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Reference data for the quality of life questionnaire EORTC QLQ-C30 in the general German population

R. Schwarz *, A. Hinz

Institute of Occupational and Social Medicine, University of Leipzig, Riemannstr. 32, 04107 Leipzig, Germany

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Abstract

The objective of this study was to obtain age- and sex-specific reference values for the European Organization for Research and Treatment of Cancer (EORTC) Quality of Life Questionnaire QLQ-C30. A randomly selected sample of the German adult population (3015 subjects) was used, 2081 subjects agreed to take part in the investigation. Most of the scales and symptom items of the questionnaire proved to be dependent on age and sex. Men reported fewer symptoms than women. Age differences were even more pronounced. Younger people reported better functioning and fewer symptoms. Compared with the results of a similar Norwegian study (Hjermstad MJ, Fayers PM, Bjordal K, Kaasa S. Health related quality of life in the general Norwegian population assessed by the European Organization for research and treatment of cancer core quality-of-life questionnaire: The QLQ-C30(+3). *J Clin Oncol* 1998, **16**, 1188–1196) the prevalence of some symptoms was markedly less. Norm values for age and sex groups are given and regression analyses are performed which help to calculate expected mean scores. The results show that age and sex differences must be taken into consideration when different groups of cancer patients are compared. The norm values help to interpret quality of life data for clinicians.

Keywords: EORTC QLQ-C30; Norm values; Quality of life; Reference data

1. Introduction

The impact of disease and treatment on the patient's overall well-being and functioning is a topic of growing interest in clinical research and practice [2,3]. Several questionnaires have been developed which measure health-related quality of life, including physical, social and psychological aspects. Some of these questionnaires are designed for the assessment of non-disease groups, e.g. the Short-Form-36-Questionnaire (SF-36) [4] and the Nottingham Health Profile (NHP) [5], while others were developed to be used for specific disease groups. The following questionnaires are all cancer-specific: European Organization for Research and Treatment of Cancer (EORTC) Quality of Life Questionnaire Core 30 (QLQ-C30) [6], the Rotterdam Symptom Checklist (RSCL) [7], the Functional Living Index Cancer (FLIC) [8] and the Functional Assessment of Cancer Therapy scale (FACT) [9]. While for generic quality of life questionnaires norm values for the general population are often available [10,11], disease-specific questionnaires mainly focus on reference values for specific disease groups. This results in a lack of population-based norms.

The EORTC QLQ-C30 is frequently used to assess the health related quality of life in various groups of cancer patients. Special research objectives are: comparisons across groups of diagnoses and stages of disease, assessments of changes in quality of life (pre–post comparisons), and comparisons of the patients' quality of life in clinical trials. A CD-ROM distributed by the EORTC Quality of Life Study Group [12] provides reference values for many types of cancer using a basis of over 200 studies. Psychometric properties of the EORTC QLQ-C30 are described in several studies [13–16]. However, as with other disease-specific questionnaires, the database for norm values for the general population is limited. There are two investigations which report such reference data. Klee and colleagues [17] obtained norm values from 608 women out of a Danish population sample, and Hjermstad and colleagues [1,18] obtained reference data on 1965 Norwegians

* Corresponding author. Tel.: +49-341-9715-408; fax: +49-341-9715-419.

E-mail address: schwarzr@medizin.uni-leipzig.de (R. Schwarz).

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(men and women). One important result of these studies was the evidence found indicating differences between the age groups in most of the scales and items. These differences must be taken into account in other studies which compare groups with different age distributions.

The aim of our study is to replicate the Hjermstad and colleagues [1] study by using a comparable German sample. We wanted to describe age and sex differences, to test whether the German norms differ from the Scandinavian ones, and to provide regression coefficients which enable researchers and clinicians to calculate expected mean scores for each age and sex distribution.

