Improved survival of Danish cancer patients 2007-2009 compared with earlier periods

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ABSTRACT

INTRODUCTION: For the majority of cancers, improved long-term survival may be accessed from survival during the first year after diagnosis. A steady improvement in survival was seen both before and after the introduction of cancer control plans in 2000 and 2005. On the basis of data from 2007-2009, we studied the trend in 1-year survival after the introduction of the 2005 plan.

MATERIAL AND METHODS: All cancers from 1995-2009 were studied in five 3-year cohorts of incident cases which were followed-up for death to the end of 2010. Age-standardised 1-, 3- and 5-year relative survival was calculated and 1-year survival presented for 2004-2006 and 2007-2009 to allow comparison with our previous publication.

RESULTS: The improvement over time in overall 1-year age-standardised relative survival was maintained with a three percentage point increase to 72% for men and 75% for women. Exclusion of prostate and breast cancer from calculations lowered relative survival to 65% and 67%, respectively; but improvement was maintained. Cancer sites which previously enjoyed a high survival saw the least or no improvement as was the case for haematological cancers, except for non-Hodgkin lymphoma in men. The differences in survival between men and women are diminishing, especially for cancers of the digestive tract.

CONCLUSION: The improvements over time in survival after introduction of the cancer plans were maintained for non-haematological cancers. The fast-track system for diagnosis and treatment introduced gradually by cancer sites until the end of 2008 along with some centralisation of elective surgery may have narrowed the gap in cancer survival between men and women for digestive tract cancers and may also have improved survival for other cancers, e.g. the sex-specific types and kidney and brain cancers.

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Estimates of population-based cancer survival and trends in survival are, alongside cancer incidence and mortality, important indicators when assessing the overall performance of cancer-related health care. Close observation of these indicators is especially important when radical changes in the health care system for cancer are introduced, which was the case in Denmark following the adoption of the three national cancer control plans in 2000, 2005 and 2010 [1-3]. Furthermore, international benchmarking of these indicators should demonstrate if a national target such as "the highest international standard of cancer care" was met. Recently, we published results documenting the improved survival of Danish cancer patients in the 1995-2006-period. Patients were followed to 2009 and the results demonstrated a clear improvement in cancer survival for several primary sites over the period [4, 5].

Furthermore, we showed that similar improvements were observed in the other Nordic countries, and also that the survival in the first year, essentially seen during the first three month, determines the 5-year relative survival [6]. A major change in the management of Danish cancer patients including fast-track fixed "packages" for diagnosis and treatment was introduced with the second cancer control plan in 2005 [2] and its implementation in 2008-2009. The data of our previously published analysis were not subject to influence from this change in cancer care. Based on our observation of the importance of survival in the first year and the changes in the clinic introduced as from 2006, we decided to analyse the 1-year relative survival for the period 2007-2009 as soon as data were made available to us. The aim of this study is to describe any impact of the fast-track cancer packages introduced and implemented during this period.

MATERIAL AND METHODS

All cancers diagnosed in the 1995-2009-period reported to the Danish Cancer Registry and included in the NORDCAN [7] were studied as five 3-year incidence cohorts ranging from 1995-1997 to 2007-2009. The 3-year cohorts were introduced to separate the period before and after the introduction of cancer control plans. Each patient's cancer data classified according to international standards in NORDCAN were linked to the Central Population Register in Denmark to follow-up on vital status or emigration through to 31 December 2010. Cancer cases known from death certificates only or diagnosed at autopsy only were excluded from the file. In the rare cases where the month of diagnosis was unknown, it was set to July. However, if the patient had died during the year of incidence, month of death divided by two was chosen as the month of diagnosis.

