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.. not available for a specific reference period
... not applicable
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0^s value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p} preliminary
^{r} revised
x suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E} use with caution
F too unreliable to be published
* significantly different from reference category ($p < 0.05$)

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Highlights

- The rate of diagnosis of pancreatic cancer increased with age. During the period from 2011 to 2013, it went from 1.3 per 100,000 among those aged 35 to 39 at diagnosis to 87.2 per 100,000 among those aged 90 and older.
- Pancreatic cancer tends to be diagnosed at older ages relative to most other types of cancer. During the period from 2011 to 2013, nearly 4 in 5 cases were aged 60 or older at diagnosis and just over one half were 70 or older.
- Age-specific rates of pancreatic cancer were generally 20% to 30% higher in males than females during the period from 2011 to 2013.
- Survival from pancreatic cancer is low and decreases with age.

Pancreatic cancer is known as one of the deadliest types of cancer. In Canada, it is associated with the lowest overall five-year survival.[1] This helps explain why pancreatic cancer ranks as the fourth most common cause of cancer death in Canada,[2] despite ranking outside the top 10 most commonly diagnosed cancers.[1] While nearly 6% of all cancer deaths are attributed to pancreatic cancer, it accounts for just over 2% of all newly diagnosed cancer cases.[1]

The pancreas is located deep in the upper abdomen between the stomach and the spine. It is situated close to both the gallbladder and the upper portion of the small intestine.[3,4]

As part of the hormonal system, the pancreas contains a group of cells that produce hormones that regulate blood sugar levels.[4,5] As part of the digestive system, the pancreas produces juices that are required for the digestion of food. The vast majority of pancreatic cancer cases start in the ducts that carry the digestive juices.[6]

The risk of developing pancreatic cancer increases with age, and it is more commonly diagnosed in males than females. Other factors that have been associated with an increased risk of pancreatic cancer include tobacco use, obesity and a family history of the disease.[4,6]

This article presents age-specific statistics on a number of measures of the burden of pancreatic cancer on the people of Canada. The data sources are Statistics Canada's **Canadian Cancer Registry** (2011 to 2013), **Canadian Vital Statistics – Death Database** (2011 to 2013), **population data** (2006 to 2013), and **population life table data** (2005 to 2008).

Rates of pancreatic cancer incidence and mortality increase with age

Typical of many types of cancer, the rate of diagnosis of pancreatic cancer increases with age. Pancreatic cancer is very rare at the youngest ages. From 2011 to 2013, new cases identified prior to the age of 35 were diagnosed at a rate of 0.2 per 100,000 persons in Canada and accounted for 0.5% of all pancreatic cancers (data not shown). However, the **incidence** rate of this cancer increased from 1.3 per 100,000 among those aged 35 to 39 at diagnosis to 87.2 per 100,000 among those 90 and older (Chart 1). The largest **absolute** increase in incidence rates from one age group to the next occurred between the 65-to-69 and 70-to-74 age groups. More generally, the largest increases occurred between the ages of 55 and 84.

One distinguishing feature of pancreatic cancer is that the diagnosis of this disease tends to happen at older ages than it does for most other cancers. From 2011 to 2013, 79.5% of people were aged 60 or older at diagnosis and 52.0% were 70 or older (data not shown).[7] In addition, the **median** age at diagnosis of pancreatic cancer has recently been reported to be among the highest observed for cancer types in Canada.[8]

