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RESEARCH ARTICLE

Trends in prostate cancer in elderly in Denmark, 1980–2012

Mads Hvid Poulsen[a], Lars Dysager[b], Oke Gerke[c], and Lars Lund[a,d] ; On behalf of the Academy of Geriatric Cancer Research (AgeCare)

[a]Department of Urology, Odense University Hospital, Odense, Denmark; [b]Department of Oncology, Odense University Hospital, Odense, Denmark; [c]Department of Nuclear Medicine, Odense University Hospital, Centre of Health Economics Research, University of Southern Denmark, Odense, Denmark; [d]Clinical Institute, University of Southern Denmark, Odense, Denmark

ABSTRACT

Backgound The purpose of the study is to elucidate the epidemiology of elderly patients with prostate cancer in Denmark and identify the differences between younger (<70 years) and elderly (≥70 years) patients.

Material and methods Prostate cancer was defined as ICD-10 code C61. Data were derived from the NORDCAN database with comparable data on cancer incidence, mortality, prevalence and relative survival in the Nordic countries, where the Danish data are delivered from the Danish Cancer Registry and the Danish Cause of Death Registry.

Results The average annual number of newly diagnosed prostate cancers in Denmark has risen from 1297 patients in 1980 to 4315 patients in 2012. The prevalence increased consistently in all age groups more than seven-fold in the period, from 3987 patients in 1980 to 28 951 patients in 2012. The cancer-specific mortality in Denmark has slightly increased over the observed period, in coherence with the growth of the population, resulting in unchanged mortality rates, with the exception of the patients above 80 years, where the mortality rates are increased. The one- and five-year relative survival for prostate cancer improved significantly for all age groups over the time period from 1980 to 2012.

Conclusion The incidence, prevalence, and survival of elderly prostate cancer patients has increased over the observed period but with unchanged mortality rates, except in patients above 80 years, where the mortality rates were increasing.

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Prostate cancer has become the most commonly non-skin cancer diagnosed in the developed countries and the third leading cause of death among men [1]. In Europe, about 190 000 men are diagnosed annually with prostate cancer and around 80 000 men die annually of prostate cancer [2]. Prostate cancer is generally a disease of the elderly (≥70 years) and few men are diagnosed before the age of 50 years, the median age at being 68 years [3,4]. However, despite high incidence and mortality rates in the elderly, more studies suggest that the elderly are undertreated [5–8]. Recent guidelines state that age alone should not prelude patients from efficient treatment [9]. It is important to assess the health status and comorbidities, whereby patients can be managed according to their individual state of health, not according to age [10,11].

Denmark was the last of the Nordic countries to introduce curative treatment of prostate cancer. The first patient who had a radical prostatectomy was in 1995, since then the management of patients has rapidly evolved reaching an equivalent level with the rest of the European community [12]. The aim of this study was to elucidate the incidence and mortality among elderly patients with prostate cancer in the period from 1980 to 2012, covering the introduction of curative treatment, the extended use of prostate-specific antigen (PSA) in pseudo-screening and change of the Gleason graduation [13].

Methods

Prostate cancer was defined as ICD-10 code C61. Data were derived from the NORDCAN database with comparable data on cancer incidence, mortality, prevalence and relative survival in the Nordic countries, where the Danish data are delivered from the Danish Cancer Registry and the Danish Cause of Death Registry with follow-up for death or emigration until the end of 2013. A more detailed description of the materials and methods appear elsewhere [14]. This study focuses on the elderly population with age categorized as 0–69, 70–79, 80–89 and 90 + years.

For incidence and mortality, age group-specific numbers and rates per 100 000 person years are shown in tables and graphs with calendar periods for time of diagnosis 1978–1982, 1988–1992, 1998–2002, 2003–2007, 2010, 2011 and 2012. Prevalence is defined as the number of cancer patients (including cured patients as well) with that specific diagnosis

CONTACT L. Lund, Lars.lund@rsyd.dk Department of Urology L, Odense University Hospital, Sdr Boulevard 23, 5000 Odense, Denmark

still alive and is shown in tables by the end of 1980, 1990, 2000, 2005, 2010, 2011 and 2012.

