International Journal of Research in Medical Sciences
Ranganatha A et al. Int J Res Med Sci. 2025 May;13(5):1791-1796
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20251271

Original Research Article

Pancreatic cancer in the United States: a retrospective study of incidence patterns

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Received: 25 February 2025
Revised: 18 March 2025
Accepted: 01 April 2025

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ABSTRACT

Background: The seventh most common cause of cancer-related deaths globally is pancreatic cancer. The 5-year survival rate for pancreatic cancer is about 12%, despite advances in its identification and treatment. The present study thus aims to perform an age, gender, race, and state-wise distribution trend analysis of pancreatic cancer incidence in the US from 1999 to 2020.
Methods: The present study is a retrospective research study conducted using the CDC-WONDER database to investigate trends in pancreatic cancer incidence by age, gender, and race from 1999 to 2020. The data was extracted on 18 May 2024, based on temporal trends, demography, and exported to a Microsoft excel sheet. Statistical analysis was done using R version 4.3.1. The figures/graphs were created using GG plot 2, version 3.5.0.
Results: From 1999 to 2020, pancreatic cancer occurred in 919,317 individuals (0.0137%) out of a population of 6,722,531,044, with a crude rate of 13.7 per 100,000. The highest incidence was observed in individuals over 75 years (38.63%), followed by the 65-74 age group (29.02%). Both males and females showed nearly equal incidence rates, while Whites had the highest incidence (83.76%), followed by African Americans (12.22%). Temporal trends indicate increasing incidence overall, particularly among the elderly and Whites, with state-wise highest incidences in California, Florida, and New York.
Conclusion: In summary, the incidence of pancreatic cancer has been increasing for years. Analysis of pancreatic cancer epidemiology and modifiable risk factors can help to determine the preventive measures to reduce pancreatic cancer among the population worldwide.

Keywords: Pancreatic cancer, Trends, Pancreas cancer incidence, CDC-WONDER

INTRODUCTION

The aggressiveness, delayed detection, and poor prognosis of pancreatic cancer make it one of the most difficult cancers to treat in modern oncology. Pancreatic cancer is the seventh leading cause of cancer-related death globally and the third in the USA.[1] It is expected to become the 2nd leading cause of cancer-related death by 2030.[2] With five-year survival rates still tragically low at 9%, despite significant progress in cancer research and treatment,

pancreatic cancer continues to present significant challenges.[3]

Pancreatic cancer is a malignant tumor that arises from the epithelial cells of the glandular structure of the pancreatic duct, pancreatic adenocarcinoma accounts for more than 90% of this cancer and the less common types include adeno-squamous, squamous cell, giant cell, acinar cell and small cell carcinoma.[4]

Research has shown that socioeconomic status affects the overall survival of patients with pancreatic cancer.[5] Another study demonstrates that non-white individuals had an increased risk of developing an invasive pancreatic cancer diagnosis after surgical resection.[6] Allocating resources and implementing focused population-based healthcare initiatives are required in light of these disparities.

The critical need for novel approaches to comprehend this disease better, identify it early, and treat it makes ongoing research efforts essential. Since the foundation of every successful healthcare strategy must be solid facts, this study provides an overview of the current pancreatic cancer epidemiology in the United States of America (USA). This information also helps determine which population segment should receive special attention when treating pancreatic cancer. Research like this one, which presents the most recent incidence of pancreatic cancer according to age, gender, race, and different US states, is therefore desperately needed.

Aims and objectives

This study analyzes the pancreatic cancer incidence trends in the United States from 1999 to 2020 by age, gender, and race, using the Center for Disease and Prevention Wide-ranging online data for epidemiologic research (CDC-WONDER) data.

This study aims to identify overall trends, age, and gender-specific differences, racial disparities, and interactions among these demographics. These findings seek to guide future research and inform targeted public health strategies.

METHODS

Study design and setting

This web-based retrospective cohort study was conducted virtually to analyze the incidence of Pancreatic Cancer in the United States of America over 21 years from 1999 to 2020. The data was extracted on 18 May 2024. The CDC-WONDER database was accessed using the Online Portal.

