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ORIGINAL ARTICLE

Affiliation to the work market after curative treatment of head-and-neck cancer: A population-based study from the DAHANCA database

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Abstract

Objectives. Survivors of squamous cell carcinoma of the head and neck (HNSCC) are more severely affected in regard to affiliation to the work market than other cancer survivors. Few studies have investigated associations between socioeconomic and disease-related factors and work market affiliation after curative treatment of HNSCC. We investigated the factors for early retirement pension due to disability and unemployment in patients who had been available for work one year before diagnosis. *Methods*. In a nationwide, population-based cohort study, data on 2436 HNSCC patients treated curatively in 1992–2008 were obtained from the Danish Head and Neck Cancer Group database and linked to Danish administrative population-based registries to obtain demographic and socioeconomic variables. We used multivariate logistic regression models to assess associations between socioeconomic factors (education, income and cohabitating status), cancer-specific variables such as tumour site and stage, comorbidity, early retirement pension and unemployment, with adjustment for age, gender and year of diagnosis. *Results*. Short education [odds ratio (OR) 4.8; 95% confidence interval (CI) 2.2–10.4], low income (OR 3.2; 95% CI 1.8–5.8), living alone (OR 3.0; 95% CI 2.1–4.4) and having a Charlson comorbidity index score of 3 or more (OR 5.9; 95% CI 3.1–11) were significantly associated with early retirement overall and in all site groups. For the subgroup of patients who were employed before diagnosis, the risk pattern was similar. Tumour stage was not associated with early retirement or unemployment. *Conclusions*. Cancer-related factors were less strongly associated with early retirement and unemployment than socioeconomic factors and comorbidity. Clinicians treating HNSCC patients should be aware of the socioeconomic factors related to work market affiliation in order to provide more intensive social support or targeted rehabilitation for this patient group.

Although more than 60% of cancer patients are able to return to work one year after treatment [1], cancer survivors in general are at increased risk for unemployment and early retirement and are less likely to be re-employed [1–5]. Unemployment or a change in working hours might have a considerable impact on the economic situation and on the psychological well-being of cancer survivors of working age. The ability to continue to work throughout treatment, to resume work or to take a new job after treatment are important for both the survivor and society in general.

Socioeconomic factors, such as shorter education and lower income, and work-related factors, such as blue-collar jobs or hard labour, have been associated with unemployment among cancer survivors [6,7]. The type of cancer is another potential predictor of unemployment or job loss. As patients with squamous cell carcinoma of the head and neck (HNSCC) are considered to be one of the least advantaged groups of cancer patients [8–10], survivors of such cancers may be more severely affected with regard to work market affiliation than other cancer survivors [11,12].

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Although the importance of socioeconomic factors cannot be underestimated in regard to work market affiliation, cancer-related factors such as tumour stage and site of the HNSCC and comorbidity may also be important. Cancer of the head and neck comprises a heterogeneous group of diseases with different natural histories, treatments and prognoses. Despite advances in treatment, many HNSCC survivors may have long-term morbidity due to the location of the cancer and to extensive, high-dose treatment [8,13]. Vulnerable patients may have more difficulties to keep their jobs or find new jobs in a competitive work market. Further, many HNSCC patients present at an advanced tumour stage. In a welfare system such as that in Denmark, early retirement is a protection against economic problems that might occur if physical or mental illness reduces the ability to work by more than 50%. If a cancer is diagnosed at a late stage, early retirement is more likely to be granted by the authorities. This study therefore solely focuses on HNSCC patients who were treated curatively.

Few studies have assessed disease-related factors and work market affiliation after curative treatment of different HNSCCs. We studied HNSCC patients who were treated curatively and thus, in principle, were still available for the work market. The aim of this population-based study was to investigate the association between socioeconomic, cancer-related factors, and comorbidity and affiliation to the work market and also the risk factors for early retirement due to disability or unemployment.

Material and methods

Study population

A total of 9389 patients with HNSCC in the larynx, pharynx and oral cavity diagnosed in Denmark between 1992 and 2008 and treated with primary curative radiotherapy were identified in the national clinical database of the Danish Head and Neck Cancer Group (DAHANCA) [14], in which information on these cancers and their treatment has been recorded prospectively since 1979. All data are registered locally in five Danish oncology centres and subsequently collected and processed by the DAHANCA data centre. From this database we obtained the unique personal identification number, type of cancer, date of diagnosis, type of treatment (surgery or radiation), tumour recurrence, tumour site and TNM stage for each patient.

Information on exposure indicators and identification of potential confounding

Our main area of interest was the extent to which socioeconomic, cancer-related variables and comorbidity affect the affiliation of the younger curatively treated patient population to the work market. We used the personal identification number (which has been assigned to all Danish residents since 1 April 1968 [15]) to link each patient in the cohort to the database of a nationwide cohort study on social inequality and cancer (CANULI), which contains extensive information on socioeconomic status, vital status, emigration, immigration and somatic and psychiatric health for more than 3.4 million Danes born after 1920 [16]. The information in the database is accumulated by linkage to several Danish administrative registries provided by Statistics Denmark, including the Integrated Database for Labour Market Research, which was established in 1980 and contains annual data on a broad range of individual sociodemographic factors, such as educational status, disposable income, marital and cohabiting status and work market affiliation.

We extracted information on the highest attained educational level and disposable income for all the patients in our cohort one year before the diagnosis. Highest attained education was grouped into short education (mandatory education of up to 7 and 9 years for patients born before and after 1 January 1958, respectively); medium education (the highest grades of primary school, secondary school and vocational education: 8–12 years for patients born before 1 January 1958 and 10–12 years for those born after 1 January 1958); and higher education (>12 years).

Disposable income one year before diagnosis was calculated from household income after taxation and from the number of people in the household and deflated according to the 2000 value of the Danish crown. The disposable income was categorised according to the quartiles of the national gender-specific disposable household income per person distribution into low (1st quartile), medium (2nd – 3rd quartile) and high (4th quartile).

