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Sociodemographic factors and quality of life as prognostic indicators in head and neck cancer

A. de Graeff [a,*], J.R.J. de Leeuw [b], W.J.G. Ros [b], G.J. Hordijk [c], G.H. Blijham [a], J.A.M. Winnubst [b]

[a] *Department of Internal Medicine, F.02.126, University Medical Center, Heidelberglaan 100, 3584 HM Utrecht, The Netherlands*
[b] *Research Group Psychology of Health and Illness, University Medical Center, Utrecht, The Netherlands*
[c] *Department of Otorhinolaryngology, University Medical Center, Utrecht, The Netherlands*

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Abstract

Pre-treatment quality of life (QOL) has been found to be an independent prognostic factor for survival in cancer patients, in particular in patients with advanced cancer. Sociodemographic factors such as marital and socioeconomic status have also been recognised as prognostic factors. We studied the influence of QOL and mood (measured with the European Organization for Research and Treatment of Cancer Core Questionnaire (EORTC QLQ-C30) and the Head and Neck Cancer Questionnaire (EORTC QLQ-H&N35), and with the Center for Epidemiologic Studies-Depression Scale (CES-D)) as measured before treatment, the use of cigarettes and alcohol and sociodemographic factors (age, gender, marital status, income and occupation) on recurrence and survival in 208 patients with head and neck cancer prior to treatment with surgery and/or radiotherapy, using Kaplan–Meier and Cox regression analyses. Cognitive functioning and, to a lesser degree, marital status were independent predictors of recurrence and survival, along with medical factors (stage and radicality). Patients with less than optimal cognitive functioning and unmarried patients had a relative risk (RR) of recurrence of 1.72 (95% confidence interval (95% CI) 1.01–2.93) and 1.85 (95% CI 1.06–3.33), respectively, and a RR of dying of 1.90 (95% CI 1.10–3.26) and 1.82 (95% CI 1.03–3.23), respectively. Performance status, physical functioning, mood and global QOL and smoking and drinking did not predict for recurrence and survival. The influence of cognitive functioning might be related to the use of alcohol. Marital status may influence prognosis through mechanisms of health behaviour and/or social support mechanisms.

Keywords: Head and neck cancer; Quality of life; Sociodemographic factors; Prognostic factors

1. Introduction

Quality of life (QOL) is increasingly acknowledged as an important endpoint in cancer clinical trials and clinical practice, along with the traditional endpoints like tumour response rate, disease-free survival and overall survival [1,2]. Studies that include a QOL endpoint have focused primarily on the longitudinal impact of disease or treatment on QOL. However, recent studies have established that pretreatment QOL may also have prognostic significance [3].

One of the first measures of QOL was the Karnofsky performance status (KPS) [4], which is a physician-rated instrument evaluating three dimensions of health status simultaneously (activity, work, and self-care) [5]. Although by today's standards this is considered to be an inadequate tool to measure QOL, it has been shown to correlate with survival in several studies in cancer patients [6–8]. However, it seems that some multidimensional measures of QOL may be more accurate predictors of survival than the KPS. Pre-treatment QOL has been shown to correlate with survival in studies in lung cancer [9–14], breast cancer [15,16], colorectal cancer [17,18], multiple myeloma [19], malignant melanoma [20], and mixed populations of cancer patients [21–27]. The majority of these studies used patient-rated instruments; in some of the studies a physician-rated instrument (the Spitzer QOL Index) [28] was also or only used [15,18,20,21]. Almost all of these studies were performed in patients with advanced and often incurable disease, and QOL was usually assessed prior to chemotherapy, usually within a clinical trial.

* Corresponding author. Tel.: +31-30-2506308; fax: +31-30-2523741.

E-mail address: a.graeff@digd.azu.nl (A. de Graeff).

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Sociodemographic factors, in particular marital and socioeconomic status, have been shown to correlate with survival in cancer patients. In a population-based study in 27 779 cancer patients, unmarried persons had an increased risk of dying (relative risk (RR) 1.23, 95% confidence interval (95% CI) 1.19–1.28) [29]. In one of the studies assessing the prognostic influence of QOL on survival in lung cancer patients, marital status was also found to have an influence on survival [10]. In a Canadian study, in several types of cancer (including head and neck cancer), a strong and statistically significant association was found between socioeconomic status and survival [30]. Socioeconomic differences in cancer survival were also found in another study [31].

