QUALITY OF LIFE AND CURRENT COPING IN YOUNG ADULT SURVIVORS OF CHILDHOOD CANCER: POSITIVE EXPECTATIONS ABOUT THE FURTHER COURSE OF THE DISEASE WERE CORRELATED WITH BETTER QUALITY OF LIFE

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SUMMARY

Objectives: As a result of advances in the treatment of childhood cancer many patients who may previously have had a limited life expectancy, are now surviving into adulthood. More insight is needed into the long-term adjustment of young adult survivors of childhood cancer. The purpose of this study was to (1) assess health-related quality of life (HRQoL), and (2) to explore the role of cognitive coping in relation to HRQoL.
Methods: HRQoL of 353 Dutch young adult survivors of childhood cancer was compared with HRQoL of 507 peers. Linear regression analyses predicted survivors' HRQoL by cognitive coping, independent of the impact of demographics and medical variables.
Results: Survivors reported a lower HRQoL than their peers. Health status was the best predictor of the Physical Component Scale of the RAND-36; health status and cognitive coping contributed almost equally well to the Mental Component Scale. The explanatory value of cognitive coping could mainly be attributed to the use of predictive control strategies.
Conclusions: Because current coping seemed to be an important predictor of HRQoL, interventions directed at the coping strategies of survivors should be useful. The strong association between predictive coping and HRQoL stresses the importance of focusing at having positive expectations about the further course of the disease. Copyright © 2005 John Wiley & Sons, Ltd.

KEY WORDS: neoplasm in childhood; long-term survivors; quality of life; psychological adaptation

INTRODUCTION

As a result of advances in the treatment of childhood cancer, the number of survivors reaching adulthood has increased enormously in the last decades. With the increasing number of long-term survivors of childhood cancer, the need to assess their quality of life (QoL) becomes more and more important. The concept of health-related QoL (HRQoL) refers to the impact of health and illness on the individual's QoL (Eiser and Morse, 2001; Eiser, 2004). Numerous long-term physical effects of childhood cancer have been documented, but the impact of such sequelae on the HRQoL of patients is much less well understood. Reviews about the HRQoL of young adult survivors of childhood cancer mention a wide variety of studies with contradictory results (Eiser *et al*., 2000; Langeveld *et al*., 2002). The contradictory results are due to several causes. The assessment of HRQoL is complex because there is not yet an universally accepted definition for it. The current consensus is that it should include at least four

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domains: physical, cognitive, social and emotional functioning. Furthermore, HRQoL studies are characterized by a high degree of heterogeneity with respect to: the patient samples (e.g. survivors with different cancers who have undergone a variety of treatments), the comparison groups selected, the HRQoL dimensions assessed, and the instruments employed (Langeveld et al., 2002).

As we learn more about the challenges associated with long-term survival of childhood cancer, more insight is needed into the predictors of adjustment of young adult survivors to enable us to detect the survivors at risk for adjustment problems. Factors related to the functioning of survivors, especially demographics and medical variables, have been discussed to some extent in many studies of HRQoL (Langeveld et al., 2003; Pastore et al., 2001; Pui et al., 2003; Zebrack and Chesler, 2002; Zebrack et al., 2004) (see also: review of Langeveld et al., 2002). Although inconsistent data have been reported across studies, the results suggest the following. Firstly, an increased risk for emotional problems proved to be associated with female gender, older age at follow-up, a greater number of relapses, the presence of severe functional impairment, cranial irradiation, and belonging to a minority. Secondly, survivors of CNS tumours and subsets of survivors of acute lymphatic leukaemia (ALL) seemed to be at risk for educational deficits; the same is true for cranial irradiation and early age at diagnosis. Thirdly, survivors of bone tumours were more likely to perceive their health as fair or poor, and also reported lower physical functioning than their controls. The demographics and medical variables described above only explain variations in HRQoL to a limited extent.

Apart from medical variables, more insight is needed into other predictors of adjustment among survivors of childhood cancer, such as coping and family functioning, in order to enable health care providers to detect and help survivors at risk.

