





# Geographical disparities in survival rates for urological cancers in Poland from 2000 to 2015

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**Introduction.** In 2020 in Poland, urological cancers (testis, prostate, kidney, urinary bladder) accounted for 32% of cancer incidence among men and 5% among women. There has been an improvement in the survival rate for urological cancers in recent years. The aim of this study was to determine whether survival rates for urological cancers differ according to the region in Poland.

**Material and methods.** Data on 5-year relative survival come from the Polish National Cancer Registry and cover the patients diagnosed during period 2000–2014. The analysis was performed for four locations of urological cancers: prostate (C61), testis (C62), kidney (C64) and bladder (C67). Differences in survival rates are presented on maps divided into 16 voivodships.

**Results.** In the years 2000–2014, an increase in the 5-year survival rate of patients with urological cancer was recorded in Poland. A similar trend has been observed in other European countries, with the average survival rate of patients with prostate, bladder, kidney, and testicular cancer being lower in Poland than in the EU. We characterise the geographical differences between survival and the sex of the patient. In prostate, bladder, and kidney cancers, the highest survival rate was recorded in the Pomeranian Voivodship, regardless of gender and period.

**Conclusions.** In most of the analysed voivodships, survival rates for urological cancers increased in subsequent periods. This is proof that health care in Poland is continuously improving. The level of public knowledge in Poland about urological cancers is still low. National-scale educational and preventive campaigns are needed to achieve a greater increase in 5-year survival rates in the coming years.

**Key words:** urologic neoplasms, survival rate, Poland

## Introduction

Regional differences in 5-year survival rates for the most common cancers are observed in most European countries. Among urinary tract cancers, an example is the survival rate for prostate cancer estimated in the Concord-3 project for selected

European country regions analyzed for patients diagnosed in 2010–2014, for example France: 85.5% Somme region vs. 96.8% Hérault region; Germany: 88.1% Bremen region vs. 93.9% Schleswig-Holstein region or Italy: 78.9% Latina region vs. 91.8% Ferrara region [1].

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In 2020 in Poland, urological cancers (testis, prostate, kidney, urinary bladder) accounted for 32% of cancer incidence among men and 5% among women. Among men, the most common is prostate cancer. There is a continuing trend in which prostate cancer is the most frequently diagnosed cancer among men (19.6% of all incidences in 2020) [2]. Survival rates for testicular cancer, prostate cancer, kidney cancer, and bladder cancer are growing, as in other countries in Europe. In bladder cancer, the survival rate is higher among women than among men, unlike in Europe [3–6].

Survival studies show that survival rates for urologic cancer have improved in countries with the highest spending on health care [7]. In recent years, there has been an improvement in the survival rate for urological cancers, which may be related to the implementation of new drugs [8], and better health care facilities [9]. The purpose of this study was to determine whether survival rates for urological cancers differ depending on region and sex in Poland.

## Material and methods

Data on 5-year relative survival come from the Polish National Cancer Registry [10]. The data cover patients diagnosed during the period 2000–2014 and are presented in three 5-year intervals (2000–2004, 2005–2009, 2010–2014). The Pohar-Perme estimator was used to calculate 5-year survival rates [11]. The analysis was performed for four locations of urological cancers: prostate (C61), testis (C62), kidney (C64) and bladder (C67). Differences in survival rates are presented on maps divided into 16 voivodships (fig. 1). All maps use the same percentage scale that corresponds to the same color. A color gradient was used to represent specific values in particular voivodships. All maps were prepared using Python software with the geopandas library [12]. The predefined Poland map was sourced from Chief Sanitary Inspectorate (Główny Inspektorat Sanitarny – GIS) support [13]. This website shares data from geoportal.gov.pl.

## Results

### ***Malignant neoplasm of the prostate (C61)***

The 5-year survival rate for Poland was higher in each subsequent follow-up period. In the first observation period (2000–2004), the 5-year survival rate for prostate cancer was 70.6%. In the period (2005–2009) it was 76.6%, and in the last observation period (2010–2014) 81.8%.