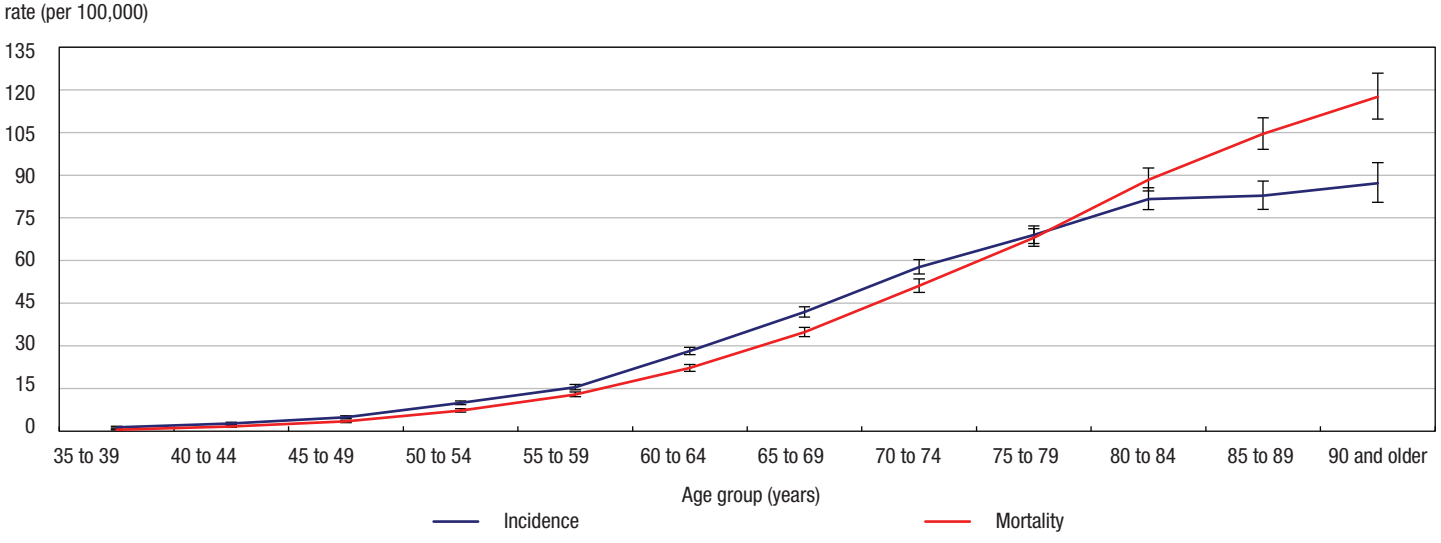
The rate of death attributed to pancreatic cancer also increases with age. During the period from 2011 to 2013, the **mortality** rate of this cancer increased from 0.5 per 100,000 among those aged 35 to 39 at diagnosis to 117.6 per 100,000 among those 90 and older. The highest absolute increases in pancreatic cancer mortality rates (20.4 per 100,000) occurred between the 75-to-79 and 80-to-84 age groups. The increase was such that the mortality rate exceeded the incidence rate for those aged 80 to 84 and in subsequent age groups. It is important to note that pancreatic cancer deaths occurring from 2011 to 2013 will reflect not only pancreatic cancer cases diagnosed during this period, but also those diagnosed in previous years.

Rate of diagnosis consistently higher in males

Age-specific incidence rates of pancreatic cancer were consistently higher among males than females in Canada during the period from 2011 to 2013 (Chart 2). While rates increased with age for both sexes, they tended to do so at a slightly faster absolute pace among males. As such, the largest sex-specific difference in age-specific incidence rates occurred in the oldest age group (99.9 per 100,000 males aged 90 and older versus 79.9 per 100,000 females 90 and older). Relatively speaking, age-specific rates were generally 20% to 30% higher in males than females.

