The correlation between indices of deprivation and health-related quality of life in patients with oral and oropharyngeal squamous cell carcinoma ☆

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Abstract

Deprivation influences the incidence and outcome of patients with cancer. Health-related quality of life (HR-QoL) is an important measure of outcome but there is little on this subject and its correlation with deprivation in patients with oral and oropharyngeal cancer.

Our aim was to ascertain the extent of deprivation in a cohort of patients who had operations for primary oral and oropharyngeal cancer and how deprivation affected HR-QoL in these patients during and after their treatment.

A total of 278 consecutive patients who were operated on for oral and oropharyngeal cancer were included in this study. Validated measures of deprivation scores (Townsend, Carstairs, Jarman and Index of Multiple Deprivation 2000) were calculated, as well as patient-based indicators of social circumstances (marital status, smoking habit, alcohol intake). Comparison was made with the University of Washington-Quality of Life (UW-QoL) scores before and after treatment (6, 12, and 24 months).
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Introduction

Deprivation is an important aspect of the presentation, management, and outcome of patients with cancer. People living in deprived areas are more likely to get upper aerodigestive cancer and are more likely to die of their cancer than people living in affluent areas.[1,2] Deprivation implies a demonstrable disadvantage relative to others and, although it may take many forms, broadly speaking it consists of two dimensions: material deprivation and social deprivation. Material deprivation concerns such aspects as diet, clothes, work, and home environment whereas social deprivation refers to relations among people in the family, the workplace, and the community. Townsend[3] described the latter as providing a useful means of generalising the condition of those who do not or cannot enter into ordinary forms of family and other social relations. Material deprivation can be relatively easy to identify and measure, although not necessarily always accurately. On the other hand, social deprivation is difficult to define and measure and yet there is a need to do so as the importance of the impact of social relations on health is being increasingly realised.[4]

Health-related quality of life (HR-QoL) is an important aspect of outcome in head and neck cancer.[5] It is a subset of overall quality of life (QoL) that refers to the physical, emotional, and social impact of diseases and their treatment.[6] The main predictors of HR-QoL outcome in the

surgically managed patient with oral and oropharyngeal cancer are the size of the tumour, the type of operation, and adjuvant radiotherapy.[7,8] However, aspects of deprivation are important.[9,10] Deprivation may influence outcome as reflected by social support and coping mechanisms. Isolation, bereavement, withdrawal from family or other social relationships, and breakdown of support in the community are likely to have a deleterious impact on HR-QoL. To date there is little information on the correlation between deprivation and health-related quality of life.

Increasingly sophisticated techniques in reconstruction and adjuvant treatment have led to considerable improvements in functional and cosmetic outcome but with little improvement in survival figures. Owen et al.[11] reported that two government-commissioned papers in the UK and the British Association of Head and Neck Oncologists (BAHNO) have advised that attention should therefore be turned to improving QoL in the management of head and neck cancer. They also suggested that in future cancer centres might have to provide not only survival figures, but also QoL scores as a measure of outcome. As living in a deprived area is associated with poorer survival and with the potential implications for HR-QoL it may prudent for cancer centres to include aspects of deprivation in their figures to allow for bias in reporting outcomes.

Measurement of deprivation

There are a number of deprivation indices in common use that "generally measure the proportion of households in a defined small geographical unit, with a combination of circumstances indicating low living standards or a high need for services or both".[12] Four common measures include the Townsend[13] Carstairs,[14] Jarman underprivileged area score,[15] and index of multiple deprivation (IMD) 2000.[16] Data about deprivation is obtained at ward level.

The aim of our study was to ascertain the extent of deprivation in patients operated on for oral and oropharyngeal cancer in the Mersey region and to compare this with wards in England and Wales. Secondly, we studied the extent to which living in a deprived area affected HR-QoL in these patients during and after their treatment.

Methods

We studied consecutive patients who had operations for previously untreated oral and oropharyngeal squamous cell carcinoma at the regional maxillofacial unit in Liverpool between the years 1995 and 1999. Patients were asked to complete the University of Washington quality of life questionnaire (UW-QoL) at baseline, 6, 12, and at least 18 months after treatment. The UW-QoL questionnaire was first published in 1993 and although it has undergone minor modifications eight items (pain, appearance, activity, recreation, swallowing, chewing, speech, and shoulder function) are common to

all versions.[5] Scoring is scaled so that a score of 0 reflects the worst, and a score of 100 the best quality of life. The questionnaire is the patients' own perception of their quality of life.

Validated measures of deprivation (Townsend, Carstairs, Jarman, and IMD-2000 scores) were obtained at ward level using patients' postcodes. Patient-based indicators of social circumstance (smoking, alcohol consumption, and marital state) were obtained from the Liverpool head and neck cancer database. Survival data were acquired through the regional unit's links to the Office of National Statistics (ONS). Follow-up was through ONS to 31 December 2001, allowing a minimum of 24 months follow-up.

