

The Changing Age Distribution of Prostate Cancer in Canada

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ABSTRACT

Background: Prostate cancer incidence rates are still increasing steadily; mortality rates are levelling, possibly decreasing; and hospitalization rates for many diagnoses are decreasing. Our objective is to examine changes in age distributions of prostate cancer during these times of change.

Methods: Prostate cancer cases were derived from the Canadian Cancer Registry, prostate cancer deaths from Vital Statistics, hospitalizations from the Hospital Morbidity File. Age-standardized rates were calculated based on the 1991 Canadian population. A prevalence correction for incidence rates was calculated.

Results: Age-specific incidence rates increased until 1995 for all ages, but a superimposed peak (1991-94) was greatest between ages 60-79. After 1995, increases in incidence continued for the under-70 age groups. Prevalence correction indicated the greatest underestimation of incidence rates for the oldest ages, but was less in Canada than in the United States. Mortality rates increased until 1994, then levelled and slowly decreased; age-specific mortality rates showed the greatest increase for the oldest ages but the earliest downturn for younger age groups. While hospitalizations dropped drastically after 1991, this drop was confined to elderly men (70+).

Conclusions: Dramatic changes in age distributions of prostate cancer incidence, mortality and hospitalizations altered age profiles of men with prostate cancer. This illustrated the changing nature of prostate cancer as a public health issue and has important implications for health care provision, e.g., the increased numbers of younger new patients have different needs from the increasing numbers of elderly long-term patients who now spend less time in hospital.

MeSH terms: Prostate cancer; age distribution; mortality; incidence; prevalence

La traduction du résumé se trouve à la fin de l'article.

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Prostate cancer incidence rates have risen steadily in Canada over the past decades, except for a transient increase with a sharp peak in 1993 and subsequent decrease back to the previous trends.^{1,2} A similar peak in the United States (US) started a few years earlier, especially for Whites, and was larger, especially for African-Americans.³⁻⁷ This peak in incidence is generally attributed to PSA testing, which in Canada became available in 1986 and gained widespread use in the early 1990s.⁸ In the US, PSA use started earlier resulting in a slightly earlier peak.^{2,9,10} These changes in incidence rates may be likely accompanied by changes in prevalence, changes in use of hospital resources and, if earlier detection is effective, lead to lowering mortality rates. These changes may well have led to considerable changes in age distribution of the prostate cancer population.

The objective of this article is to determine whether changes in incidence, mortality and hospitalizations occurred uniformly for all age groups. Since prostate cancer is a common cancer among men, especially at older ages, and survival rates are long and increasing,^{11,12} the proportion of men with prostate cancer in the general population can be high. Since men diagnosed with prostate cancer are no longer at risk for becoming a new case, incidence rates may be underestimated. Merrill et al. applied prevalence corrections to US incidence rates and found that without these corrections, prostate cancer incidence was considerably underestimated, especially at the older ages.¹⁰ We will apply prevalence corrections to Canadian incidence rates to ascertain whether the same effect occurs in Canada.

METHODS

Incidence data for 1970-2001 were obtained from the Canadian Cancer Registry (CCR); in-patient hospital separations with a primary diagnosis of prostate cancer (ICD-9, 185) for 1980-2002 from the Hospital Morbidity File (HMF); and death registrations with prostate cancer as underlying cause of death for 1970-2002 from Vital Statistics Data (see statcan.ca for further information). All are maintained by Statistics Canada. HMF data are organized by fiscal year, which will be referred to as single years (e.g., the fiscal year, April 1, 1981 to March 31, 1982,

will be referred to as 1981). If patients have more than one hospital stay over the study period, each hospital stay is treated as a separate event. National prevalence rates (1983-2000) were estimated by applying Saskatchewan 15-year survival rates to national prostate cancer incidence figures.^{1,13} A prevalence correction for Canadian incidence rates was calculated by subtracting an estimate of prevalent cases from the denominator.