Cohabitation status was categorised into married/cohabiting or living alone (unmarried, widowed or divorced). Cohabitating was defined as, in the absence of marriage, two persons of the opposite sex, over the age of 16, with a maximum age difference of 15 years, who live at the same address, with no other adults in residence.

The CANULI database includes full histories of all somatic diseases leading to hospitalisation from 1978 and, from 1995, also outpatient visits, based on information from the Danish National Patient Register [17]. The information includes diagnoses coded according to the Danish modified versions of ICD8 and ICD10 (from 1994). Comorbidity was categorised with the Charlson comorbidity index, which provides an overall score weighted by level of severity assigned to 19 selected conditions scored

from 1 to 6 [18]. The scores were grouped on the basis of the cumulated sum into scores of 0, 1–2 and 3 or more.

Tumour stage was defined according to the UICC TNM classification [19,20]. We defined early-stage HNSCC as stages I–II (T1–T2 and N0 and M0) and advanced stage as stages III–IV (T3–T4b and/or N1–N3 or M1).

We divided the cancers into five groups by site: glottic lanynx, other larynx (supraglottic and subglottic), oropharynx, hypopharynx and oral cavity. This study did not include patients with nasopharyngeal carcinoma.

Identification of outcomes

The primary end-point of the study was affiliation to the Danish work market one year after diagnosis for patients who had been affiliated one year before diagnosis. In Denmark, unemployment benefits are available only for people actively seeking a job and only for a limited period (two times 52 weeks within a three-year period). A person who is ill is entitled to sickness benefits for a maximum of 52 weeks within 18 months. People on sickness benefit are assumed to be able to resume work after recovery. People who are unable to work permanently because of a mental or physical disability that reduces their work by at least 50% may be granted an early retirement pension by the Danish authorities.

We extracted information on affiliation to the work market in the CANULI database and grouped the patients into five groups: early retirement due to disability, pensioner due to age (in Denmark in the study period, 65 years), self-selected anticipatory pensioner (available in Denmark from age 60 in the study period), unemployed and employed.

Exclusions

Of the 9389 patients treated curatively for HNSCC, we excluded 315 with cancer of the nasopharynx; 189 for whom there were insufficient data on site, stage or treatment; 611 who were born before 1920; 65 who were under the age of 30 at diagnosis; 27 who did not reside in Denmark one year before diagnosis and two for whom information in Denmark Statistics was missing or outlying. We excluded a further 1413 patients who had tumour recurrence within the first year after diagnosis. A further 3630 patients were excluded because they were over 60 years one year before diagnosis, because we assumed that people in this age group were so close to retirement that the personal decision of whether to retire would probably be in favour of anticipatory retirement pension. We also excluded 701 patients who were on early retirement or age pension before diagnosis. In total, therefore, 6953 patients were excluded, leaving data on 2436 patients for further analysis (Figure 1).

Statistical analyses

Descriptive measures were used to examine demographic, socioeconomic and cancer-related variables and comorbidity. We used multivariate logistic regression models to assess the association between each socioeconomic variable and affiliation to the work market. We conducted two sets of analyses. In the first, we estimated the risk for early retirement of all patients who were registered as affiliated to the work market one year before diagnosis, including unemployed patients ($n = 2436$) by site. In the second set, we calculated the risk for unemployment of the subgroup of patients who were working one year before diagnosis ($n = 1808$). In both sets of analyses, two models were run: with affiliation to the work market as a dependent variable and each socioeconomic variable, cancer-related variables and comorbidity as independent variables. The logistic regression analyses were computed to estimate crude and adjusted odds ratios (ORs) with 95% confidence intervals (CI), with adjustment for age, calendar year and gender in model 1 and additionally civil status, education, income, comorbidity, site and stage in model 2. The linearity of age was tested, and we found no departure from linearity. Further, interactions between socioeconomic variables, age, stage and comorbidity were tested, and none were found.

Results

Table I shows the general sociodemographic characteristics of the patients and their cancer-related factors and comorbidity. The median age was 52 years. Most of the patients were male (80%), married or cohabitating (69%), with a medium level of education (58%) and a disposable income in the 2nd or 3rd quartile (49%). Most patients had had oropharyngeal cancers (37%), followed by cancers of the oral cavity (22%), other larynx (16%), glottis (16%) and hypopharynx (9%). Most patients presented with stage IV disease (41%), and 20% had a Charlson comorbidity index score ≥ 1. All patients received radiotherapy, either as the only treatment (93%) or with surgery (6%) or chemotherapy (1%). A total of 1808 (74%) patients were employed and 628 (26%) unemployed one year before diagnosis (Table II). One year after diagnosis, 55 patients in the employed group (3% of all employed patients) and 74 patients in the unemployed group (12% of all unemployed patients) had received an early retirement pension. Further, 510 of all patients