Chart 1

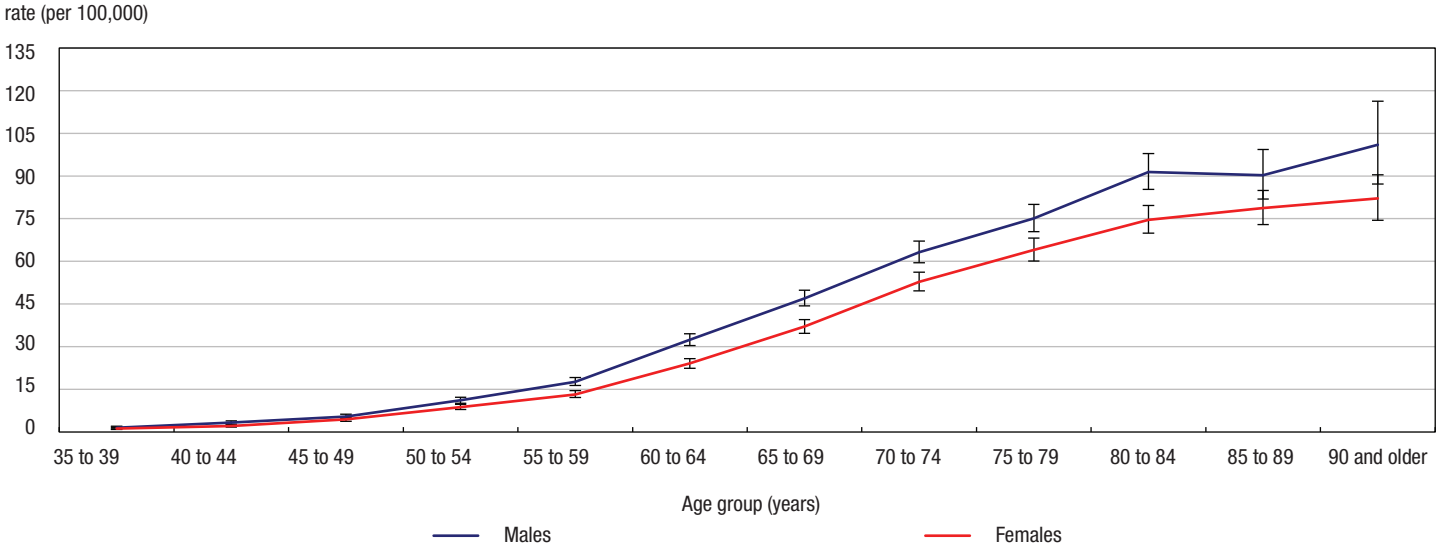
Age-specific pancreatic cancer incidence and mortality rates, by age group, ages 35 and older, Canada,[1] 2011 to 2013



1. Incidence data for Quebec were imputed as such data were unavailable beyond 2010. See Methods section for more detail.
Note: 95% confidence intervals are denoted by vertical bars overlaid on the trend lines. They indicate the degree of variability in the estimates. Rates are based on counts that have been randomly rounded to a base of five.
Source: Statistics Canada, Canadian Cancer Registry and Canadian Vital Statistics – Death Database.

Chart 2

Age-specific pancreatic cancer incidence rates, by sex and age group, ages 35 and older, Canada,[1] 2011 to 2013



1. Incidence data for Quebec were imputed as such data were unavailable beyond 2010. See Methods section for more detail.
Note: 95% confidence intervals are denoted by vertical bars overlaid on the trend lines. They indicate the degree of variability in the estimates.
Source: Statistics Canada, Canadian Cancer Registry and Canadian Vital Statistics – Death Database.

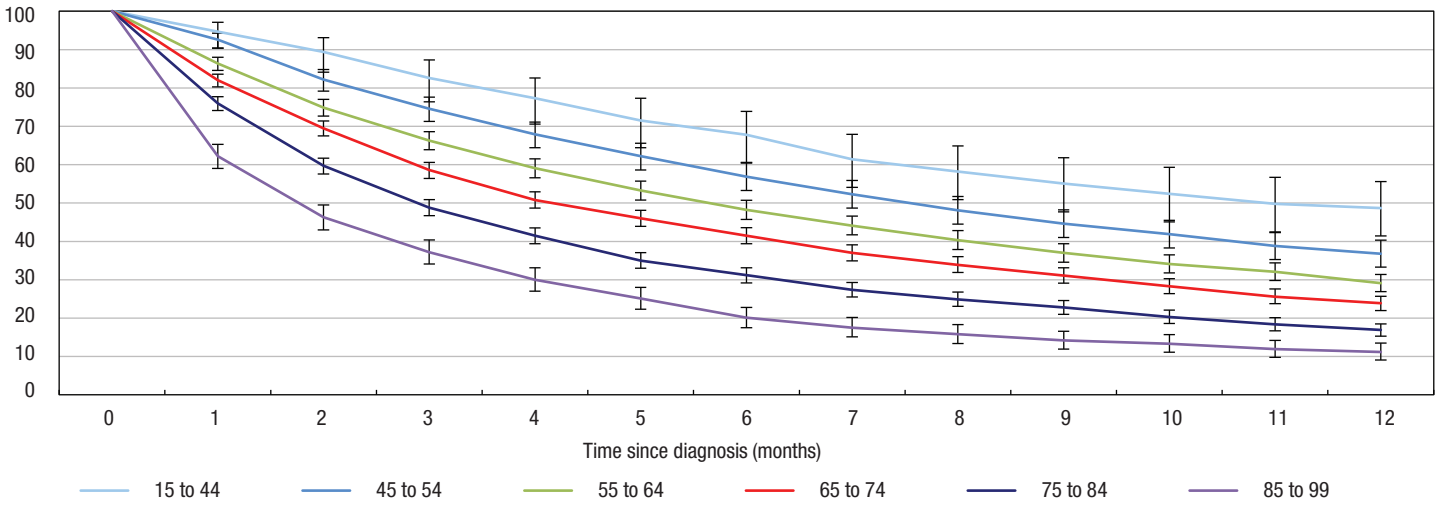
The overall pancreatic cancer **age-standardized incidence rate** among males was 14.7 per 100,000, while it was 11.8 among females (data not shown). Higher rates in males than females have been noted elsewhere.[9,10,11] The reason behind this is not clear, although differences in lifestyle factors, such as greater tobacco use among males, may play a role.[11]