2. Patients and methods

The investigation was conducted in 1998. Using the random-route-technique, a sample of 3020 subjects was used based on 216 sample points (random selection of street, house, flat and target subject in the household). 2041 subjects of the original sample provided information that could be used for the study.

The persons were interviewed in their private homes by skilled interviewers. In 132 cases, no interview could be performed (4.4%) because nobody could be met in the flat after three tries. Of the remaining households, 2081 people (72.1%) agreed to participate. The final sample comprised 2041 persons. People younger than 16 years old were excluded, as well as those with insufficient command of the German language ($n=40$ in total). Sociodemographic variables were obtained (age, profession, income, education, marital status, number of family members, etc.), and several standardised psychological and sociological questionnaires were filled in, one of them being the EORTC QLQ-C30, version 3.0.

98% of the subjects responded to the QLQ-C30 questions without omitting any item. When only one item per subscale was missing, the value was replaced by the rounded mean of the remaining item(s) of the subscale. Subscales with two or more missing values were not considered in the calculation. This procedure yielded 2028 complete questionnaires (99.4%) for further analysis. Sociodemographic data is shown in Table 1. This data indicate that the sample can be assumed to be representative for the adult German population.

3. Results

3.1. Internal consistency

Cronbach's alpha [19] was calculated for all scales consisting of two or more items. The coefficients were as

Table 1
Sociodemographic characteristics of the sample

Variable	Total ($n=2028$) n (%)	Men ($n=889$) n (%)	Women ($n=1139$) n (%)
Age (years)	49.4	49.5	49.4
Mean S.D. (range)	17.2 (16–92)	16.7 (16–90)	17.6 (16–92)
Age category (years)			
16–29	306 (15)	135 (15)	171 (15)
30–39	363 (18)	141 (16)	222 (19)
40–49	343 (17)	152 (17)	191 (17)
50–59	350 (17)	168 (19)	182 (16)
60–69	390 (19)	193 (22)	197 (17)
70–92	276 (14)	100 (11)	176 (15)
Education			
Did not finish school	36 (2)	12 (1)	24 (2)
8th, 9th class	947 (47)	417 (47)	530 (47)
10th, 11th class	681 (34)	283 (32)	398 (35)
12th, 13th class	364 (18)	177 (20)	187 (16)
Profession[a]			
Never before employed	36 (2)	3 (0.5)	33 (3)
Unskilled workers	214 (11)	57 (7)	157 (14)
Skilled workers	601 (31)	406 (48)	195 (18)
Farmers	30 (2)	17 (2)	13 (1)
Freelancers	25 (1)	9 (1)	16 (1)
Self-employed	93 (5)	58 (7)	35 (3)
Employees	857 (44)	243 (29)	614 (57)
Officials (state employees)	71 (4)	49 (6)	22 (2)

S.D., standard deviation.

[a] The numbers for the profession do not add up to the totals due to missing data. Totals of 1927, 842 and 1085 were used to calculate the profession percentages.

follows: 0.81 (physical functioning), 0.89 (role functioning), 0.80 (emotional functioning), 0.68 (cognitive functioning), 0.86 (social functioning), 0.89 (global health/quality of life), 0.80 (fatigue), 0.65 (nausea/vomiting) and 0.84 (pain).

3.2. Mean values

Figs. 1 and 2 show how subscales and symptom items are dependent on age (cf. also Table 2). As in the study by Hjermstad and colleagues [1], functional scales (except emotional functioning) and global health/quality of life markedly decrease with increasing age. Among the symptom scales and items, fatigue, pain, dyspnoea and insomnia also showed clear age differences with higher values for older subjects.

Men reported better functioning than women in all subscales (Table 2) with the greatest difference occurring in the emotional functioning scale. The global health status/quality of life was also assessed as being better in the men's group, and all symptom scales (single items and scales) showed higher values for women. The mean differences between men and women may be slightly overestimated because women had a higher mean age in the oldest age group (70 years and above), resulting in more pronounced sex differences within this age group. However, most of the other age strata with comparable mean ages show roughly the same differences as those in the total sample. Age and sex differences are analysed in more detail in the following section.