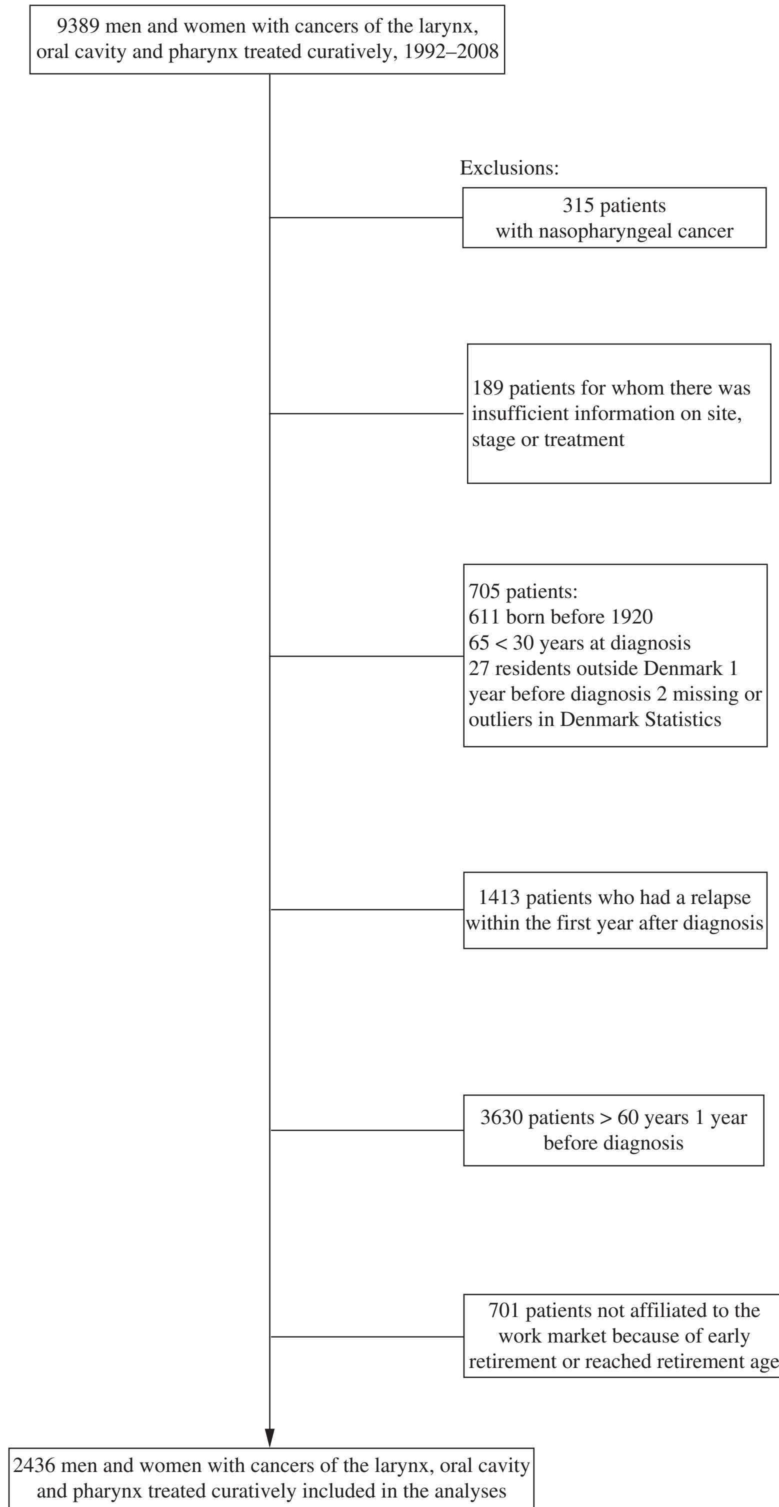

Figure 1. Inclusion of study participants.

(21%) were registered as unemployed one year after diagnosis, most of whom (n = 358, 70%) were unemployed before diagnosis (Table II).

In the fully adjusted logistic regression models of risk factors for early retirement among all patients affiliated to the work market, those significantly associated were: short or medium education (OR 4.8; 95% CI 2.2–10.4 and 2.7; 1.3–5.7), disposable income in the first and second to third quartiles (3.2; 1.8–5.8 and 1.8; 1.0–3.1), living alone (3.0; 2.1–4.4) and comorbidity score 1–2 or ≥ 3 (1.9; 1.3–3.0 and 5.9; 3.1–11) when compared with

Table I. Sociodemographic and disease- and treatment-related factors among 2436 curatively treated head-and-neck cancer patients who were affiliated to the work market 1 year before diagnosis, 1992–2008.

	No.	%
Age at diagnosis (years)		
31–40	91	3.7
41–50	810	33.3
51–60	1535	63
Mean	52	
Sex		
Male	1948	80
Female	488	20
Period of diagnosis		
1992–1996	611	25.1
1997–2000	568	23.3
2001–2004	637	26.1
2005–2008	620	25.5
Civil status		
Unmarried	320	13.1
Married or cohabitating[1]	1671	68.6
Divorced	413	17
Widow or widowed	32	1.3
Length of education[2]		
Short	543	22.3
Medium	1420	58.3
High	402	16.5
Unknown	71	2.9
Disposable income[3]		
Lowest (first quartile)	514	21.1
Middle (second to third quartile)	1193	49
Highest (fourth quartile)	697	28.6
Unknown	32	1.3
Charlson comorbidity index[4]		
0	1956	80.3
1–2	402	16.5
≥3	78	3.2
Site		
Glottic larynx	385	15.8
Other laryngeal cancers	399	16.4
Oropharynx	903	37.1
Hypopharynx	209	8.6
Oral cavity	540	22.1
Disease stage[5]		
I	459	18.8
II	483	19.8
III	489	20.1
IV	1005	41.3
Treatment		
Radiotherapy only	2264	92.9
Surgery and radiotherapy	144	5.9
Chemotherapy and radiotherapy	28	1.2

[1]Cohabitation is defined as, in the absence of marriage, two persons of the opposite sex, over the age of 16 years, with a maximum age difference of 15 years living at the same address with no other adult in residence.

[2]Short education: mandatory education of up to 7 and 9 years for patients born before and after 1 January 1958, respectively; medium education: highest grade of primary school, secondary school or vocational education (8–12 years for patients born before 1 January 1958 and 10–12 years for patients born after 1 January 1958); higher education: >12 years of education.

[3]Household income after taxation and interest adjusted for number of persons in the household; categorised on the basis of sex-specific distribution of household disposable income per person.

