# Social inequality and incidence of and survival from cancers of the kidney and urinary bladder in a population-based study in Denmark, 1994–2003

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ARTICLE INFO

ABSTRACT

We investigated the effects of socioeconomic, demographic and health-related indicators on the incidence of and survival from cancers of the kidney and urinary bladder diagnosed in Denmark during 1994–2003 with follow-up through 2006 using information from nation-wide registers. The analyses were based on data on 2941 patients with kidney cancer and 9471 patients with urinary bladder cancer in a cohort of 3.22 million people born between 1925 and 1973 and aged ⩾ 30 years. Our results indicate that lower socioeconomic position is associated with higher incidences of cancers at both sites in both sexes, whether socioeconomic position is measured as educational level, disposable income, affiliation to the work market, housing tenure or size of dwelling. We also found a moderate pattern of better survival from cancers at both sites in the most advantaged groups, most clearly reflected by the level of education, disposable income and affiliation to the work market.

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## 1. Introduction

The incidence rates of cancers of both the kidney and the urinary bladder increase with age and are highest in men and in western countries. In Denmark, the incidences of cancers at both sites, but particularly that of urinary bladder cancer in men, have been increasing since 1943 when registration began, although the trend has levelled out in recent decades.[1] In Denmark, in 2003, urinary bladder cancer was the fourth most frequent cancer in men (1385 cases) and the ninth most frequent cancer in women (489 cases). Kidney cancer is less common, being diagnosed in 319 men and 195 women that year, making this cancer the 12th most frequent cancer in men and the 15th most frequent cancer in women.[1]

The aetiology of kidney cancer is largely unknown, but smoking, certain occupational exposures, hypertension and obesity are all considered risk factors.[2–4] Further, racial differences and familial clustering have been reported.[2,4] For urinary bladder cancer, smoking is a well-established risk factor but various occupational bladder carcinogens have also been reported.[5,6] Studies in several countries have shown that lower socioeconomic position is associated with higher incidences of urinary bladder cancer[7,8] and kidney cancer;[3,9] however, the results are not consistent.[10,11]

The survival of patients with kidney and urinary bladder cancers diagnosed in 1990–1994 was poorer in Denmark than in Europe as a whole.[12] In the period 1994–2001 in Denmark, urinary bladder cancer was the fourth most frequent cause
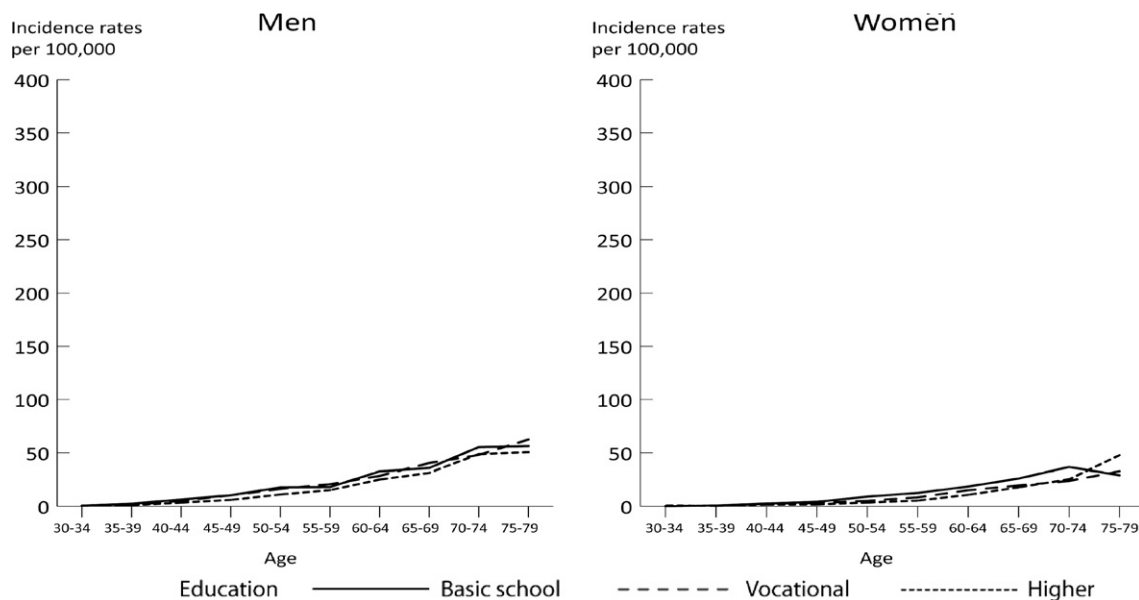
of death from cancer in men and the eighth in women, and kidney cancer was the 11th and the 12th most frequent cause of death from cancer in men and women, respectively.[1] In general, survival from cancer depends on socioeconomic position, and many studies have indicated that lower socioeconomic position is associated with poorer survival after cancers of both the kidney and the urinary bladder.[13–16]

The aim of this study was to investigate the association between various socioeconomic, demographic and health-related factors and the incidence of and survival from cancers of the kidney and the urinary bladder in Denmark, as part of a rigorous, comprehensive analysis of the role of socioeconomic position in cancer incidence and survival.

## 2. Material and methods

The material and methods are described elsewhere.[17] Briefly, the study population comprised all 3.22 million Danish residents born between 1925 and 1973 without a previous cancer and who entered the cohort at age 30 (see Fig. 1 in [17]). Infor-

mation on socioeconomic, demographic and health-related indicators was obtained from various Danish registers based on administrative data.[17] Crude, age-specific and age-standardised incidence rates are presented for kidney cancer (ICD-10: C64) and urinary bladder cancer, including cancers of the renal pelvis and the ureter (ICD-10: C65-68, D09, D41.4), diagnosed in the cohort in 1994–2003. The incidence rates were standardised by age (in 5-year age groups) and period (in two 5-year periods), with the total study population as the standard.[18] Further, we used log-linear Poisson regression to model incidence rate ratios (IRRs), first adjusted for period (in 5-year periods) and age (as two continuous variables: age and $age^2$ in years) and second by adding education and disposable income to the models. For each level of each indicator, we conducted relative survival analyses, adjusting for population mortality amongst the incident cancer cases in 1994–2003 with follow-up through 2006.[17] Population mortality rates were stratified by age, period and the respective indicators. Except for the analyses of ethnicity, all analyses included only residents born in Denmark to at least one Danish-born parent with Danish citizenship.[17]



| Incidence rate | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Basic school | Vocational | Higher | Basic school | Vocational | Higher |
| | (n =787 ) | (n =754 ) | (n =262 ) | (n =666 ) | (n =243) | (n =102 ) |
| Crude | 18 | 14 | 10 | 12 | 6 | 4 |
| Standardised | 16 | 15 | 12 | 9 | 7 | 6 |
| Difference | 4 | 3 | 0 | 3 | 1 | 0 |

Persons with unknown level of education not included

**Fig. 1 – Age-specific incidence rates per 100,000 person–years for kidney cancer by education amongst persons born between 1925 and 1973, Denmark, 1994–2003. Supplementary table shows the crude incidence rate and the incidence rate standardised by age (5-year age groups) and period (two 5-year periods) with the total study population as the standard and the incidence rate difference with higher education as the reference.**