3.3. Distribution of the variables

The variability of the scores is indicated in Tables 3 and 4. As in all other studies, the distributions were skewed since most subjects reported no symptoms and best functioning. There are many possible values for the functional scales with the physical functioning scale allowing for 20 different scores (five items and four answer categories). The distribution of scale values with two or more items are therefore summarised using frequency ranges (Table 3).

3.4. Regression models

Age and sex differences have already been shown in Table 2 and Figs. 1 and 2. For comparisons between patient groups with different mean ages, it is useful to

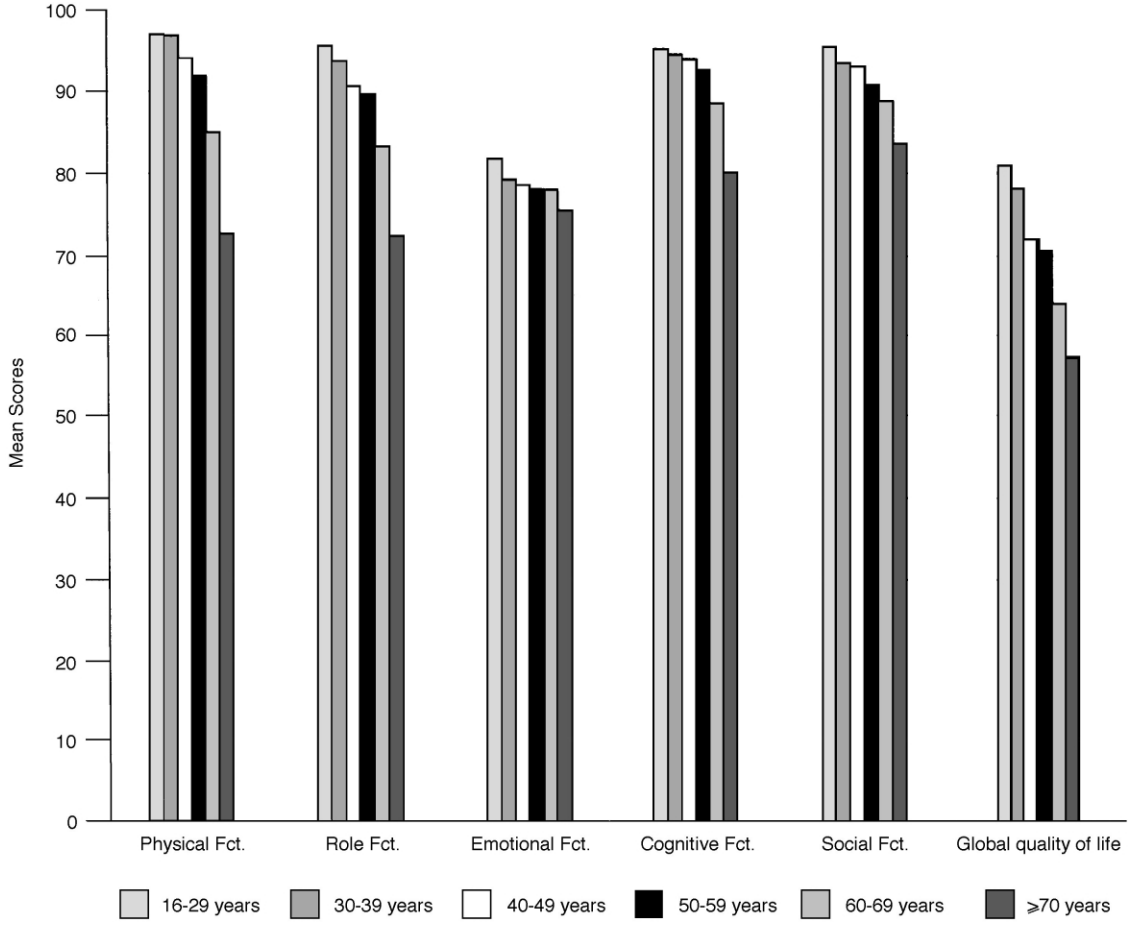

Fig. 1. Mean functioning scores by age. Fct, functioning. Error bars are not supplied for the clarity of the figure as, due to the skewness of some of the distributions, some of the bars for the functioning scales would reach >100%.