Age-specific rates were calculated using census estimates of the population of Canadian males. These rates are only presented for ages 50 and over, as few cases occur for younger men. Rates were age-standardized to the 1991 Canadian population.

RESULTS

Trends in age-standardized incidence, mortality, and hospital separation rates in recent decades diverge widely (Figure 1). Incidence rates increased from 1969 culminating in a sharp peak in 1993, followed by a dramatic decrease until 1996 when the rate resumed its climb at an even steeper rate. Mortality rates rose only slightly and then levelled off in the early 1990s, followed by a decrease back to the 1970 rates. Hospitalization rates increased until 1991, followed by a sudden decrease.

Age-specific incidence rates varied greatly over time, especially in the last decade (Figure 2a). The increasing trends were steepest for the oldest age groups, who did not show the 1991-93 peak, although rates dropped sharply after 1994. The superimposed peak in 1991-93 was the sharpest and highest for ages 65-74 and less for both younger and older age groups. For ages 55-69, incidence rates rose even more steeply after the peak than before. Between 1995 and 2000, incidence rate curves bunched together for the four oldest groups, and by 2002 the next age group, 65-69, also reached the same level, even though prior to 1994 these rates differed considerably (e.g., in 1985, the rate for ages 85+ was more than triple that for ages 65-69). A changing age distribution of new cases was seen over the years with increasing numbers of new cases at younger ages and fewer at the highest ages (Figure 2b). The biggest increase in percentage of new cases was between ages 60 and 64. The proportion of new cases under age 75 was

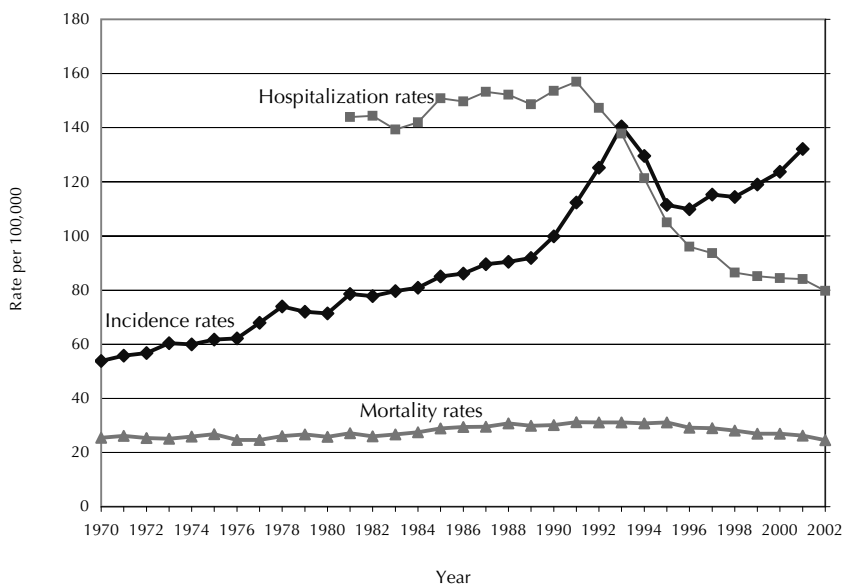


Figure 1. Age-standardized incidence, mortality, and hospital separation rates. Rates were age-standardized to the 1991 Canadian population. Sources: Hospital Morbidity Files; the Canadian Cancer Registry; Vital Statistics Death Registrations.