Ethical committee approval was deemed exempt in view of the usage of the CDC-WONDER database only, which contains deidentified, publicly available data.[7]

Inclusion and exclusion criteria

Data specific to pancreatic cancer in the United States was extracted using the 'cancer statistics data' from 1999 to 2020, based on the International Classification of Diseases (ICD-10) code for pancreatic cancer: C25 (pancreatic cancer). Next, the variables that determined this data's categorization were: temporal variables: the year of diagnosis; and geographical variables the state of residency in the United States. The study further considered three demographic variables: gender (male and female), race (American Indian or Alaskan Native, Asian or Pacific Islander. Black or African American, White, Other races), and age (people of all ages were included and grouped into 10-year age brackets).

Data and statistical analysis

The overall number of instances of pancreatic cancer based on the aforementioned criteria was then summarized once all data was downloaded and exported to a Microsoft excel sheet. In a total population of 6,722,531,044, pancreatic cancer was found to occur in 919,317 (0.0137%) individuals. The incidence was calculated and represented as tables and line diagrams to understand the temporal trends of Pancreatic Cancer Incidence among different age groups, races, and genders. Statistical analysis was done using RStudio v4.3.1. and the R package GGPlot 2 version: 3.5.0 was used for plotting the graphs.

RESULTS

In the present study, data from the CDC-WONDER database was utilized, starting from 1999 to 2020. In a total population of 6,722,531,044, pancreatic cancer was found to occur in 919,317 (0.0137%) individuals. The crude rate per 100,000 is 13.7.

The demographic characteristics of patients diagnosed with pancreatic cancer in the United States between 1999 and 2020 are displayed in Table 1. The analysis of cancer incidence using temporal trends based on age, gender, and race facilitates the identification of cohorts with a higher incidence as well as the understanding of current trends in pancreatic cancer. Based on age, the highest incidence is present in the age group of patients more than 75 years with the incidence being 355,167 (38.63%) and the crude rate per 100,000 is 85.3. The age group 65-74 years has an incidence of 266,830 (29.02%) with a crude rate of 52.5 and the age group 55-64 years has an incidence of 192,750 (20.97%) with a crude rate of 25.2. There is a lesser incidence of pancreatic cancer in the younger age groups with less than 15 years of age group having 311 (0.03%), crude rate 0. The observed trend is a decrease in incidence with decreasing age.

Based on gender, the incidence of pancreatic cancer in males is 466,577 (50.75%) with a crude rate of 14.1, and in females, it is 452,740 (49.25%) with a crude rate of 13.2. Therefore, both males and females have an almost equal

incidence of pancreatic cancer. Based on race, the highest incidence is present in Whites 770,053 (83.76%) with a crude rate of 14.4. Blacks or African Americans have the second highest incidence of pancreatic cancer of 112,372 (12.22%) with a crude rate of 12.3. Asian or Pacific Islanders have an incidence of 3.01% with a crude rate of 7.4 and American Indian or Alaskan Natives have an incidence of 4,740 (0.52%) with a crude rate of 5.4. It was observed that there is a lesser incidence of pancreatic cancer among American Indian or Alaskan Native and Asian or Pacific Islander groups as compared to Whites and African American races (Table 1).

Figure 1 elucidates the state-wide incidence of pancreatic cancer in the United States from 1999-2020. In the last 21 years, the incidence of pancreatic cancer was highest in California followed by Florida and New York. It was the lowest in the state of Wyoming.

Figure 2 shows the temporal trends in the incidence of pancreatic cancer in the United States from 1999-2020 based on age, gender, and race. In Figure 2a, overall, there is an increase in the temporal trends of pancreatic cancer from 1999 to 2020.

In Figure 2b, the incidence of pancreatic cancer is rising in the age group >75 years followed by the age group 65-74 years. The incidence is falling in the age group <15 years. In Figure 2c, the incidence of pancreatic cancer is rising in males. In Figure 2d, the incidence of pancreatic cancer is rising in Whites whereas it falling in American Indians or Alaskan Natives.