In cancer patients, disease- and treatment-related factors have a major influence on prognosis, and any study of prognostic factors should take these into account. In head and neck cancer, stage is probably the most important factor. Other factors, such as site, grade of differentiation, growth pattern, type of treatment and positive tumour margins may also have an influence, but their prognostic influence is less clear [32].

We performed a prospective study in patients with head and neck cancer receiving surgery and/or radiotherapy with curative intent, in which QOL was measured before treatment. One of the aims of the study was to assess the prognostic significance (with regard to both recurrence and survival) of pre-treatment QOL variables in this patient group. We also studied whether smoking, drinking and sociodemographic variables were an independent prognostic factor. In this paper, we analyse the results after a minimum follow-up of 3 years.

2. Patients and methods

2.1. Patients

Patients were eligible for the study if they had squamous cell carcinoma of the oral cavity, oropharynx, hypopharynx or larynx treated with surgery and/or radiotherapy with curative intent. Other inclusion criteria were: age less than 80 years; no previous or synchronous malignancies; no cognitive impairment (as judged by the physician); ability to understand and to read Dutch. During the inclusion period (May 1994–June 1996), 266 patients met the inclusion criteria. Fifty-eight patients refused to participate in the study (refusal rate 22%). Reasons for refusal were almost always related to the fact that the patients had recently heard their diagnosis and treatment plan and felt emotionally unable to participate in this study. Patients who refused to participate did not differ significantly with regard to gender, age, tumour site and stage compared with the study patients.

Patient characteristics are summarised in Table 1. Sixty-three per cent ($n=101$) of married patients had American Joint Committee on Cancer (AJCC) stage 0–II disease, as opposed to 48% ($n=23$) of unmarried (including divorced or widowed) patients ($P=0.06$, Chi-square test). Forty per cent ($n=83$) of the patients did not use alcohol, 45% ($n=94$) used 1–5 units/day and 15% ($n=31$) used more than 5 units alcohol/day. Thirty-seven per cent ($n=77$) did not smoke, 16% ($n=33$) smoked 1–10 cigarettes/day, 21% ($n=44$) smoked 11–20 cigarettes/day and 26% ($n=54$) smoked

Table 1
Patient characteristics ($n=208$)

Median age (range)	60 years (29–78)
Sex	
Male	163 (78%)
Female	45 (22%)
Martial status	
Married	160 (77%)
Unmarried/divorced/widowed	48 (23%)
Karnofsky performance status	
60–80	26 (13%)
90	158 (76%)
100	24 (12%)
Total score of the CES-D[a]	
<16	147 (71%)
$\geqslant 16$	61 (29%)
Site	
Oral cavity	85 (41%)
Oropharynx	15 (7%)
Hypopharynx	11 (5%)
Larynx	94 (45%)
Oral cavity + oropharynx	2 (1%)
Oral cavity + larynx	1 (0.5%)
AJCC[b] Stage	
0	2 (1%)
I	69 (33%)
II	53 (25%)
III	12 (6%)
IV	72 (35%)
Grade of differentiation	
well	25 (12%)
moderately	170 (82%)
poorly	13 (6%)
Growth pattern	
favourable	37 (18%)
unfavourable	78 (38%)
undetermined	93 (45%)
Treatment	
Surgery	40 (19%)
Radiotherapy	91 (44%)
Surgery + radioteraphy	77 (37%)
Radicality	
Radical resection	74 (36%)
Dysplasia in surgical margins	20 (10%)
Irradical resection	23 (11%)
Not applicable (radiotherapy only)	91 (44%)

[a] CES-D, Center for Epidemiological Studies-Depression Scale.
[b] AJCC, American Joint Committee on Cancer.

>21 cigarettes/day. There were no significant differences in the use of alcohol or cigarettes between married and unmarried patients (data not shown). Baseline QOL data are given in Table 2. The study was approved by the ethical committee of the hospital.