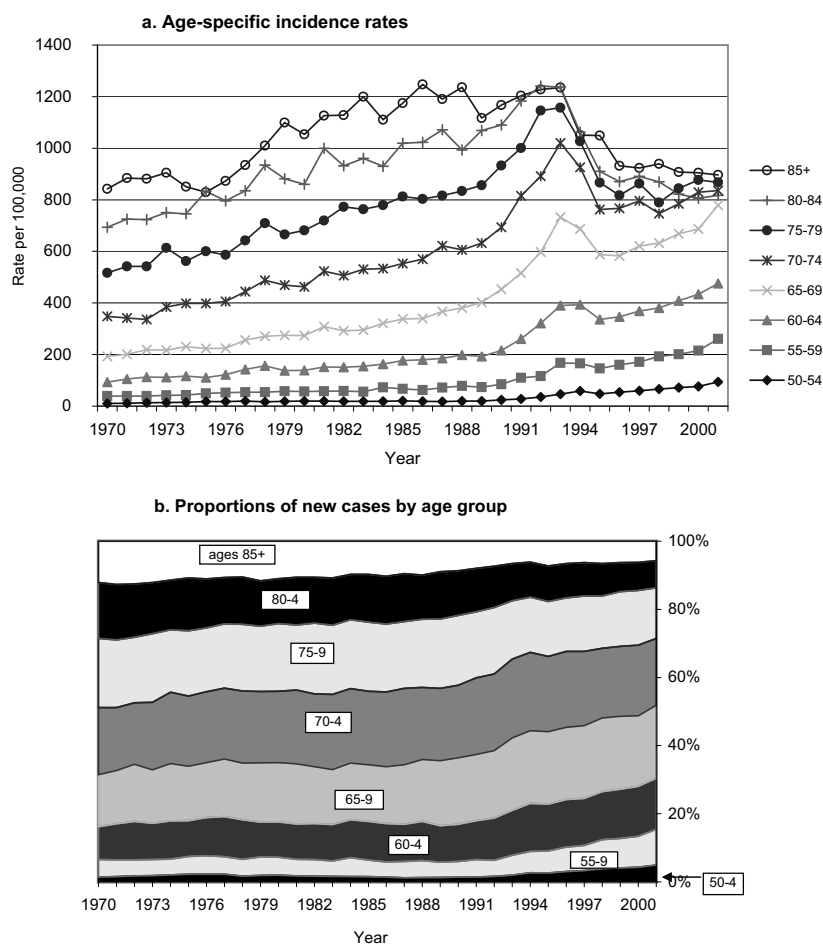


Figure 2. Incidence of prostate cancer by age, Canada, 1971-2000. The distance between the lines in Figure 2b is the percent of new cases added by the age group specified. Source: The Canadian Cancer Registry.