Sex- and age-specific one- and five-year relative survival proportion ratios were calculated for each of the diagnostic groups for the age groups 0–69, 70–79, 80–89 and 90 + years and for the five-year periods of diagnosis 1968–1972, 1973–1977, . . ., 2003–2007 and 2008–2012.

Relative survival for a group of cancer patients is calculated as the observed survival (where all causes of death are considered events) divided by the expected survival for a group from the Danish population with the same age and year of birth composition. Actuarial method is used for observed survival and Ederer II method for expected survival [15]. Relative survival can be interpreted as the survival if the cancer was the only cause of death. For the most recent period, 2008–2012, not all patients can be followed up for death in five years and we used hybrid methods where we supplement with survival experience from cancer patients diagnosed earlier years.

Results

The average annual number of newly diagnosed prostate cancers in Denmark has risen from 1297 patients around 1980 to 4315 patients in 2012 (Table I). During this time period, a shift in the age distribution of the prostate cancer patients has been observed; around 1980, 70% of the patients diagnosed were over the age of 70 years, whereas in 2012 this fraction had decreased to 49%. Throughout the time period the incidence rates were more than three times higher in men aged 70 years or more than in younger men (Figure 1). Among the elderly, incidence rates increased slightly from 1980 to 2000 and sharply up to 2005 and then decreased. In younger patients (<70 years), the incidence more than tripled mainly from 2000 and onwards

The average annual number of deaths from prostate cancer increased from 733 in 1980 to 1153 in 2012 with an almost constant proportion (82%) aged over 70 years (Table II). Mortality rates after prostate cancer remained rather constant for men aged up to 85 years while the rates increased for those aged more than 85 years (Figure 2). Throughout the observed period the mortality rates were higher among elderly men than among younger men.

Both the one- and five-year relative survival for prostate cancer improved substantially in all age groups from 1980 to 2012 (Figure 3). The survival rates were similar for men up to 80 years, with a one-year survival rate around 98% in 2008–2012, and five-year survival rates of 88–81% whereas lower rates were observed for men aged more than 80 years.

The prevalence of prostate cancer increased more than seven times over the observed period, from 3987 patients with prostate cancer in 1980 to 28 951 patients in 2012 (Table III). The increase was consistent in all age groups. The elderly accounted for 74% of all the prostate cancer patients in 1980 and 64% in 2012, equivalent to 2940 and 18 561 elderly prostate cancer patients, respectively.

Discussion

From 1980 to 2012 there has been a marked increase in prostate cancer incidence, survival, and prevalence in Danish men while the mortality rate remained unchanged for patients aged less than 80 years. The increase in prostate cancer, newly diagnosed, treated patients, as well as patients living with prostate cancer has primarily been driven by pseudo-screening, introduction of curative treatment options, and a change in the Gleason grading system, while chemotherapy and palliative treatments may have played a minor role, within the observed period [16]. The improvement in the relative survival is likely to reflect mainly an increasing incidence rather than an effect of the treatment, as the mortality was unchanged for the vast majority of all the patients (patients <80 years).

The NORDCAN data report of an annual mean reduction in mortality rate over the last 10 years of 1% for the Danish cohort. The trend towards reduction in mortality rate over the last decade has solely been driven by the younger prostate cancer patients, while the mortality rate for the elderly has been unchanged. Among patients above 80 years an increasing mortality rate was observed. There are two factors which may influence the trend in mortality. The first is lead-time; only within the last decade of the observed period has the curative treatments been fully implemented, around the year 2000 approximately 200 patients per year were given curative treatment in Denmark, whereas in the year 2011 approximately 2000 patients were given curative treatment [17,18]. Due to the slow natural history of prostate cancer, the full effect of curative treatment may first be seen 10–20 years after implementation [2–4]. The other factor which has influenced the mortality rates in Denmark is under-treatment of the elderly within the observed period; when the elderly themselves were younger they were not offered curative treatment. As elderly they may still not be offered curative treatment,

Table I. Average annual number of new prostate cancers in Denmark, 1980–2012.

