

Special Section: Pancreatic Cancer

Cancer of the pancreas is one of the deadliest cancer types. Most pancreatic cancer patients will die within the first year of diagnosis, and just 6% will survive five years. Over the past decade, pancreatic cancer death rates have been slowly increasing among US men and women, in contrast to the downward trend in rates for most other major cancer sites, such as lung, colorectum, female breast, and prostate. The lack of progress in primary prevention, early diagnosis, and treatment underscores the need for additional efforts in pancreatic cancer research and has motivated us to address this disease in the current edition of *Cancer Facts & Figures*. Specifically, this special section provides updated information on occurrence, prevention, early detection, diagnosis, and treatment of pancreatic cancer. This information is intended to inform anyone interested in learning more about pancreatic cancer, including policy makers, researchers, clinicians, cancer control advocates, patients, and caregivers.

The pancreas contains two types of glands that each perform very different functions. The exocrine glands produce enzymes that help digest food; the endocrine glands produce important hormones such as insulin, which regulates blood sugar levels. Exocrine and endocrine cells form completely different types of tumors with distinct risk factors, symptoms, diagnostic tests, treatment, and survival rates. Exocrine tumors are the focus of this special section because they are by far the most common type of pancreatic cancer, representing about 95% of cases.

How Many Cases and Deaths Are Estimated to Occur in 2013?

Pancreatic cancer is the 10th most common cancer diagnosis among men and the 9th most common among women in the US. In 2013, an estimated 45,220 new cases of pancreatic cancer will be diagnosed nationwide.

Pancreatic cancer accounts for about 7% of all cancer deaths and ranks fourth as a cause of cancer death among both men and women in the US. In 2013, approximately 38,460 people are expected to die from pancreatic cancer nationwide.

Who Gets Pancreatic Cancer?

Sex

- Pancreatic cancer is about 30% more common in men than in women. During 2005-2009, the age-adjusted incidence rate (per 100,000 persons) of pancreatic cancer was 13.6 for men and 10.5 for women.
- The lifetime risk of developing pancreatic cancer is about 1.5% for both men and women (Table 1).

- Men are more likely than women to develop pancreatic cancer at every age after 35 years (Figure 1a, page 26).
- During 2005-2009, the age-adjusted death rate (per 100,000 persons) for pancreatic cancer was 12.5 for men and 9.5 for women.

Age

- Pancreatic cancer incidence and death rates increase with advancing age, with a steep increase after about age 50.
- During 2005-2009, the incidence rate (per 100,000) in men was 1.2 among those 35 to 39 years of age compared to 100.5 among those 85 years and older; in women the rate was 1.0 among those 35 to 39 years of age compared to 87.7 among

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with an even greater risk of pancreatic cancer and a younger age of disease onset.¹⁶ Abdominal obesity may increase risk independent of general obesity, especially in women.^{15,17}

Results regarding the association between physical activity and pancreatic cancer risk are mixed.^{14,18-21} A slightly decreased risk of pancreatic cancer was linked to total and occupational physical activity in a recent literature review²² but not in a previous one.²³ There is currently limited evidence to support a protective effect of recreational physical activity on risk of pancreatic cancer.²²

Alcohol use

Whether alcohol use causes pancreatic cancer remains to be determined. A positive association between alcohol use and pancreatic cancer was found in several but not all studies.²⁴ Accumulating evidence suggests that a moderate increased risk is limited to heavy alcohol users.²⁵ A recent meta-analysis showed that consumption of three or more drinks of alcohol per day is associated with a 20% to 30% increased risk of pancreatic cancer.²⁵ However, due to the strong relationship between alcohol consumption and tobacco use, it is difficult to eliminate the effect of smoking when studying the association between alco

Can Pancreatic Cancer Be Prevented?

The causes of pancreatic cancer are not well understood, though there are several factors known to increase risk. Known modifiable risk factors include obesity, cigarette smoking, and other forms of tobacco use. Risk factors that are not modifiable include a family history of pancreatic cancer and certain inherited syndromes. Strategies for preventing pancreatic cancer include not smoking and maintaining normal body weight. Consuming adequate quantities of fruits and vegetables may also have a preventive effect, although strong evidence for this association is lacking.