2.2. Methods

The patients completed a questionnaire before the start of treatment. The questionnaire consisted of the The European Organization for Research and Treatment of Cancer Core Quality of Life Questionnaire (EORTC QLQ-C30)(+3), the The European Organization for Research and Treatment of Head and Neck Cancer Quality of Life Questionnaire (EORTC QLQ-H&N35), and the Centre for Epidemiological Studies-Depression (CES-D) Scale.

Table 2
Baseline quality of life (QOL)

EORTC QLQ-C30(+3)[a]	
Physical functioning	88.9±18[b]
Emotional functioning	68.5±22
Cognitive functioning	86.7±19
Social functioning	87.0±19
Role functioning	84.0±23
Global QOL	69.9±20
Fatigue	21.3±22
Pain	20.4±23
Nausea and vomiting	2.5±8
Dyspnoea	12.0±20
Insomnia	26.0±30
Appetite loss	9.9±21
Constipation	3.7±12
Diarrhoea	3.8±13
Financial difficulties	6.6±17
EORTC QLQ-H&N35[c]	
Pain	25.0±22
Swallowing	15.0±22
Senses (taste/smell)	6.7±15
Speech	23.2±24
Social contact	5.4±10
Social eating	10.7±16
Sexuality	19.8±28
Teeth	22.2±31
Open mouth (trismus)	8.9±22
Dry mouth	17.8±27
Sticky saliva	17.9±27
Cough	21.5±27
Feeling ill	13.1±20
CES-D[d]	
Total score	12.4±8
Percentage with total score ⩾16	29%

[a] EORTC QLQ-C30, The European Organization for Research and Treatment of Cancer Core Quality of Life Questionnaire.

[b] Values are given as mean±standard deviation. A high score reflects a high level of symptoms or functioning or global QOL.

[c] EORTC QLQ-H&N35, The European Organization for Research and Treatment of Head and Neck Cancer Quality of Life Questionnaire.

[d] CES-D, see Table 1.

The EORTC QLQ-C30 is a widely used questionnaire incorporating a range of QOL issues relevant to a broad range of cancer patients [33]. It has been validated for many types of cancer including head and neck cancer [34]. It contains five functional scales (physical, role, cognitive, emotional and social), three symptom scales (fatigue, pain and nausea/vomiting), a global QOL scale and six single-items (dyspnoea, insomnia, appetite loss, constipation, diarrhoea and financial difficulties). Version 30(+3) contains two additional items on role functioning and one additional item on overall health. The EORTC QLQ-C30(+3) is meant to be used in conjunction with a tumour-specific module.

The EORTC QLQ-H&N35 is a module used for assessing QOL in head and neck cancer patients [35]. It contains seven symptom scales (pain, swallowing, taste/smell, speech, social eating, social contacts and sexuality) and six symptom items (teeth problems, trismus, dry mouth, sticky saliva, cough and feeling ill). It has been validated in a sample of 500 patients with head and neck cancer from Norway, Sweden and The Netherlands [36].

All scales and items of the EORTC QLQ-C30(+3) and QLQ-H&N35 range in score from 0 to 100. A high score for a functional or global QOL scale represents a high level of functioning or global QOL, whereas a high score for a symptom scale or item represents a high level of symptoms or problems [37].

The CES-D Scale is an instrument used for measuring depression in the general (non-psychiatric) population [38]. The Dutch translation has also been validated [39]. It results in a total score ranging from 0 to 60. A high score reflects a high level of depression. A total score of ⩾16 indicates a possible case of depression.

2.3. Analysis

The data were analysed using the Statistical Package for the Social Sciences (SPSS) for Windows [40]. Kaplan–Meier and Cox Regression analyses were performed for time to progression (TTP) (defined as locoregional recurrence and/or distant metastases), survival (time to death, regardless of cause), and time to event (TTE) (which was defined as the time to progression or death, whichever came first). Patients who were still alive at the time of the analysis were censored for survival at the time of their last visit to the outpatient clinic; patients who died due to other causes were censored for TTP at the time of their death.

For univariate analysis, Kaplan–Meier and Cox regression analyses were used for categorical and continous variables, respectively. The log rank test was used to test the equality of the survival distributions for different levels of categorical variables. A RR was calculated (with a 95% CI) for every categorical variable.