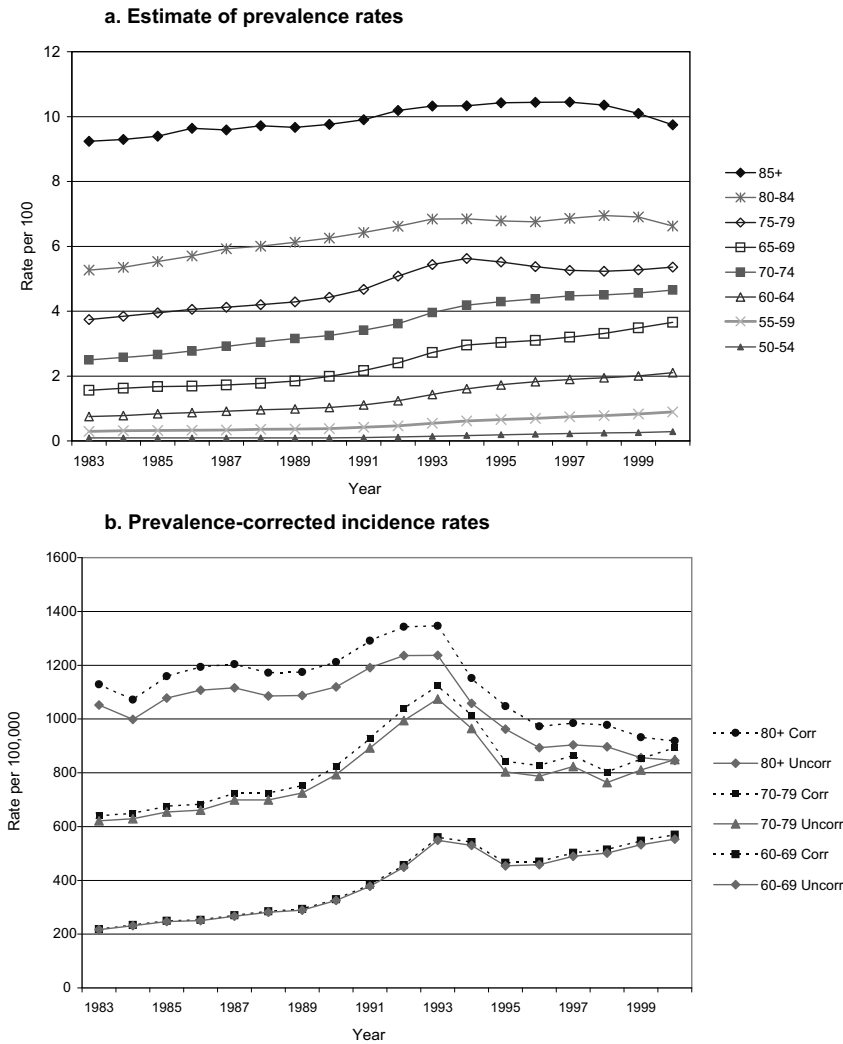


Figure 3. Prevalence rates and prevalence-corrected incidence rates by age. Prevalence corrections were calculated by subtracting an estimate of prevalence cases from the denominator population. Source: Prevalence rates as calculated by the Surveillance and Risk Assessment Division, CCDPC, Public Health Agency of Canada. Incidence rates from the Canadian Cancer Registry.

relatively level before 1992 at about 57%, but then rose to 70% by the year 2000.

Estimates of prevalence rates show that between 1991 and 1999, more than 10% of men over 85 and 7% of those between ages 80-84 were living with prostate cancer (Figure 3a). These prevalence rates were used to calculate prevalence-corrected incidence rates (Figure 3b). The discrepancy (i.e., increases in rates after correction) increased with the passing years, as well as with age. Thus, for ages 80+, the correction changed from a low of 7.3% in the early years to a high of 9.0% in 1998, but was nearly negligible for the younger age groups. Since prevalence data were not available for the same years and in the same detail as the data of Figure 2, a prevalence correction could not be applied to all data points.

Age-specific hospitalization rates for prostate cancer remained level from 1981 to 1990 for each of the age groups (Figure 4a). After 1991, the rates for the oldest two age groups declined dramatically within six years to less than half their earlier level, while rates for younger age groups declined less rapidly or not at all. Percentages of hospitalizations by age group shifted over time toward a much larger proportion of patients at younger ages (Figure 4b). For example, the percentage of hospital separations for those aged under 70 was about 33-35% for most of the 1980s but jumped to 41% in 1993 and reached 53% in 2000.

The increase in mortality rates was most pronounced up to 1995 for the oldest ages, after which a downturn started (Figure 5). Rates increased less rapidly, or not at all, in

younger age groups over the years while declines started around 1991. During our study period, the distribution of deaths shifted toward older age groups such that the proportion of men aged 80+ increased from 37% in 1977 to over 45% in recent years.

DISCUSSION

As illustrated by these results, much can be learned from the Canadian mortality, cancer registry and hospital discharge databases. Data from these sources show that trends in incidence, mortality and hospitalization rates for prostate cancer changed considerably in recent decades, displaying varying trends for different age groups. Strengths of these databases are that they cover the entire population over many years. The main weakness was in the estimates of the prevalence data as discussed below.

Overall prostate cancer incidence rates show similar patterns in Canada and the US – an increasing incidence with a superimposed peak, which has been attributed to increasing use of early detection methods such as PSA testing.¹⁻⁷ These PSA-related increases in incidence have been shown to vary with intensity of PSA testing.¹⁴ The 60-79 age groups received the highest rate of PSA testing at 65%,¹⁵ corresponding to the age group with the highest peak in incidence. While the PSA-related peak did not occur in the oldest population, this age group showed the greatest drop in rates after 1993. This likely indicates that cases previously identified at these elderly ages are now identified earlier, thus decreasing new cases at the oldest age groups.