[4]Disorders as defined in the Charlson comorbidity index, grouped according to accumulated sum of scores. This index provides an overall score for comorbidity based on a composite of values weighted by level of severity assigned to 19 selected conditions scored from 1 to 6 [18]. For the purposes of this study, no cancers were included in the index. Scores are summarised on the basis of information on hospitalisations from 1978 onwards. The weights are assigned for each condition that a patient has and the total equals the score. Example: chronic pulmonary (1) and hemiplegia (2) = total score (3). Score 1: myocardial infarct, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease, ulcer disease, mild liver disease, diabetes type 1 and diabetes type 2. Score 2: hemiplagia, moderate-to-severe renal disease, diabetes with end-organ damage type 1 or type 2. Score 3: moderate-to-severe liver disease. Score 6: AIDS.

[5]Disease stage groupings are defined according to the UICC TNM stage grouping system [19].

patients with high education, disposable income in the fourth quartile, who were married and had a comorbidity score of 0 (Table III). None of the cancer-related factors, such as tumour site or stage, was significantly associated with early retirement.

For the subgroup of patients who were employed one year before diagnosis (n = 1808), the risk pattern was similar, although weaker, with short or medium education, low disposable income and living alone significantly associated with unemployment (Table III).

In analyses by tumour site, the associations between socioeconomic and cancer-related factors including comorbidity and early retirement (Table IV) and unemployment (Table V) showed the same pattern of increased ORs for socioeconomic factors and cohabitation status, although not all the estimates reached statistical significance and the confidence intervals were wide. Having a comorbidity score of ≥3 was significantly associated with early retirement in patients with cancers diagnosed in the oral cavity (OR 4.6; 95% CI 1.0–21), other larynx sites (11.5; 2.7–48) and oropharynx (7.8; 2.7–22) (Table IV). Among patients with glottic cancer, advanced tumour stage was significantly associated with unemployment (3.5; 1.2–10) when compared with patients with early-stage disease (Table V).

Discussion

In this nationwide register-based study of work market affiliation among 2436 younger Danish HNSCC survivors, lower level of education, lower disposable income, living alone and having comorbid conditions were significantly associated with early retirement for disability and unemployment one year after diagnosis. This pattern was found for all tumour sites. Our results also show that having been unemployed one year before diagnosis made early retirement one year after diagnosis more likely

Table II. Work market affiliation 1 year after diagnosis by employment status 1 year before diagnosis in 2436 patients with head-and-neck cancer, 1992–2008.

	1 year after diagnosis				
1 year before diagnosis	Employed n (%)	Unemployed n (%)	Anticipatory pensioner n (%)	Early retirement n (%)	Dead n (%)
Employed (N = 1808)	1530 (85)	152 (8)	9 (1)	55 (3)	62 (3)
Unemployed (N = 628)	124 (20)	358 (57)	8 (1)	74 (12)	64 (10)

than for people who had had a job one year before diagnosis. Cancer-related factors had less impact on the work market affiliation than socioeconomic factors and comorbidity.

Like previous studies [7], we found significant associations between a broad range of socioeconomic factors, such as level of education and disposable income, and risk for early retirement and unemployment. A study by Mehnert et al. [21] investigating among other things work-related predictors of return to work, found that belonging to a higher social class at baseline were associated with a significant higher rate of employment at follow-up, which suggests that people belonging to a higher social class have work environments that may provide more favourable working conditions in terms of flexibility, a lower degree of physically exhausting work, and better earnings [21]. A patient in a lower socioeconomic position may not encounter these beneficial work-environmental factors and the individual decision to apply for early retirement may therefore be easier. Our study shows that even though this patient population is at least in principle expected to be able to work, as they were registered as employed or available for the work market and treated with curative intent, poor social circumstances might determine whether they actually worked after treatment.

Previous studies suggested that post-treatment symptoms affect the work market affiliation of HNSCC survivors. Buckwalter and colleagues [22] investigated patient-reported factors associated with discontinuing employment among 239 employed HNSCC patients and found that 38% reported discontinuing work at the time of diagnosis, and only 41% of these returned to work within one year of treatment. The main reasons for not returning to work were fatigue, functional difficulties such as speech and eating problems, pain and changes in appearance. Taylor et al. [23] found that 52% of 384 HNSCC patients who were working before their diagnosis were disabled for work by their treatment; patients who had undergone neck dissection, chemotherapy or had a high pain score were the most severely affected. In other studies, the rates of discontinuing work after HNSCC treatment ranged from 17% to 59% [7,24,25]. Although our study indicates that pretreatment socioeconomic factors have a much stronger effect on work affiliation than cancer-related factors, more studies are needed to determine the impact of late-onset symptoms on work market affiliation.

HNSCC has been treated with radiotherapy in Denmark, in recent years with accelerated radiation and concomitant chemotherapy [8]. Although these procedures have been successful in minimising the disfigurement due to surgery, the combination treatment has enhanced toxicity in patients and induces a greater symptom burden after treatment [13,22,26]. It has been suggested that the prevalence of treatment-related symptoms is higher among patients treated with concomitant chemotherapy, which likely plays a role for the ability to work [22,27–29]. As most of the patients in this study were treated before concomitant chemotherapy became standard in Denmark, we were unable to investigate the association between combination therapy and work market affiliation.

The results of this study must be considered in the light of its strengths and limitations. The strengths include use of a comprehensive, nationwide study cohort obtained from a detailed clinical database over a long period, with virtually no loss to follow-up because of the precise linkage between our cohort and the population-based Danish administrative registries. Another strength is that we included only curatively treated, younger patients.

As this is a register-based study, we did not have information on the occurrence of late-onset symptoms in each individual and consequently no information on their impact on patients' daily lives. A previous study that included some of the patients studied here showed that 21–24% of the patients were suffering from pain requiring opioids, severe dysphagia (16–17%), severe xerostomia (18–21%), severe late mucosal oedema (11– 13%), severe mucosal atrophy (7%), severe fibrosis (11–13%), osteoradionecrosis (10%) and excessive dental caries (15–17%) [13]. These conditions affect eating, speaking and breathing functions and perhaps also the appearance of individuals, influencing their daily interactions with other people, which again might affect their work market affiliation.