The Townsend score[13] is based on statistics derived from the 1991 census for unemployment, overcrowding, home ownership, and car ownership, while the similar Carstairs score[14] uses social class instead of housing tenure. The Jarman Underprivileged Area score[15] was first developed to measure the workload of general practitioners but is now more in use as a general deprivation index. Census statistics for 1991 were used for unemployment, overcrowding, lone parent state, under 5-year olds, elderly living alone, ethnicity, social class, and residential mobility. The Index of Multiple Deprivation 2000 (IMD 2000)[16] was commissioned by the Department of the Environment, Transport and the Regions (DETR). It is made up of various domains—income (25%), health deprivation and disability (15%), employment (25%), education skills and training (15%), housing (10%), and geographic access to services (10%). The six domains are derived from 33 indicators. As well as IMD scores there are also IMD national ranks attached to each ward of residence. There are 8414 wards in England. The most deprived ward for each domain is given a rank of 1 and the least deprived ward is given a rank of 8414. For each of the ward-based deprivation indicators described in this study the higher the deprivation score the more the deprivation. A few patients lived outside England and some postcodes could not be assigned deprivation scores and consequently there were some missing data, 2% for the Townsend and Carstairs measures, and 6% for Jarman and IMD.

Statistical methods

Presentation is primarily descriptive and we used means, standard deviations, standard errors and percentages. Associations between clinicodemographic variables, UW-QoL scores, and indices of deprivation were tested using the Mann–Whitney test, Kruskal–Wallis test, or Spearman correlation as appropriate. Longitudinal trends in UW-QoL scales were shown graphically using three equally sized groups (tertiles) for the ward-based indicators derived from the scores. Kaplan–Meier survival curves and the log-rank test were used to compare survival between subgroups. Because of the multitude of tests we regarded a probability of less than 0.01 as being statistically significant.

Results

The mean (S.D.) age of the 278 patients was 62 (12) years. Thirty-six percent (65/180) of the men and 56% (55/98) of the women were aged 65 years or more (Table 1). Eighty-six percent (*n* = 238) had tumours of the oral cavity, whilst 12% (*n* = 34) had oropharyngeal tumours and 2% (*n* = 6) had tumours of the maxillary sinus. Tumour size was estimated as 4 cm or larger in 29% (*n* = 82). T4 advanced tumours were present in 28% (*n* = 78). About half the patients had soft-tissue flap operations, one-quarter had bone flap operations while one quarter did not have a flap operation. Adjuvant radiotherapy was given for 40% (*n* = 110). Half the patients

Table 1
Patient characteristics (*n* = 278)

	Percentage	*n*
Sex		
Female	35	98
Tumour site		
Oral cavity	86	238
Oro-pharynx	12	34
Maxillary sinus	2	6
Tumour size		
<2 cm	23	65
2–3 cm	26	73
3–4 cm	21	58
>4 cm	29	82
Clinical stage		
T1	20	56
T2	35	98
T3	11	31
T4	28	78
Tis	4	12
TX	1	3
Operation		
Soft tissue flap	53	147
Bone tissue flap	23	63
Soft and bone tissue flaps	3	7
Obturator/pect maj ped	2	5
Laser/primary closure/ssg	20	56
Adjuvant radiotherapy	40	110
Marital state		
Married	46	127
Single	15	41
Divorced	14	38
Widowed	16	45
Unknown	10	27
Smoking		
Smokers	59	165
Ex-smoker	16	45
Non-smokers	13	36
Unknown	12	32
Alcohol units/week		
40+ units	29	80
5–39	41	114
<5	25	69
Unknown	5	15

were married. Two-thirds were smokers, and nearly one-third drank 40 or more units of alcohol a week, and virtually all (70/77) of these heavy drinkers were also smokers.

Deprivation scores for the IMD 2000, Townsend, Carstairs, and Jarman were strongly correlated with one another (Spearman coefficients ranging from 0.81 to 0.98, median 0.92). The median rank was 4202 and it is clear from Table 2 that many of these 278 patients lived in deprived parts of the country, particularly in regard to health deprivation and disability, employment, and income. A quarter of the 100 most deprived wards in England and Wales are found in the Mersey health authority area and hence in the catchment area of the regional maxillofacial unit.

There were no significant associations between UW-QoL composite score and any of the ward-based indicators of deprivation (Spearman correlation coefficients ranged from −0.14 to −0.01, median −0.04). The only significant correlations between any of the 8 UW-QoL domain scores and the ward-based indicators (Spearman correlations from −0.23 to 0.07, median 0.01) were of UW-QoL activity with geographical access (−0.21, *p* = 0.005) and of UW-QoL recreation also with access (−0.23, *p* = 0.002). Marital state (*p* = 0.15), smoking habit (*p* = 0.14), and alcohol consumption (*p* = 0.45) were not significantly associated with composite UW-QoL, nor with any of the UW-QoL domain scores. Other analyses indicated significant associations between baseline UW-QoL and tumour size, T stage, postoperative radiotherapy, and type of operation (results not shown).

There were no obvious associations of sex, or of the clinical variables (tumour site, size, stage, operation, and radiotherapy) with the ward-based indicators. However, there were clear associations indicating that patients who were younger unmarried smokers, and who drank alcohol heavily were more likely to live in a deprived area (Table 3).