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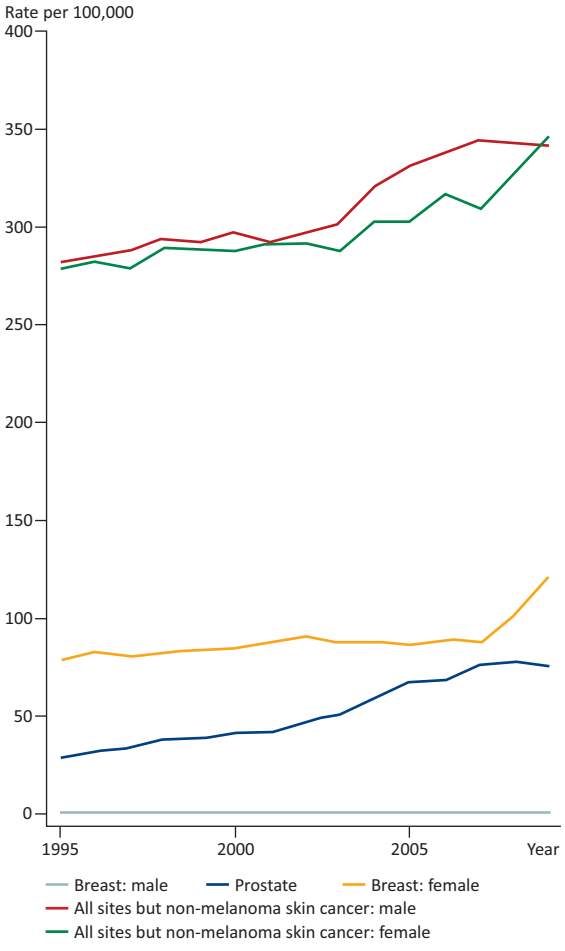
FIGURE 1

The age-standardized cancer rate (world) per 100,000. Age: 0-85+ years.



We calculated the age-standardized 1-year relative survival using the cohort method for each period, for each site and for all cancers combined excluding non-melanoma skin cancer, and also when excluding breast and prostate [8]. Age-standardization was done with a slightly modified version of the standard used by EUROCARE [9] in which patients aged 90+ years were given the weight of zero to avoid any impact on the survival estimates from these old patients.

As in our previous study [5], we also analysed the 3- and 5-year relative survival. For the last period, 2007-2009, where follow-up was less than three and five years, we used a hybrid analysis combining the cohort and the period method [10].

As the important conclusions can be drawn from 1-year survival, these results are not presented here in tabular form. We also do not offer a tabular presentation of the analysed data for the period 1995-2003. These data appear in our previous paper and virtually no change in survival estimates was seen. Furthermore, tables of 1-, 3- and 5-year relative survival for all 3-year cohorts in the entire period can be seen at the home page of the Danish Cancer Society [11].

Trial registration: not relevant.

RESULTS

Altogether, 47,239 men and 46,919 women diagnosed during 2004-2006 were included. Analyses were conducted after exclusion of 608 patients only known from death certificates or autopsies. For the 2007-2009 period, 51,775 men and 51,718 women were included and 124 patients were excluded because their data stemmed solely from a death certificate or an autopsy. The age-standardized incidence (world) per 100,000 increased from 329.5 to 342.3 among men, primarily due to an increase in prostate cancer, and from 306.8 to 327.7 among women, an increase which was primarily due to breast cancer (**Figure 1**).

The overall 1-year age-standardized relative survival for all sites combined increased by three percentage points from 2004-2006 to 2007-2009 in both sexes; to 72% for men and 75% for women (**Table 1** and **Table 2**). Exclusion of prostate cancer in men lowered the overall survival to 65%, but increased the improvement in survival by four percentage points, whereas exclusion of breast cancer in women lowered the survival to 67% and decreased the improvement to two percentage points. The similar developments in 3- and 5-year survival for the two periods were seen, however demonstrated only one percentage point improvement, respectively (not shown, but can be seen at the home page of the Danish Cancer Society) [11]. The trend in overall survival demonstrates a steady increase (Table 1), which is somewhat accelerated for cancers of the mouth, oesophagus, pancreas and kidney, especially towards the end of the observation period (Table 2).

Studying the relative survival by site and period (Table 2), the general pattern is a larger progress in men than in women, which for many sites has lowered the difference in survival between the sexes. For both sexes, we see significantly improved survival for cancers of the mouth, oesophagus, pancreas, lungs and kidney. Improvements are seen in both sexes although only significantly so in men for cancers of the pharynx, stomach, colon, rectum, brain and non-Hodgkin lymphoma. For the sex-specific cancers, we see significant survival improvements for cancer of the breast, cervix and ovary in women, and for prostate in men. It is of note that for sites where survival was already high, only small or no improvement was observed for cancer of the testis and skin cancer, be it melanoma or other skin. In both sexes, a small, but insignificant decrease in survival was observed for Hodgkin lymphoma, multiple myeloma and leukaemia.