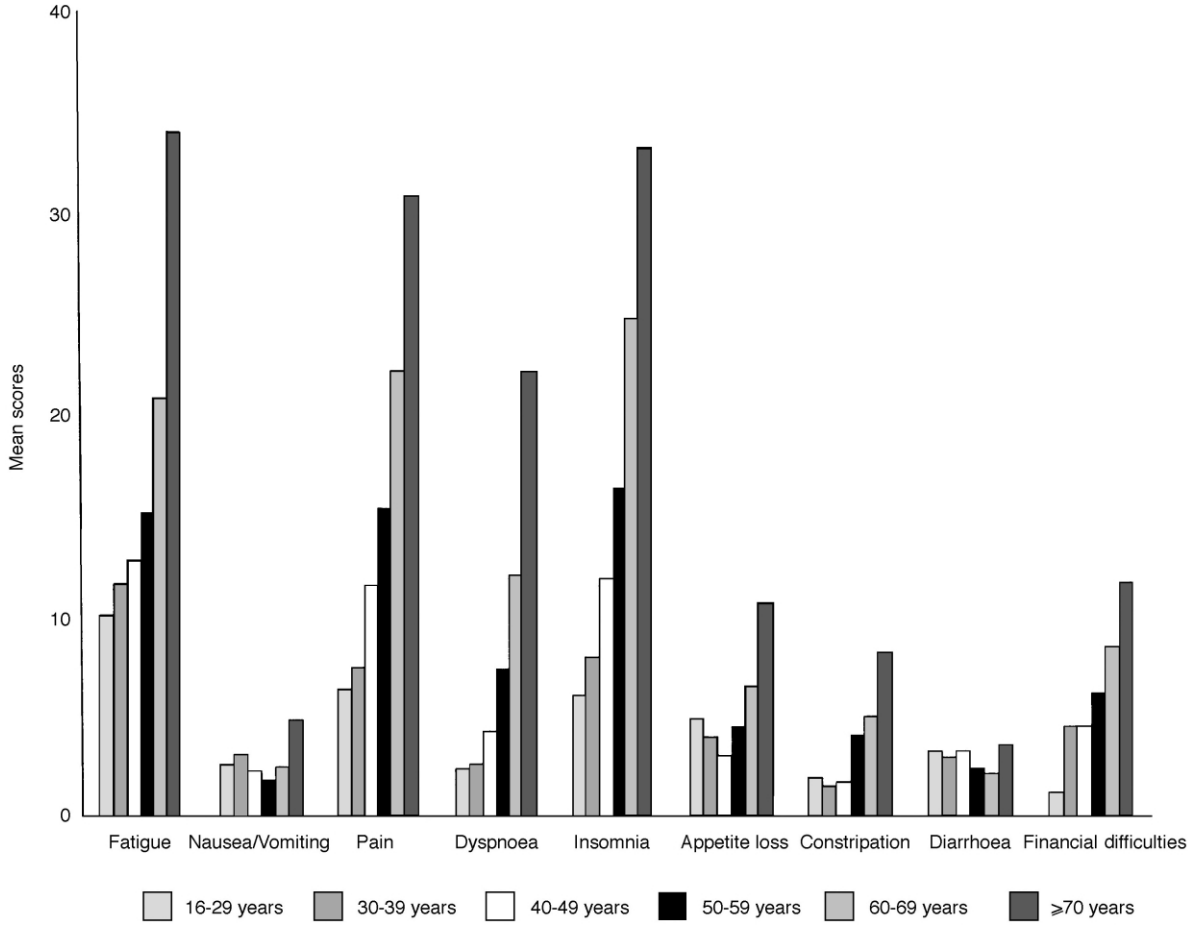

Fig. 2. Mean symptom scale and item scores by age. As in Fig. 1, error bars are omitted to maintain clarity of the figure.