**Table 1 – Incidence rate ratios (IRRs) with 95% confidence intervals (95% CI) for kidney cancer in Danish persons born between 1925 and 1973 and aged ⩾30 years, by socioeconomic, demographic and health-related variables, Denmark, 1994–2003**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) |
| *Level of education* | | | | | | |
| Basic or high school | 787 | 1.00 | 1.00 | 666 | 1.00 | 1.00 |
| Vocational education | 754 | 0.98 (0.88–1.08) | 1.00 (0.91–1.11) | 243 | 0.74 (0.64–0.86) | 0.78 (0.67–0.91) |
| Higher education | 262 | 0.76 (0.66–0.87) | 0.82 (0.71–0.95) | 102 | 0.59 (0.48–0.73) | 0.65 (0.52–0.81) |
| Unknown | 34 | 1.17 (0.83–1.65) | 1.18 (0.84–1.67) | 9 | 0.75 (0.39–1.45) | 0.77 (0.40–1.48) |
| *Disposable income*[c] | | | | | | |
| Lowest (1st quartile) | 597 | 1.15 (1.03–1.28) | 1.13 (1.01–1.27) | 392 | 1.16 (1.00–1.33) | 1.10 (0.95–1.27) |
| Middle (2nd–3rd quartile) | 828 | 1.00 | 1.00 | 461 | 1.00 | 1.00 |
| Highest (4th quartile) | 412 | 0.84 (0.75–0.95) | 0.88 (0.78–0.99) | 167 | 0.72 (0.60–0.86) | 0.78 (0.65–0.94) |
| *Affiliation with work market*[d] | | | | | | |
| Working | 1067 | 1.00 | 1.00 | 400 | 1.00 | 1.00 |
| Unemployed or other | 199 | 1.22 (1.04–1.42) | 1.11 (0.95–1.31) | 164 | 1.20 (1.00–1.45) | 1.08 (0.89–1.30) |
| Early retirement pensioner | 156 | 1.30 (1.09–1.54) | 1.16 (0.97–1.39) | 184 | 1.52 (1.26–1.82) | 1.29 (1.06–1.56) |
| *Social class*[e] | | | | | | |
| Creative core | 77 | 0.70 (0.55–0.89) | 0.94 (0.72–1.22) | 8 | 0.45 (0.22–0.93) | 0.71 (0.34–1.50) |
| Creative professional | 310 | 0.97 (0.85–1.11) | 1.14 (0.98–1.31) | 69 | 0.71 (0.52–0.96) | 1.00 (0.72–1.38) |
| Bohemian | 13 | 1.29 (0.75–2.23) | 1.53 (0.88–2.66) | | – | – |
| Service | 427 | 0.92 (0.82–1.04) | 0.98 (0.87–1.10) | 507 | 0.75 (0.61–0.93) | 0.85 (0.69–1.05) |
| Manual | 768 | 1.00 | 1.00 | 105 | 1.00 | 1.00 |
| Agricultural | 85 | 0.75 (0.60–0.93) | 0.74 (0.59–0.92) | 24 | 0.87 (0.56–1.36) | 0.88 (0.56–1.36) |
| Unknown | 157 | 1.00 (0.85–1.19) | 1.01 (0.85–1.20) | 307 | 0.86 (0.69–1.07) | 0.88 (0.70–1.10) |
| *Housing tenure* | | | | | | |
| Owner-occupied | 1233 | 1.00 | 1.00 | 603 | 1.00 | 1.00 |
| Rental | 586 | 1.24 (1.13–1.37) | 1.20 (1.09–1.33) | 412 | 1.23 (1.08–1.39) | 1.17 (1.03–1.33) |
| Unknown | 18 | 0.83 (0.52–1.32) | 0.79 (0.49–1.25) | 5 | 0.52 (0.22–1.26) | 0.50 (0.21–1.21) |
| *Size of dwelling (m²)* | | | | | | |
| 0–49 | 67 | 1.28 (0.99–1.64) | 1.19 (0.93–1.54) | 12 | 0.86 (0.48–1.53) | 0.81 (0.45–1.44) |
| 50–99 | 635 | 1.15 (1.03–1.28) | 1.11 (1.00–1.24) | 460 | 1.20 (1.04–1.38) | 1.15 (1.00–1.32) |
| 100–149 | 717 | 1.00 | 1.00 | 358 | 1.00 | 1.00 |
| ⩾150 | 418 | 0.89 (0.78–1.00) | 0.92 (0.81–1.04) | 190 | 0.93 (0.78–1.11) | 1.00 (0.83–1.19) |
| *Cohabiting status* | | | | | | |
| Married | 1255 | 1.00 | 1.00 | 646 | 1.00 | 1.00 |
| Cohabiting | 136 | 1.16 (0.97–1.39) | 1.15 (0.96–1.38) | 54 | 1.02 (0.77–1.36) | 1.01 (0.77–1.34) |
| Single | 182 | 1.22 (1.04–1.43) | 1.15 (0.98–1.35) | 40 | 0.77 (0.56–1.07) | 0.77 (0.56–1.06) |
| Widow or widower | 80 | 1.29 (1.03–1.63) | 1.26 (1.00–1.58) | 175 | 1.14 (0.95–1.36) | 1.09 (0.92–1.31) |
| Divorced | 184 | 1.31 (1.12–1.52) | 1.24 (1.06–1.45) | 105 | 1.01 (0.82–1.24) | 0.96 (0.78–1.18) |
| *Type of district* | | | | | | |
| Capital area | 595 | 1.00 | 1.00 | 276 | 1.00 | 1.00 |
| Provincial city | 923 | 0.91 (0.82–1.00) | 0.87 (0.78–0.97) | 564 | 1.24 (1.07–1.43) | 1.16 (1.00–1.34) |
| Rural area | 209 | 0.84 (0.72–0.98) | 0.79 (0.68–0.93) | 125 | 1.22 (0.98–1.50) | 1.10 (0.89–1.37) |
| Peripheral rural area[f] | 110 | 0.98 (0.80–1.20) | 0.91 (0.74–1.12) | 55 | 1.15 (0.86–1.54) | 1.03 (0.77–1.38) |
| *Ethnicity*[g] | | | | | | |
| Danish | 1837 | 1.00 | 1.00 | 1020 | 1.00 | 1.00 |
| Immigrant or descendant from western country | 26 | 0.72 (0.49–1.06) | 0.73 (0.49–1.07) | 9 | 0.35 (0.18–0.67) | 0.38 (0.20–0.73) |
| Immigrant or descendant from non-western country | 38 | 0.88 (0.63–1.21) | 0.79 (0.57–1.11) | 11 | 0.54 (0.30–0.97) | 0.57 (0.30–1.08) |
| *Charlson comorbidity index*[h] | | | | | | |
| None | 1393 | 1.00 | 1.00 | 821 | 1.00 | 1.00 |
| 1 | 283 | 1.38 (1.21–1.57) | 1.35 (1.19–1.54) | 115 | 1.25 (1.03–1.53) | 1.21 (0.99–1.47) |
| ⩾2 | 161 | 1.61 (1.36–1.90) | 1.57 (1.33–1.85) | 84 | 1.60 (1.28–2.01) | 1.54 (1.23–1.94) |
| *Depression* | | | | | | |
| No | 1807 | 1.00 | 1.00 | 977 | 1.00 | 1.00 |
| Yes | 30 | 0.94 (0.65–1.34) | 0.91 (0.64–1.31) | 43 | 1.28 (0.95–1.74) | 1.25 (0.92–1.69) |

| Table 1 – *continued* | | | | | | |
|---|---|---|---|---|---|---|
| | **Men** | | | **Women** | | |
| | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) |
| *Schizophrenia or other psychosis* | | | | | | |
| No | 1813 | 1.00 | 1.00 | 1003 | 1.00 | 1.00 |
| Yes | 24 | 1.42 (0.95–2.13) | 1.35 (0.90–2.02) | 17 | 1.39 (0.86–2.25) | 1.31 (0.81–2.12) |

a Adjusted for calendar period (in 5-year intervals) and age modelled as age and age$^2$ in years.
b Adjusted for calendar period and age (as above) and additionally for level of education and disposable income.
c Household income after taxation and interest, adjusted for number of persons in household; categorised by gender-specific distribution of household disposable income per person.
d For pensioners, work market affiliation before pension date was assigned and follow-up was done up to age 69.
e Based on theory of creative class:[23] the creative core (e.g. researchers, designers, architects), creative professionals (e.g. managers, business and finance, lawyers, doctors), bohemians (e.g. artists, models), the service class (e.g. nurses, hairdressers, caterers), the manual class (e.g. construction workers, transport and production workers) and the agricultural class (e.g. farmers, fishermen).
f More than 40 km to a local centre with adequate possibilities for employment and not sharing a border with a centre municipality.
g Included as a separate indicator, but ethnic groups were excluded from the study population in all other analyses presented in Table 1, e.g. education and income.
h The presence of disorders, as defined in the Charlson index, was defined as an in- or out-patient contact with one of the diagnoses listed in Table 1 in[17] between 1978 and 2 years before the diagnosis of cancer. Grouped according to the accumulated sum of scores.