Another limitation is that we had no information on work-related factors such as physical workload,

Table III. Associations between early retirement or unemployment 1 year after diagnosis and socioeconomic, treatment- and disease-related factors among 2436 curatively treated head-and-neck cancer patients who were affiliated to the work market 1 year before diagnosis and a subgroup of 1808 patients who were employed 1 year before diagnosis.

	Early retirement among patients affiliated to the work market (including unemployed) 1 year before diagnosis (N = 2436)[1]		Unemployment among patients who were employed 1 year before diagnosis (N = 1808)[1]	
	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)
Age (years)				
≤50	Reference	Reference	Reference	Reference
>50	1.4 (1.0–2.1)	1.4 (1.0–2.1)	1.0 (0.7–1.4)	1.0 (0.7–1.4)
Gender				
Male	Reference	Reference	Reference	Reference
Female	0.9 (0.6–1.3)	0.8 (0.5–1.2)	1.0 (0.6–1.5)	0.9 (0.6–1.5)
Cohabitation status				
Married/cohabiting[4]	Reference	Reference	Reference	Reference
Living alone	3.0 (2.1–4.2)	3.0 (2.1–4.4)	2.5 (1.5–4.2)	2.3 (1.6–3.2)
Length of education[5]				
High	Reference	Reference	Reference	Reference
Medium	2.9 (1.4–6.0)	2.7 (1.3–5.7)	2.1 (1.2–3.7)	1.9 (1.1–3.5)
Short	5.1 (2.4–10.9)	4.8 (2.2–10.4)	2.6 (1.4–4.8)	2.3 (1.2–4.2)
Disposable income[6]				
Highest (4th quartile)	Reference	Reference	Reference	Reference
Middle (2nd–3rd quartile)	2.5 (1.5–4.1)	1.8 (1.0–3.1)	2.2 (1.5–3.4)	1.8 (1.2–2.7)
Lowest (1st quartile)	5.4 (3.2–9.3)	3.2 (1.8–5.8)	2.9 (1.7–5.3)	2.4 (1.3–4.3)
Charlson comorbidity index[7]				
0	Reference	Reference	Reference	Reference
1–2	2.1 (1.5–3.3)	1.9 (1.3–3.0)	1.5 (1.0–2.4)	1.5 (1.0–2.3)
≥3	5.2 (2.8–9.8)	5.9 (3.1–11)	0.6 (0.1–2.4)	0.6 (0.1–2.3)
Site				
Glottic larynx	Reference	Reference	Reference	Reference
Other laryngeal	1.7 (0.9–3.2)	1.4 (0.7–2.6)	1.2 (0.7–2.0)	0.9 (0.5–1.7)
Oropharynx	1.5 (0.9–2.7)	1.4 (0.7–2.6)	0.8 (0.5–1.4)	0.7 (0.4–1.2)
Hypopharynx	2.0 (0.9–4.2)	1.5 (0.6–3.3)	1.7 (0.9–3.3)	1.3 (0.7–2.7)
Oral cavity	1.4 (0.8–2.6)	1.2 (0.6–2.3)	1.2 (0.7–2.1)	1.0 (0.5–1.7)
Disease stage[8]				
Early	Reference	Reference	Reference	Reference
Advanced	1.1 (0.8–1.6)	1.1 (0.7–1.5)	1.2 (0.9–1.7)	1.2 (0.9–1.7)

CI, confidence interval; OR, odds ratio.
[1]Missing values are not included in the analyses.
[2]Adjusted for age, gender and year of diagnosis.
[3]Adjusted for age, gender, year of diagnosis, stage, comorbidity status, civil status, education and site.
[4]Cohabitation is defined as, in the absence of marriage, two persons of the opposite sex, over the age of 16 years, with a maximum age difference of 15 years living at the same address with no other adult in residence.
[5]Short education: mandatory education of up to 7 and 9 years for patients born before and after 1 January 1958, respectively; medium education: highest grade of primary school, secondary school or vocational education (8–12 years for patients born before 1 January 1958 and 10–12 years for patients born after 1 January 1958); higher education: >12 years of education.
[6]Household income after taxation and interest adjusted for number of persons in the household; categorised on the basis of sex-specific distribution of household disposable income per person.
[7]Disorders as defined in the Charlson comorbidity index, grouped according to accumulated sum of scores. This index provides an overall score for comorbidity based on a composite of values weighted by level of severity assigned to 19 selected conditions scored from 1 to 6 [18]. For the purposes of this study, no cancers were included in the index. Scores are summarised on the basis of information on hospitalisations from 1978 onwards. The weights are assigned for each condition that a patient has and the total equals the score. Example: chronic pulmonary (1) and hemiplegia (2) = total score (3). Score 1: myocardial infarct, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease, ulcer disease, mild liver disease, diabetes type 1 and diabetes type 2. Score 2: hemiplagia, moderate-to-severe renal disease, diabetes with end-organ damage type 1 or type 2. Score 3: moderate-to-severe liver disease. Score 6: AIDS.
[8]Disease stage groupings are defined according to the UICC TNM stage grouping system [19].

Table IV. Stratified analyses of associations between socioeconomic and treatment- and disease-related variables and early retirement due to disability 1 year after cancer diagnosis among 2436 curatively treated, younger head-and-neck cancer patients who were affiliated to the work market (including unemployed patients) 1 year before diagnosis, by site.