During the initial observation period from 2000 to 2004, survival rates ranged between voivodships from 57.5% to 76.8%. The Pomorskie Voivodeship and the Mazowieckie Voivodeship had the highest 5-year survival rates at 76.8% and 76.4%, respectively. Across all voivodships, an improvement in the 5-year survival rate was observed at the end of the observation period compared to the initial period. The greatest improvement in the analyzed periods occurred in the Lubuskie Voivodship, with a significant increase of 28

percentage points (pp). Furthermore, this voivodeship was characterized by the highest 5-year survival rates in the final observation period (85.5%).

### ***Malignant neoplasm of the testis (C62)***

The 5-year survival rate for testicular cancer for Poland as a country was higher in each subsequent observation period. In subsequent observation periods, it was 85.3%, 86.2%, and 89.5%, respectively.

The 5-year survival rate for testicular cancer by voivodship was characterized by the greatest variability in the observed periods among the cancers analyzed. In the Pomorskie, Lubuskie, Lubelskie, and Opolskie Voivodships, the 5-year survival rate increased in the period 2005–2009 and then decreased in the most recent period. During the entire period, the greatest improvement in 5-year survival was observed in the Kujawsko-Pomorskie Voivodship (changed by 16.9 pp). In the last period, the highest 5-year survival rate was recorded in the Zachodniopomorskie Voivodship (99.4%), the Małopolskie Voivodship (95.2%), and the Podlaskie Voivodship (93.9%). In five voivodships (Łódzkie, Warmińsko-Mazurskie, Mazowieckie, Pomorskie, Lubuskie), the survival rate of the last observation period decreased compared to the initial observation period. The greatest reduction in the 5-year survival rate occurred in the Łódzkie Voivodship (reduction by 12.9 pp).

### ***Malignant neoplasm of the kidney, except for the renal pelvis (C64)***

The 5-year survival rate for kidney cancer increased in subsequent observation periods across both sexes. Among women in the first period (2000–2004), it was 59.3%, in the middle period (2005–2009) 65.6%, and in the last period (2010–2014) 70.6%. Among men during the same observation periods, survival rates were 54.3%, 58.8%, and 63.9% in the last period.

Over the years under observation, there was a gradual increase in the 5-year survival rate for kidney cancer among men. The largest increase in the 5-year survival rate occurred in the Pomorskie Voivodship (16.5 pp – 61.2% in the period [2000–2004], 77.7% in the period (2010–2014)). During the 2010–2014 period, the Pomorskie Voivodship also had the highest survival rate for this cancer. In the second period (2005–2009), compared to the first (2000–2004), three voivodships (Dolnośląskie, Opolskie, Lubuskie) showed a slight decline in the survival rate, respectively, 0.7, 1.9 and 2.4 pp. In the Podlaskie Voivodship, in the first two analyzed periods of 5-year survival (2000–2004, 2005–2009), the rates remained at the same level – 58.9%. For the period 2000–2005, the lowest survival rate was in the Zachodniopomorskie Voivodship – 45%. In the last observation period, this rate improved by 10 pp.

For women, a similar phenomenon was observed for this cancer site, and the 5-year survival rate increased with subsequent analyzed periods. The Świętokrzyskie Voivodship showed

the greatest increase (by 22.5 pp), reaching 76.2% in the period 2010–2014. But the voivodeship with the highest survival rate in the last period was the Pomorskie Voivodeship – 81%. In the Dolnośląskie Voivodeship, which had the highest survival rate (64.1%) in the first observation period, no improvement was observed in the second observed period. The lowest survival rate in the period 2000–2004 occurred in the Lubuskie Voivodeship (47.7%), but over the following years it improved (by 21.2 pp), and in the last observed period the lowest value of the survival rate was observed in the Zachodniopomorskie Voivodeship (59.8%). Moreover, in Podlaskie and Zachodniopomorskie voivodeships, there were a decline in the survival rate between the periods 2005–2009 and 2010–2014, while in the rest of the voivodeships there was an improvement in this rate.

### **Malignant neoplasm of the bladder (C67)**

The results regarding 5-year survival rates for the entire country increase regardless of gender in the second observation period compared to the first period (among men in the period [2000–2004] 60.4% and in the period [2005–2009] 63.7%; among women in the period [2000–2004] it was 63.1% and in the period [2005–2009] 66.0%). Among men in the third period, it was slightly higher than in the second period (63.3% for the period [2010–2014] compared to 63.1% for the period [2005–2009]). Among women in the last observation period, the 5-year survival rates were lower than in the second observation period (in the period [2005–2009] 66.0% and in the period [2010–2014] 64.9%).