## 3. Results

### 3.1. Incidence of kidney cancer

We included 2941 persons (1901 men and 1040 women) born between 1925 and 1974 in whom kidney cancer was diagnosed in the period 1994–2003, representing 58% of the total number of diagnoses of kidney cancer in Denmark during that period. Amongst Danish persons, the overall age- and period-standardised incidence rates were 15 per 100,000 person–years for men and 8 per 100,000 person–years for women.

We found that a higher educational level was associated with a lower incidence rate in both men and women (Fig. 1). Incidence rate ratios by socioeconomic, demographic and health-related variables are shown in Table 1. Overall, the IRR for kidney cancer was higher for persons of lower socioeconomic position, defined by educational level, disposable income, affiliation to the work market, housing tenure and size of dwelling.

No clear pattern emerged when patients were categorised according to social class (Table 1). Married people had lower IRRs than widowed people. Married men had lower IRRs than single and divorced men, whereas this was not the case for women. Men living in the capital area had higher IRRs than those in provincial cities and rural areas, whilst the opposite picture was seen for women. Immigrants and their descendants had lower IRRs than people of Danish ethnicity, although this result is based on very few cases. Further, the IRRs were higher when kidney cancer was associated with somatic and psychiatric disorders, except for depression in men, up to 2 years before diagnosis.

### 3.2. Relative survival from kidney cancer

The 1-year relative survival of men and women in whom kidney cancer was diagnosed between 1994 and 2003 was 64% and 65%, respectively. The 5-year relative survival was 39% for men and 44% for women.

Table 2 shows 1-year and 5-year relative survival after a diagnosis of kidney cancer by socioeconomic, demographic and health-related variables. Both sexes had lower relative survival in association with lower disposable income, less education and poorer affiliation to the work market. Owner-occupied housing tenure and larger dwelling appeared to be associated with better short-term survival only in men. No clear pattern emerged for either short- or long-term relative survival from kidney cancer when social class and type of district were used as indicators. Married men and cohabiting and married women had better relative survival than the other groups, as did male immigrants and their descendants when compared with persons of Danish origin. Further, the presence of somatic disorders appeared to be associated with poorer survival.

The age-standardised relative survival curves by educational level showed that higher education was associated with better relative survival for both sexes; however, for men, this was apparent only within the first 2 years after diagnosis (Fig. 2). This finding was due to lower excess mortality rate amongst highly educated persons during the first 6 months after the diagnosis (Fig. 2). During the next approximately 12 months, men in this group had the highest excess mortality rate. Thus, the relative survival of men in the three educational groups was similar from about 2 years after diagnosis.

### 3.3. Incidence of urinary bladder cancer

We included 9471 persons (7078 men and 2393 women) born between 1925 and 1974 in whom urinary bladder cancer was diagnosed in the period 1994–2003, representing 53% of the total number of diagnoses of this cancer in Denmark in that period. Amongst Danish persons, the age- and period-standardised incidence rates for urinary bladder cancer were 54

**Table 2 – One-year and 5-year relative survival[a] (%) with 95% confidence interval (95% CI) by socioeconomic, demographic and health-related variables in patients aged ⩾30 years born between 1925 and 1973, with kidney cancer diagnosed in Denmark between 1994 and 2003 and followed through 2006**

| | Men | | | | | Women | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | 1-year survival | | 5-year survival | | No. | 1-year survival | | 5-year survival | |
| | | % | 95% CI | % | 95% CI | | % | 95% CI | % | 95% CI |
| *Level of education* | | | | | | | | | | |
| Basic or high school | 752 | 62 | 58–65 | 38 | 35–42 | 653 | 61 | 57–65 | 42 | 38–46 |
| Vocational education | 735 | 65 | 62–69 | 40 | 36–44 | 239 | 70 | 64–76 | 47 | 41–54 |
| Higher education | 257 | 68 | 62–74 | 41 | 35–48 | 100 | 74 | 65–83 | 49 | 40–60 |
| Unknown | 29 | 60 | 44–82 | 38 | 24–61 | 9 | 81 | 69–95 | 38 | 21–70 |
| *Disposable income*[b] | | | | | | | | | | |
| Lowest (1st quartile) | 568 | 62 | 58–66 | 37 | 33–42 | 381 | 60 | 54–66 | 38 | 32–45 |
| Middle (2nd–3rd quartile) | 799 | 65 | 62–69 | 39 | 36–43 | 454 | 65 | 61–69 | 44 | 40–49 |
| Highest (4th quartile) | 406 | 68 | 63–73 | 44 | 38–50 | 166 | 70 | 62–79 | 50 | 41–60 |
| *Affiliation with work market*[c] | | | | | | | | | | |
| Working | 1047 | 72 | 70–75 | 49 | 46–52 | 398 | 79 | 75–83 | 58 | 54–63 |
| Unemployed or other | 187 | 62 | 55–71 | 41 | 33–50 | 161 | 70 | 63–79 | 55 | 47–65 |
| Early retirement pensioner | 142 | 56 | 47–66 | 35 | 26–46 | 175 | 57 | 46–70 | 49 | 38–65 |
| *Social class*[d] | | | | | | | | | | |
| Creative core | 78 | 66 | 57–78 | 39 | 29–52 | 8 | 83 | 68–100 | 83 | 69–100 |
| Creative professional | 301 | 68 | 63–74 | 41 | 35–47 | 68 | 74 | 64–85 | 44 | 33–57 |
| Bohemian | 13 | 92 | 79–106 | 78 | 55–110 | 0 | – | – | – | – |
| Service | 415 | 67 | 63–72 | 42 | 37–47 | 499 | 68 | 64–72 | 47 | 43–52 |
| Manual | 739 | 61 | 57–65 | 37 | 33–41 | 102 | 56 | 47–66 | 38 | 29–49 |
| Agricultural | 80 | 64 | 54–76 | 43 | 33–57 | 24 | 63 | 49–81 | 52 | 37–72 |
| Unknown | 147 | 60 | 53–69 | 37 | 29–47 | 300 | 57 | 50–64 | 36 | 29–44 |
| *Housing tenure* | | | | | | | | | | |
| Owner-occupied | 1202 | 67 | 65–70 | 41 | 38–44 | 595 | 66 | 62–69 | 43 | 40–48 |
| Rental | 552 | 57 | 53–61 | 37 | 32–41 | 401 | 64 | 59–69 | 44 | 38–49 |
| Unknown | 19 | 75 | 59–95 | 23 | 13–39 | 5 | 79 | 55–114 | 62 | – |
| *Size of dwelling (m$^2$)* | | | | | | | | | | |
| 0–49 | 62 | 55 | 43–70 | 40 | 28–55 | 11 | 83 | 68–100 | 76 | 65–90 |
| 50–99 | 606 | 58 | 54–62 | 34 | 30–38 | 450 | 64 | 59–68 | 44 | 39–49 |
| 100–149 | 695 | 67 | 63–71 | 43 | 39–47 | 350 | 66 | 61–71 | 44 | 38–49 |
| ⩾ 150 | 410 | 68 | 64–73 | 42 | 37–48 | 190 | 66 | 59–73 | 43 | 36–50 |
| *Cohabiting status* | | | | | | | | | | |
| Married | 1225 | 67 | 64–69 | 42 | 39–45 | 637 | 68 | 64–71 | 46 | 42–50 |
| Cohabiting | 129 | 60 | 52–70 | 37 | 29–48 | 54 | 68 | 57–81 | 55 | 43–72 |
| Single | 170 | 56 | 48–66 | 34 | 26–45 | 37 | 52 | 37–72 | 32 | 21–50 |
| Widow/widower | 76 | 66 | 56–79 | 38 | 28–53 | 170 | 53 | 44–63 | 33 | 24–44 |
| Divorced | 173 | 52 | 44–60 | 28 | 22–36 | 103 | 62 | 53–72 | 42 | 33–54 |
| *Type of district* | | | | | | | | | | |
| Capital area | 565 | 61 | 57–65 | 39 | 35–43 | 271 | 68 | 63-74 | 49 | 43–56 |
| Provincial city | 905 | 67 | 64–70 | 41 | 37–44 | 551 | 64 | 60-68 | 41 | 37–46 |
| Rural area | 197 | 65 | 59–72 | 39 | 32–46 | 125 | 64 | 56–72 | 41 | 33–51 |
| Peripheral rural area[e] | 106 | 60 | 52–70 | 37 | 29–48 | 54 | 66 | 55–79 | 50 | 39–65 |
| *Ethnicity*[f] | | | | | | | | | | |
| Danish | 1773 | 64 | 62–66 | 39 | 37–42 | 1001 | 65 | 62–68 | 44 | 41–47 |
| Immigrant or descendant from western country | 25 | 82 | 68–98 | 64 | 47–88 | 8 | 49 | 40–61 | 36 | 26–49 |
| Immigrant or descendant from non-western country | 38 | 76 | 62–95 | 49 | 34–70 | 11 | 43 | 43–43 | 32 | 18–55 |
| *Charlson comorbidity index*[g] | | | | | | | | | | |
| None | 1355 | 65 | 62–68 | 40 | 37–43 | 811 | 66 | 62–69 | 43 | 40–47 |
| 1 | 271 | 62 | 56–68 | 40 | 33–47 | 111 | 65 | 55–76 | 50 | 39–63 |
| ⩾2 | 147 | 64 | 56–73 | 34 | 26–45 | 79 | 57 | 47–70 | 40 | 29–55 |
| *Depression* | | | | | | | | | | |
| No | 1745 | 64 | 62–66 | 39 | 37–42 | 959 | 65 | 62–68 | 44 | 41–47 |
| Yes | 28 | 61 | 45–83 | 35 | 20–61 | 42 | 61 | 46–80 | 41 | 25–67 |

