NCR SR).

Breast cancer (C50)

Breast cancer is the most common newly diagnosed cancer and also the most common cause of death of all cancer in Slovak

women. It is the leading cause of cancer-related deaths in women aged 45 years and older (15). Breast cancer is diagnosed in 17.7% of all new cancer cases. The age standardized incidence and mortality are presented in Figure 1. In recent decades breast cancer is the leading cancer-related cause of death in the female population of Slovakia. Majority of breast cancer cases, 97% in 2007 and 94.5% in 2014, were diagnosed in patients over 40 years of age. According to NHIC prediction for 2021, 95.2% of breast cancer cases are detected in the age group 40+ and 79.3% in the age group 50+.

Colorectal cancer (C18-20)

Colorectal cancer belongs to the cancer diseases with highest incidence and mortality in both the male and female populations. In 2001, colorectal cancer accounted for 14.2% of newly diagnosed cancers in men and 11.2% in women, in 2021, according to the NHIC prediction, it is 13.4% for men and 9.5% for women. Despite the fact the colo-

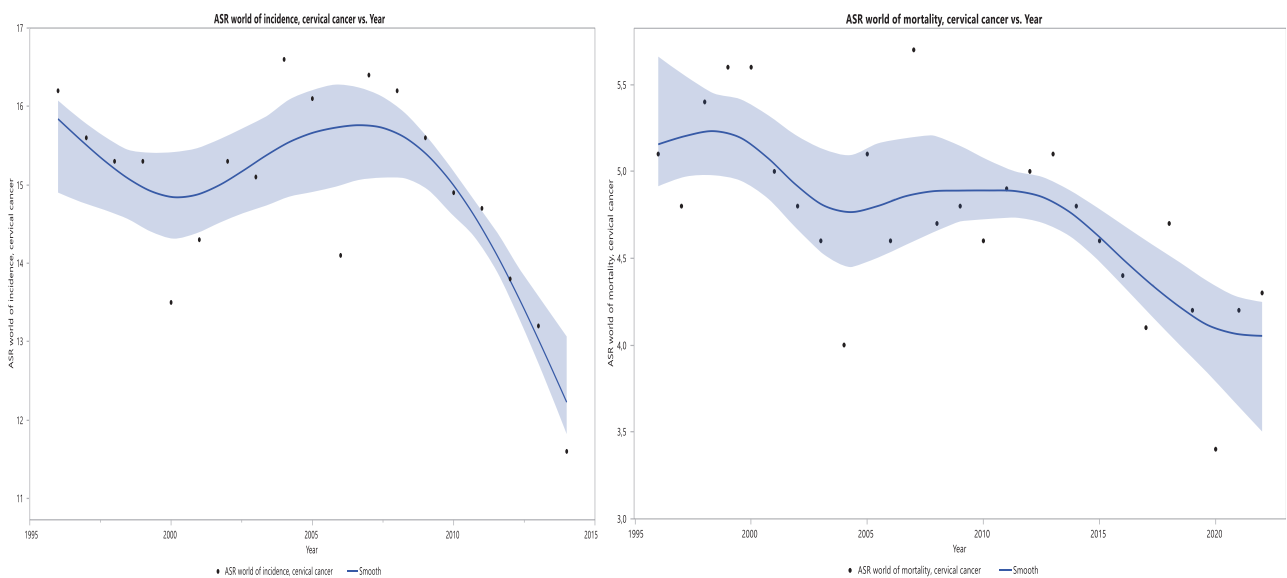


Fig. 5. Incidence ASR-W (left) and mortality ASR-W (right) of cervical cancer in female population of the Slovakia in years 1997–2022 (data source: NCR SR, new cases in 2017–2021 are estimations based on insured population).

rectal cancer is a slowly progressing disease with symptoms that may not be present for many years, survival rates have improved in recent decades, mainly due to the screening (8).

We present the age standardized incidence and mortality of colorectal cancer in men in Figure 3a and in women in Figure 3b. Colorectal cancer incidence is higher in the male population than in the female population in Slovakia. We observe this difference in incidence for a long time and it persists in the 21st century.

Incidence of colorectal cancer is increasing significantly in older age groups. More than 90% of new cases are in the age 50 years and more in both male and female populations.

The highest proportion of new cases in males in 2014 was found in the age category 65–69 years (17.8%).

In the female population, the highest proportion of newly diagnosed cases in 2014 was in the age group 70–74 years (15.6%).

Colorectal cancer mortality has a decreasing trend in the Slovakia.

Colon cancer (C18)

In the group of colorectal cancer diagnoses (C18-C20), the most frequent is colon cancer (C18) – about 55% of all colorectal cancers in men, 64% in women.

More than 40% of all new colon cancer cases are diagnosed in Clinical Stages III and IV. In 2014, 25.2% of newly diagnosed colon cases in men were in Clinical Stage III, 21.0% in clinical Stage IV (Fig. 4a). In 2014 in the female population 30.3% of all newly diagnosed colon cases were in Clinical Stage III and 24.4% in Clinical Stage IV (Fig. 4b).

Cervical cancer (C53)

Cervical cancer is the second most common cancer in Slovak women.

Of all newly diagnosed malignancies in 2014 cervical cancer cases accounted for 2.7%. NHIC estimation for 2021 is 552 new cervical cancer cases (2.8%). Age standardized incidence and mortality rates are presented in Figure 5.