Table 2
Mean scores (standard deviations in parentheses) of scales and items by sex and age groups

	Men							Women							Total
Age (years)	All	16–29	30–39	40–49	50–59	60–69	⩾70	All	16–29	30–39	40–49	50–59	60–69	⩾70	
Functioning scales															
Physical	92.0 (15.6)	97.9	98.3	95.7	92.9	86.5	78.3	88.7 (17.5)	96.8	96.2	93.1	91.2	83.8	69.4	90.1 (16.7)
Role	89.8 (21.7)	96.9	96.5	92.2	89.4	84.5	78.3	86.6 (23.7)	95.1	92.6	89.4	90.0	82.1	69.2	88.0 (22.9)
Emotional	81.8 (18.8)	87.2	82.4	81.0	79.3	80.5	81.5	76.3 (22.2)	77.8	77.4	76.5	77.5	75.9	72.4	78.7 (21.0)
Cognitive	92.7 (15.0)	97.9	96.0	95.6	93.0	88.3	84.3	90.1 (18.4)	93.4	94.1	92.8	92.6	88.7	78.0	91.2 (17.0)
Social	92.0 (18.3)	98.1	96.5	95.1	90.6	86.7	85.3	90.3 (20.1)	93.7	91.8	91.3	90.9	90.9	82.7	91.0 (19.4)
Global quality of life	72.7 (22.2)	83.6	79.8	74.3	71.4	65.6	61.5	69.2 (21.9)	78.9	77.4	70.2	70.1	62.6	55.1	70.8 (22.1)
Symptom scales															
Fatigue	14.0 (0.3)	6.7	8.5	9.6	14.7	18.6	27.8	19.5 (23.1)	12.7	13.8	15.5	15.6	23.0	37.8	17.1 (22.0)
Nausea/vomiting	1.8 (7.6)	0.7	1.8	1.6	1.8	2.2	2.3	3.6 (11.4)	4.0	4.0	2.8	1.8	2.8	6.2	2.8 (9.9)
Pain	13.0 (23.1)	3.7	4.4	9.0	14.9	20.3	27.0	17.2 (25.3)	8.3	9.4	13.7	15.9	23.9	33.2	15.4 (24.4)
Single items															
Dyspnoea	6.9 (18.5)	1.0	1.2	2.4	6.9	12.6	18.7	9.1 (21.6)	3.5	3.5	5.6	7.7	11.7	24.1	8.1 (20.3)
Insomnia	13.0 (24.4)	3.7	5.9	9.6	14.5	19.5	25.7	19.1 (29.0)	7.8	9.2	13.6	18.1	29.8	37.7	16.4 (27.2)
Appetite loss	4.2 (14.0)	2.7	2.4	3.1	4.2	6.2	6.3	6.3 (17.4)	6.4	4.8	3.0	4.6	6.6	13.1	5.4 (16.0)
Constipation	2.5 (11.8)	0.2	0.9	0.7	3.0	3.5	8.3	4.3 (14.9)	3.1	1.8	2.4	4.9	6.3	8.0	3.6 (13.7)
Diarrhoea	2.5 (10.4)	1.2	1.7	3.7	3.4	2.1	2.7	3.1 (12.6)	4.7	3.8	2.8	1.5	2.2	4.0	2.8 (11.7)
Financial difficulties	5.5 (17.8)	0.5	3.3	3.3	6.2	10.2	9.0	6.3 (18.6)	1.8	5.1	5.2	6.0	6.6	13.3	6.0 (18.2)

Table 3
Distribution of scale values (in %)