Survival decreases with age

For those diagnosed with pancreatic cancer[12] from 2005 to 2007 the one-year **net survival** was highest in the youngest age group and then declined with each successive age group (Chart 3). Among those diagnosed between the ages of 15 and 44, the one-year net survival was 48.7%. In contrast,

Chart 3

One-year cumulative pancreatic cancer net survival,[1] by age group, ages 15 to 99, Canada excluding Quebec, 2005 to 2007



1. Net survival refers to the probability of survival adjusted for causes of death other than pancreatic cancer. See "Data sources, Methods and Definitions" box for a more detailed definition of net survival.
Note: 95% confidence intervals are denoted by vertical bars overlaid on the trend lines. They indicate the degree of variability in the estimates.
Source: Statistics Canada, Canadian Cancer Registry and life tables.

the lowest one-year, age-specific net survival, 11.2%, was for people who were aged 85 to 99 at diagnosis.

Differences in net survival by age group were apparent as early as one month after diagnosis. One-month net survival estimates ranged from 94.7% for those in the youngest age group to 62.2% for those in the oldest age group. For all age groups combined, pancreatic cancer net survival was 79.9% at one month and 23.1% at one year. At both of these times since diagnosis, net survival was below the overall estimate for those aged 75 to 84 and 85 to 99, but above the overall estimate for all other age groups.

Median survival time short

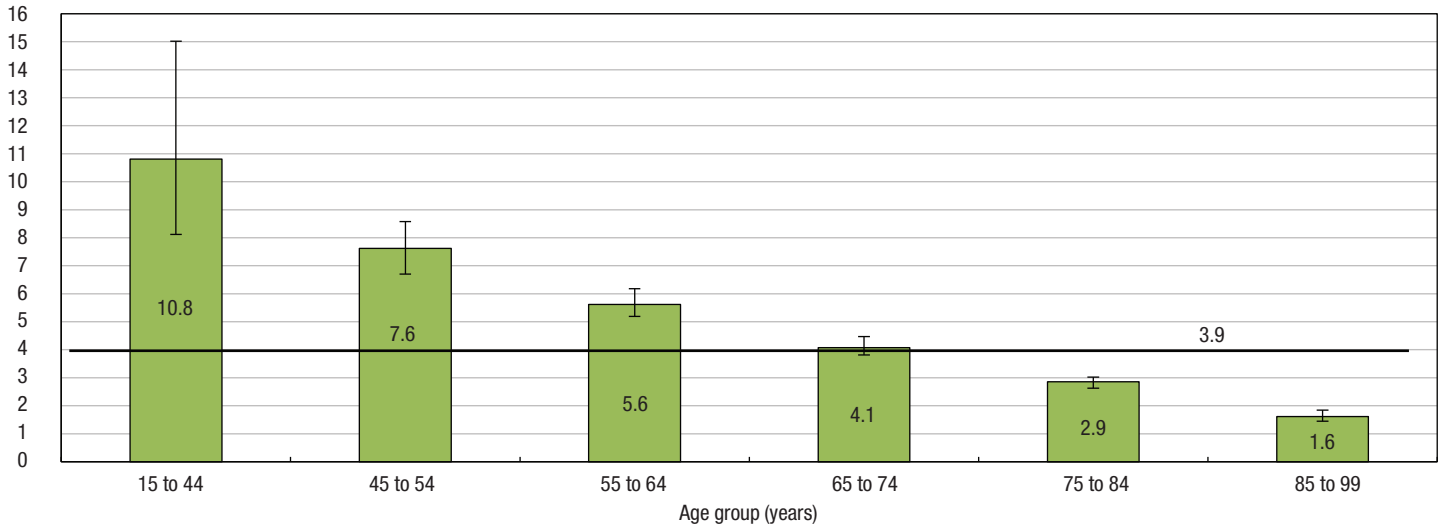
A complimentary outcome measure which helps to summarize the severity and prognosis of pancreatic cancer is the median **survival time**. For those diagnosed with pancreatic cancer[12] from 2005 to 2007, the median survival time from any cause of death was 3.9 months, or just under 17 weeks (Chart 4). In other words, one half of those diagnosed with pancreatic cancer during this period were alive approximately 3.9 months later, while one half died some time before then. It is important to keep in mind that this estimate is based on a large group of people with varying circumstances.[13] One important consideration is age at diagnosis.