In the last observation period, the 5-year survival rate for bladder cancer for both sexes in the country was similar (63.3% among men and 64.9% among women), but greater disproportions were observed among women depending on the region of Poland. Among both sexes, the highest 5-year survival in the last year of observation were recorded in the following voivodships: Lubelskie, Pomorskie, and Świętokrzyskie. Among men, the highest 5-year survival rates were also observed in the Kujawsko-Pomorskie Voivodship and among women in the Małopolskie and Podkarpackie Voivodships.

For men, the situation worsened in the following 5 voivodships: Zachodniopomorskie (–9.3 pp, from 60% to 50.7%), Dolnośląskie (–5.7 pp, from 65.3% to 59.6%), Łódzkie (–2.3 pp, from 65.3% to 63%) Śląskie (–1.9 pp, from 60.6% to 58.7%), and Wielkopolskie (–1.7 pp, from 60.6% to 58.9%). The reduction in the 5-year survival rate among women in the last observation period in relation to the first observation period occurred in the six following voivodships: Mazowieckie (–8.1 pp, from 63.8% to 55.7%), Łódzkie (–7.3 pp, from 67.3% to 60%), Dolnośląskie (–6 pp, from 67.9% to 61.9%), Śląskie (–5.6 pp, from 60.9% to 55.3%), Opolskie (–5.5 pp, from 74.1% to 68.6%) and Podlaskie (–3.4 pp, from 66% to 62.6%).

Regardless of gender, the greatest improvement occurred in the Lubuskie Voivodship, 17.6 pp among men (from 43.2% to 60.8%), and 29.3 pp among women (from 36.5% to 65.8%).

## **Discussion**

Survival serves as the most precise indicator of the future of the disease at a specific moment, deriving from data collected on all diagnosed individuals within a defined period and tracking their vital status until the conclusion of the observation period. Cancer mortality rates are crucial for guiding public health and health care priorities. They have proven valuable in recognizing potential distortions in metrics like cancer incidence and survival, such as the risk of overdiagnosis. When coupled with cancer survival data, cancer mortality rates can assess the long-term effectiveness of treatments [14]. The first work on the differentiation of medical care has dissatisfying results. Mortality rates have been observed since the end of the twentieth century, and regional differences within European countries have been observed for many years.

In the period 2000–2014, an increase in the 5-year survival rate of patients with urological cancer was recorded in Poland. A similar trend has been observed in other European countries, with the average survival rate of patients with prostate, bladder, kidney, and testicular cancer being lower in Poland than in the EU. In the CONCORD-3 study for the years 2000–2014, prostate cancer survival rates were higher than in Poland in 23 European countries [1].

The older EURO CARE-5 study for 2000–2007 noted that for testicular cancer, the age-standardized 5-year relative survival (RS) was 93% for patients from Northern Europe, 92% for those from Ireland/UK and from Central Europe, 89% for patients from Southern Europe, and 80% for patients from Eastern Europe. In Poland, the age-standardized 5-year RS was 78.3% [15]. However, for kidney cancer, the best prognosis was observed in Central Europe (64%), particularly in Austria and Germany showing figures  $\geq 70\%$ , and Southern Europe (64%). In Poland, the age-standardized 5-year RS was 55.1%. For urinary bladder cancer, the best prognosis was observed in Southern and Northern Europe, particularly in Italy and Finland, where survival was  $\geq 75\%$ . In Poland, age-standardized 5-year RS was 61.5% [16].

The lead time is important to assess the survival rate, especially in the case of prostate cancer. Due to the small number of publications on this topic from Europe, we used data from the United States. In prostate cancer, after the introduction of PSA testing, the diagnostic advance is approximately 4.59 years for white people and 6.78 years for black people [17].

In kidney cancer, early stage diagnosis is strongly correlated with survival rates: 5-year cancer-specific survival rates for patients diagnosed with stage I and IV kidney cancer in Europe are 83% and 6%, respectively [18]. In bladder cancer, early detection by cystoscopy or urinary sediment cytology prolongs survival. The relative 5-year survival rates for whites vs. blacks are overall 81% vs. 58%; for localized disease, 88% vs. 74%; for regional disease, 44% vs. 30%; for distant disease, 9% vs. 8%; and for unknown stage, 61% vs. 35% [19].