For multivariate analysis, Cox regression analysis was performed in two ways: either a group of variables was

entered simultaneously using method enter, or a stepwise method (likelihood ratio statistic) was used. For the stepwise method, both forward and backward procedures were performed. Both methods yielded the same results.

For comparisons of recurrence or death between groups at 3 years, Pearson's Chi-square test was used.

The following variables were analysed:

- Sociodemographic: Sex, age, marital status (married or living with partner versus unmarried (including divorced or widowed)), family income, and occupation. For occupation, we used the classification of the Netherlands Central Bureau of Statistics [41]. In this classification, five occupational levels are distinguished.
- The number of cigarettes and units of alcohol per day, as reported by the patients themselves.
- Medical:
  - KPS (60–80 versus 90 versus 100);
  - Site;
  - AJCC stage [42] (0, I, or II, versus III or IV)
  - Grade of differentiation (well, moderate or poor);
  - Growth pattern (defined as unfavourable (in case of spidery growth, angio-invasion, and/or perineural growth), versus favourable (in the absence of all of these characteristics) or undetermined (if only a biopsy was available));
  - Treatment (radiotherapy or surgery as single treatments versus the treatments combined);
  - Radicality (irradical resection or dysplasia in the surgical margins versus radical resection or not applicable (in the case of radiotherapy as the only treatment));
- Quality of life: All scales and single items of the EORTC QLQ-C30(+3) and the EORTC QLQ-H&N35, and the total score of the CES-D. QOL variables were treated in two ways: as continuous variables in Cox regression analyses and as dichotomous variables (split according to the median) in Kaplan–Meier analyses. The method yielding the most significant results was used in the multivariate analysis.

We were primarily interested in the prognostic value of the QOL, smokling, drinking and sociodemographic variables. Clearly, correction for the influence of medical variables is essential. In multivariate analysis, this was achieved by either entering the medical variables first, followed by QOL and sociodemographic variables, or by entering all the variables simultaneously.

3. Results

The median follow-up of the living patients is 45 months (range 36–62). The occurrence of local recurrence and/or distant metastases, secondary tumours and death is shown in Table 3. 55 patients developed a local recurrence and/or distant metastases. At the time of the analysis, 16 of these patients had received curative treatment (laryngectomy or neck dissection) and were free of disease, two were alive with incurable disease, and 37 had died of local recurrence or distant metastases. Twenty-five patients developed a secondary tumour of the oral cavity ($n=1$), oropharynx ($n=2$), oesophagus ($n=1$), bronchus ($n=13$), or elsewhere ($n=8$). 11 of these patients died due to their secondary tumour. 9 patients died due to other causes. Univariate analyses of the influence of sociodemographic and medical variables on TTP, survival and TTE are presented in Table 4. Relative risks of recurrence and death are summarised in Table 5.

Table 3
Recurrence, secondary tumours and death ($n=208$)

Recurrence:	55 (26%)
Locoregional	43
Distant metastases	8
Locoregional and distant metastases	4
Secondary tumour:	25 (12%)
Head and neck	4
Bronchus	13
Elsewhere	8
Death	57 (27%)
Due to primary tumour	37
Due to secondary tumour	11
Due to other causes	9

Table 4
Univariate analysis: influence of sociodemographic and medical variables on time to progression (TTP), survival and time to event (TTE)

	TTP	Survival	TTE
Sex	NS[a]	NS	NS
Age	NS	NS	NS
Marital status	$P=0.05$	$P=0.01$	$P=0.02$
Family income	NS	NS	NS
Occupational level[b]	NS	NS	NS
Karnofsky performance status[c]	NS	NS	NS
Site	NS	NS	NS
Stage[d]	$P=0.004$	$P=0.0001$	$P=0.006$
Grade of differentiation[e]	NS	NS	NS
Growth pattern[f]	$P=0.008$	$P=0.008$	$P=0.01$
Treatment[g]	$P=0.01$	$P=0.001$	$P=0.02$
Radicality[h]	$P=0.0002$	$P=0.00001$	$P=0.001$

[a] NS, non significant ($P>0.05$).
[b] Classification of The Netherlands Bureau of Statistics.
[c] 60–80 versus 90 versus 100.
[d] O, I or II versus III or IV.
[e] Well versus moderate versus poor.
[f] Unfavourable versus Favourable/undetermined.
[g] Radiotherapy or surgery versus combined treatment.
[h] Radical/not applicable versus irradical/dysplasia in the resection margins.