DISCUSSION

The present analysis of the Danish data confirms the continuation of improved cancer survival seen in our previous studies [4, 5]. We see larger improvements up to the latest period for several sites compared with our previous studies. This lends support to an effect of the efforts made in relation to the cancer plans, and perhaps in particular to the "cancer packages" instituted for head and neck, lung, colorectal and breast cancer during the spring of 2008, followed by gynaecological cancers and the haematological cancers after the summer of 2008, and, finally, for cancers of urinary system, melanoma, brain and nervous system, prostate, other gastrointestinal and a rest group by the end of 2008 [12]. The cancer packages secure fast track referral from the GPs to diagnosis and treatment for suspected cancer in the hospital system, they minimize waiting times and secure a coherent and planned flow in treatment delivery.

However, for most of the sites, the fast-track system was only in place during the final year of the study period and we have no information on who followed the fast-track system and who did not. To monitor the effect of the cancer control plans, it will be of value to make a cancer registry record showing if a patient's diagnosis is made following inclusion in a fast-track package and, if so, which one, so that these data may be used in the analyses. Nevertheless, the overall net results are positive and there is an indication of some accelerated improvement towards the end of the period. This effect will hopefully be confirmed when data from 2010-2012 become available for analysis.

It is important, though, to realize that diagnostic activities, such as the increased prostate-specific antigen (PSA) testing in general practice of asymptomatic men and organized screening for e.g. breast cancer among women, influence the incidence (Figure 1) and thus also survival as pointed out by us and others [5, 13]. The steep increase in breast cancer incidence towards the end of 2009 is confined to women aged 50-69, and is thus clearly related to the national breast cancer screening from 2008. However, 1-year survival after breast cancer is normally excellent and thus the improvement we do see is noteworthy. It is reassuring to observe that improvement persists even after exclusion of breast and prostate cancer from the analysis. This potential bias therefore does not change the overall conclusions.

Since the mid-1990s, the life expectancy has increased steeply by nearly five years among Danish men and four years among women. The decrease in the proportion of smokers and the improved treatment of cardiovascular diseases are important factors in this development. In the present study, the evaluation of cancer survival was adjusted for the decrease in total mortality rates, since we used the measure of relative survival defined as the observed survival among cancer patients divided by the expected survival calculated from the population survival.

Another concern is quality of the data. A traditional indicator of quality is the proportion of cases only known from death certificates or autopsy. Autopsies are today only performed in a fraction of patients. The number of cases excluded from the analyses in each of

TABLE 1

Trend in 1-year relative survival (and 95% confidence intervals) of all cancers combined in Denmark 1995-2009. The values are percentages.

	Men		Women	
Period	all cancers excl. non-melanoma skin	all cancers excl. non-melanoma skin & prostate	all cancers excl. non-melanoma skin	all cancers excl. non-melanoma skin & breast
1995-1997	59 (59-60)	55 (54-56)	68 (67-68)	59 (59-60)
1998-2000	62 (62-63)	57 (57-58)	69 (68-69)	60 (60-61)
2001-2003	65 (64-65)	59 (58-59)	70 (70-71)	62 (61-62)
2004-2006	69 (68-69)	61 (60-61)	72 (72-72)	65 (64-65)
2007-2009	72 (72-73)	65 (64-65)	75 (74-75)	67 (66-67)

TABLE 2

1-year relative survival (and 95% confidence intervals) for Danish cancer patients 2004-2009. The values are percentages.