	0–69 years		70–74 years		75–79 years		80–84 years		85–89 years		90 + years		All ages	
	Cases male (incidence)		Cases male (incidence)		Cases male (incidence)		Cases male (incidence)		Cases male (incidence)		Cases male (incidence)		Cases male (incidence)	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1980	387	29.8	293	22.6	298	23.0	200	15.4	94	7.2	25	1.9	1297	100
1990	420	27.7	329	21.7	360	23.7	254	16.7	122	8.1	32	2.1	1518	100
2000	662	32.9	393	19.5	419	20.8	334	16.6	163	8.1	45	2.2	2015	100
2005	1441	41.6	696	20.1	639	18.4	438	12.6	192	5.5	60	1.7	3466	100
2010	2067	50.0	854	20.7	609	14.7	375	9.1	177	4.3	48	1.2	4130	100
2011	2222	51.4	869	20.1	627	14.5	355	8.2	192	4.4	61	1.4	4326	100
2012	2223	51.5	871	20.2	608	14.1	357	8.3	194	4.5	62	1.4	4315	100

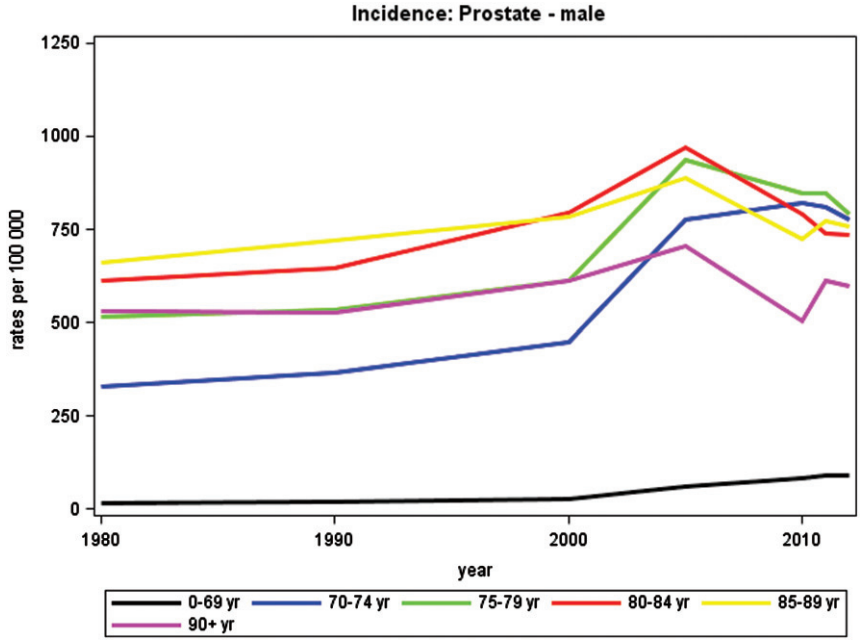

Figure 1. Incidence rates of prostate cancer in Denmark, 1980–2012, by age group.

Table II. Average annual number of deaths from prostate cancer in Denmark, 1980–2012.