Mortality

There was a minimum of 24 months of follow-up from operation for the whole cohort. By 12 months 17% (*n* = 47) had died and by 24 months 26% (*n* = 72) had died. The estimated (life-table) mortality after 3 and 4 years from operation was 31 and 36%. At around 6 and 12 months and beyond 18 months about two-thirds of available patients completed the UW-QoL questionnaire. Response rates were 71% at baseline, 63% at 6 months, 74% at 1 year and 66% at 18 months and longer. There was no correlation between the number of questionnaires completed by a patient and any of the indices of deprivation (Spearman correlation coefficients: range 0.00–0.05).

There were no obvious associations or trends for any of the ward-based indicators with all causes mortality (log-rank test *p*-values ranged from 0.34 to 0.91). Nor was there any clear correlation with marital state (*p* = 0.18), smoking habit (*p* = 0.50), or units of alcohol (*p* = 0.76). In other analyses, however, there were associations with age (*p* = 0.002), tumour size (*p* = 0.001), T stage (*p* < 0.001), radiotherapy (*p* = 0.02),

Table 2
Ward-based deprivation indices

	1995–1999 Patient cohort			
	Patients	Mean (S.D.)	Median (IQR) score	Median (IQR) rank[a]
Townsend	273	2.9 (4.8)	2.9 (−1.2, 6.6)	
Carstairs	273	3.3 (5.1)	2.5 (−1.6, 7.2)	
Jarman	261	11 (20)	13 (−5, 27)	
IMD 2000	259	42 (23)	38 (21, 61)	1244 (252, 3330)
Income	259	33 (17)	29 (18, 45)	1453 (272, 3406)
Employment	259	21 (11)	20 (12, 28)	777 (172, 2436)
Health	259	1.3 (0.9)	1.4 (0.6, 2.0)	563 (141, 2071)
Education	259	0.3 (1.0)	0.3 (−0.4, 1.2)	3045 (697, 5766)
Housing	259	0.2 (1.0)	0.3 (−0.6, 1.0)	3029 (1190, 6155)
Access	259	−0.5 (0.6)	−0.5 (−0.9, −0.2)	5943 (4653, 7273)

IQR: inter-quartile range. The higher the deprivation score, or the lower the ward rank, the more the deprivation.

[a] This uses the national ranks attributed to the wards in which the patients lived at the time of operation.

and type of operation ($p = 0.01$). There were no obvious trends for the ward-based indicators when analysed separately by age group (<65, 65+), tumour size (<4, 4+ cm), clinical stages (T1–2, T3–4), radiotherapy (yes, no), and type of operation (flap, no flap) (results not shown).

UW-QoL at follow-up

For ease of presentation the cohort was divided into three equal-sized groups or tertiles using IMD 2000 scores: a least deprived group, a most deprived group and a middle group. Patients in the least deprived group reported better composite UW-QoL scores on average than patients living in more deprived areas (Fig. 1). The trends seen for IMD 2000 were also evident for Townsend, Carstairs, and Jarman (results not shown). The trend was strongest for the income, employment, and housing domains of the IMD (Fig. 2). Similar trends were seen for each UW-QoL domain (Fig. 3) especially in the pain

domain, and these trends were again typical of the trends and patterns seen for the Townsend, Carstairs, and Jarman indicators and for all the IMD domains except for geographical access in which there were no discernible trends (results not shown).

Unmarried patients seemed to do worst over time, as did smokers and heavier alcohol users (Fig. 4). In other analyses UW-QoL composite scores were associated with tumour size and T staging in which broadly speaking the differences before and after operation remained similar (results not shown). Patients not requiring flap reconstruction maintained a good mean UW-QoL score over time, while patients who had radiotherapy had worse scores on average from 6 months onwards (results not shown). Numbers were small but there were trends to suggest that the deprivation indices were associated with UW-QoL independent of other factors that were also associated with UW-QoL. Results adjusting for radiotherapy and operation are shown in Fig. 5, but similar trends were seen for T staging, tumour size, marital state, smoking, and drinking.

A major difficulty in assessing longitudinal trends is the loss of information about patients with time. To assess the extent of this problem the main longitudinal analyses were re-run for the 85 patients with complete UW-QoL data at presentation, at 6 months, 12 months, and after 18 months, and also for the 162 patients with differing amounts of data at one or more of these times. The remaining 31 patients had no QoL records at all. These analyses gave broadly similar trends that were consistent with the overall trends for the IMD 2000, Townsend, Carstairs, and Jarman indicators.
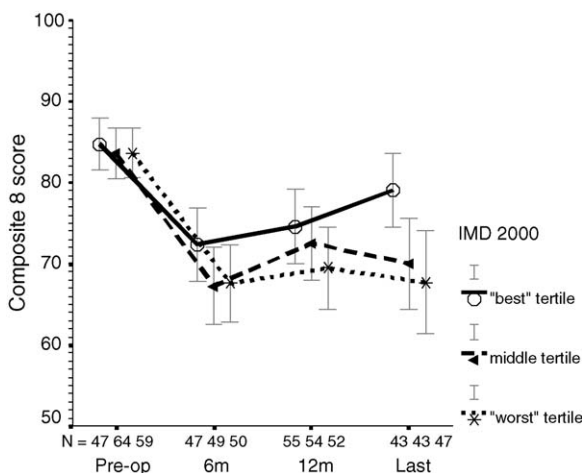
Discussion