Prostate cancer prevalence rates. In Canada, as many as 10% of men over 85 live with prostate cancer. In the US, this proportion was as high as 25% of elderly White men in 1992, but subsequently decreased.¹⁰ For both countries, prevalence rates under age 70, although lower, were still increasing by 1999. While Canadian prevalence rates were estimated by applying population-based Saskatchewan survival data to national data, US rates were based on SEER data that cover only part of the population. While differences in representativeness of data might account for some of the discrepancies in prevalence rates shown, the higher prevalence rate in the US likely results from greater use of PSA testing, which is consistent with Canada's lower incidence rate but

similar mortality.² The resulting higher US prevalence would lead to a larger prevalence-correction for incidence rates. While for Canada the underestimate was 9% for ages 80+, for the US it reached 20% for White men of that age and even more for Black men.¹⁰ In neither country did the prevalence-correction alter the shape of the PSA-related peak in incidence.

The prostate cancer mortality rates in this study show overall trends similar to other studies,^{3,6} however, this study showed that the changes are not the same for all age groups. The steeper increases in mortality for the elderly, followed by levelling and then a decrease in the 1990s is consistent with increasing survival times.^{11,12} Longer survival transfers deaths to higher age groups, so that a mortality downturn for higher age groups does not occur until cases transferring from younger age groups have been depleted. How much of this increased survival is attributable to earlier detection, e.g., PSA testing, is not known. Earlier diagnosis does not guarantee more cures because of lead-time bias, i.e., earlier diagnosis without altering the disease history.⁴ Even if earlier detection led to decreasing mortality, the increasingly multi-year course of the disease would result in a considerable delay before a noticeable decrease in mortality. Treatment practices in surgery and hormonal treatments, etc., have also experienced changes, again resulting in longer survival.^{16,17} Prostate cancer mortality may also decrease since, with longer survival, competing causes of death become more likely.^{18,19}

In-patient hospitalization rates show changes that may be considered paradoxical – during the time of the greatest increase in incidence, hospitalization rates declined the most. In fact, age-specific incidence rates were highest in the elderly, which was the group experiencing the greatest decline in hospital admissions. The dramatic peak in incidence in the early 1990s is barely seen in hospitalization rates, despite the expectation that at least some of those making up this large increase in new cases would be admitted to hospital for first-line treatment. Major changes in in-patient hospital management must have occurred to result in such decreases in admissions. Increased use of day surgery may account for some of the decline while changes in use of treatment modalities not requiring hospital admission might account for some more, but other