	0–69 years		70–74 years		75–79 years		80–84 years		85–89 years		90 + years		All ages	
	Cases male (mortality)		Cases male (mortality)		Cases male (mortality)		Cases male (mortality)		Cases male (mortality)		Cases male (mortality)		Cases male (mortality)	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1980	154	21.0	148	20.1	169	23.0	156	21.2	81	11.0	26	3.6	733	100
1990	178	18.9	166	17.7	234	24.9	197	20.9	125	13.3	41	4.3	941	100
2000	202	18.7	164	15.2	239	22.1	245	22.7	166	15.4	62	5.8	1078	100
2005	196	17.8	156	14.2	237	21.5	250	22.7	172	15.6	90	8.1	1101	100
2010	222	18.9	166	14.1	225	19.1	253	21.5	204	17.3	106	9.0	1176	100
2011	211	17.2	160	13.0	234	19.1	259	21.1	239	19.5	125	10.2	1228	100
2012	210	18.2	155	13.4	213	18.5	246	21.3	216	18.7	113	9.8	1153	100

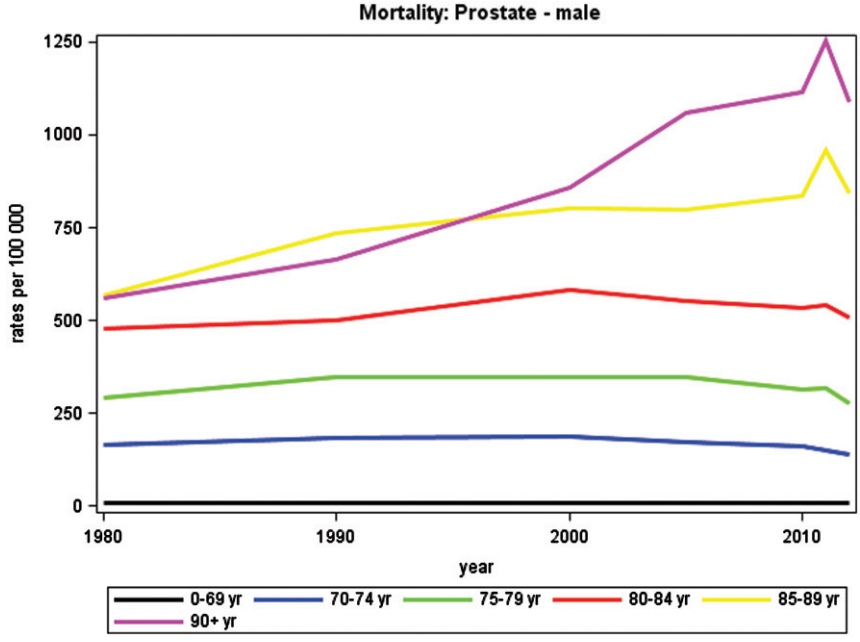

Figure 2. Mortality rates from prostate cancer in Denmark, 1980–2012, by age group.

as this primarily has been offered to patients under the age of 70–75 years, whereby the elderly once again have been excluded from potentially curative treatment.

In the neighboring Nordic countries, the corresponding reduction in annual mortality rate over the last 10 years has been 2.1%, 2.9%, and 2.9% in Norway, Sweden, and Finland, respectively [19]. When exploring the mortality rate of younger and elderly patients in our neighboring Nordic countries, Denmark differs by unchanged mortality rate over the last 10 years of the elderly. The variation may to some extent be caused by differences in death registration or differences in the diagnostic approach to fragile and terminally ill men, but the main difference in the prostate cancer treatment among the countries has been the late introduction of curative treatment in Denmark [19,20].

The Danish guidelines for diagnosis and treatment of prostate cancer have evolved throughout the observed period. At present the Danish guidelines for prostate cancer are coherent with the guidelines of the European Association of Urology [3,4,9]. These guidelines recommend that elderly patients are evaluated by life expectancy, comorbidities and health status, whereby they can be divided into four groups (healthy, vulnerable, frail, and terminal illness). The groups of healthy and vulnerable patients, with a high risk prostate cancer, and a life expectancy of 10 years or more, should be offered standard treatment. The frail patients should receive adaptive treatment, and the patients who have terminal illness should receive symptomatic palliative treatment. By full implementation of these guidelines we may experience improved mortality rates of prostate cancer in Denmark, whereby we may match our neighboring countries. Currently, there are no national quality indicators focusing on the elderly, as there are for the younger patients. A set of quality indicators may be the next step to facilitate the implementation of the present guidelines to complete the paradigm shift that is needed to reduce the mortality rate of prostate cancer in elderly men in Denmark.