The issue of deprivation and HR-QoL is important. The absolute scores obtained in the various QoL and HR-QoL indices seem simple to interpret. However, there is a wide range of processes at work in a patient that ultimately affect this final value.[17] Recent attention has focussed on those factors that

Fig. 1. Composite UW-QOL by the IMD 2000 deprivation indicator. The figure gives mean scores with 95% confidence intervals. IMD 2000 scores: "best" tertile: 2–25; "middle" tertile: 26–56; "worst" tertile: 57–83. Kruskal–Wallis test *p*-values between the tertile groups were 0.71 (pre-op), 0.23 (6 months), 0.34 (12 months), 0.01 (last QOL beyond 18 months).
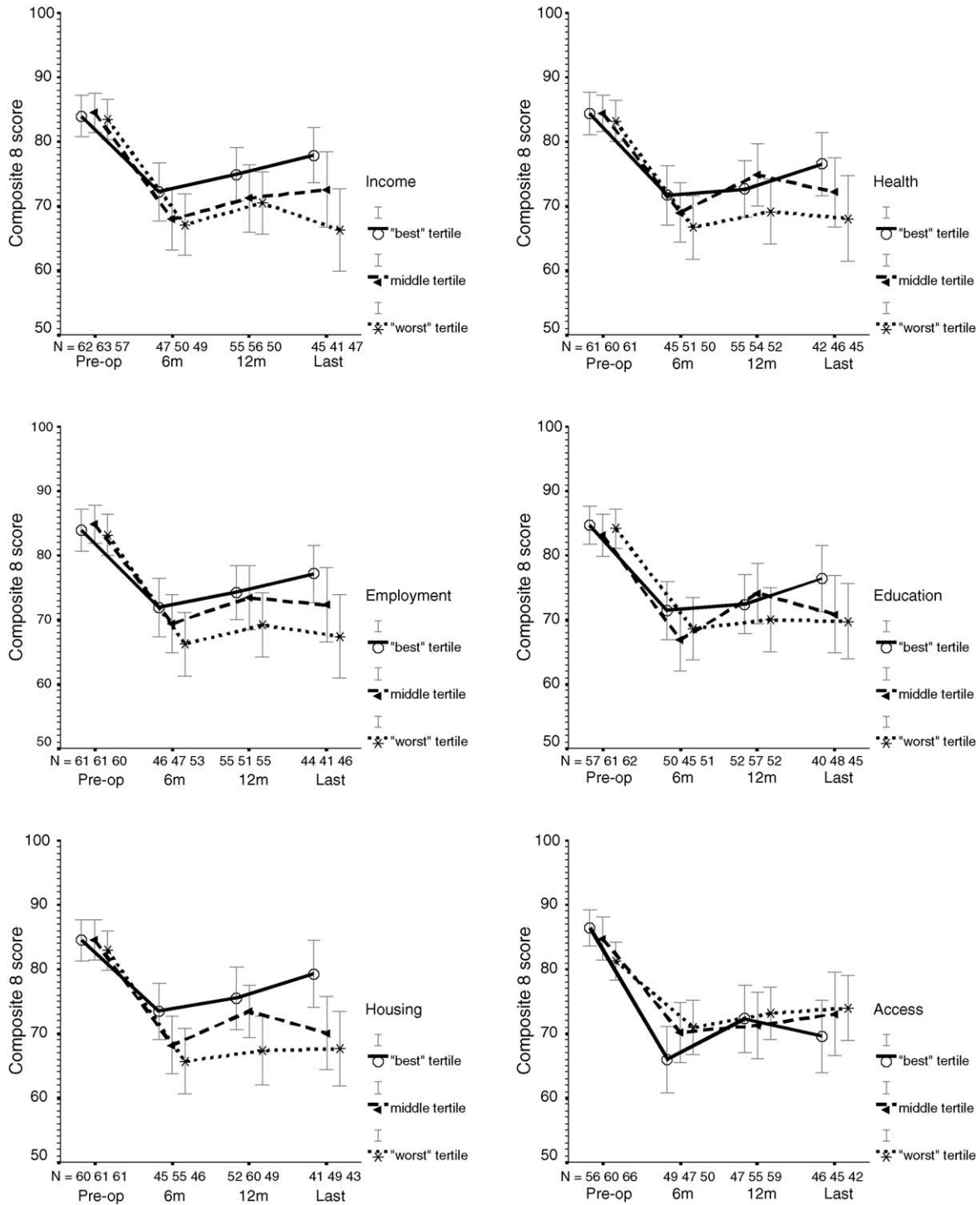
Fig. 2. Composite UW-QOL by IMD domain indicators of deprivation. The figure gives mean scores with 95% confidence intervals.

act upon each other to affect what is finally measured in a QoL score. Grumann and Schlag have suggested an extended quality of life model.[17] They described internal-psychological and external-psychosocial factors. Internal factors largely reflect personality traits and coping style whereas external factors particularly reflect socioeconomic state and quality of social network. Deprivation has both material and social

dimensions and therefore has an effect on these external factors. Social deprivation with its lack of participation in or access to employment, education, and family and social activities denies patients access to coping resources.