Table 5
Relative risk (RR) (with 95% confidence intervals (95% CIs)) of recurrence (locoregional and/or distant) and death associated with selected sociodemographic and medical factors

	Recurrence	Death
Marital status		
Married	1.00	1.00
Unmarried/divorced/widowed	1.85 (1.06–3.33)	1.82 (1.03–3.23)
Stage		
0, I or II	1.00	1.00
III or IV	2.24 (1.31–3.82)	3.00 (1.75–5.14)
Growth pattern		
Favourable/not determined	1.00	1.00
Unfavourable	2.10 (1.24–3.57)	2.19 (1.30–3.69)
Treatment		
Surgery or radiotherapy	1.00	1.00
Combined treatment	2.06 (1.21–3.50)	2.79 (1.69–4.73)
Radicality:		
Radical resection/not applicable	1.00	1.00
Irradical resection/dysplasia in The surgical margins	2.73 (1.57–4.74)	3.24 (1.89–5.55)

There were no significant differences in TTP, survival and TTE between the study patients and the patients who refused to participated in the study (data not shown).

With regard to sociodemographic factors, marital status was significantly related to TTP, survival and TTE. Unmarried patients had a (RR) of recurrence of 1.85 (95% CI 1.06–3.33) and a RR of dying of 1.82 (95% CI 1.03–3.23). Twenty-three per cent ($n=37$) of married patients developed a recurrence within 3 years, as opposed to 37% ($n=18$) of unmarried patients ($P=0.04$); the percentages of patients, who died, were 21% ($n=34$) and 35% ($n=17$), respectively ($P=0.03$). Sex, age, income and occupational level were unrelated to TTP, survival and TTE.

The influence of smoking and drinking on TTP, survival or TTE was studied by using Cox regression analysis (using the number of cigarettes or units of alcohol per day) and by comparing non-users and users. Neither of the analyses yielded any significant results.

Advanced stages, unfavourable growth patterns, combined treatment and irradical resections or dysplasia in the surgical margins were all significantly predictive of recurrence (RR 2.24 (95% CI 1.31–3.82), 2.10 (95% CI 1.24–3.57), 2.06 (95% CI 1.21–3.50), and 2.73 (95% CI 1.57–4.74), respectively) and death (RR 3.00 (95% CI 1.75–5.14), 2.19 (95% CI 1.30–3.69), 2.79 (95% CI 1.69–4.73), and 3.24 (95% CI 1.89–5.55), respectively). Karnofsky performance status and grade of differentiation had no significant influence.

With regard to QOL variables, cognitive, role and social functioning, trismus, social contact and speech were significantly ($P<0.05$) related to TTP, whereas physical, cognitive, and social functioning, social contact, fatigue and trismus were all significantly related to survival. All these variables and also cough and global QOL were significantly related to TTE. Lower levels of functioning and global QOL, and higher levels of symptoms were associated with a lower TTP, survival and TTE. The total score of the CES-D did not predict for recurrence or survival.

Multivariate analysis was performed in several ways. Firstly, all QOL variables which were significantly related in the univariate analysis to TTE (physical, cognitive, role and social functioning, social contact, global QOL, fatigue, trismus, speech and cough), were entered simultaneously in a stepwise procedure. With regard to TTP and TTE, cognitive functioning remained independently significant. Cognitive and social functioning were independent predictors of survival.

Secondly, all sociodemographic and medical variables, which were significantly related in the univariate analysis to TTE (marital status, stage, growth pattern, treatment and radicality), were entered first (using method enter), followed by entering the same QOL variables as in the first analysis in a stepwise procedure. During this procedure, cognitive functioning was the only QOL variable which remained an independent predictor of TTP, survival and TTE.