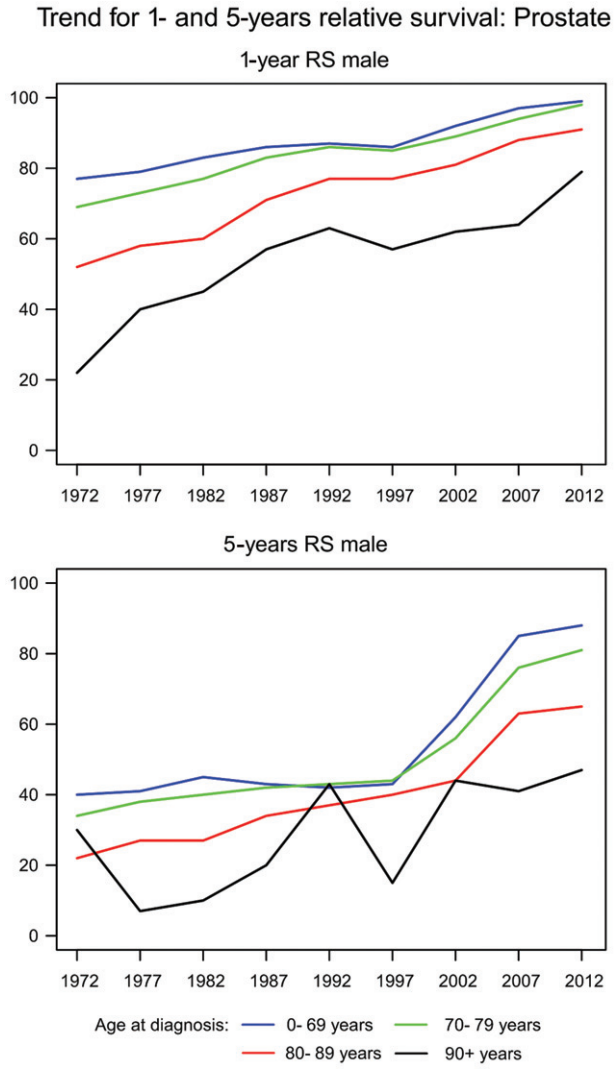

Figure 3. Age-specific relative survival after prostate cancer in Denmark.

Conclusion

Incidence, survival, and prevalence of prostate cancer has increased in the elderly while the mortality rates have remained unchanged, except in patients above 80 years, where the mortality rates have been increasing. A shift of paradigms may be needed to facilitate optimal treatment of elderly patients with prostate cancer.

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Table III. Annual number of men alive with prostate cancer in Denmark by 31 December, 1980–2012.

	0–69 years		70–74 years		75–79 years		80–84 years		85–89 years		90 + years		All ages	
	Prev cases male		Prev cases male		Prev cases male		Prev cases male		Prev cases male		Prev cases male		Prev cases male	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1980	1047	26.3	932	23.4	935	23.5	657	16.5	333	8.4	83	2.1	3987	100
1990	1199	21.4	1213	21.6	1407	25.1	1081	19.3	561	10.0	150	2.7	5611	100
2000	1688	23.5	1360	19.0	1624	22.6	1440	20.1	801	11.2	257	3.6	7170	100
2005	4023	31.4	2508	19.6	2689	21.0	2133	16.7	1074	8.4	372	2.9	12799	100
2010	9001	36.6	5432	22.1	4644	18.9	3299	13.4	1683	6.8	518	2.1	24577	100
2011	9830	36.7	5907	22.1	5200	19.4	3508	13.1	1750	6.5	562	2.1	26757	100
2012	10390	35.9	6529	22.6	5753	19.9	3759	13.0	1877	6.5	643	2.2	28951	100

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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