There is no one best way to measure deprivation. The various deprivation indices currently in use have been developed to meet a range of different objectives and each has

its own merits. The Townsend, Carstairs, and Jarman UPA scores are well established and have been used in numerous studies of the link between deprivation and the mortality and morbidity of disease and its treatment.[18] There is, however, relatively little on the relation between deprivation and cancer in the head and neck region. It is clear that the four indices used in this study show a high correlation with each

other and therefore the use of the IMD 2000 is considered to be valid. It is a comparatively new measure of deprivation. It has potential advantages over other indices because it uses up-to-date information, has a wide range of indicators (33 spread across 6 domains) and it attempts to measure the social aspects of deprivation. However, it may underestimate the extent of deprivation in certain areas. The geographical
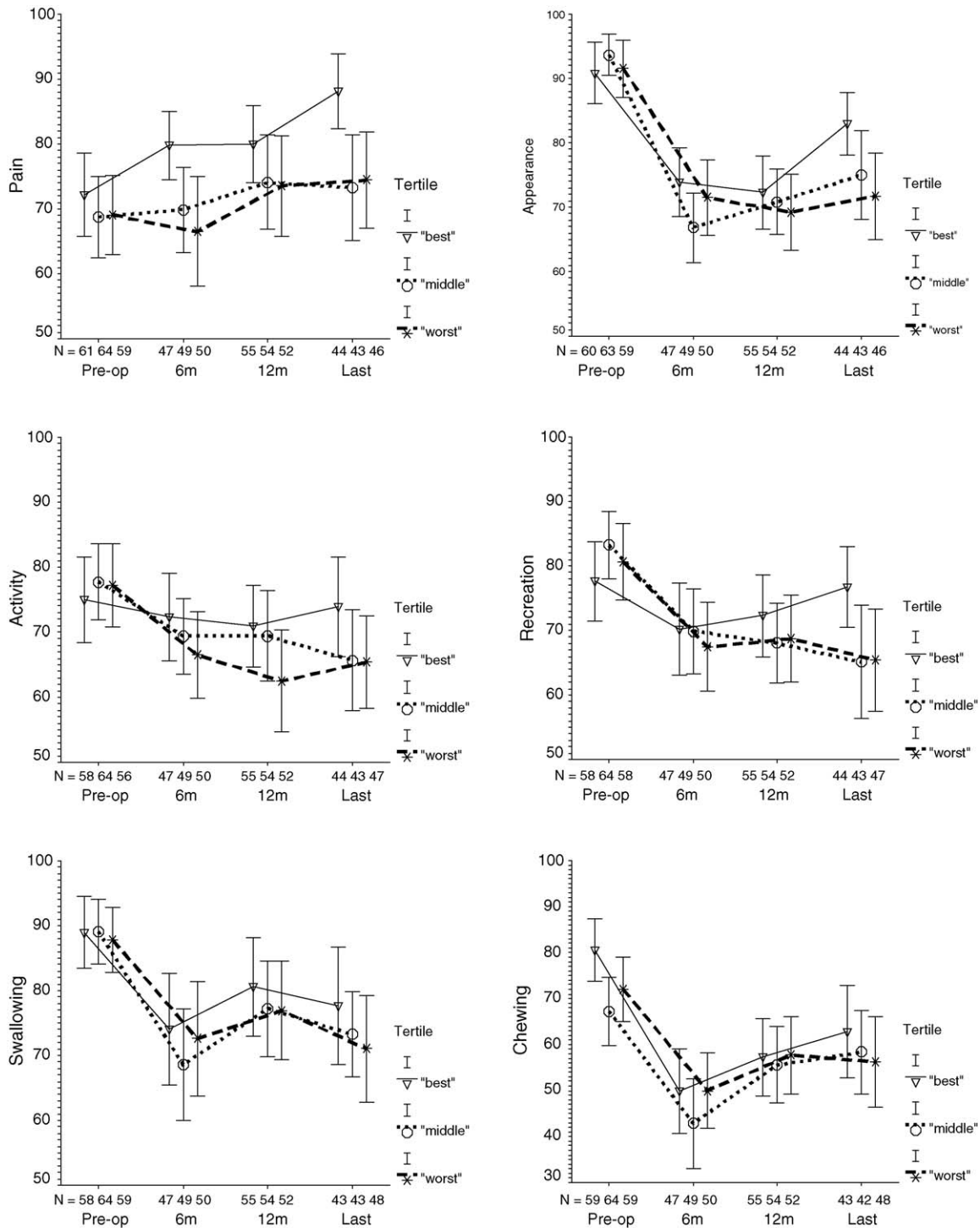