| Table 2 – continued | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Men** | | | | | **Women** | | | |
| | No. | 1-year survival | | 5-year survival | | No. | 1-year survival | | 5-year survival | |
| | | % | 95% CI | % | 95% CI | | % | 95% CI | % | 95% CI |
| *Schizophrenia or other psychosis* | | | | | | | | | | |
| No | 1751 | 64 | 62–67 | 39 | 37–42 | 986 | 65 | 62–68 | 44 | 41–47 |
| Yes | 22 | 44 | 28–69 | 38 | 21–68 | 15 | 69 | 51–92 | 58 | 37–94 |

a Ratio of observed survival of cancer patients and survival that would have been expected if the patients had had the same age-, period-, socioeconomic, demographic or health-related indicator-specific mortality as the total study population; for 'social class' and 'ethnicity', expected survival is adjusted only for age, not period, because of low power.

b Household income after taxation and interest, adjusted for number of persons in household; categorised by gender-specific distribution of household disposable income per person.

c For pensioners, work market affiliation before pension date was assigned and follow-up was done up to age 69.

d Based on theory of creative class[23]: the creative core (e.g. researchers, designers, architects), creative professionals (e.g. managers, business and finance, lawyers, doctors), bohemians (e.g. artists, models), the service class (e.g. nurses, hairdressers, caterers), the manual class (e.g. construction workers, transport and production workers) and the agricultural class (e.g. farmers, fishermen).

e More than 40 km to a local centre with adequate possibilities for employment and not sharing a border with a centre municipality.

f Excluded from the study population in all other analyses presented in Table 2.

g The presence of disorders, as defined in the Charlson index, was defined as an in- or out-patient contact with one of the diagnoses listed in Table 1 in[17] between 1978 and 2 years before the diagnosis of cancer. Grouped according to the accumulated sum of scores.

per 100,000 person–years for men and 19 per 100,000 person–years for women.

For both sexes, we found a pattern of lower IRR associated with higher socioeconomic position, measured as educational level, disposable income, affiliation to the work market, housing tenure or size of dwelling (Table 3). This pattern is reflected in Fig. 3, which shows generally lower incidence rates for the highest educational level, especially for older groups in which most cases were diagnosed; for men, however, this pattern shifted at around age 70, so that the lowest incidence rate was seen for men with only basic schooling.

For both sexes, the IRRs for urinary bladder cancer were lower for creative professionals and agricultural workers than for manual workers (Table 3). Single and married people appeared to have lower IRRs than other cohabiting groups. Inhabitants of the capital area had higher IRRs than those of other areas. Immigrants and their descendants had lower IRRs than people of Danish ethnicity, except for males of western descent. Further, the presence of somatic disorders and depression was associated with higher IRRs, whereas the opposite pattern was seen for schizophrenia and other psychoses.

### 3.4. Relative survival from urinary bladder cancer

The 1-year relative survival of patients in whom urinary bladder cancer was diagnosed during 1994–2003 was 88% for men and 83% for women. The relative survival 5 years after diagnosis was 69% for men and 64% for women.

For both sexes, the relative survival was highest for those most highly educated (Fig. 4), which was due to much lower excess mortality rate in this group of people during the first year after diagnosis (Fig. 4). Table 4 shows the 1-year and 5-year relative survival after a diagnosis of urinary bladder cancer according to socioeconomic, demographic and health-related variables. Overall, we found that relative survival was better with higher socioeconomic position, for married people and for male immigrants and their descendants, especially those from non-western countries. A high comorbidity index was associated with decreased relative survival. The creative classes had the best survival at both times, although the estimates for 'bohemians' were limited by low numbers. Neither type of district nor psychiatric disorders appeared to have a clear effect.

## 4. Discussion

Our results indicate a moderate association between lower socioeconomic position and higher incidences of cancers of the kidney and urinary bladder for both sexes. This was found when socioeconomic position was measured as educational level, disposable income, affiliation to the work market, housing tenure or size of dwelling. This finding is in accordance with those of many other studies that showed that lower socioeconomic position is a predictor of urinary bladder cancer[7,8] and kidney cancer.[3,9]

