



A comparison of prostate cancer survival in England, Norway and Sweden: a population-based study

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Introduction

Survival in prostate cancer patients has improved dramatically over the last 20 years.¹ The trend is similar in all regions of Europe, but substantial differences still exist between countries.² These improvements in prostate cancer survival depend on several different – and interacting – mechanisms: early detection by prostate specific antigen (PSA) testing, increased diagnostic activity with aggressive biopsy policies, development of surgical and radiotherapeutic methods, and widened indications for hormonal treatments. The contribution of each of these has not been quantified, but the fact that incidence in a given country is strongly correlated with survival indicates that early diagnosis plays a major role.

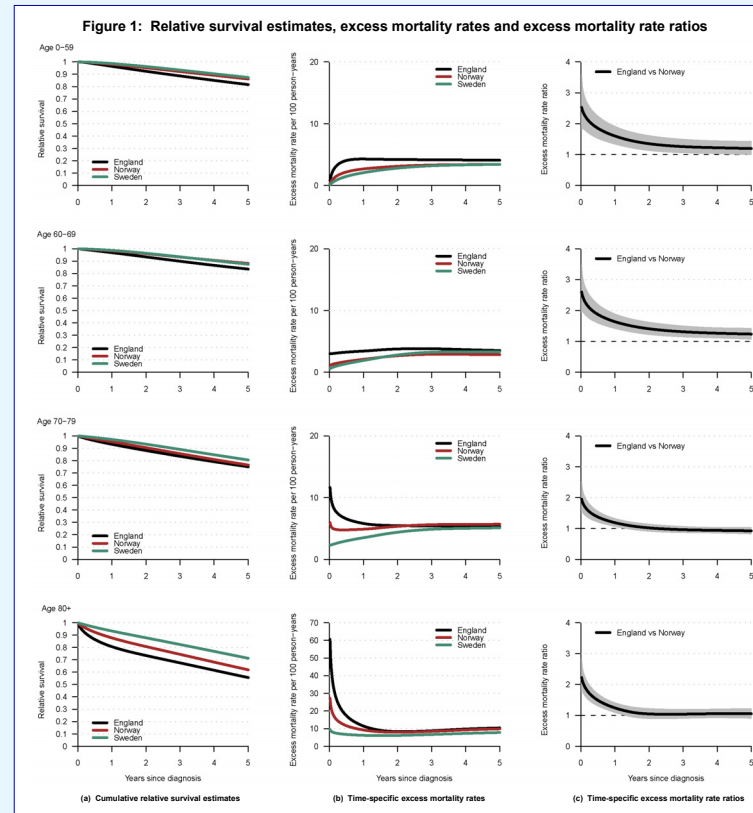
Despite these complexities, there is still potential for the use of population-based cancer registry data in in-depth explorations of national differences. For example, findings showing differences which are largest in specific follow-up intervals or age groups may point to important problem areas to explore further. Consequently, we have compared patterns of survival during 2002-2004 in prostate cancer patients from England, Norway and Sweden (countries with similar national healthcare systems and total national expenditure on healthcare) in relation to different ages and periods of follow-up. All three countries have nationwide population-based coverage, and their registration systems are similar.

Methods

Data on men diagnosed with prostate cancer (ICD-10: C61) between 1996 and 2004 were extracted from the cancer registries in England, Norway and Sweden. Cases registered only from death certificates (DCO cases) were excluded. These amounted to 3.7% of the cases from England and 1.0% of those from Norway. No use is made of death certification information in the primary case ascertainment process in Sweden, and hence DCO registrations do not exist in this country. Also excluded were cases aged < 18 years at diagnosis, those with missing or negative survival times, and also those with a recorded survival time of zero days. The latter amounted to 1.3%, 0.9% and 1.5% of the total cases in England, Norway and Sweden respectively.

Relative survival was calculated as the ratio of observed survival to expected survival, the latter computed on the basis of annual sex- and age-specific life tables for each of the three countries. In order to obtain up-to-date estimates of five year relative survival, the period approach of Brenner and Gefeller³ was applied by focusing on the most recent period of follow-up (2001-2004). Using this method, patients diagnosed in the period 1996-2000 contributed to the analysis only if they provided person-years in the period 2001-2004.

Age at diagnosis was stratified into the following groups: 0-59; 60-69; 70-79; 80+. To study further the differences between countries, we plotted the excess number of deaths per 100 person-years, i.e. the difference between the observed number of deaths and the corresponding expected number of deaths based on the population life tables, for each country and age group, by length of follow-up. The excess mortality rate was estimated using flexible parametric models,⁴ a separate model being fitted for each combination of country and age at diagnosis.