	Men		Women	
Cancer	2004-2006	2007-2009	2004-2006	2007-2009
Mouth	68 (62-74)	75 (70-81)	70 (63-76)	81 (76-86)
Pharynx	62 (57-67)	69 (65-74)	68 (61-75)	69 (62-76)
Oesophagus	28 (25-31)	37 (34-41)	28 (23-34)	37 (32-43)
Stomach	41 (38-45)	46 (43-49)	41 (37-45)	43 (39-47)
Colon	73 (71-75)	76 (74-77)	75 (74-77)	77 (75-78)
Rectum	79 (77-81)	83 (81-84)	82 (80-83)	83 (82-85)
Pancreas	17 (15-20)	23 (21-26)	18 (16-21)	22 (20-25)
Larynx	82 (78-85)	85 (82-89)	84 (77-91)	80 (73-87)
Lung	31 (30-33)	34 (33-35)	35 (34-37)	40 (38-41)
Breast	97 (91-103)	95 (88-101)	95 (94-95)	96 (95-96)
Cervix			81 (78-83)	84 (81-86)
Uterus			91 (89-92)	91 (90-92)
Ovary			70 (68-72)	73 (71-75)
Prostate	93 (92-94)	96 (95-96)		
Testis	94 (91-98)	95 (92-98)		
Kidney	65 (62-68)	70 (68-73)	63 (59-67)	73 (70-76)
Bladder	85 (83-86)	86 (85-88)	79 (77-81)	77 (74-79)
Skin melanoma	94 (93-95)	95 (94-96)	97 (96-98)	97 (96-98)
Non-melanoma skin	96 (95-97)	97 (96-98)	97 (95-98)	97 (96-98)
Brain	65 (63-67)	73 (71-75)	79 (77-81)	81 (80-83)
Non-Hodgkin lymphoma	75 (73-77)	82 (80-84)	78 (76-81)	80 (78-82)
Hodgkin lymphoma	90 (86-94)	89 (85-93)	93 (89-97)	89 (86-93)
Multiple myeloma	77 (73-81)	76 (72-80)	79 (76-84)	76 (72-80)
Leukaemia	74 (71-77)	71 (69-74)	76 (73-79)	74 (71-77)
All[a]	69 (68-69)	72 (72-73)	72 (72-72)	75 (74-75)
All[b]	61 (60-61)	65 (64-65)	65 (64-65)	67 (66-67)

a) All cancers excluding non-melanoma skin cancer; b) All cancers excluding non-melanoma skin, breast and prostate cancer.

the two periods differs by a factor 5, with only 124 cases from the 2007-2009-period. The reason for this improvement is a change in registration methods used to collect cases from the Hospital Discharge Registry system and the National Register for Pathology. In the previous registration system, about 1-2% of the total incidence was based on death certificate only cases, and about 5-8% was first known from death certificates and included after back tracing. Such cases usually have a very short survival, and as all of these cases are now included owing to higher data completeness and quality, results may be driven towards lower survival compared with earlier years. For Denmark, this effect will be small; it may, however, explain some of the differences seen in international comparisons.

The narrowing of survival differences between men and women is of note. This is seen for the digestive tract cancers in particular. Survival after kidney cancer has improved, but, interestingly, bladder cancer survival in men remains higher than in women as one of few sites. Smoking is the major risk factor for bladder cancer, with a later incidence peak than seen for lung cancer. It is possible that the high smoking prevalence in men in the past combined with symptoms from the male bladder region has led to earlier diagnosis and recording of cancers in the bladder in men than in women, thus improving male survival. To study this, more detailed data on the grade and stage of the bladder tumour at presentation will be needed.

Although our national results show progress, it is important to perform international benchmarking of cancer survival as we recently did among all the Nordic countries [7]. Our national analysis for patients diagnosed up to 2004 [5] also had a positive trend which was found to be of similar magnitude as that observed in our neighbouring countries [7]. A recent benchmark analysis comparing cancer survival after colorectal, lung, breast and ovarian cancer for Australia, Canada, Denmark, Norway, Sweden and the UK in the 1995-2007 period, and thus before the implementation of the Danish "cancer packages", showed improvement in all countries. The Danish improvement was higher than that seen in the United Kingdom, but lower than those observed in Norway and Sweden [14]. It will be important now to analyse the most recent Nordic data to see if we are closing the gap and are on the track to the highest international standard, which is the political goal of the cancer control plans.

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CONFLICTS OF INTEREST: none

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