Socioeconomic position can be a proxy for both known and unknown cancer risk factors. We measured socioeconomic position by various socioeconomic, demographic and health-related variables, which cannot be expected to be interchangeable proxies of the same underlying phenomena. For example, type of district may reflect differences in health risk behaviour and lifestyle, such as cigarette smoking and dietary habits, whereas social class may reflect occupational exposure to carcinogens. Smoking is a well-characterised risk factor for urinary bladder cancer,[5] and smoking and obesity have been suggested as risk factors for kidney cancer.[2] These lifestyle-associated factors have been shown to be associated with low socioeconomic position[15,19] and could, therefore, be underlying causal explanations of the overall higher IRR for
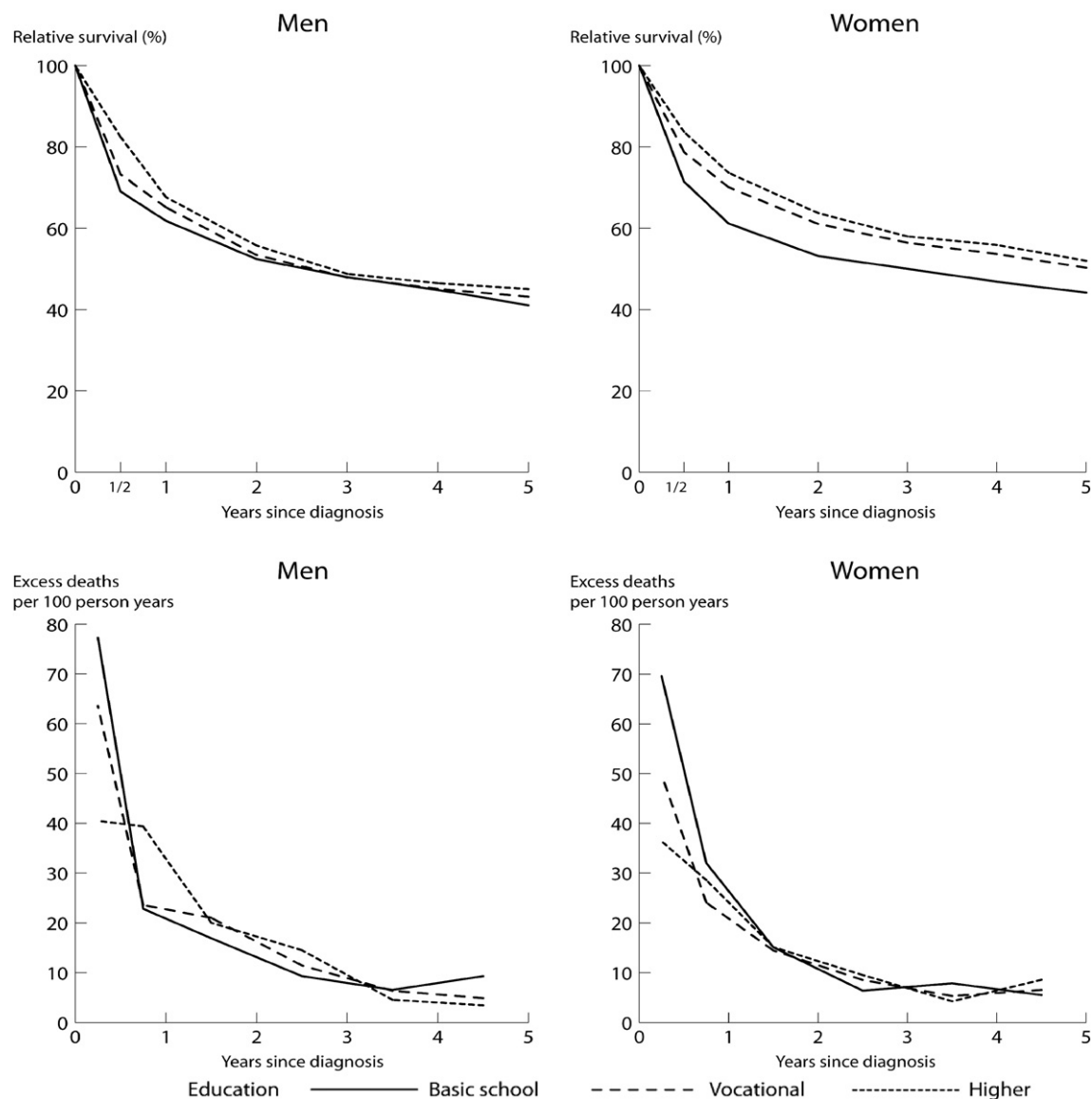
Fig. 2 – Age-standardised relative survival and excess mortality rates per 100 person–years by level of education in patients born between 1925 and 1973, with kidney cancer diagnosed in Denmark during 1994–2003 and followed through 2006. Relative survival is the ratio of the observed survival of the cancer patients and the survival that would have been expected if the patients had had the same age-, period- and education-specific mortality as the total study population. Excess mortality is excess to the same population mortality and estimated in intervals since diagnosis. Estimates were standardised for age on the basis of the age distribution of all patients with kidney cancer in the study cohort.

people of lower socioeconomic position. The presence of somatic disorders was also associated with higher IRRs for both kidney and urinary bladder cancer, which might reflect a high prevalence of smoking in persons with some diseases. Being an immigrant or the descendant of an immigrant was associated with lower incidences of kidney and urinary bladder cancer, which may reflect relatively greater cigarette use by people of Danish ethnicity, in particular women,[20] but may also reflect differences in genetic profile, such as slow or fast acetylators.

Various occupational exposures have been associated with urinary bladder cancer (e.g. aromatic amines, polycyclic aro-

matic hydrocarbons, chlorinated solvents and dyestuffs)[21] and with kidney cancer (e.g. cadmium, asbestos and paints).[2,22] Consistent with this knowledge, we found a tendency towards higher IRRs in manual workers (e.g. in construction, transport and production) than in other social classes.

In general, our results showed modest associations between several indicators of lower socioeconomic position (level of education, disposable income and affiliation to the work market) and lower 1- and 5-year relative survival after a diagnosis of kidney or urinary bladder cancer. Much of the literature supports this conclusion.[13–16] For both kidney