Modifiable Risk Factors

Tobacco use

Tobacco use is the most important known risk factor for pancreatic cancer; approximately 20% of pancreatic cancers are attributable to cigarette smoking.⁴ The risk of developing pancreatic cancer is about twice as high among smokers as among never smokers;⁵ risk increases with greater tobacco use and longer duration of smoking.^{6,7} Cigar and pipe smoking also increase risk.^{8,9} Quitting smoking rapidly reduces the risk of pancreatic cancer; after 5-10 years of cessation, the risk among former smokers returns to that of never smokers.^{4,10} Use of smokeless tobacco products also increases the risk of pancreatic cancer.¹¹ Evidence on secondhand smoke exposure and pancreatic cancer is inconsistent.¹²

Obesity and physical activity

Obesity has also been fairly consistently linked to increased risk of pancreatic cancer. Obese individuals have a 20% higher risk of developing pancreatic cancer than those who are normal weight.¹³⁻¹⁵ Being obese during early adulthood may be associated

Figure 3. Geographic Patterns in Pancreatic Cancer Death Rates* b State and Race, US, 2005-2009.



*Age adjusted to the 2000 US standard population. Insufficient data indicates states with fewer than 20 deaths.

Source: US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

American Cancer Society, Surveillance Research, 2013

- Examining new biomarkers for drug response to optimize the effectiveness of common chemotherapeutic agents, such as gemcitabine
- Testing new therapeutic agents for targeted therapy, such as PARP inhibitors and glutaminase inhibitors
- Exploring targeted delivery of pro-apoptotic therapeutics into pancreatic cancer cells
- Integrating immunotherapy into pancreatic cancer treatment regimens

The Society's intramural research program also conducts a wide range of research on pancreatic cancer. For example, researchers from the surveillance research program monitor trends in pancreatic cancer incidence and mortality, and recently published a study showing that socioeconomic disparities in pancreatic cancer death rates widened among working-age US populations during 1993-2007. Using data collected in the Society's Cancer Prevention Study II (CPS-II), Society epidemiologists have also examined the relationship between pancreatic cancer death and various factors, including alcohol consumption, carbohydrate intake, aspirin use, and reproductive patterns. In addition, the CPS-II Nutrition Cohort is part of a large international Pancreatic Cancer Cohort Consortium (PanScan), which aims to identify genetic factors, environmental exposures, and gene-environment interactions that contribute to the development of pancreatic cancer. To date, PanScan researchers have discovered four novel regions in the genome associated with risk for pancreatic cancer. In addition, many other epidemiological studies on environmental risk factors (including lifestyle factors) have been published.

Advocacy

The American Cancer Society Cancer Action NetworkSM (ACS CAN), the nonprofit nonpartisan advocacy affiliate of the American Cancer Society, recognizes that cancer research is the engine behind our ongoing progress in the fight against cancer. Research offers hope to the millions of people who face cancer – for better treatments, for more opportunities to prevent and detect the disease early, and for improved quality of life for those already diagnosed. The National Cancer Institute (NCI) – one of the 27 institutes and centers that comprise the National Institutes of Health (NIH) – is the foundation of the nation's cancer research efforts. As a federal agency, NCI-funded research has played a role in every major advance in the fight against cancer over the past 70 years. That's why it is so important that the NCI continues to receive the government investment that it needs to support lifesaving research projects. Funding for pancreatic cancer research at NCI has increased from \$73 million in 2007 to \$100 million in 2011. Billions of dollars exist in the federal budget for medical research purposes, and ACS CAN is leading the effort to lobby our government for the crucial funds necessary for the clinical research that could lead to the prevention, early detection, and effective treatment of pancreatic cancer.

Resources outside the American Cancer Society

- **National Cancer Institute:** cancer.gov/cancertopics/types/pancreatic/
- **Pancreatic Cancer Action Network:** pancan.org/
- **The Lustgarten Foundation:** lustgarten.org/
- **Hirshberg Foundation for Pancreatic Cancer Research:** pancreatic.org/
- **National Pancreas Foundation:** pancreasfoundation.org/
- **Pancreatica Initiative:** pancreatica.org/