	Glottic larynx (n = 385)		Other laryngeal cancers[1] (n = 399)		Oropharynx (n = 540)		Hypopharynx (n = 903)		Oral cavity (n = 209)	
	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)
Age (years)										
≤50	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
>50	0.6 (0.2–1.6)	0.7 (0.2–1.8)	1.4 (0.6–3.1)	1.2 (0.5–2.9)	2.2 (1.1–4.3)	1.9 (0.9–3.8)	1.8 (0.5–6.7)	2.7 (0.5–14)	1.4 (0.7–3.1)	1.6 (0.7–3.5)
Gender										
Male	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Female	0.9 (0.2–4.2)	0.9 (0.2–4.3)	1.2 (0.4–2.9)	1.1 (0.4–2.9)	0.7 (0.3–1.3)	0.5 (0.3–1.1)	NA	NA	0.9 (0.4–1.9)	0.6 (0.3–1.5)
Cohabitation status[4]										
Married/ cohabiting	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Living alone	2.4 (0.9–6.8)	2.3 (0.8–6.6)	2.9 (1.3–6.4)	3.4 (1.4–8.1)	3.4 (1.9–6.2)	3.5 (1.9–6.7)	1.8 (0.6–5.8)	2.4 (0.7–8.6)	3.5 (1.7–7.3)	3.9 (1.7–8.5)
Length of education[5]										
High	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Medium	NA	NA	1.8 (0.2–14)	2.2 (0.2–20)	2.3 (0.9–6.2)	1.8 (0.7–5.0)	1.8 (0.2–15)	1.6 (0.2–14)	5.4 (0.7–41)	5.8 (0.7–47)
Short	NA	NA	5.3 (0.7–42)	6.9 (0.8–62)	3.3 (1.4–9.5)	3.3 (1.1–9.9)	2.7 (0.3–29)	2.3 (0.2–26)	9.0 (1.1–72)	8.0 (1.0–66)
Disposable income[6]										
Highest (4th quartile)	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Middle (2nd–3rd quartiles)	6.9 (0.9–55)	5.1 (0.6–41)	1.8 (0.6–5.9)	1.4 (0.4–4.8)	1.9 (0.9–4.0)	1.3 (0.6–2.9)	1.8 (0.3–9.7)	0.8 (0.1–5.8)	3.5 (1.0–12)	3.5 (0.8–16)
Lowest (1st quartile)	15.3 (1.9–130)	14.1 (1.5–130)	6.5 (2.0–21)	4.4 (1.2–17)	3.6 (1.5–8.8)	1.9 (0.7–4.9)	6.6 (1.2–36)	5.6 (0.8–38)	5.1 (1.4–19)	3.7 (0.7–19)
Charlson comorbidity index[7]										
0	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
1–2	0.7 (0.1–3.1)	0.6 (0.1–2.9)	1.8 (0.7–4.4)	1.9 (0.7–4.9)	2.9 (1.4–5.8)	2.8 (1.3–6.0)	2.1 (0.6–7.5)	1.0 (0.2–5.1)	2.9 (1.4–6.3)	2.9 (1.3–6.5)
≥3	NA	NA	6.1 (1.6–23)	11.5 (2.7–48)	6.8 (2.5–18)	7.8 (2.7–22)	2.3 (0.2–23)	2.3 (0.2–24)	6.5 (1.6–27)	4.6 (1.0–21)
Disease stage[8]										
Early	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Advanced	1.0 (0.2–4.7)	0.9 (0.2–4.5)	1.2 (0.6–2.6)	1.1 (0.5–2.5)	1.2 (0.6–2.6)	1.1 (0.5–2.3)	1.1 (0.3–4.2)	1.7 (0.3–8.7)	0.7 (0.3–1.4)	0.7 (0.3–1.5)

CI, confidence interval; NA, not applicable because of small number; OR, odds ratio; missing values are not included in the analyses.

[1]Supraglottic or subglottic cancers.

[2]Adjusted for age, sex and year of diagnosis.

[3]Adjusted for age, sex, year of diagnosis, stage, comorbidity status, civil status and education.

[4]Cohabitation is defined as, in the absence of marriage, two persons of the opposite sex, over the age of 16 years, with a maximum age difference of 15 years living at the same address with no other adult in residence.

[5]Short education: mandatory education of up to 7 and 9 years for patients born before and after 1 January 1958, respectively; medium education: highest grade of primary school, secondary school or vocational education (8–12 years for patients born before 1 January 1958 and 10–12 years for patients born after 1 January 1958); higher education: >12 years of education.

[6]Household income after taxation and interest adjusted for number of persons in the household; categorised on the basis of sex-specific distribution of household disposable income per person.

[7]Disorders as defined in the Charlson comorbidity index, grouped according to accumulated sum of scores. This index provides an overall score for comorbidity based on a composite of values weighted by level of severity assigned to 19 selected conditions scored from 1 to 6 [18]. For the purposes of this study, no cancers were included in the index. Scores are summarised on the basis of information on hospitalisations from 1978 onwards. The weights are assigned for each condition that a patient has and the total equals the score. Example: chronic pulmonary (1) and hemiplegia (2) = total score (3). Score 1: myocardial infarct, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease, ulcer disease, mild liver disease, diabetes type 1 and diabetes type 2. Score 2: hemiplagia, moderate-to-severe renal disease, diabetes with end-organ damage type 1 or type 2. Score 3: moderate-to-severe liver disease. Score 6: AIDS.

[8]Disease stage groupings are defined according to the UICC TNM stage grouping system [19].

Table V. Stratified analysis of associations between unemployment 1 year after diagnosis and socioeconomic and treatment- and disease- related factors among 1808 head-and-neck cancer patients who were working 1 year before diagnosis, by site.