Results

After exclusions, 208,588 cases from England, 26,739 from Norway and 67,106 from Sweden were available for analysis. The numbers of informative patients (i.e. those contributing follow-up time in the period 2001-2004) were 179,112 in England, 23,192 in Norway and 59,697 in Sweden. The age distributions of cases in the three countries were very similar. Table 1 shows the cumulative five-year relative survival for each country stratified by age. In all age groups, England had lower survival than the other two countries. This difference was particularly marked in the oldest (80+) age group. Overall age-standardised five year survival was 76.4%, 80.3% and 83.0% for England, Norway and Sweden respectively.

Figure 1(a) shows the cumulative relative survival estimates, and Figure 1(b) the time-specific excess mortality rates per 100 person-years of follow-up for the three countries, by age and length of follow-up. In each country, relative survival in the 0-59 age group was similar to that in the 60-69 year-olds, then survival decreased from age 70. Relative survival in Norway was similar to that in Sweden up to age 69. For patients aged 70-79, relative survival levels in Norway were lower than in Sweden, and close to those in England, whereas for the oldest group (80+) Norwegian levels were intermediate between Swedish and English values.

Table 1: Five year cumulative relative survival, with 95% confidence intervals in parentheses, in England, Norway and Sweden						
	Age 0-59	Age 60-69	Age 70-79	Age 80+	Age-standardised	
England	81.6 (80.7-82.6)	83.5 (83.0-84.1)	75.0 (74.4-75.6)	55.6 (54.5-56.7)	76.4	(76.0-76.7)
Norway	86.2 (84.2-88.2)	88.1 (86.7-89.4)	76.4 (74.7-78.1)	61.9 (58.7-65.1)	80.3	(79.3-81.2)
Sweden	87.4 (86.1-88.7)	87.4 (86.6-88.3)	80.5 (79.5-81.5)	71.2 (69.2-73.3)	83.0	(82.4-83.6)

Likewise, excess mortality rates were similar for Norway and Sweden up to age 69, after which Norwegian rates were intermediate between Swedish and English values. Excess mortality rates were higher in England at all ages, the majority of this excess being confined to the first year of follow-up, especially in the older patients.

Figure 1(c) summarises these results by showing the modelled relative excess risk ratio (i.e. the excess death rate in England divided by that in Norway) by age and time since diagnosis. At all ages, the ratio was highest in the short term (i.e. the first twelve months after diagnosis), approaching unity after around two years.

Table 2: Annual excess deaths in prostate cancer patients vs. expectation based on national life tables					
	0 - 3 months	3 months - 1 year	1 - 2 years	2 - 5 years	Total
England	812 (16.5%)	1205 (24.4%)	1017 (20.6%)	1896 (38.5%)	4930 (100.0%)
Norway	51 (10.5%)	101 (20.8%)	106 (21.9%)	227 (46.8%)	485 (100.0%)
Sweden	59 (5.1%)	179 (15.5%)	251 (21.7%)	666 (57.7%)	1155 (100.0%)

Table 2 shows the absolute numbers of excess deaths per annum in prostate cancer patients within each country, by time since diagnosis. In total these amounted to 4,930 excess deaths in England, 485 in Norway and 1,115 in Sweden. A larger proportion of these deaths occurred within the first year after diagnosis in Norway (31.3%) than in Sweden (20.6%), and an even larger proportion (40.9%) in England.

By applying the mortality rates observed in the prostate cancer patients in Norway to the English prostate cancer patients, we can calculate the numbers and proportions of the excess deaths in England which would be avoided if the English excess death rates could be reduced to those in Norway. Overall, 735 deaths (15% of all excess deaths) could be avoided, mostly in the first twelve months after diagnosis. Of the excess deaths which occur in the first three months after diagnosis, 47% would be avoided - and 36% of those in the first year.

Conclusions

We found prostate cancer survival to be consistently worse in England, with the main differences occurring within the first year of follow-up. Although the underlying mechanisms are difficult to disentangle without very detailed information on screening activity, staging, diagnostic methods and treatment regimes, the effects of early detection and the associated lead time are the most probable determinants of these findings. The fact that the results are similar to those found in other types of cancer,^{5,6} despite the more complex underlying clinical picture in prostate cancer, suggests a general pattern underlying the small proportion of rapidly fatal cancers in England.

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