Scale	0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100
Physical functioning	0	1	0	2	1	4	3	9	9	70
Role functioning	2	1	0	4	4	0	11	0	7	72
Emotional functioning	1	1	1	3	8	6	1	12	15	42
Cognitive functioning	0	1	0	1	3	0	9	0	14	71
Social functioning	1	1	0	2	3	0	9	0	6	77
Global quality of life	1	1	2	5	15	6	15	11	21	22
Fatigue	46	15	14	9	6	4	2	2	1	1
Nausea/vomiting	90	6	0	3	1	0	1	0	0	0
Pain	62	11	0	12	5	0	5	0	2	2

Table 4
Distribution of answers for symptom items (in %)

Item	Not at all	A little	Quite a bit	Very much
Dyspnoea	83	10	5	2
Insomnia	68	19	9	4
Appetite loss	88	9	2	1
Constipation	92	5	2	1
Diarrhoea	93	5	1	1
Financial difficulty	88	7	3	2

perform the comparison on the basis of regression models which can be calculated from the data of the general population [18]. Regression models should be simple and accurate. For reasons of clarity, we decided to assume equal regression models for all scales, even though some of the components do not significantly contribute to the explained variance for some of the scales. The models contain the main effects of age and sex, the interaction between age and sex (which allows the slopes for the two sexes to be unequal), and a quadratic age term (which can account for non-linear dependencies). Additionally, it was necessary to include a constant in the model. In the regression model, all these effects were forced into inclusion in the model. The resulting parameters are given in Table 5.

The data of Table 5 allows for the calculation of expected scores for each age and sex combination. Men are coded with 0 and women with 1. The quadratic component (Age^2) has to be divided by 100. For example, the expected physical functioning scores for people with 65 years of age are calculated as follows:

E (physical functioning; woman; 65 years) $= 0.77 \times 65 + 1.41 \times 1 - 0.09 \times (65 \times 1) - 1.17 \times 65^2/100 + 85.8 = 82.0$

E (physical functioning; man; 65 years) $= 0.77 \times 65 + 1.41 \times 0 - 0.09 \times (65 \times 0) - 1.17 \times 65^2/100 + 85.8 = 86.3$

Table 5
Regression coefficients[a]

	Regression coefficients						
	Age	Sex	Age×Gender	Age^2	Constant	Mult. R	Adjusted R^2
Functioning							
Physical	0.77	1.41	−0.09	−1.17	85.8	0.51	0.26*
Role	0.59	−0.80	−0.04	−0.99	87.4	0.34	0.12*
Emotional	−0.16	−6.77	0.03	0.05	88.5	0.15	0.02*
Cognitive	0.53	−3.95	0.03	−0.81	88.8	0.31	0.09*
Social	0.06	−7.89	0.13	−0.34	98.5	0.20	0.04*
Global quality of life							
Symptom scales	−0.14	−3.41	0.00	−0.31	88.2	0.36	0.13*
Fatigue	−0.65	5.51	0.00	1.07	16.8	0.37	0.14*
Nausea/vomiting	−0.22	2.41	−0.01	0.26	5.7	0.13	9.02*
Pain	−0.21	5.08	−0.02	0.70	4.2	0.35	0.12*
Single items							
Dyspnoea	−0.48	2.53	−0.01	0.84	7.7	0.32	0.10*
Insomnia	−0.13	0.15	0.12	0.60	3.2	0.36	0.13*
Appetite loss	−0.41	1.90	0.00	0.51	10.2	0.16	0.02*
Constipation	−0.16	4.02	−0.05	0.31	1.9	0.18	0.03*
Diarrhoea	−0.06	3.15	−0.05	0.08	3.1	0.05	0.00
Financial.difficulties	0.04	2.80	−0.04	0.17	−1.1	0.18	0.03*

*$P < 0.001$.

[a] Age×gender represents the interaction between age and gender. Age (in years) must be multiplied with the code for gender (0 for men and 1 for women).