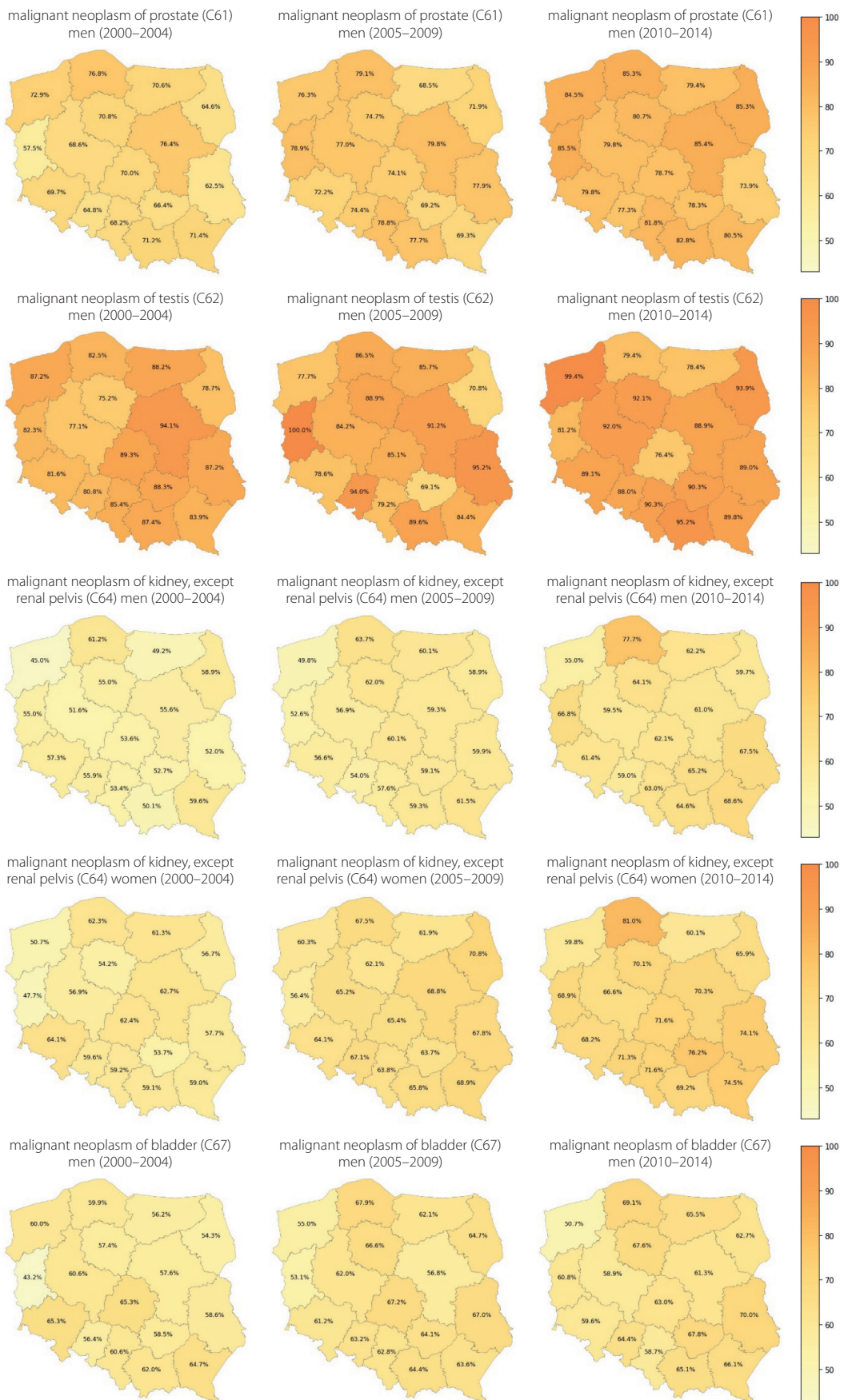
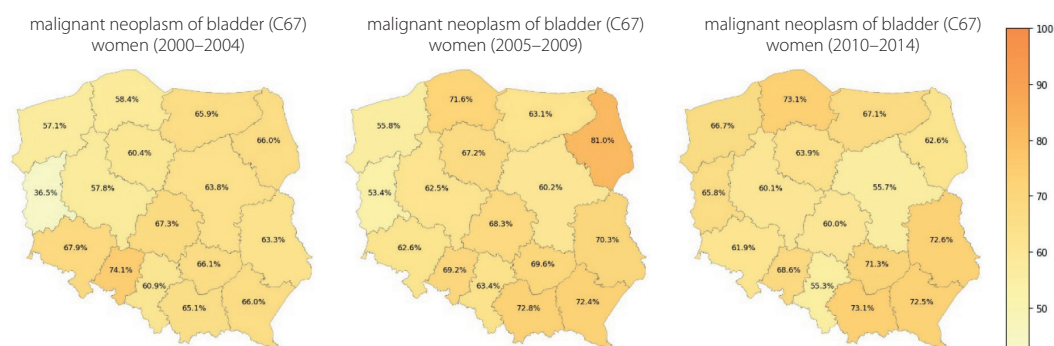