The role of coping seems to be important in relation to the adjustment of children with cancer (Last and Grootenhuis, 1998). The more we know about disease-specific coping and about the relation between coping and HRQoL the better health care providers will be able to help patients to cope with the consequences of their disease. However, in the literature no former studies were found about the young adults' coping with the long-term consequences of childhood cancer. Therefore, the current study was directed at this topic.

According to the model of stress and coping developed by Lazarus and Folkman (1984), coping consists of actions, behaviours and thoughts aimed at dealing with the demands of events and situations that are appraised as stressful. So, coping mediates the effect of stress on an individual's well-being. Two main types of coping can be distinguished: problem- and emotion-focused coping. Problem-focused coping involves direct effort to modify the problem causing the distress, whereas emotion-focused coping is directed at regulating affects surrounding a stressful experience.

Rothbaum's concept of primary- and secondary control (Rothbaum et al., 1982) is related to problem- and emotion-focused coping. All the actions of problem-focused coping can be seen as primary control. If stressors are perceived as uncontrollable, primary control fails, and people will try to adjust to the situation, which is called secondary or cognitive control. Rothbaum et al. (1982) distinguish four control strategies: predictive control, vicarious control, illusory control, and interpretative control.

It is reasonable to say that cancer is an uncontrollable stressor because patients cannot solve the problem and are dependent on physicians. So, patients have to rely predominately on emotion-focused coping or, in other words, secondary or cognitive control, the main topic of this paper. In the context of coping with a life-threatening illness the following disease-related cognitive control strategies are relevant (Grootenhuis et al., 1996). Predictive control means that one attempts to predict events in order to create the feeling that one is able to control the situation. Having positive expectations helps patients to deal with the consequences of disease. Vicarious control strategies concern the attribution of special power to others, in the case of cancer patients to the doctors, on whom all hope is focused. Because one cannot alter the course of the disease, belief in powerful others can be adaptive. With illusory control one attempts to associate with chance, such as hoping for a miracle or wishful thinking. Finally, interpretative control refers to the search for meaning and understanding. Using information to help to understand emotional reactions or to reduce uncertainty are interpretative control strategies.

The purpose of the present study was (1) to assess the HRQoL of young adult survivors of childhood cancer in comparison with the HRQoL

of peers without a history of childhood cancer, and (2) to explore the role of cognitive coping in relation to HRQoL, independent of the impact of medical variables. With respect to the first purpose we hypothesize that survivors report worse HRQoL than peers. Furthermore, we expected that cognitive coping is correlated with HRQoL.

PATIENTS AND METHODS

Procedure

The results presented here concern the cross-sectional part of the VOLG-study, a Dutch study on the late psychosocial consequences of cancer in childhood. The respondents for this part of the study were recruited from the long-term follow-up clinic at The Emma Children's Hospital/Academic Medical Center in Amsterdam, established in 1996 to monitor long-term sequelae of childhood cancer and its treatment. Patients become eligible for transfer from active-treatment clinics to the follow-up clinic when they had successfully completed their cancer treatment at least 5 years earlier. Survivors are evaluated annually in the clinic by a paediatric oncologist (patients aged <18 years) or by an internist-oncologist (patients aged >18 years) for late medical effects, as well as a research nurse or psychologist for psychosocial effects.

In 2001 and 2002, the survivors of childhood cancer, aged between 18 and 30 years, who attended the long-term follow-up clinic were asked (by letter or by a psychologist) to fill in anonymously questionnaires about HRQoL, course of life, and coping with the disease. After having completed the questionnaires at home, they could return them in a stamped addressed return envelope. After a month, all eligible survivors received a reminder letter together with the same questionnaires. The inclusion criteria were: (1) age at study 18–30 years, (2) end of successful treatment at least 5 years before, (3) age at cancer diagnosis <18 years, and (4) being able to understand Dutch questionnaires.