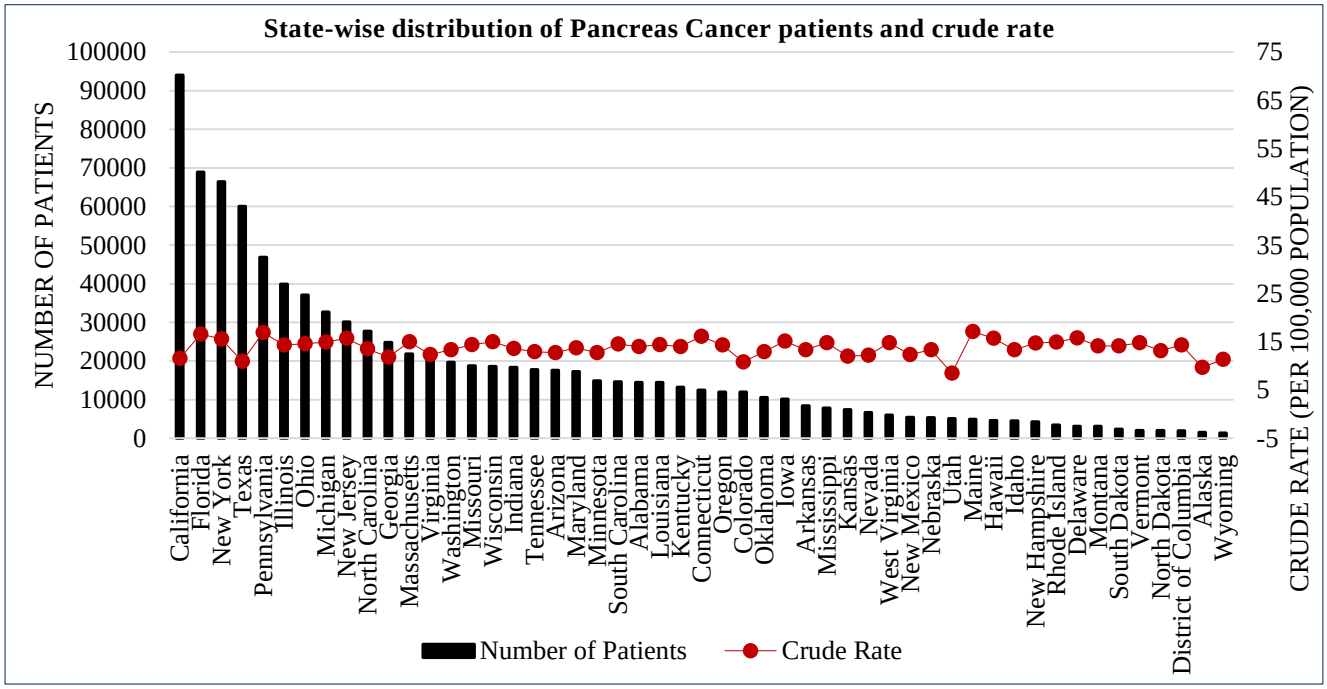

Figure 1: State-wise distribution of pancreas cancer patients in the United States from 1999-2020.

Table 1: Demographic characteristics of pancreas cancer patients in the United States from 1999-2020 based on age, gender, and race.

Variables	Population	Count N (%)	Crude rate per 100,000
Age (years)			
<15	1331960119	311 (0.03)	0
15-24	932609300	1144 (0.12)	0.1
25-34	917100206	3924 (0.43)	0.4
35-44	927607896	18942 (2.06)	2
45-54	924339992	80249 (8.73)	8.7
55-64	763946196	192750 (20.97)	25.2
65-74	508470217	266830 (29.02)	52.5
≥75	416497118	355167 (38.63)	85.3
Gender			
Male	3305492262	466577 (50.75)	14.1
Female	3417038782	452740 (49.25)	13.2
Race			

Continued.

Variables	Population	Count N (%)	Crude rate per 100,000
American Indian or Alaskan Native	88290475	4740 (0.52)	5.4
Asian or Pacific Islander	373820618	27715 (3.01)	7.4
Black or African American	914358967	112372 (12.22)	12.3
White	5346060984	770053 (83.76)	14.4
Other races	Not applicable	4437 (0.48)	Not applicable