Figure 1. Differences in survival rates – divided into 16 voivodships





**Figure 1 cont.** Differences in survival rates – divided into 16 voivodships

The improved survival rate of prostate cancer in Poland can be explained by new treatments that have transformed prostate cancer into a chronic disease. We observe a constant increase in prostate cancer survival rates, due to progress in the treatment of metastatic castration resistant prostate cancer (docetaxel-based chemotherapy (2004), cabazitaxel registration (2010), the introduction of the latest generation of non-steroidal antiandrogen drugs into treatment (abiraterone acetate in 2011, enzalutamide in 2012) [20], and also due to the progress in surgical treatment of prostate cancer (2010 saw the first robot-assisted radical prostatectomy in Poland), the promotion and greater availability of serum PSA concentration determination, and transrectal ultrasound.

In the last period of observation (2010–2014), the highest survival rate was recorded in the Mazowieckie, Pomorskie, Podlaskie, Zachodniopomorskie, and Lubuskie Voivodships, and the lowest in the Lubuskie Voivodships. The phenomenon of highest survival in the Lubuskie Voivodship recorded a high percentage of consultations per 1,000 inhabitants and the highest number of oncology clinics in the country per 10,000. However, no entity meets the criteria of a urooncology center and the criterion of the minimum number of radical prostatectomy procedures.

The same survival rate in the Zachodniopomorskie and Mazowieckie Voivodship. Zachodniopomorskie is characterized by one of the highest percentages of urological consultations per 1,000 inhabitants, and in the Mazowieckie Voivodship we have the largest number of urological clinics in the country, the largest number of physicians working in the field of urology, the largest number of patients of the special drug B.56 program (treatment of patients with prostate cancer with apalutamide, darolutamide, enzalutamide, cabazitaxel, olaparib, radium [Ra-223] dichloride [21]), 6 centers that meet the criterion of the minimum number of radical prostatectomy procedures and one of two centers in Poland that perform robotic surgeries in urology at an expert level [22].

Survival rates in testicular cancer, lower in Poland than in Europe, may be justified by the low level of public knowledge of testicular cancer [23, 24].

Increased survival and decreased mortality in testicular cancer result from the introduction of cisplatin-based chemotherapy for the treatment of non-seminomas in the 1970s. The increase in survival is also due to the greater availability of scrotal ultrasound, the introduction of tumor markers for testicular cancer in diagnostics, and more frequent occurrence of seminomas (they have a better prognosis) than nonseminomas [25].

The greatest reduction in the 5-year survival rate occurred in the Łódź Voivodship by 12.9 pp. The highest survival rate was recorded in the Zachodniopomorskie and Podlaskie Voivodships, and the lowest in the Pomorskie, Łódzkie and Lubuskie Voivodships. The Zachodniopomorskie and Podlaskie Voivodships conduct large-scale preventive campaigns against testicular cancer (they support the Movember campaign, Męskie Zdrowie, Profilaktyka 40Plus, leaflets, educational films for patients, radio broadcasts, campaigns on social networks, teaching self-examination on dummies, etc.) [26, 27].