The values correspond with the figures (83.8 for women and 86.5 for men in the age group 60–69 years) given in Table 2. Compared with reference values as those in Table 2, regression models have the advantages of having lower standard errors and the fact that age can be exactly accounted for without interpolation. A disadvantage of the data in Table 5 is that it cannot be seen whether or not there are significant linear age dependencies. Nevertheless, the data are useful for making group comparisons.

4. Discussion

With the exception of one single item (diarrhoea) all scales and all single items showed significant dependencies on age and/or sex (Table 5). This is in line with the results previously reported, and it underlines the necessity to account for age and sex differences when patient populations with different age and sex distributions are compared.

The comparison between the mean values of our investigation and those of the Norwegian sample [1,18] reveals some remarkable differences. The functioning scales show higher values for social, cognitive and role (new) functioning and lower values for emotional functioning in the German group. The mean global health/quality of life is somewhat lower (men: 72.7 versus 77, women 69.2 versus 73) than in the Norwegian sample. However, the symptom items and symptom scales showed great differences with lower mean values in the German sample for all symptoms. The values for constipation and diarrhoea were approximately 3 times higher in the Norwegian group, for both sexes. For all but one symptom item, the mean scores of the Danish sample [17] were between those of Norway and Germany. The CD-ROM of the EORTC Quality of Life Unit [12] summarises mean scores for various types of cancer. For head and neck cancer, and stage I/II diseases, the mean values for fatigue, nausea/vomiting, pain, constipation and diarrhoea were also lower than those of the Norwegian general population. Reasons for the differences are difficult to establish; the German translation of the category labels (not at all; a little, quite a bit; very much) does not seem to be responsible for a trend towards no symptom reporting. Since the same differences can be found in all age groups, differences in the sampling technique (the German sample was only recruited from private households, and did not include people hospitalised, institutionalised or living in nursing homes) can only partly account for the differences.

A part of the Norwegian study [1] was devoted to investigating the relationship between socioeconomic status and the EORTC QLQ-C30 variables. Our study also took into account several sociodemographic features. Most of these variables were interrelated with age, a factor which correlates with marital status (single, married, divorced, widowed) and work related variables (studying; employed, unemployed, retired), educational status (higher mean educational level for younger persons), profession and income. Because of the age differences in the EORTC QLQ-C30 variables, simple comparisons between different socioeconomic groups can be misleading, so we do not report the results here.

Comparisons between patient groups with different age and sex distributions can be performed best with the help of the regression coefficients given in Table 5. Hjermstad and colleagues [18] have already shown how such comparisons can be conducted, but they only provided the coefficients for one single item. Now it is easily possible to calculate expected scores for each variable and each age and sex group. Most of the variables show a roughly linear relationship between age and scale score or item score. However, the decrease of abilities and the increase of symptoms is most pronounced in the oldest age groups. This results in a non-linear component of the relationship between age and the above mentioned variables, expressed with the Age^2 component in the regression model. Models which are applied to smaller age ranges will possibly be able to omit this quadratic trend. Overall significance tests of the regression models are given in Table 5, but they are of limited value for two reasons. The first reason is, the standard tests are not exact due to skewed distributions. The second is that in a sample of 2000 subjects even very low correlation and regression coefficients become statistically significant and reveal little about their clinical relevance. Nevertheless, with the exception of the diarrhoea item, all adjusted R-squares of Table 5 are statistically significant with $P < 0.001$.

The scores given here are interesting from a clinical point of view. Comparisons with a 'general' population give a better insight into the significance of differences between cancer groups, and change scores (pre–post differences) are also easier to interpret when general distributions are known. The data shows that age and sex differences should not be neglected. Furthermore, the differences between the Norwegian and the German sample indicate that it is necessary to perform replications of norming studies, especially when questionnaires are used in different languages and countries.