Fig. 3. UW-QOL domain scores by IMD 2000 score. The figure gives mean scores with 95% confidence intervals.
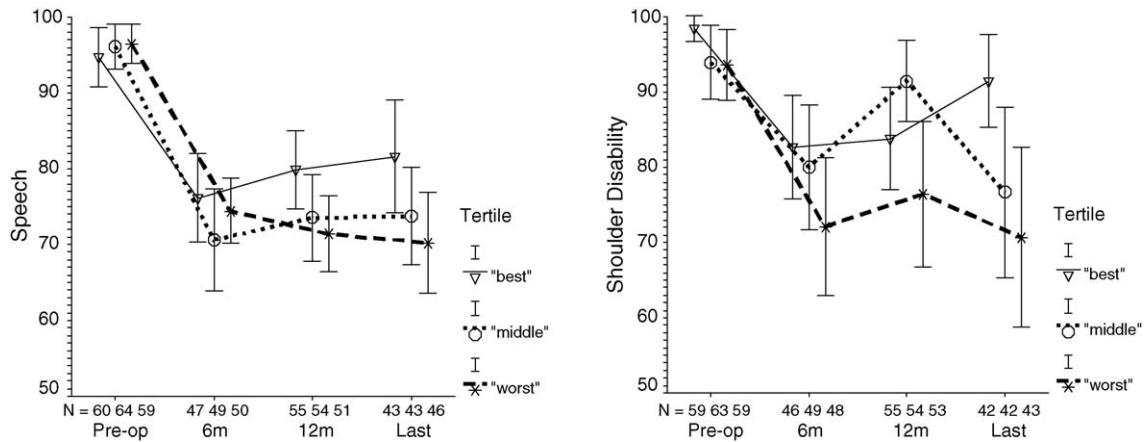
Fig. 3. (*Continued*).

Table 3
Associations with ward-based deprivation indices

	Age		Marital State				Smoked			Units of alcohol		
	<65	65+	Married	Widow	Divorced	Single	Yes	Ex	No	<5	5–39	40+
Patients	158	120	127	45	38	41	165	*45*	36	69	114	80
Townsend[a]	5	1	1	3	5	5	5	0	1	1	2	5
Carstairs[a]	4	1	1	3	6	6	5	1	0	1	2	6
Jarman[a]	18	5	6	18	22	20	19	2	3	6	10	20
IMD 2000[b]	46	29	32	37	54	59	47	28	29	31	37	51
Income[b]	36	23	27	29	39	45	39	24	25	26	29	39
Employment[b]	21	17	16	20	25	28	23	16	17	17	19	23
Health[b]	1.5	1.1	1.1	1.4	1.8	1.9	1.6	1.1	1.1	1.1	1.4	1.6
Education[c]	0.7	0.0	0.1	0.2	0.9	1.0	0.7	0.2	0.1	0.2	0.1	0.8
Housing[b]	0.6	0.0	0.0	0.4	0.6	0.9	0.6	0.0	−0.3	0.0	0.0	0.6
Access	−0.5	−0.5	−0.4	−0.6	−0.6	−0.7	−0.5	−0.5	−0.5	−0.5	−0.4	−0.5

The table gives median deprivation scores. The higher the score the more the deprivation. Mann–Whitney test (with age group), Kruskal–Wallis test (with marital state, smoked, units of alcohol).

　[a] All $p < 0.01$.
　[b] All $p < 0.01$ except with units of alcohol.
　[c] $p < 0.01$ with age group and marital state only.

access to services domain comprises access to a post office, food shops, general practitioner, and primary schools. There was a negative correlation between this and overall deprivation scores (Spearman rank coefficient −0.68 to −0.52), those with better access to such services being more deprived in regard to all the other ward indicators. This may reflect the inner city bias of the sample. As stated previously, only a small part (2 of 33 indicators) of the IMD 2000 score relies on census data compared with the other three indices. Instead most of the indicators are updated far more often than the every 10 years of census data.

There are further limitations common to all four measures of deprivation. The importance of social deprivation and HR-QoL has been stressed. At an area level participation in social activities and social support from family and the wider community cannot be measured directly. Certain indicators such as unemployment, lone parenthood, single person households, and access to facilities can merely attempt to act as a marker for assumed social deprivation. Social deprivation itself can be measured reliably only by personal questionnaire. It is important to remember that "not everyone in a deprived ward is deprived and not all deprived people live in deprived wards".[3] A more accurate reflection of deprivation may be obtained by measuring it within enumeration districts (ED),[19] which consist of about 150 households with on average 20 EDs to a ward.