Thirdly, all the sociodemographic, medical and QOL variables mentioned above were entered simultaneously in a single stepwise procedure. In this model, radicality, stage and cognitive functioning were independent predictors of recurrence, survival and TTE. For TTE, marital status was a fourth independent predictor.

In order to define a RR, cognitive functioning was dichotomised: patients with a score of 100 ($n=120$) versus patients with a lower score ($n=88$). In the multivariate model, patients with a cognitive functioning score <100 had a RR of 1.72 (95% CI 1.01–2.93) of recurrence, and a RR of death of 1.90 (1.10–3.26), compared with patients with a maximal score. Fig. 1 shows survival according to the cognitive functioning score. The difference between the two curves was significant ($P=0.017$).

4. Discussion

In this prospective study in patients with head and neck cancer receiving primary treatment with surgery and/or radiotherapy, we found that cognitive functioning, as measured by the EORTC QLQ-C30(+3), was a strong predictor of recurrence and survival, independent of medical factors (stage and radicality). Marital status was only an independent prognostic factor with regard to TTE. When only QOL variables were studied, social functioning was also predictive of survival, but this effect disappeared after correction for prognostic medical factors.

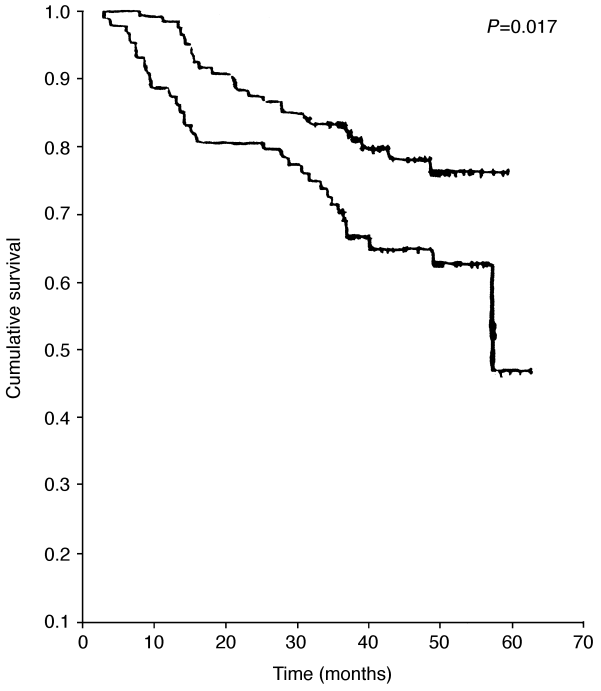

Fig. 1. Survival (months) of patients with optimal cognitive functioning (score = 100, upper curve)(n = 120) versus survival of patients with less than optimal cognitive functioning (score < 100, lower curve) (n = 88).

Several studies have shown pretreatment (domains of) QOL to be predictive of survival in cancer patients. In multivariate analyses, the following QOL variables were shown to be predictive: performance status [13,14,19, 20,22–25], physical functioning [9,19,25–27], physical well being [15], symptom scores as assessed by the Functional Living Index-Cancer [10,13,14,16,18], the Rotterdam Symptom Checklist [17], or the Memorial Symptom Assessment Scale [16,22], pain [11], psychosocial functioning [12,20,23,24], Spitzer QOL index [15,18,20,21], and global QOL [20,22,23]. Six studies used the EORTC QLQ-C30 [11,19,23,24,26,27]. In two of these [19,23], cognitive functioning was a prognostic factor for survival, but only in univariate analysis. It should be realised that these studies almost exclusively included patients with advanced disease with a poor prognosis, in which large variations in performance status and QOL are likely to exist. QOL variables which predict survival in these patients may not be relevant for cancer patients receiving primary treatment. For example, in our sample of patients the great majority of patients had a pretreatment KPS of 90 or 100, and a score of the physical functioning scale of the QLQ-C30(+3) of 80–100. The patients generally had few symptoms and indicated a high level of global QOL prior to treatment. Thus, it is not surprising that these variables have no predictive value for recurrence or survival in our sample of patients.