References

1. Hjermstad MJ, Fayers PM, Bjordal K, Kaasa S. Health related quality of life in the general Norwegian population assessed by the European Organization for research and treatment of cancer core quality-of-life questionnaire: the QLQ-C30(+3). *J Clin Oncol* 1998, **16**, 1188–1196.
2. Guyatt G, Veldhuyzen Van Zanten S, Feeny D, Patrick D. Measuring quality of life in clinical trials: a taxonomy and review. *Can Med Assoc J* 1989, **140**, 1441–1448.

3. Lauper P, Versteegen U. The importance of quality of life in policy decisions: new end points in medical outcome assessment. *Pharm Med* 1992, **5**, 43–50.
4. Ware JE. *SF-36 Health Survey Manual and Interpretation Guide*. Boston, MA, New England Medical Center, 1993.
5. Hunt SM, McKenna SP, McEwen P, Williams J, Papp E. The Nottingham Health Profile: subjective health status and medical consultations. *Soc Sci Med* 1981, **15A**, 221–229.
6. Aaronson NK, Ahmedzai S, Bergman B, *et al*. The European Organisation for Research and Treatment of cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst* 1993, **85**, 365–376.
7. De Haes JCJM, van Knippenberg FCE, Neijt JP. Measuring psychological and physical distress in cancer patients: structure and application of the Rotterdam Symptom Checklist. *Br J Cancer* 1990, **62**, 1034–1038.
8. Schipper H, Clinch J, McMurray A, Levitt M. Measuring the quality of life of cancer patients: the functional living index-cancer: development and validation. *J Clin Oncol* 1984, **2**, 472–483.
9. Cella DF, Bonomi AE, Lloyd SR, Tulsky DS, Kaplan E, Bonomi P. Reliability and validity of the Functional Assessment of Cancer Therapy-Lung (FACT-L) quality of life instrument. *Lung Cancer* 1995, **12**, 199–220.
10. Jenkinson C, Wright L, Coulter A. *Quality Of Life Measurement In Health Care. A Review Of Measures And Population Norms for the UK SF-36*. Health Services Research Unit, University of Oxford, 1993.
11. Hunt S, McKenna S. Validating the SF-36. *Br Med J* 1992, **305**, 645.
12. EORTC. *Quality of Life Study Group QLQ-C30. Reference Values*. CD-ROM, version 1.0. Bruxelles, EORTC Data Center, Quality of Life Unit, 1998.
13. Bjordal K, Kaasa S. Psychometric validation of the EORTC Core Quality of Life Questionnaire, 30-item version and a diagnosis-specific module for head and neck cancer patients. *Acta Oncol* 1992, **31**, 311–321.
14. Kaasa S, Bjordal K, Aaronson N, *et al*. The EORTC Core Quality of Life Questionnaire QLQ-C30: validity and reliability when analysed with patients treated with palliative radiotherapy. *Eur J Cancer* 1995, **31A**, 2260–2263.
15. Osoba D, Zee B, Pater J, Waif D, Kaizer L, Latreille J. Psychometric properties and responsiveness of the EORTC Quality of life questionnaire (QLQ-C30) in patients with breast, ovarian and lung cancer. *Qual Life Res* 1994, **3**, 353–364.
16. Hjermstad MJ, Fossa DS, Bjordal K, Kaasa S. Test/retest study of the European Organization for Research and Treatment of Cancer core quality of life questionnaire. *J Clin Oncol* 1995, **13**, 1249–1254.
17. Klee M, Groenvold M, Machin D. Quality of life of Danish women: population-based norms for the EORTC QLQ-C30. *Qual Life Res* 1997, **6**, 27–34.
18. Hjermstad MJ, Fayers PM, Bjordal K, Kaasa S. Using reference data on quality of life — the importance of adjusting for age and gender, exemplified by the EORTC QLQ-C30(+3). *Eur J Cancer* 1998, **34**, 1381–1389.
19. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika* 1951, **16**, 297–334.