**Table 3 – Incidence rate ratios (IRRs) with 95% confidence intervals (95% CI) for urinary bladder cancer in Danish persons born between 1925 and 1973 and aged ⩾30 years, by socioeconomic, demographic and health-related variables, Denmark, 1994–2003**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) |
| *Level of education* | | | | | | |
| Basic or high school | 3000 | 1.00 | 1.00 | 1420 | 1.00 | 1.00 |
| Vocational education | 2756 | 1.06 (1.00–1.11) | 1.06 (1.01–1.12) | 643 | 0.96 (0.88–1.06) | 0.98 (0.89–1.08) |
| Higher education | 965 | 0.85 (0.79–0.91) | 0.87 (0.80–0.94) | 239 | 0.70 (0.61–0.81) | 0.73 (0.63–0.84) |
| Unknown | 116 | 1.18 (0.98–1.42) | 1.18 (0.98–1.42) | 25 | 1.01 (0.68–1.50) | 1.02 (0.69–1.52) |
| *Disposable income[c]* | | | | | | |
| Lowest (1st quartile) | 2372 | 0.98 (0.93–1.04) | 0.97 (0.92–1.03) | 827 | 0.98 (0.89–1.07) | 0.95 (0.87–1.05) |
| Middle (2nd–3rd quartile) | 3008 | 1.00 | 1.00 | 1079 | 1.00 | 1.00 |
| Highest (4th quartile) | 1457 | 0.88 (0.83–0.94) | 0.91 (0.85–0.97) | 421 | 0.80 (0.72–0.90) | 0.85 (0.75–0.95) |
| *Affiliation with work market[d]* | | | | | | |
| Working | 3439 | 1.00 | 1.00 | 884 | 1.00 | 1.00 |
| Unemployed or other | 680 | 1.06 (0.98–1.16) | 1.04 (0.96–1.14) | 363 | 1.13 (1.00–1.29) | 1.10 (0.97–1.25) |
| Early retirement pensioner | 602 | 1.28 (1.18–1.40) | 1.24 (1.13–1.35) | 419 | 1.44 (1.27–1.63) | 1.36 (1.20–1.55) |
| *Social class[e]* | | | | | | |
| Creative core | 319 | 0.83 (0.73–0.93) | 0.98 (0.86–1.12) | 29 | 0.86 (0.58–1.27) | 1.15 (0.77–1.73) |
| Creative professional | 1008 | 0.87 (0.81–0.93) | 0.94 (0.87–1.02) | 123 | 0.64 (0.51–0.80) | 0.78 (0.62–1.00) |
| Bohemian | 29 | 0.79 (0.55–1.15) | 0.88 (0.61–1.27) | 2 | 0.38 (0.10–1.54) | 0.46 (0.12–1.87) |
| Service | 1666 | 0.98 (0.92–1.04) | 1.00 (0.94–1.06) | 1242 | 0.91 (0.79–1.06) | 0.96 (0.83–1.11) |
| Manual | 2914 | 1.00 | 1.00 | 215 | 1.00 | 1.00 |
| Agricultural | 295 | 0.63 (0.56–0.71) | 0.64 (0.56–0.72) | 36 | 0.62 (0.44–0.88) | 0.63 (0.44–0.90) |
| Unknown | 606 | 0.90 (0.83–0.98) | 0.91 (0.84–1.00) | 680 | 0.88 (0.76–1.03) | 0.90 (0.77–1.05) |
| *Housing tenure* | | | | | | |
| Owner-occupied | 4517 | 1.00 | 1.00 | 1294 | 1.00 | 1.00 |
| Rental | 2231 | 1.23 (1.17–1.29) | 1.21 (1.15–1.27) | 1009 | 1.38 (1.27–1.50) | 1.34 (1.23–1.46) |
| Unknown | 89 | 1.18 (0.96–1.46) | 1.17 (0.95–1.45) | 24 | 1.18 (0.79–1.77) | 1.16 (0.77–1.74) |
| *Size of dwelling ($m^2$)* | | | | | | |
| 0–49 | 210 | 1.16 (1.01–1.34) | 1.16 (1.01–1.34) | 30 | 1.00 (0.70–1.45) | 1.00 (0.69–1.44) |
| 50–99 | 2547 | 1.20 (1.13–1.26) | 1.19 (1.12–1.25) | 1163 | 1.40 (1.27–1.53) | 1.38 (1.25–1.51) |
| 100–149 | 2589 | 1.00 | 1.00 | 766 | 1.00 | 1.00 |
| ⩾150 | 1491 | 0.91 (0.86–0.97) | 0.93 (0.87–0.99) | 368 | 0.85 (0.75–0.96) | 0.87 (0.77–0.99) |
| *Cohabiting status* | | | | | | |
| Married | 5089 | 1.00 | 1.00 | 1355 | 1.00 | 1.00 |
| Cohabiting | 430 | 1.09 (0.98–1.20) | 1.07 (0.97–1.18) | 142 | 1.37 (1.15–1.63) | 1.35 (1.13–1.61) |
| Single | 398 | 0.75 (0.68–0.84) | 0.74 (0.67–0.82) | 102 | 0.98 (0.80–1.20) | 1.00 (0.82–1.23) |
| Widow or widower | 357 | 1.09 (0.98–1.21) | 1.08 (0.97–1.20) | 430 | 1.26 (1.13–1.42) | 1.24 (1.11–1.39) |
| Divorced | 563 | 1.03 (0.95–1.13) | 1.01 (0.93–1.11) | 298 | 1.36 (1.20–1.54) | 1.34 (1.18–1.53) |
| *Type of district* | | | | | | |
| Capital area | 2253 | 1.00 | 1.00 | 785 | 1.00 | 1.00 |
| Provincial city | 3417 | 0.87 (0.83–0.92) | 0.86 (0.81–0.90) | 1179 | 0.91 (0.83–0.99) | 0.88 (0.80–0.96) |
| Rural area | 786 | 0.82 (0.76–0.89) | 0.80 (0.74–0.87) | 254 | 0.87 (0.75–1.00) | 0.83 (0.72–0.96) |
| Peripheral rural area[f] | 381 | 0.85 (0.76–0.95) | 0.83 (0.74–0.93) | 109 | 0.80 (0.65–0.97) | 0.76 (0.62–0.93) |
| *Ethnicity[g]* | | | | | | |
| Danish | 6837 | 1.00 | 1.00 | 2327 | 1.00 | 1.00 |
| Immigrant or descendant from western country | 134 | 1.09 (0.92–1.29) | 1.10 (0.93–1.31) | 47 | 0.79 (0.59–1.06) | 0.83 (0.62–1.11) |
| Immigrant or descendant from non-western country | 107 | 0.77 (0.64–0.93) | 0.75 (0.62–0.92) | 19 | 0.42 (0.27–0.66) | 0.44 (0.27–0.71) |
| *Charlson comorbidity index[h]* | | | | | | |
| None | 5031 | 1.00 | 1.00 | 1796 | 1.00 | 1.00 |
| 1 | 1137 | 1.27 (1.19–1.36) | 1.26 (1.18–1.34) | 333 | 1.60 (1.43–1.81) | 1.58 (1.40–1.78) |
| ⩾2 | 669 | 1.46 (1.34–1.58) | 1.44 (1.33–1.56) | 198 | 1.66 (1.43–1.93) | 1.63 (1.41–1.89) |
| *Depression* | | | | | | |
| No | 6700 | 1.00 | 1.00 | 2231 | 1.00 | 1.00 |
| Yes | 137 | 1.09 (0.92–1.29) | 1.09 (0.92–1.29) | 96 | 1.23 (1.00–1.51) | 1.21 (0.99–1.49) |

| Table 3 – *continued* | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) | No. | IRR[a] (95% CI) | Adjusted IRR[b] (95% CI) |
| *Schizophrenia or other psychosis* | | | | | | |
| No | 6787 | 1.00 | 1.00 | 2303 | 1.00 | 1.00 |
| Yes | 50 | 0.88 (0.67–1.16) | 0.87 (0.66–1.15) | 24 | 0.86 (0.57–1.28) | 0.83 (0.56–1.24) |

a Adjusted for calendar period (in 5-year intervals) and age modelled as age and age$^2$ in years.

b Adjusted for calendar period and age (as above) and additionally for level of education and disposable income.

c Household income after taxation and interest, adjusted for number of persons in household; categorised by gender-specific distribution of household disposable income per person.

d For pensioners, work market affiliation before pension date was assigned and follow-up was done up to age 69.

e Based on theory of creative class:[23] the creative core (e.g. researchers, designers, architects), creative professionals (e.g. managers, business and finance, lawyers, doctors), bohemians (e.g. artists, models), the service class (e.g. nurses, hairdressers, caterers), the manual class (e.g. construction workers, transport and production workers) and the agricultural class (e.g. farmers, fishermen).

f More than 40 km to a local centre with adequate possibilities for employment and not sharing a border with a centre municipality.

g Included as a separate indicator, but ethnic groups were excluded from the study population in all other analyses presented in Table 3, e.g. education and income.

h The presence of disorders, as defined in the Charlson index, was defined as an in- or out-patient contact with one of the diagnoses listed in Table 1 in[17] between 1978 and 2 years before the diagnosis of cancer. Grouped according to the accumulated sum of scores.
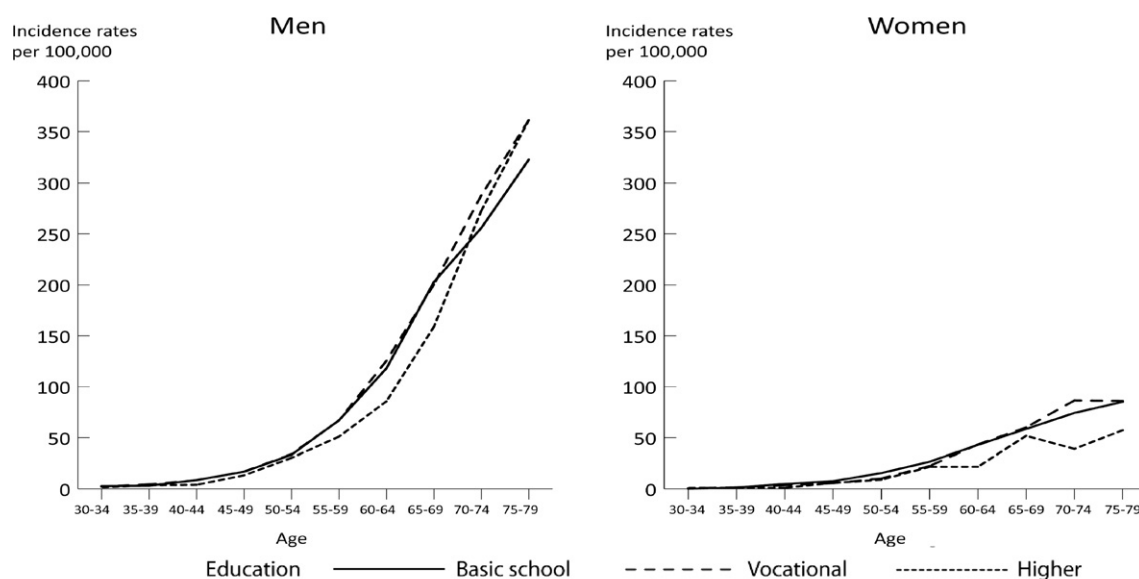


| Incidence rate | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Basic school ($n$ = 3000) | Vocational ($n$ =2756 ) | Higher ($n$ =965 ) | Basic school ($n$ =1420 ) | Vocational ($n$ =643) | Higher ($n$ =239 ) |
| Crude | 67 | 51 | 37 | 26 | 16 | 9 |
| Standardised | 56 | 59 | 48 | 19 | 19 | 13 |
| Difference | 8 | 11 | 0 | 6 | 6 | 0 |