One longitudinal study has been published with regard to psychosocial and physical correlates of survival and recurrence in a sample of 133 patients with head and neck cancer [43]. Multivariate analysis indicated that the absence of lymph node metastases, pretreatment non-smoking, high self-efficacy (i.e. higher perceived physical abilities, possibly related to coping and adaptation), and expression of psychosocial complaints prior to treatment predicted for less recurrence and better survival.

The relationship between cognitive functioning and prognosis is not immediately clear. In one other prospective study (in breast cancer patients), a relationship was found between a low level of cognitive disturbances and disease-free survival, but not overall survival [44]. No clear explanation for this finding was given. We can only speculate about the explanation of this relationship in head and neck cancer patients. A possible explanation is the use of alcohol, which is also a prognostic factor in head and neck cancer, possibly as a result of malnutrition and/or immunosuppression [45]. Alcoholism is frequent in head and neck cancer patients and may be associated both with cognitive disturbances and a poor prognosis. However, we were unable to find a correlation between the use of alcohol (as reported by the patients themselves, which may be an unreliable measure) and prognosis, although this was not the primary aim of our study.

One negative finding of our study deserves some comment. Many patients had a high total score for the CES-D. Twenty-nine per cent had a score of 16 or more, indicating a possible case of depression. In some studies in cancer patients, psychological functioning and mood were predictive of survival [13,26]. In the study in head and neck cancer patients mentioned above [43], psychosocial complaints as measured with the Rotterdam Symptom Checklist, was found to be an independent prognostic factor. However, in our study we found no relationship between emotional functioning (as measured with the QLQ-C30(+3)) or depressive symptomatology (as measured with the CES-D), and recurrence or survival.

Marital status was also found to be a prognostic factor, although only when both recurrence and survival were taken as an endpoint. In the general population, people who are married or living together have lower mortality risks than people who are not; in particular, people who are divorced, have a higher mortality especially due to malignancies [46–48]. In a study in the USA, unmarried cancer patients were more likely to be diagnosed at a later stage and more likely to be untreated [29]. Even after correction for these factors, unmarried patients had a higher risk of dying from their cancer.

Several explanations are possible for the better prognosis of cancer patients who are married or living

together [46–48]. Married people may have better health habits (in particular with regard to smoking and use of alcohol) and less delay in seeking medical care after the occurrence of symptoms. We found a non-significant trend for lower stages of disease in married patients and no differences in drinking or smoking between married and unmarried patients. Marital status may also be related to socioeconomic status, which is also related to prognosis [30,31]. In our study, family income and the level of occupation were not found to be prognostic factors. This may be related to the fact that health care in The Netherlands is largely independent of socioeconomic status. Finally, marriage provides social support which has been postulated to buffer the effects of stressful events and thus to lead to better survival [49,50].

Some limitations of this study deserve comment. Firstly, 22% of the eligible patients refused to participate in the study. Refusing patients did not differ with regard to sociodemographic and medical characteristics from the study patients, but we have no indication whether their QOL before treatment was different. Thus, some kind of selection bias cannot be excluded. However, we found no differences in prognosis between study patients and patients refusing to participate in the study. Secondly, the number of events (recurrences and death) in our study is rather small. Thus, we may have missed existing correlations. Thirdly, we have performed multiple correlated comparisons, increasing the chance of false-positive correlations. However, the correlations for cognitive functioning and marital status (the most important finding of our study) were consistent and these findings are therefore likely to be real.

In conclusion, we found that pre-treatment cognitive functioning and, to a lesser degree, marital status were independent prognostic factors for recurrence and survival of head and neck cancer patients receiving primary treatment, along with medical factors (stage and radicality). Other pretreatment QOL variables, in particular performance status, physical functioning, mood and global QOL, did not predict for recurrence or survival. The influence of cognitive functioning on prognosis might be related to the use of alcohol, but we were unable to find a relationship between the use of alcohol and prognosis in our study. The influence of marital status might be related to health behaviour and/or the influence of social support. It is difficult to translate these findings into recommendations for clinical practice. Although our study adds little to the existing arguments, there are clearly a lot of reasons to discourage the use of alcohol and nicotine in these patients. Otherwise, little can be done about the cognitive functioning and marital status of these patients. Clinicians should be aware of the increased chance of recurrence and death in patients who are unmarried and/or have a poor cognitive functioning.

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