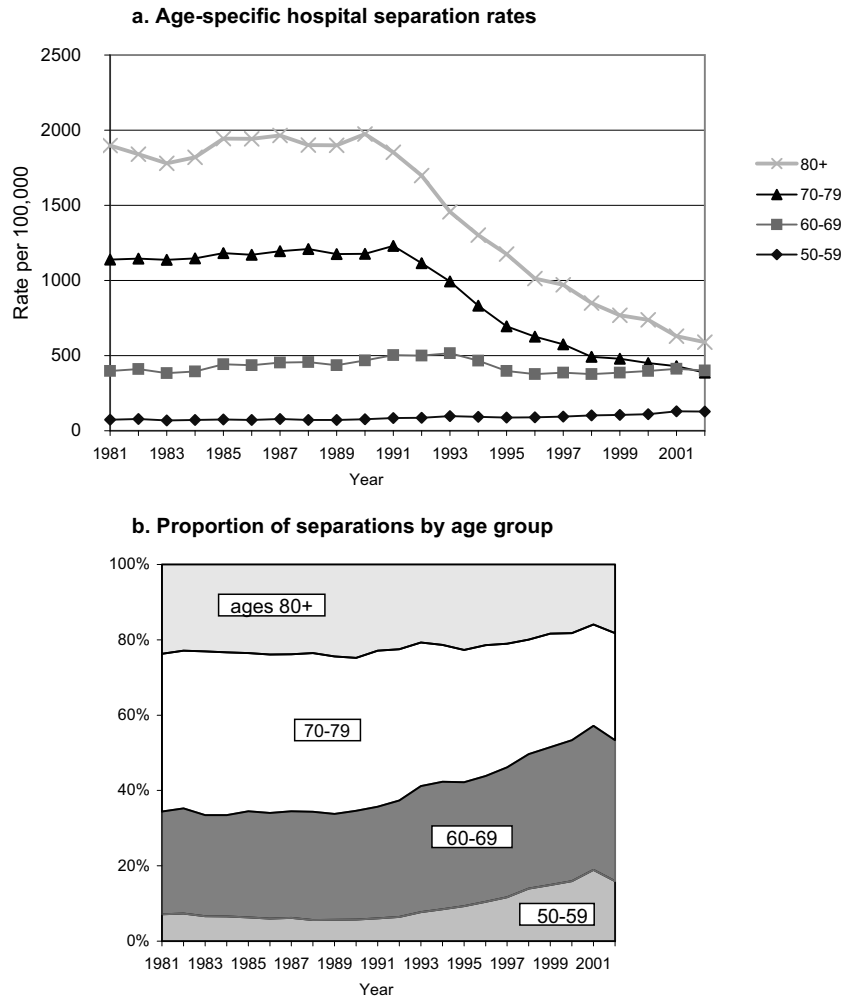


Figure 4. Age-specific hospital separations for prostate cancer, Canada, 1981-2000

The distance between the lines in Figure 4b is the percent of hospital separations added by the age group specified.

Source: Hospital Morbidity File.

factors may also contribute to the decline.²⁰ The changes in age distribution of patients admitted is also significant since the elderly have larger proportions of severe cases²⁰ which require supportive and palliative care increasingly done in settings other than general hospitals.

Clearly, the age distribution of prostate cancer has changed dramatically over the years. Larger proportions of younger men are diagnosed with the disease and live much longer with diagnosed cancer. These findings demonstrate the need for a careful evaluation not only of the effectiveness of health care of prostate cancer patients as they are today, but also of the psychological effects of having cancer at younger ages and for longer durations. At the same time, the proportion of in-patient hospitalization for elderly men is decreasing, likely reflecting more effective use of out-patient settings,

such as supportive and palliative care, again demonstrating the need to evaluate the impact and quality of this type of care.

Our findings demonstrate the importance of the changing nature of prostate cancer as a public health issue. The complex interrelation of the trends in incidence, hospital separations and mortality occurs in an environment with changes in screening, diagnosis, treatment and other parameters of the health care system. For a disease like prostate cancer where primary prevention is insufficient, secondary prevention in terms of effective early detection, and tertiary prevention which allows people to achieve the highest possible quality of life even while coping with the disease, are crucial. Understanding the changes in age distribution of patients at all these stages will help provide optimal health care.