At 10.8 months, the median survival time for pancreatic cancer from any cause of death was longest for those diagnosed between the ages of 15 and 44 (Chart 4).[14] With each successive age group, however, there was a steady decrease in median survival time. For the oldest age group, the median survival time was down to 1.6 months, or seven weeks.

The low survival for pancreatic cancer results from a combination of factors including late diagnosis, the aggressiveness of the disease, and the shortage of curative treatment options.[15] Pancreatic cancer is typically diagnosed at an advanced (metastatic) stage because of the lack of early symptoms.[15] The stage of a cancer is a measure of disease progression. While a number of factors may go into determining the stage, one important consideration is the extent of the spread of the cancer. One such example is whether the tumour has remained in its original location (localized) or whether it has spread (metastasized) to other parts of the body far from its origin.[16] The only treatment

Chart 4

Pancreatic cancer median survival time,[1] by age group, ages 15 to 99, Canada excluding Quebec, 2005 to 2007[2]



1. The median survival time refers to the midpoint of individual survival times sorted by size. Survival times were measured from date of diagnosis to date of death from any cause, or to the end of follow-up for vital status (2008).
2. Based on pancreatic cancer cases diagnosed from 2005 to 2007 and followed up for vital status to the end of 2008.

Note: Horizontal bar indicates the median survival time for ages 15 to 99 combined. 95% confidence intervals are denoted by vertical lines overlaid on the bars. They indicate the degree of variability in the estimates.

Source: Statistics Canada, Canadian Cancer Registry.

for pancreatic cancer for which the intent is a possible cure is surgery.[15] However, surgery is generally only considered an option for the minority of cases that are diagnosed at an earlier (localized) stage of the disease.[15,17]

Conclusion

While pancreatic cancer is not one of the most common types of cancer, it is one of the deadliest. When the rate of pancreatic cancer is examined more closely by age at diagnosis, a number of important distinctions become apparent. In particular, pancreatic cancer is rare in younger age groups, but the incidence rate rises sharply with age. The median age at diagnosis for this disease is higher than for most other types of cancer. At the same time, a significant decline in survival with age is evident.

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Data sources, methods and definitions

Data sources

The **Canadian Cancer Registry** http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3207 is a dynamic, person-oriented, population-based database maintained by Statistics Canada. It contains information on cancer cases diagnosed from 1992 onward, compiled from reports from every provincial and territorial cancer registry in Canada. Cancer incidence data in this report are from the July 2016 tabulation master file released in February 2017. The analysis file was created using the multiple primary coding rules of the International Agency for Research on Cancer.[18] Cases were defined based on the International Classification of Diseases for Oncology, Third Edition.[19] Survival analyses were based on the October 2011 version of the Canadian Cancer Registry (CCR) and population life tables.