In 2014 the highest number of newly diagnosed cervical cancer cases was in the age category 45–49, 61 (34,3/100 000), which represents 12.8% of cervical cancer incidence cases. NHIC prediction for 2021 is 75 cases in the age category 65–69, which is 13.6% of cervical cancer incidence cases (Fig. 6).

The proportion of cases diagnosed in Clinical Stage I is increasing. In 2001, the number of newly diagnosed cases in Clinical Stage I was 228, representing 44.5%, in 2006 it was 204 cases (38.5%) and in 2014 it was 240 cases (50.7%). The proportion of Clinical Stage IV is still around 10%.

In 2001 the number of Clinical Stage IV cases was 39 (7.6%), in 2006 it was 57 cases (10.8%) and in 2014 it was 50 cases (10.8%) (Fig. 7).

Discussion

Globally, cancer poses a significant healthcare burden, and the Slovakia is no exception. In our study we analyzed trends of incidence and mortality for three prevalent cancers (colorectal, breast, and cervical), included in recently strengthened national screening programs. The study aim was to establish baseline information for evaluating program effectiveness.

The overall incidence of cancer in Slovakia has increased in recent decades and the data show a decrease in the past few years. There have been encouraging signs of decrease in mortality rates, particularly for breast and colorectal cancer.

It is necessary to note the cancer incidence data in the Slovakia is of poor quality, which is declared also by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO). Slovakia went from being rated highest (A1) level of cancer data quality until 2005 to the current lowest (3b) quality (16).

A comparison of cancer incidence and mortality rates in the Slovakia with other European countries reveals a mixed picture

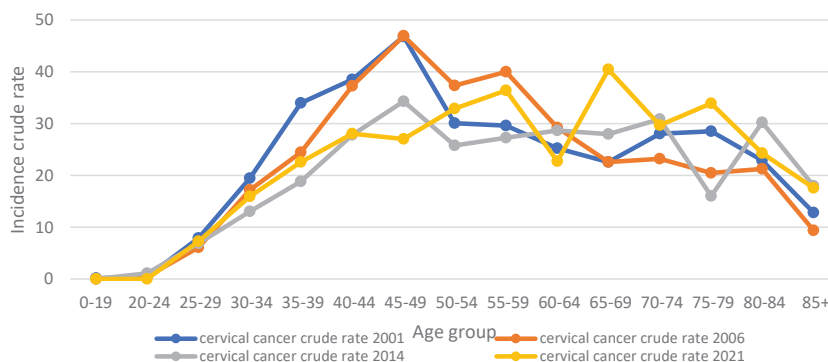


Fig. 6. Incidence crude rate of cervical cancer in women in the Slovakia in years 2001, 2006, 2014 and 2021 (data source: NCR SR, new cases in 2021 are estimations based on insured population).

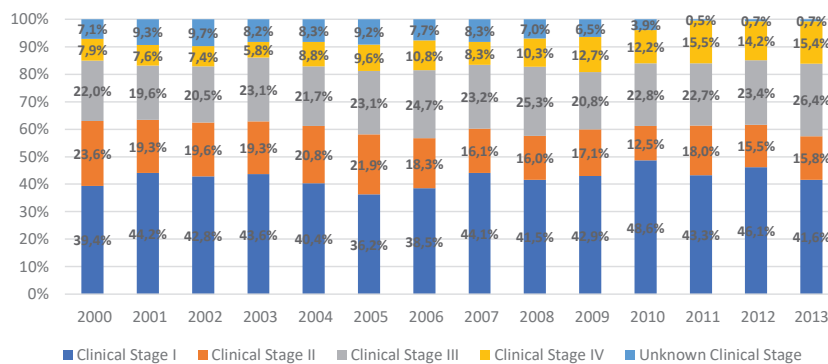


Fig. 7. Cervical cancer stages in female population of the Slovakia in years 2000–2014 (data source: NHIC, NCR SR).

(17). The incidence rate of breast cancer in Slovakia is lower than the average for European Union (EU) countries, while the mortality rate is slightly higher. For colorectal and cervical cancer, both incidence and mortality in Slovakia are higher than the EU average (18).

Elevated cancer mortality rates in Slovakia suggest potential shortcomings in early detection, particularly through targeted screening programs. Compared to other countries, a significantly higher proportion of cancer cases are diagnosed in advanced stages. This necessitates interventions to increase population engagement and adherence to recommended screening protocols.

The observed increasing trend in incidence can be attributed to several factors, including improved diagnostic methods, aging population, and lifestyle factors. Improved diagnostics is desired and the aging population brings along an increased number of new cancer cases.

The Slovakia has a higher prevalence of lifestyle factors that predispose to cancer and other noncommunicable diseases, such as smoking, daily consumption of fruits and vegetables, regular physical activity, than the average of the Organisation for Economic Co-operation and Development (OECD) countries (5). Multi-tiered preventive strategies encompassing both population-wide interventions and targeted approaches for high-risk individuals need to be implemented.

Strengthened cancer prevention and screening is important especially in light of global long-term observed trends that lead to prognosis that cancer may surpass cardiovascular diseases as the leading cause of premature death during over the course of next decades (19).

Conclusion

While Slovakia has made progress in some areas of cancer care, such as improvements in early detection of breast cancer, there is still room for improvement in other areas, such as colorectal cancer and cervical cancer. By increasing cancer screening uptake and implementing comprehensive cancer prevention strategies, Slovakia can further reduce the burden of cancer on its population and improve the health outcomes of its citizens.

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