Persons with unknown level of education not included

Fig. 3 – Age-specific incidence rates per 100,000 person–years for urinary bladder cancer by education amongst persons born between 1925 and 1973, Denmark, 1994–2003. Supplementary table shows the crude incidence rate and the incidence rate standardised by age (5-year age groups) and period (two 5-year periods) with the total study population as the standard and the incidence rate difference with higher education as the reference.
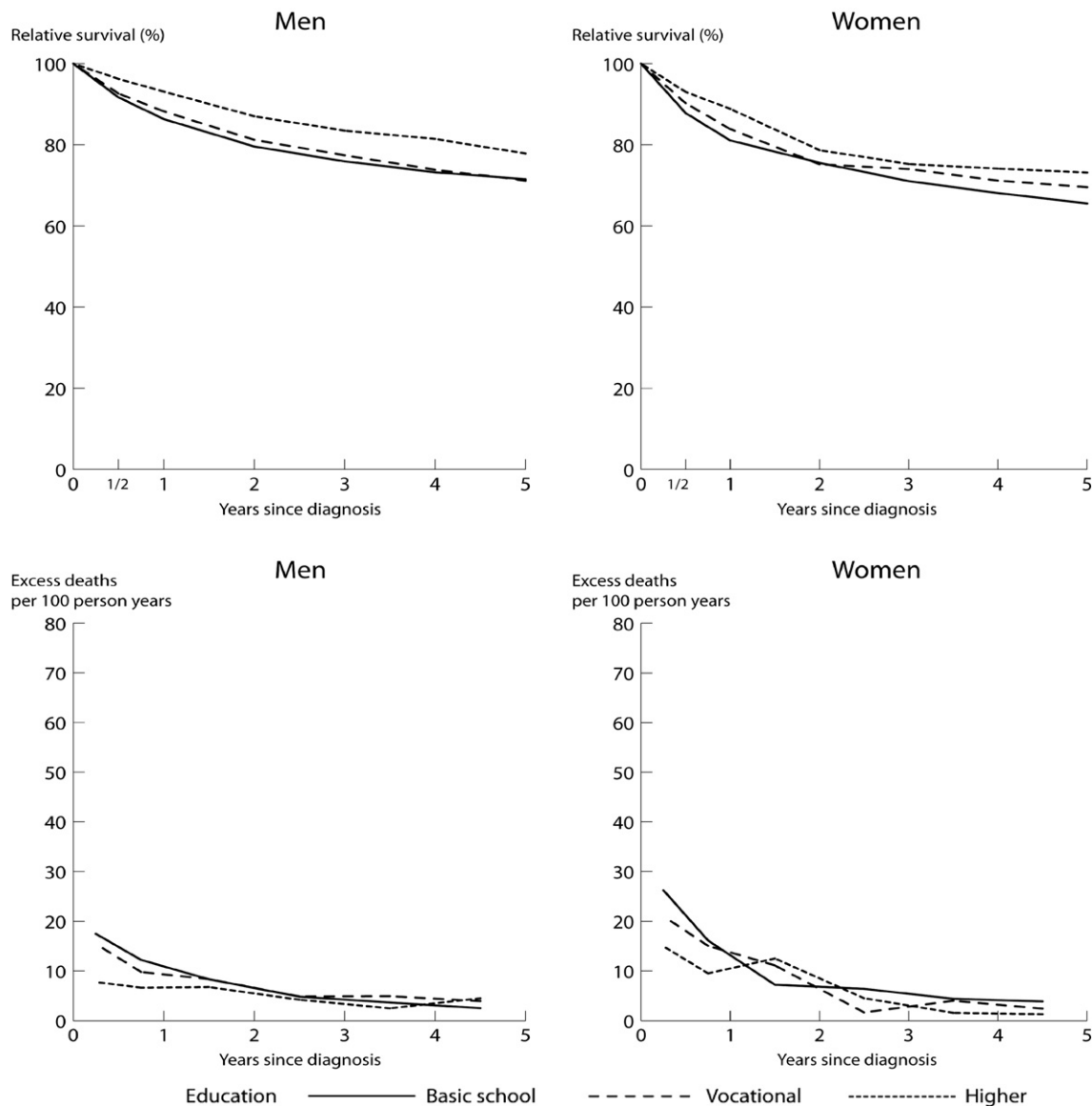
Fig. 4 – Age-standardised relative survival and excess mortality rates per 100 person–years by level of education in patients born between 1925 and 1973, with urinary bladder cancer diagnosed in Denmark during 1994–2003 and followed through 2006. Relative survival is the ratio of the observed survival of the cancer patients and the survival that would have been expected if the patients had had the same age-, period- and education-specific mortality as the total study population. Excess mortality is excess to the same population mortality and estimated in intervals since diagnosis. Estimates were standardised for age on the basis of the age distribution of all patients with urinary bladder cancer in the study cohort.

cancer and urinary bladder cancer, having no affiliation to the work market and comorbidity were associated with poorer survival for both sexes. These patterns are in accordance with the general notion that the usual health of a patient is a significant prognostic factor after a cancer diagnosis.[15]

We also found lower excess mortality rates from cancers of the kidney and urinary bladder during the first 6–12 months after diagnosis for persons with the highest education, which might be a result of diagnosis at an earlier stage of disease. The pattern might equally be a chance finding, although it was seen for cancers at both sites. The apparent effect was short-lived for male patients with kidney cancer,

but the survival of women with this cancer and for patients of both sexes with urinary bladder cancer who had the highest level of education was better throughout the follow-up period.

Variations in survival by socioeconomic position might be due to differences in approaches to and the responses of the health-care system, which might affect the stage of disease at diagnosis, the degree of change in health behaviour and perhaps even the choice and timing of therapy, all of which are potentially important for survival.