HR-QoL at baseline

In our study we did not find that deprivation was linked to more advanced disease at presentation. As with other cancers[1,20,21] it might be expected that those patients with oral and oropharyngeal cancer and poorer socioeconomic state and without family support would present with more advanced disease. There was, however, a similar profile of tumour site, size, stage, type of operation, and adjuvant radiotherapy, and irrespective of the extent of deprivation there was no significant difference in the recorded HR-QoL at
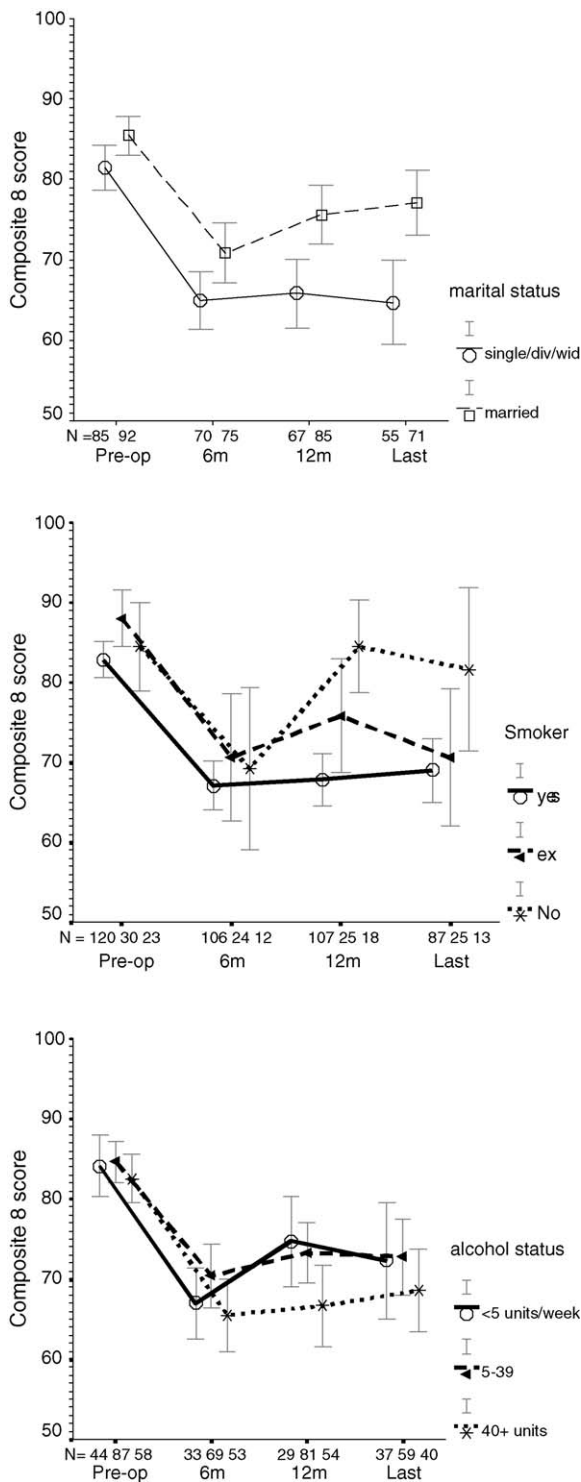
Fig. 4. Composite UW-QOL by marital state, smoking habit and alcohol consumption. The figure gives mean scores with 95% confidence intervals.

presentation in either the IMD 2000 or the patient-based measures of deprivation (smoking, marital state, and alcohol consumption). The high level of deprivation within the cohort as a whole may explain this lack of correlation between deprivation and HR-QoL at presentation. This high level of deprivation may also explain the distribution of results obtained by dividing the group into tertiles for analysis. The pattern seen elsewhere in the United Kingdom may well be different.

HR-QoL with time

Patients living in the least deprived areas reported a better HR-QoL. Why should this be? The stage of disease and therefore the extent of subsequent treatment, factors known to affect HR-QOL adversely, was not related to deprivation. We return to the extended QOL model of Gruman and Schlag[17] and their suggestion that both material and social deprivation affect QOL. Coping mechanisms are an important part of a patient's ability to deal with the devastation caused by cancer and its treatment.[22] An intact social network provides resources for coping (friends, family, work) and a sufficient income aids the means to get access to them. Inadequate income may affect patients' ability to attend their general practitioner, hospital, or self-help group.

The last point may be particularly pertinent to the results seen in the pain domain of the UW-QoL questionnaire. There were notable differences in pain scores between the least and most deprived patients. Pain is an important part of HR-QoL.[9] The increase in prevalence of self-reported orofacial pain in areas of relative deprivation was noted by Aggarwal et al.[23] Their findings could not be explained by various confounding factors such as age and sex and they were unable to identify a possible mechanism for this finding. Both their results and ours may be explained by a greater incidence of depression among deprived patients,[24] depression being related to an increased reporting of pain. However, the converse may be true, in that those with more pain become more depressed. Deprived patients may also not have the means to reach methods of pain relief as readily as less deprived patients. De Leeuw et al. in a study of the prediction of depression following treatment of head and neck cancer found that, although there was an insignificant reduction in the incidence after treatment, it remained significantly higher than in the general population.[25] The best predictor of depression after treatment was the presence of depression before treatment. However, in addition to tumour-related predictors four social support variables were also able to predict depression up to 3 years after treatment. These variables included openness to discuss cancer in the family, available support, received emotional support, and the size of the social network.