	Glottic larynx (n = 321)		Other laryngeal cancers[1] (n = 290)		Oropharynx (n = 706)		Hypopharynx (n = 148)		Oral cavity (n = 343)	
	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)	Crude[2] OR (95% CI)	Adjusted[3] OR (95% CI)	Crude[1] OR (95% CI)	Adjusted[2] OR (95% CI)	Crude[1] OR (95% CI)	Adjusted[2] OR (95% CI)	Crude[1] OR (95% CI)	Adjusted[2] OR (95% CI)
Age (years)										
≤ 50	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
> 50	1.0 (0.5–2.4)	1.6 (0.6–4.2)	0.8 (0.4–1.9)	0.9 (0.4–2.1)	1.2 (0.6–2.2)	1.0 (0.5–1.9)	0.5 (0.2–1.6)	0.6 (0.2–1.7)	1.0 (0.5–2.1)	1.2 (0.5–2.6)
Gender										
Male	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Female	0.9 (0.2–3.2)	0.6 (0.2–2.5)	0.7 (0.3–1.9)	0.7 (0.3–1.9)	1.4 (0.6–3.2)	1.4 (0.6–3.3)	1.8 (0.3–9.1)	1.8 (0.3–9.2)	0.7 (0.3–1.7)	0.6 (0.2–1.4)
Cohabitation status[4]										
Married/cohabiting	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Living alone	6.9 (2.8–17)	6.6 (2.6–16)	2.3 (1.0–5.5)	2.2 (0.9–5.3)	2.1 (1.1–4.0)	2.0 (1.1–3.9)	1.5 (0.4–5.1)	1.5 (0.4–5.6)	1.9 (0.9–4.0)	2.0 (0.9–4.5)
Length of education[5]										
High	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Medium	5.7 (0.7–44)	7.3 (0.8–67)	1.3 (0.3–6.3)	1.2 (0.2–5.7)	1.3 (0.6–2.9)	1.2 (0.5–2.7)	3.2 (0.4–28)	3.0 (0.3–27)	3.3 (1.0–12)	2.7 (0.8–10)
Short	5.9 (0.7–48)	6.2 (0.7–59)	1.8 (0.4–8.9)	1.2 (0.2–6.7)	2.2 (0.9–5.6)	2.0 (0.8–5.2)	5.9 (0.6–59)	5.9 (0.6–60)	1.6 (0.3–7.4)	1.1 (0.2–5.6)
Disposable income[6]										
Highest (4th quartile)	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Middle (2nd–3rd quartile)	1.6 (0.6–3.9)	0.9 (0.3–2.4)	1.8 (0.7–4.9)	1.5 (0.5–4.3)	2.8 (1.3–5.9)	2.4 (1.0–5.3)	2.6 (0.8–9.4)	2.4 (0.6–9.1)	2.4 (0.9–6.3)	2.1 (0.8–5.6)
Lowest (1st quartile)	2.7 (0.8–9.2)	1.1 (0.3–4.6)	2.6 (0.7–10)	2.0 (0.5–8.6)	3.4 (1.2–9.8)	3.0 (1.0–8.8)	0.9 (0.1–11)	0.8 (0.1–11)	3.6 (1.1–12)	2.8 (0.8–10)
Charlson comorbidity index[7]										
0	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
1–2	0.9 (0.3–2.8)	0.9 (0.3–3.0)	1.8 (0.7–4.4)	1.8 (0.7–4.5)	1.5 (0.7–3.3)	1.4 (0.6–3.2)	0.7 (0.1–3.9)	0.6 (0.1–3.6)	2.5 (1.0–5.9)	2.7 (1.1–6.8)
≥ 3	NA	NA	NA	NA	1.1 (0.1–8.8)	1.2 (0.1–9.9)	1.2 (0.1–12)	1.4 (0.1–15)	NA	NA
Disease stage[8]										
Early	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Advanced	3.4 (1.2–9.2)	3.5 (1.2–10)	1.2 (0.5–2.8)	1.2 (0.5–2.8)	0.9 (0.4–2.0)	0.9 (0.4–2.0)	1.6 (0.4–6.5)	1.5 (0.3–6.2)	1.6 (0.7–3.5)	1.3 (0.6–2.9)

CI, confidence interval; NA, not applicable because of small numbers; OR, odds ratio; missing values are not included in the analyses.

[1]Supraglottic or subglottic cancers.

[2]Adjusted for age, sex and year of diagnosis.

[3]Adjusted for age, sex, year of diagnosis, stage, comorbidity status, civil status and education.

[4]Cohabitation is defined as, in the absence of marriage, two persons of the opposite sex, over the age of 16 years, with a maximum age difference of 15 years living at the same address with no other adult in residence.

[5]Short education: mandatory education of up to 7 and 9 years for patients born before and after 1 January 1958, respectively; medium education: highest grade of primary school, secondary school or vocational education (8–12 years for patients born before 1 January 1958 and 10–12 years for patients born after 1 January 1958); higher education: > 12 years of education.

[6]Household income after taxation and interest adjusted for number of persons in the household; categorised on the basis of sex-specific distribution of household disposable income per person.

[7]Disorders as defined in the Charlson comorbidity index, grouped according to accumulated sum of scores. This index provides an overall score for comorbidity based on a composite of values weighted by level of severity assigned to 19 selected conditions scored from 1 to 6 [18]. For the purposes of this study, no cancers were included in the index. Scores are summarised on the basis of information on hospitalisations from 1978 onwards. The weights are assigned for each condition that a patient has and the total equals the score. Example: chronic pulmonary (1) and hemiplegia (2) = total score (3). Score 1: myocardial infarct, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease, ulcer disease, mild liver disease, diabetes type 1 and diabetes type 2. Score 2: hemiplagia, moderate-to-severe renal disease, diabetes with end-organ damage type 1 or type 2. Score 3: moderate-to-severe liver disease. Score 6: AIDS.

[8]Disease stage groupings are defined according to the UICC TNM stage grouping system [19].

work stress, work intensity and work hours and their effect on resumption of work and patient-perceived ability to work [1,29]. All these variables should be considered in order to obtain true estimates. Additionally, we had no information on individual motivational factors, such as scepticism about returning to work, which were shown to be significant in earlier studies [21]. Further, we did not have information on sickness absence one year after diagnosis. This may have introduced some misclassification. Although sickness absence is only granted for 52 weeks it can be prolonged and the 52 weeks can be used at any point within 18 months.