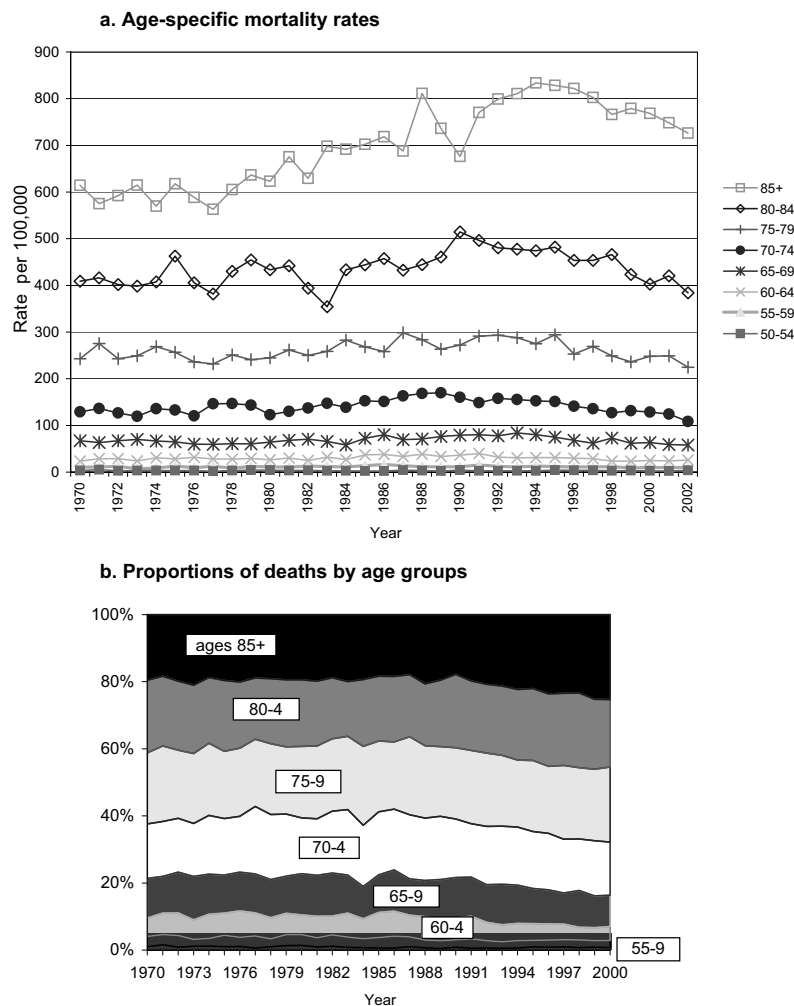


Figure 5. Prostate cancer mortality, Canada, 1970-2000

The distance between the lines in Figure 5b is the percent of deaths added by the age group specified.

Source: Vital Statistics Death Registrations.

RÉSUMÉ

Contexte : On constate que les taux d'incidence du cancer de la prostate continuent de s'accroître de façon constante, que les taux de mortalité se stabilisent et tendent même peut-être à décroître, et que les taux d'hospitalisation pour de nombreux diagnostics décroissent. Notre objectif est d'examiner les différences dans la répartition du cancer de la prostate entre les groupes d'âges en cette période de changement.

Méthode : Nous avons puisé les données sur les cas de cancer de la prostate dans le Registre canadien du cancer, celles sur les décès causés par le cancer dans les registres d'état civil, et celles sur les hospitalisations dans la Base de données sur la morbidité hospitalière. Nous avons calculé les taux normalisés par âge en fonction de la population canadienne de 1991, et calculé une correction en fonction de la prévalence pour les taux d'incidence.

Résultats : Les taux de prévalence liés à l'âge se sont accrus jusqu'en 1995 dans tous les groupes, mais un sommet sans précédent a été atteint en 1991-1994 dans le groupe des 60-79 ans. Après 1995, les taux d'incidence ont continué de s'accroître pour les groupes de moins de 70 ans. Une correction de la prévalence a révélé que les taux d'incidence les plus sous-estimés sont ceux des groupes les plus âgés, mais cette sous-estimation était plus marquée aux États-Unis qu'au Canada. Les taux de mortalité se sont accrus jusqu'en 1994. Ils se sont ensuite stabilisés et ont lentement diminué par la suite. L'accroissement le plus important des taux de mortalité en fonction de l'âge s'est produit dans les groupes les plus âgés, mais la première baisse est survenue dans les groupes les plus jeunes. Les taux d'hospitalisation ont décliné considérablement après 1991, mais seulement chez les hommes âgés (70 ans et plus).

Conclusion : Les changements très importants dans la répartition par groupe d'âge des taux d'incidence du cancer de la prostate, des taux de mortalité et des taux d'hospitalisation viennent modifier les profils d'âge des hommes atteints de ce cancer. Cette constatation montre la nature changeante du cancer de la prostate en tant que problème de santé publique, et elle a des répercussions considérables sur la prestation de soins. Par exemple, le nombre croissant de nouveaux jeunes patients n'ont pas les mêmes besoins que leurs aînés nécessitant des soins de longue durée, toujours plus nombreux, mais qui passent maintenant moins de temps à l'hôpital.

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