The trends seen in our study show that patients most at risk of not regaining their baseline HR-QOL scores were under 65-years old, smoked and drank heavily, and were unlikely to be married. The deleterious effect that heavy use of alcohol has on coping strategies, family relationships, and social support has been highlighted.[26] However, List et al. found no significant correlation between coping strategies and alcohol dependence.[27] They also found no correlation between coping strategies and marital state. This is in contrast to the importance of marriage and the ability to cope with cancer reported by Wortman.[28] She also stressed, however, that this marital support may be inadequate or even contrary. In her
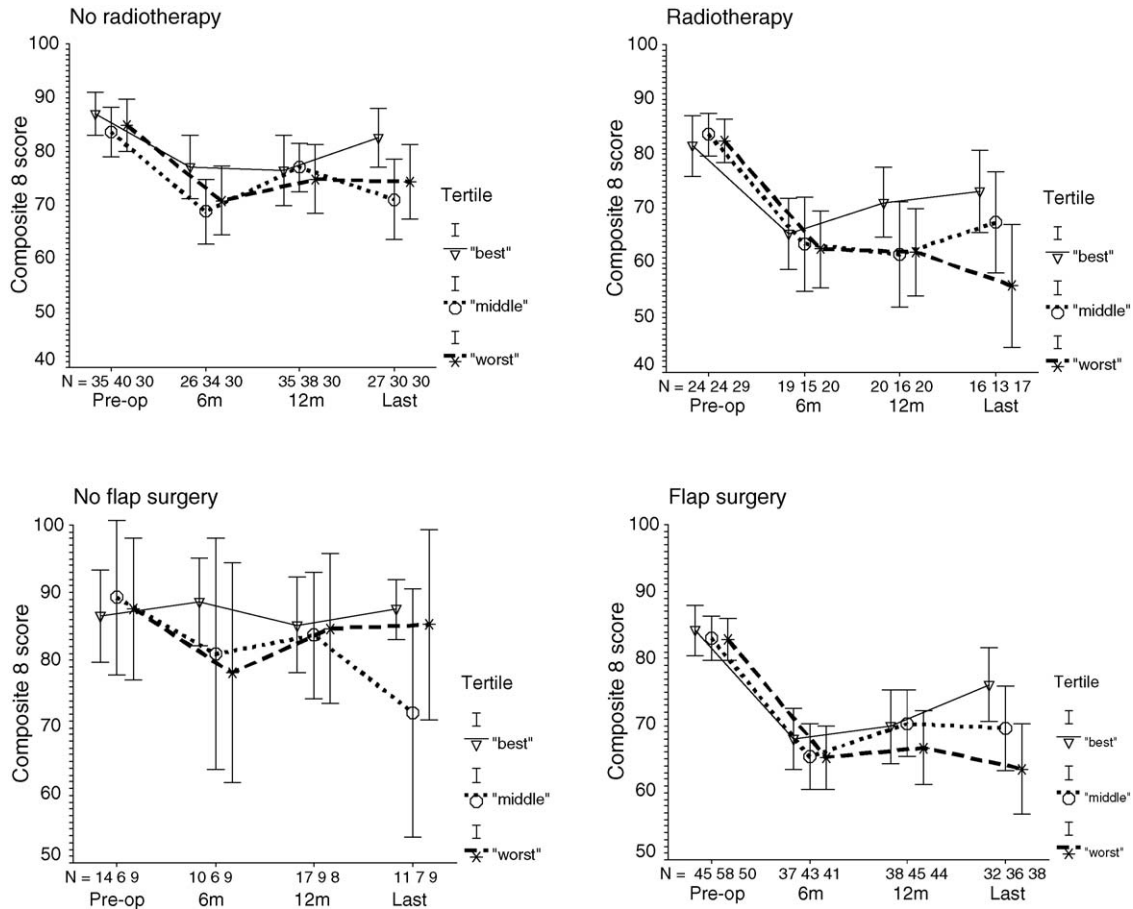
Fig. 5. Composite UW-QOL by IMD 2000 score, by radiotherapy and type of operation. The figure gives mean scores with 95% confidence intervals.

study the definitions of marital state may have been too crude and no account of long-term relationships was made. In an attempt to link coping strategies with the deprivation indices, List et al. found no correlation between coping strategies and income, but those with a lower level of education were less able to cope.

Risks such as smoking and alcohol consumption are associated with deprivation.[2] We found that patients most at risk of reporting lower HR-QOL scores after treatment for oral and oropharyngeal cancer were under 65-years old, smoked and drank heavily and were unlikely to be married. These patients could be identified in routine clinical practice without having to resort to post code analysis of deprivation score. However, it would be possible to run alongside a cancer database, a regularly updated version of the IMD 2000 scores. This would identify, from matching the postcodes, those patients with a particular extent of deprivation that puts them most at risk of an adverse outcome in terms of their HR-QOL. However, the similar trends seen with the patient-based indicators mean that these indicators that are obtained as part of a thorough routine medical history and an integral part of any cancer database provide a simpler way of identifying these patients.

If HR-QOL is to move into the clinical setting and patients at most need of intervention are to be identified resources to do this must be made available. As clinicians it is impossible to improve material deprivation, but improving aspects of social deprivation may indirectly have an effect. The cancer outpatient clinic is itself a resource and has been identified as an important one by patients with head and neck cancer.[29] The consultation itself can provide social support with the additional aim of identifying potential needs for onward referral. General practitioners, clinical nurse specialists, and social workers may all need to be alerted to potential problems. Pain after treatment has been emphasised as a particular problem for deprived patients and while referral to a specialist pain clinic is a possibility, paying attention to this in routine follow-up clinics in close association with the general practitioner may help. Self-help groups provide a support mechanism but attendance may need encouragement from general practitioners, nurses, and family members where they exist, in addition to provision of transport. The Macmillian Fund has made money available to cancer patients which they and their carers can claim. This can help with paying transport and other costs incurred by the patient as part of their cancer treatment.

Acknowledgements

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