In conclusion, this study showed that lower socioeconomic position is associated with higher incidence rates of

**Table 4 – One-year and 5-year relative survival[a] (%) with 95% confidence interval (95% CI) by socioeconomic, demographic and health-related variables in patients aged ⩾30 years born between 1925 and 1973, with urinary bladder cancer diagnosed in Denmark between 1994 and 2003 and followed through 2006**

| | Men | | | | | Women | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | 1-year survival | | 5-year survival | | No. | 1-year survival | | 5-year survival | |
| | | % | 95% CI | % | 95% CI | | % | 95% CI | % | 95% CI |
| *Level of education* | | | | | | | | | | |
| Basic or high school | 2990 | 86 | 85–88 | 68 | 66–70 | 1409 | 81 | 79–83 | 62 | 60-65 |
| Vocational education | 2748 | 88 | 87–90 | 68 | 66–70 | 639 | 84 | 81–87 | 66 | 62-70 |
| Higher education | 965 | 93 | 91–95 | 75 | 71–78 | 239 | 89 | 84–94 | 70 | 62-78 |
| Unknown | 116 | 91 | 86–97 | 68 | 58–79 | 25 | 69 | 53–89 | 48 | 32–72 |
| *Disposable income[b]* | | | | | | | | | | |
| Lowest (1st quartile) | 2361 | 85 | 84–87 | 65 | 62–67 | 818 | 81 | 78–84 | 60 | 57–65 |
| Middle (2nd–3rd quartile) | 3003 | 88 | 87–90 | 68 | 66–70 | 1073 | 83 | 80–85 | 65 | 62–68 |
| Highest (4th quartile) | 1455 | 93 | 91–94 | 74 | 71–77 | 421 | 86 | 81–90 | 66 | 60–72 |
| *Affiliation with work market[c]* | | | | | | | | | | |
| Working | 3436 | 93 | 93–94 | 81 | 80–82 | 884 | 93 | 91–94 | 80 | 77–82 |
| Unemployed or other | 676 | 90 | 88–93 | 75 | 71–80 | 359 | 85 | 80–89 | 73 | 68–78 |
| Early retirement pensioner | 599 | 88 | 84–91 | 69 | 64–75 | 414 | 80 | 74–87 | 65 | 57–74 |
| *Social class[d]* | | | | | | | | | | |
| Creative core | 318 | 93 | 91–96 | 80 | 75–85 | 29 | 87 | 75–101 | 70 | 50–97 |
| Creative professional | 1008 | 91 | 89–93 | 73 | 70–76 | 123 | 88 | 81–95 | 73 | 65–84 |
| Bohemian | 29 | 95 | 87–104 | 87 | 71–107 | 2 | 100 | – | 102 | – |
| Service | 1662 | 88 | 87–90 | 69 | 66–71 | 1236 | 84 | 82–87 | 66 | 63–69 |
| Manual | 2903 | 87 | 85–88 | 66 | 64–68 | 213 | 78 | 72–84 | 62 | 55–70 |
| Agricultural | 295 | 89 | 85–93 | 70 | 64–76 | 36 | 84 | 73–96 | 69 | 55–87 |
| Unknown | 604 | 86 | 83–89 | 65 | 60–70 | 673 | 79 | 75–82 | 57 | 53–62 |
| *Housing tenure* | | | | | | | | | | |
| Owner-occupied | 4512 | 90 | 89–90 | 70 | 69–72 | 1288 | 85 | 83–87 | 67 | 64–70 |
| Rental | 2218 | 85 | 84–87 | 66 | 63–68 | 1000 | 79 | 77–82 | 60 | 56–63 |
| Unknown | 89 | 78 | 68–89 | 63 | 50–79 | 24 | 90 | 78–103 | 86 | 70–107 |
| *Size of dwelling (m²)* | | | | | | | | | | |
| 0–49 | 205 | 75 | 69–82 | 53 | 45–62 | 30 | 92 | 80–105 | 65 | 48–87 |
| 50–99 | 2538 | 85 | 84–87 | 66 | 63–68 | 1152 | 81 | 79–83 | 61 | 58–64 |
| 100–149 | 2586 | 90 | 89–91 | 71 | 69–73 | 763 | 84 | 81–87 | 66 | 63–70 |
| ⩾150 | 1490 | 91 | 89–92 | 71 | 69–74 | 367 | 86 | 82–90 | 70 | 65–76 |
| *Cohabiting status* | | | | | | | | | | |
| Married | 5082 | 90 | 89–90 | 70 | 69–72 | 1347 | 84 | 82–86 | 66 | 63–69 |
| Cohabiting | 429 | 84 | 80–88 | 63 | 57–69 | 142 | 79 | 72–87 | 57 | 48–68 |
| Single | 395 | 79 | 75–84 | 56 | 50–63 | 101 | 79 | 71–88 | 60 | 50–72 |
| Widow/widower | 356 | 85 | 81–90 | 66 | 60–73 | 428 | 81 | 76–85 | 62 | 56–68 |
| Divorced | 557 | 84 | 81–88 | 63 | 58–68 | 294 | 82 | 77–87 | 62 | 56–69 |
| *Type of district* | | | | | | | | | | |
| Capital area | 2244 | 87 | 86–89 | 69 | 66–71 | 775 | 84 | 81–87 | 65 | 62–69 |
| Provincial city | 3409 | 88 | 87–89 | 69 | 67–71 | 1175 | 83 | 80–85 | 63 | 60–66 |
| Rural area | 786 | 89 | 87–92 | 68 | 65–72 | 254 | 80 | 75–85 | 64 | 58–71 |
| Peripheral rural area[e] | 380 | 87 | 84–91 | 66 | 61–72 | 108 | 81 | 74–89 | 63 | 54–74 |
| *Ethnicity[f]* | | | | | | | | | | |
| Danish | 6819 | 88 | 87–89 | 69 | 67–70 | 2312 | 83 | 81–84 | 64 | 62–66 |
| Immigrant or descendant from western country | 134 | 93 | 88–98 | 71 | 63–81 | 47 | 87 | 77–98 | 70 | 56–86 |
| Immigrant or descendant from non–western country | 108 | 96 | 90–102 | 78 | 68–91 | 19 | 80 | 58–110 | 58 | 30–113 |
| *Charlson comorbidity index[g]* | | | | | | | | | | |
| None | 5021 | 89 | 88–90 | 71 | 69–72 | 1789 | 84 | 82–85 | 66 | 64–68 |
| 1 | 1134 | 86 | 84–88 | 65 | 62–69 | 327 | 85 | 81–89 | 66 | 60–72 |
| ⩾2 | 664 | 83 | 79–86 | 59 | 54–65 | 196 | 73 | 66–80 | 46 | 38–56 |
| *Depression* | | | | | | | | | | |
| No | 6683 | 88 | 87–89 | 69 | 67–70 | 2219 | 83 | 82–85 | 64 | 62–66 |
| Yes | 136 | 85 | 79–92 | 70 | 61–81 | 93 | 75 | 66–84 | 64 | 54–76 |

**Table 4 – continued**

| | No. | 1-year survival | | 5-year survival | | No. | 1-year survival | | 5-year survival | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | % | 95% CI | % | 95% CI | | % | 95% CI | % | 95% CI |
| *Schizophrenia or other psychosis* | | | | | | | | | | |
| No | 6769 | 88 | 87–89 | 69 | 67–70 | 2288 | 83 | 81–84 | 64 | 62–66 |
| Yes | 50 | 80 | 66–97 | 68 | 48–98 | 24 | 75 | 58–96 | 63 | 41–95 |

a Ratio of observed survival of cancer patients and survival that would have been expected if the patients had had the same age-, period-, socioeconomic, demographic or health-related indicator-specific mortality as the total study population; for 'social class' and 'ethnicity', expected survival is adjusted only for age, not period, because of low power.

b Household income after taxation and interest, adjusted for number of persons in household; categorised by gender-specific distribution of household disposable income per person.

c For pensioners, work market affiliation before pension date was assigned and follow-up was done up to age 69.

d Based on theory of creative class:[23] the creative core (e.g. researchers, designers, architects), creative professionals (e.g. managers, business and finance, lawyers, doctors), bohemians (e.g. artists, models), the service class (e.g. nurses, hairdressers, caterers), the manual class (e.g. construction workers, transport and production workers) and the agricultural class (e.g. farmers, fishermen).

e More than 40 km to a local centre with adequate possibilities for employment and not sharing a border with a centre municipality.

f Excluded from the study population in all other analyses presented in Table 4.

g The presence of disorders, as defined in the Charlson index, was defined as an in- or out-patient contact with one of the diagnoses listed in Table 1 in[17] between 1978 and 2 years before the diagnosis of cancer. Grouped according to the accumulated sum of scores.

kidney and urinary bladder cancer. Further, some indicators of higher socioeconomic position were associated with better survival after a diagnosis of either urinary bladder or kidney cancer.

## Conflict of interest statement

None declared.

## Acknowledgement

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