In conclusion, cancer-related factors had less impact on work market affiliation than socioeconomic factors and comorbidity. Shorter education, lower disposable income, being divorced or unmarried and comorbidity were significantly associated with early retirement and unemployment in curatively treated HNSCC survivors who were affiliated to the work market before diagnosis. Clinicians treating HNSCC patients should be aware of the vulnerability of those with short education, low income and living alone in respect of their affiliation to the work market, in order to initiate intensive social support or targeted rehabilitation to improve or maintain their affiliation.

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References

[1] Mehnert A. Employment and work-related issues in cancer survivors. Crit Rev Oncol Hematol 2011;77:109–30.

[2] de Boer AG, Taskila T, Ojajarvi A, van Dijk FJ, Verbeek JH. Cancer survivors and unemployment: A meta-analysis and meta-regression. JAMA 2009;301:753–62.

[3] Moran JR, Short PF, Hollenbeak CS. Long-term employment effects of surviving cancer. J Health Econ 2011;30:505–14.

[4] Park JH, Park JH, Kim SG. Effect of cancer diagnosis on patient employment status: A nationwide longitudinal study in Korea. Psychooncology 2009;18:691–9.

[5] Damkjaer LH, Deltour I, Suppli NP, Christensen J, Kroman NT, Johansen C, et al. Breast cancer and early retirement: Associations with disease characteristics, treatment, comorbidity, social position and participation in a six-day rehabilitation course in a register-based study in Denmark. Acta Oncol 2011;50:274–81.

[6] Taskila T, Lindbohm ML. Factors affecting cancer survivors' employment and work ability. Acta Oncol 2007;46: 446–51.

[7] Vartanian JG, Carvalho AL, Toyota J, Kowalski IS, Kowalski LP. Socioeconomic effects of and risk factors for disability in long-term survivors of head and neck cancer. Arch Otolaryngol Head Neck Surg 2006;132:32–5.

[8] Brockstein B, Masters G. Head and neck cancer. Dordrecht: Kluwer Academic Publishers; 2010.

[9] Conway DI, McMahon AD, Smith K, Black R, Robertson G, Devine J, et al. Components of socioeconomic risk associated with head and neck cancer: A population-based case-control study in Scotland. Br J Oral Maxillofac Surg 2010;48:11–7.

[10] Greenwood M, Thomson PJ, Lowry RJ, Steen IN. Oral cancer: Material deprivation, unemployment and risk factor behavior – an initial study. Int J Oral Maxillofac Surg 2003;32:74–7.

[11] Schultz PN, Beck ML, Stava C, Sellin RV. Cancer survivors. Work related issues. AAOHN J 2002;50:220–6.

[12] Syse A, Tretli S, Kravdal O. Cancer's impact on employment and earnings – a population-based study from Norway. J Cancer Surviv 2008;2:149–58.

[13] Mortensen HR, Overgaard J, Specht L, Overgaard M, Johansen J, Evensen JF, et al. Prevalence and peak incidence of acute and late normal tissue morbidity in the DAHANCA 6 & 7 randomised trial with accelerated radiotherapy for head and neck cancer. Radiother Oncol 2012;103:69–75.

[14] DAHANCA (Danish Head and Neck Cancer Group), 2012. Available from: www.dahanca.dk

[15] Pedersen CB. The Danish Civil Registration System. Scand J Public Health 2011;39:22–5.

[16] Dalton SO, Steding-Jessen M, Gislum M, Frederiksen K, Engholm G, Schuz J. Social inequality and incidence of and survival from cancer in a population-based study in Denmark, 1994–2003: Background, aims, material and methods. Eur J Cancer 2008;44:1938–49.

[17] Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. Scand J Public Health 2011;39:30–3.

[18] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. J Chronic Dis 1987; 40:373–83.

[19] Sobin LH, Wittekind C. TNM classification of malignant tumours, 6th ed. New York: Wiley; 2002.

[20] Hall SF, Groome PA, Irish J, O'Sullivan B. TNM-based stage groupings in head and neck cancer: Application in cancer of the hypopharynx. Head Neck 2009;31:1–8.

[21] Mehnert A, Koch U. Predictors of employment among cancer survivors after medical rehabilitation – a prospective study. Scand J Work Environ Health Epub 2012 Mar 15.

[22] Buckwalter AE, Karnell LH, Smith RB, Christensen AJ, Funk GF. Patient-reported factors associated with discontinuing employment following head and neck cancer treatment. Arch Otolaryngol Head Neck Surg 2007; 133:464–70.

[23] Taylor JC, Terrell JE, Ronis DL, Fowler KE, Bishop C, Lambert MT, et al. Disability in patients with head and neck cancer. Arch Otolaryngol Head Neck Surg 2004;130:764–9.

[24] Nalbadian M, Nikolaou A, Nikolaidis V, Petridis D, Themelis C, Daniilidis I. Factors influencing quality of life in laryngectomized patients. Eur Arch Otorhinolaryngol 2001;258:336–40.

[25] Verdonck-de Leeuw IM, van Bleek WJ, Leemans CR, de Bree R. Employment and return to work in head and neck cancer survivors. Oral Oncol 2010;46:56–60.

[26] Miller KD, Triano LR. Medical issues in cancer survivors – a review. Cancer J 2008;14:375–87.

[27] de Boer AG, Verbeek JH, Spelten ER, Uitterhoeve AL, Ansink AC, de Reijke TM, et al. Work ability and return-to-work in cancer patients. Br J Cancer 2008;98:1342–7.

[28] Mols F, Thong MS, Vreugdenhil G, van de Poll-Franse LV. Long-term cancer survivors experience work changes after diagnosis: Results of a population-based study. Psychooncology 2009;18:1252–60.

[29] Taskila T, Martikainen R, Hietanen P, Lindbohm ML. Comparative study of work ability between cancer survivors and their referents. Eur J Cancer 2007;43:914–20.