Survival rates in bladder cancer are lower than in Europe, probably due to the low level of knowledge about bladder cancer [28–30], 15–25% of patients who present in advanced stages of the disease [31], lack of reference centers [32], comprehensive specialist care [32] and long waiting times for radical cystectomy [33]. In bladder cancer, the increase in survival rates is due to intravesical immunostimulation with BCG instillations [34] and intravesical chemotherapy and immunotherapy in patients with locally advanced or metastatic bladder cancer [35]. Progress in surgical treatment did not improve survival rates [36, 37].

In Poland, survival rates among women with bladder cancer are higher than survival rates among men. This situation differs from the trend in Europe. Many studies have shown lower survival rates for women with bladder cancer than for men [3–6]. Among patients with kidney cancer, women also have higher survival rates, although urinary tract infections and nephrolithiasis among women are associated with a delay in the diagnosis of kidney cancer more often than among men [38]. However, this trend does not differ from the European trend. Among women, kidney cancer is detected at an earlier

stage than among men, which in patients aged <59 years reduces mortality from renal cell carcinoma (RCC) by 19% compared to men [39].

The survival rate of kidney cancer patients is increasing in both sexes due to more frequent preventive examinations [18], including abdominal ultrasound and CT scans; many kidney cancers are detected accidentally during these examinations [40]. The reasons for increased survival also include modern drugs (molecularly targeted therapy [41], immunotherapy) [42].

For both sexes, the survival rate is the highest in the Pomorskie Voivodship and the lowest in the Zachodniopomorskie Voivodship. In the Pomorskie Voivodship, in the years 2000–2015, the survival rate of kidney cancer in both sexes remained one of the highest in Poland.

Survival rates for urological cancers are lower in Poland than in other European countries due to a lack of coordination and centralization of services, low level of education, and early diagnosis, and because modern treatment is not reimbursed to the same extent as in Europe. To change this state of affairs, from May 2022, patients with advanced kidney cancer are covered by modern treatment under the special drug program B.10 (treatment of patients with kidney cancer with pembrolizumab [21]). Socioeconomic status influences the degree of advancement of urological cancers, as shown in many studies [43, 44].

In all urological cancers, efforts should be made to centralize surgical treatment, especially in rare cancers, as well as decentralize chemotherapy and radiotherapy and comprehensive specialist care for patients, which can contribute to increased 5-year survival rates in these cancers. It is also necessary to increase the spending on prevention, early diagnosis, and patient education.

## Conclusions

Survival rates for patients with urinary tract cancer are lower in Poland than in Europe. In most of the analyzed voivodships, survival rates for urological cancers increased in subsequent periods. This is proof that health care in Poland is continuously improving. The exception is the decrease in 5-year survival rates in the Łódzkie Voivodship. There is a need to conduct more studies on this phenomenon.

The level of public knowledge in Poland about urological cancers is still low compared to other European countries. National research on this topic should be conducted. Educational and preventive campaigns are also needed nationwide to achieve a greater increase in 5-year survival rates in the coming years.

Primary care physicians play an important role in referring patients with urological cancers to urologists [45]. There is an increasing need for the urologist to work closely with the primary care physician to prevent, identify, and manage urological

cancer [46] because recognition and timely referral to primary care are crucial for early diagnosis of the cancer [47].

The limitation of this study is the use of historical data. The latest available 5-year survival analysis originating from the Polish National Cancer Registry covers the period 2010–2014 (end of observation 31.12.2019), i.e., there is a 10-year delay. A strength of the work is that it is the first voivodship analysis for urological cancers, with data coming from the most reliable source of information on cancer in Poland.

## Article information and declarations

### Data availability statement

Data available on [onkologia.org.pl](http://onkologia.org.pl).

### Ethics statement

No ethical issues or concerns were applicable to this research.

### Author contributions

Klaudia Barańska – performed the analysis; wrote the manuscript with input from all authors.

Marta Miklewska – performed the analysis; wrote the manuscript with input from all authors.

Iwona Wnętrzak – wrote the manuscript with input from all authors.

Urszula Wojciechowska – devised the project, the main conceptual ideas and proof outline.

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### Conflict of interest

None declared

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