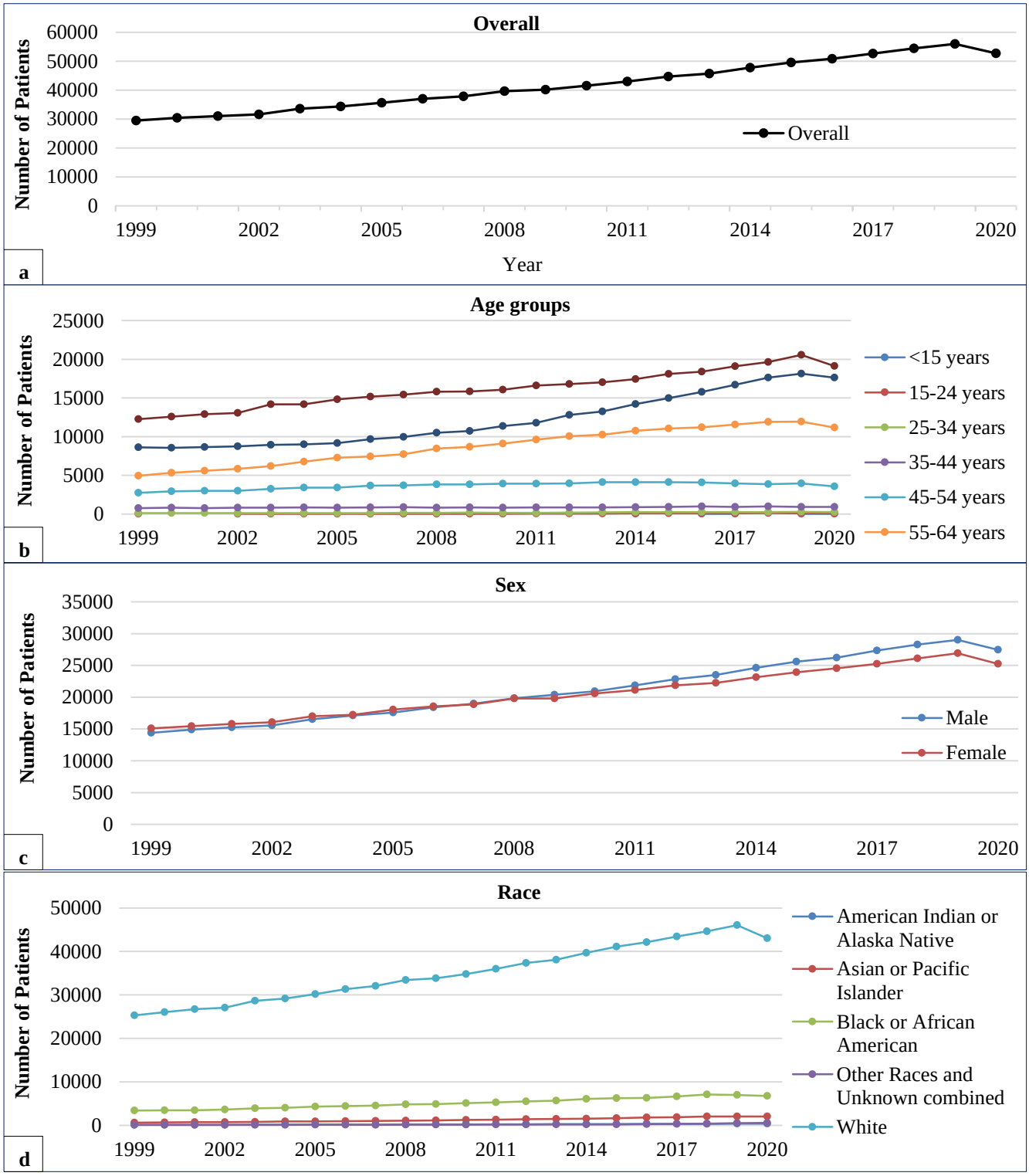

Figure 2: Temporal trends in the incidence of pancreas cancer in the United States from (a) 1999-2020, and based on (b) age, (c) gender, and (d) race.

DISCUSSION

This study sought to examine trends in the incidence of pancreatic cancer in the United States from 1999 to 2020, with an emphasis on age, gender, and racial demographics. Using data from the CDC-WONDER database, a retrospective research covered a total population of 6,722,531,044 individuals, of which 919,317 (0.0137%) individuals were diagnosed with pancreatic cancer, yielding a crude incidence rate of 13.7 per 100,000 population.

Age-based analysis of pancreatic cancer incidence in the present study showed the highest incidence in individuals aged over 75 years, with a crude rate of 85.3 per 100,000 and significantly lower incidence rates in younger age groups. These findings align with previous studies by Siegel et al, and Rahib et al, World Health Organization (WHO) also reported a similar trend of increased incidence in individuals over 70 years old. The similar trend is most likely due to the accumulation of risk factors over a lifetime, including genetic mutations, environmental exposure, and lifestyle factors such as smoking and diet.[8,9]