References

1. Silverman DT, Hoover RN, Brown LM, et al. Why do Black Americans have a higher risk of pancreatic cancer than White Americans? *Epidemiology* 2003;14(1): 45-54.
2. Jemal A, Simard EP, Xu J, Ma J, Anderson RN. Selected cancers with increasing mortality rates by educational attainment in 26 states in the United States, 1993-2007. *Cancer Causes Control* 2012.
3. Jemal A, Simard EP, Dorell C, et al. Annual Report to the Nation on the Status of Cancer, 1975-2009, Featuring the Burden and Trends in HPV-Associated Cancers and HPV Vaccination Coverage Levels. *JNCI* (in press).
4. Iodice S, Gandini S, Maisonneuve P, Lowenfels AB. Tobacco and the risk of pancreatic cancer: a review and meta-analysis. *Langenbecks Arch Surg* 2008;393(4): 535-45.
5. Anderson K, Potter JD, Mack TM. Pancreatic cancer. In: Schottenfeld D, Fraumeni JF, editors. *Cancer Epidemiology and Prevention*. New York: Oxford University Press, 2006:721-62.
6. Lynch SM, Vrieling A, Lubin JH, et al. Cigarette smoking and pancreatic cancer: a pooled analysis from the pancreatic cancer cohort consortium. *Am J Epidemiol* 2009;170(4): 403-13.
7. Bosetti C, Lucenteforte E, Silverman DT, et al. Cigarette smoking and pancreatic cancer: an analysis from the International Pancreatic Cancer Case-Control Consortium (Panc4). *Ann Oncol* 2012;23(7):1880-8.
8. Henley SJ, Thun MJ, Chao A, Calle EE. Association between exclusive pipe smoking and mortality from cancer and other diseases. *J Natl Cancer Inst* 2004;96(11): 853-61.
9. Bertuccio P, La Vecchia C, Silverman DT, et al. Cigar and pipe smoking, smokeless tobacco use and pancreatic cancer: an analysis from the International Pancreatic Cancer Case-Control Consortium (Panc4). *Ann Oncol* 2011;22(6): 1420-6.
10. Vrieling A, Bueno-de-Mesquita HB, Boshuizen HC, et al. Cigarette smoking, environmental tobacco smoke exposure and pancreatic cancer risk in the European Prospective Investigation into Cancer and Nutrition. *Int J Cancer* 2010;126(10): 2394-403.
11. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans.

15. Arslan AA, Helzlsouer KJ, Kooperberg C, et al. Anthropometric measures, body mass index, and pancreatic cancer: a pooled analysis from the Pancreatic Cancer Cohort Consortium (PanScan). *Arch Intern Med* 2010;170(9): 791-802.

16. Li D, Morris JS, Liu J, et al. Body mass index and risk, age of onset, and survival in patients with pancreatic cancer. *JAMA* 2009;301(24): 2553-62.

17. Larsson SC, Permert J, Hakansson N, Naslund I, Bergkvist L, Wolk A. Overall obesity, abdominal adiposity, diabetes and cigarette smoking in relation to the risk of pancreatic cancer in two Swedish population-based cohorts. *Br J Cancer* 2005;93(11): 1310-5.

18. Heinen MM, Verhage BA, Goldbohm R. Body mass index and risk of pancreatic cancer: a meta-analysis. *Int J Epidemiol* 2008;37(1): 10-18.

19. Heinen MM, Verhage BA, Goldbohm R, et al. Body mass index and risk of pancreatic cancer: a meta-analysis. *Int J Epidemiol* 2008;37(1): 10-18.

20. Heinen MM, Verhage BA, Goldbohm R, et al. Body mass index and risk of pancreatic cancer: a meta-analysis. *Int J Epidemiol* 2008;37(1): 10-18.

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21. Heinen MM, Verhage BA, Goldbohm R, et al. Body mass index and risk of pancreatic cancer: a meta-analysis. *Int J Epidemiol* 2008;37(1): 10-18.

22. Heinen MM, Verhage BA, Goldbohm R, et al. Body mass index and risk of pancreatic cancer: a meta-analysis. *Int J Epidemiol* 2008;37(1): 10-18.

23. Heinen MM, Verhage BA, Goldbohm R, et al. Body mass index and risk of pancreatic cancer: a meta-analysis. *Int J Epidemiol* 2008;37(1): 10-18.

24. Heinen MM, Verhage BA, Goldbohm R, et al. Body mass index and risk of pancreatic cancer: a meta-analysis. *Int J Epidemiol* 2008;37(1): 10-18.

54. Raimondi S, Lowenfels AB, Morselli-Labate AM, Maisonneuve P, Pezzilli R. Pancreatic cancer in chronic pancreatitis; aetiology, incidence, and early detection. *Best Pract Res Clin Gastroenterol* 2010;24(3): 349-58.
55. Kastrinos F, Mukherjee B, Tayob N, et al. Risk of pancreatic cancer in families with Lynch syndrome. *JAMA* 2009;302(16): 1790-5.
56. Amundadottir L, Kraft P, Stolzenberg-Solomon RZ, et al. Genome-wide association study identifies variants in the ABO locus associated with susceptibility to pancreatic cancer. *Nat Genet* 2009;41(9): 986-90.
57. Wolpin BM, Chan AT, Hartge P, et al. ABO blood group and the risk of pancreatic cancer. *J Natl Cancer Inst* 2009;101(6): 424-31.
58. Wolpin BM, Kraft P, Gross M, et al. Pancreatic cancer risk and ABO blood group allele26(, C63: (r)-9(o)1m6(, C63:u8(r)-mg)-1(e P)73(, 0)-7(09)6(TJ/T1t(e r)y.14(a))-20(, Co-14(2)-23(o)(i)--20(, Co(TJ/)-12(a)-28(m)-30(i)-33(l)-29(i)
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