The **Canadian Vital Statistics – Death Database** http://www23.statcan.gc.ca:81/imdb/p2SV.pl?Function=getSurvey&SDDS=3233&lang=en&db=imdb&adm=8&dis=2 includes demographic and cause of death information for all deaths from all provincial and territorial vital statistics registries in Canada. Prior to 2010, some data were collected on Canadian residents who died in some American states; these deaths were excluded from this analysis. Starting with the 2010 reference year, data on Canadian residents who died in American states are no longer collected. Mortality data in this report are from the March 9, 2017, release.

Incidence and mortality rates were derived using **Canada's population estimates by age and sex**.[20]

Population life tables are required to estimate expected survival, which is used in the calculation of relative (net) survival. Annual expected survival data by age, sex, and province or territory of residence were derived from complete and abridged life tables. Further detail is provided elsewhere.[1]

Methods

Classification of pancreatic cancer cases and deaths

Cancer cases were classified as pancreatic cancer if the topography (site) code was C25 and the histology code was within one of the following ranges: 8000 to 9049, 9056 to 9139, or 9149 to 9589. Only malignant cases were considered.

Deaths were classified using the World Health Organization's *International Statistical Classification of Diseases and Related Health Problems—10th Revision* (ICD-10).[21] Deaths for which the ICD-10 code was C25 were considered to be from pancreatic cancer.

The final postcensal population estimates of the July 1, 2011, Canadian population were used as the standard population in deriving age-standardized rates.[22]

Survival analysis methods are described in detail elsewhere.[1] Very briefly, net survival was estimated using the cohort approach and relative survival methodology. In particular, estimates for ages 15 to 99 combined were derived using age-standardized relative survival ratios. Data from the province of Quebec were excluded because the follow-up vital status (dead or alive) of residents of this province diagnosed with cancer was incomplete.

Incomplete data

Annual incidence counts for the diagnosis years 2011 to 2013 were imputed for Quebec, as cancer incidence data for this province were not available beyond 2010. The imputation process followed a three-step approach and was done on an age group and sex-specific basis. First,

Data sources, methods and definitions (end)

ratios of Quebec pancreatic cancer incidence rates to those of Canada excluding Quebec were calculated for the period from 2006 to 2010. Then annual pancreatic cancer incidence rates for Quebec for 2011 to 2013 were imputed by applying the above ratios to pancreatic cancer incidence rates for Canada excluding Quebec for these years. Lastly, annual pancreatic cancer counts for Quebec for 2011 to 2013 were derived by applying the corresponding imputed rates to the population estimates for this province for these years.

Death certificate only cases have not been reported for Ontario since 2007 and for Quebec since 2009. In each instance, incidence data from the last three years available in each province were used to randomly impute death certificate only cases for subsequent years in that province. The imputation of death certificate only cases is especially relevant for typically short-term survival cancers like pancreatic cancer as such cancers are more likely to be identified in this manner.

Definitions

Absolute changes in measures are determined by subtracting one rate from another.

The **age-standardized incidence rate** represents the number of new cancer cases per 100,000 persons that would have occurred if the population under study had had the same age distribution as the given standard population.

Cancer **incidence** refers to the number of newly diagnosed cancer cases in a given time period.

Median refers to the midpoint of a distribution of numbers sorted by size. While the median is a summary measure of a distribution, it does not describe the entire distribution.

Cancer **mortality** refers to the number of deaths attributed to cancer in a given time period.

Net survival is the preferred method for comparing cancer survival in **population-based** cancer studies.[23] It addresses the issue of differences in mortality due to causes other than pancreatic cancer (that is, the background mortality) in various populations for which a comparison of survival estimates is desired.[24] It does so by adjusting the background mortality in each population to a common level—specifically no background mortality at all. The resulting probability, like the age-standardized rate, allows for more "fair" comparisons and is hypothetical in nature. Net survival may be interpreted as the survival probability that would be observed in the hypothetical situation where the cancer of interest is the only possible cause of death.[23]

A **population-based** study is "a study of individuals taken from the general population who share a common characteristic such as age, sex, or health condition."[25]

The **survival time** is the time between the date of diagnosis and the date of death from any cause.

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