This study also found the incidence in males (50.75%, crude rate 14.1 per 100,000) is slightly more than the females (49.25%, crude rate 13.2 per 100,000). This aligns with the results of Hidalgo, who estimated that the probability of pancreatic cancer was roughly 1 in 63 for men and 1 in 65 for women. The findings of another study done by Yadav and Lowenfel, also indicated that men have a slightly higher incidence rate of pancreatic cancer than women. This trend of slightly higher incidence in men may be due to risk factors such as smoking, occupational exposure, alcohol consumption, diet habits, obesity, etc., which are more common among men.[10,11]

Among several racial groups in the US, there are discernible differences in the crude incidence rates of pancreatic cancer. The statistics of our study showed that Blacks or African Americans had a crude incidence rate of 12.3 per 100,000, while Whites had the highest rate at 14.4 per 100,000. Whereas Asians or Pacific Islanders have a crude rate of 7.4 and American Indians or Alaskan Natives have a crude rate of 5.4, making them the lowest. Chang et al, and Khwaja et al, found that regardless of the tumor's location, African Americans had a slightly higher percentage of tumor diagnoses than White people, and that they also had an older age-adjusted incidence rate (AAIR) than White people.[12,13] Another similar study by Paltoo and Chu on the cancer incidence among American Indians or Alaska natives in the US from 1992 to 1999 revealed that the crude rate was 6.9 per 100,000 person year for men and 5.5 per 100,000 people per year for women.[14]

Many studies have also taken both age and race combined for statistical analysis. Riall et al studied the surveillance, epidemiology, and end results (SEER)-medicare linked database with 3,425 White patients and 352 African American patients diagnosed with locoregional pancreatic cancer between 1992 and 2002. This research showed that pancreatic cancer incidence among African American patients was around the average age of 75.3 years which was almost similar to the average age of white patients i.e. 5.9 years.[15] Another similar study by Singal et al in 2012 used the SEER database which included 12,312 white patients and 1806 African American patients.[16] In this study, the average age of incidence of cancer among African Americans was 65.4 and 69.2 among white groups. The slight deviation of the results from our study can be attributed to common underlying risk factors, in diagnostic techniques, demographic changes, and also the socioeconomic status of a particular population.

There is ample opportunity for enhancement in every facet of pancreatic cancer treatment. Much of the research on pancreatic diseases has focused on identifying risk factors, clarifying the relationship between risk factors and disease, and discovering better methods for diagnosis, management, and prevention of pancreatic disorders.[11] Research regarding pancreatic cancer must give priority to protecting those at high risk, strengthening early detection, and improving screening techniques and because of the disparities in pancreatic cancer among different races, targeted screening is essential. A new first-line therapeutic option for patients is liposomal irinotecan + 5-FU+ leucovorin + oxaliplatin (also known as nalirifox). Additionally, genetic testing for a variety of inherited mutations is advised for all individuals diagnosed with pancreatic cancer and a section on biomarker profiling for advanced and metastatic pancreatic cancer has been expanded. Biomarkers can provide a molecular profile of subtle but significant features of cancer because they identify abnormal changes in cancer cell genes that have occurred during an individual's lifetime. These biomarkers can also aid in treatment planning.[17]

Limitations

The limitations of this study are that it does not include the latest data from 2020-2023 due to the impact of COVID on data collecting. Consequently, information regarding the stage, grade, and outcomes of pancreatic cancer could not be gathered.

CONCLUSION

This study reveals significant trends in pancreatic cancer incidence in the United States from 1999 to 2020, with an overall crude rate of 13.7 per 100,000 people. The data indicates that the incidence is notably higher among those aged 75 and older, males, and individuals of White race. Notably, the temporal trends demonstrate a steady increase in the incidence of pancreatic cancer over the 21 years.

These findings highlight the urgent need for targeted public health strategies, particularly for high-risk groups, such as older adults and males. The rising trend demonstrates the necessity for early detection and improved treatment approaches. Future research should

focus on identifying the stage or grade at the time of diagnosis, as well as analyzing the treatment and outcomes, to better understand the factors that determine these increases. This knowledge will be essential for developing effective policies aimed at early identification and improving patient outcomes. Addressing these areas may allow to reduce the burden of pancreatic cancer and improve the survival rates through informed healthcare interventions and policies tailored to those of increased risk.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Ranganatha A, Biswas D, Desai AD, Ibrahim DA, Polanco MAT, Vartanian K. Pancreatic cancer in the United States: a retrospective study of incidence patterns. Int J Res Med Sci 2025;13:1791-6.