At the end of 2000 and 2001 an age- and sex-matched control group was formed with the help of the general practitioners (GPs) of the survivors. The GPs were asked to select 10 patients from their registry lists, whose surnames started with a given letter from the alphabet, and who had a given sex and age. The inclusion criteria for the comparison group were: (1) age at study 18–30 years, (2) no history of cancer, and (3) being able to understand Dutch questionnaires. The GPs had to send a packet containing the questionnaires, information about the VOLG-study, and a stamped addressed return envelope to the 10 randomly selected patients. Two weeks after the original mailing date, the GPs had to send another packet with the same content and a reminder letter. The Medical Ethic Committee of the Academic Medical Center in Amsterdam has approved the study protocol.

Measures

HRQoL was assessed with the RAND-36 and the Cognitive Control Strategies Scale (CCSS) was used for measuring current cognitive coping with a disease.

The RAND-36 is a Dutch version of the MOS-SF-36 Health Survey and almost identical to the Dutch SF-36 (Aaronson *et al.*, 1998). The RAND-36 is composed of 36 items with standardized response choices, clustered into eight multi-item scales: Physical Functioning (PF), Social Functioning (SF), Role limitations due to Physical health problems (RP), Role limitations due to Emotional problems (RE), general Mental Health (MH), Vitality (VT), Bodily Pain (BP), and General Health perceptions (GH). All raw scale scores are converted to a 0–100 scale, with higher scores indicating higher levels of functioning or well-being. The validity and reliability of the RAND scales are satisfactory (van der Zee and Sanderman, 2003). In the present study we found Cronbach's alpha's in the range 0.74–0.90 among survivors and 0.74–0.89 in the comparison group.

Overall physical and overall mental health were assessed by aggregation of all scale scores according to the algorithm described by Ware and Kosinski (2001), which leads to the so-called Physical Component Scale (PCS) and Mental Component Scale (MCS). The relative contribution of each scale to PCS and MCS was derived from principal components analysis, non-orthogonal rotation (Oblimin), based on the assumption that physical health and mental health are interdependent. This is contrary to the analysis of Ware and Kosinski (2001), who conducted an orthogonal rotation.

The CCSS was used to measure coping with the disease in now-healthy survivors. The CCSS is an instrument of disease-related cognitive coping, based on the model of Rothbaum et al. (1982) and developed at the Psychosocial Department of The Emma Children's Hospital/AMC. Although the validity of this instrument has not yet been published formally, the questionnaire proved to be useful in earlier studies (Grootenhuis et al., 1996; Grootenhuis and Last, 2001; Loonen et al., 2002). The CCSS consists of 22 items, and may be applied to children, adolescents and young adults with any chronic disease. In this questionnaire respondents are asked to indicate whether they agree with a given statement on a 4-point scale: totally agree, agree, disagree, totally disagree. Higher scores on a subscale represent a stronger reliance upon the control strategy.

The items of the CCSS were grouped into three subscales: predictive control (being optimistic about the course of the illness), vicarious control (attributing power to medical-care givers and treatment), and interpretative control (searching for meaning and information in order to better understand emotional reactions and to gain insight into the situation). Because in validity studies the subscale assessing illusory control failed to show sufficient internal consistency (Cronbach's alpha of 0.45), this subscale is not included in the instrument as we use it. Items composing a subscale were selected after a principal component factor analysis with varimax rotation, and after inspection of the psychometric features of the items. Inclusion of items in the subscales was based on (1) factor loadings higher than 0.40, (2) no reduction in the Cronbach's alpha coefficient of the subscale, (3) a considerable correlation with the other items of the subscale. Test–retest reliability was tested in a population of 21 adolescents with familial hypocholesterolemia (FH), a chronic stable disease (van der Zaag-Loonen et al., 2003). The adolescents completed the questionnaire twice within 2 weeks. Test–retest reliability was analysed calculating the intra-class correlation coefficient (ICC). ICCs for the three subscales exceeded 0.60: predictive control, 0.64; vicarious control, 0.73; and interpretative control, 0.88.

The Cronbach's alpha's in the present study were satisfactory: predictive control, 0.74 (3 items); vicarious control, 0.78 (8 items); interpretative control, 0.80 (4 items). The use of the three control strategies were related to each other. Vicarious control was positively related to predictive control ($r = 0.30$, $p < 0.01$) and to interpretative control ($r = 0.16$, $p < 0.05$). There was no significant correlation between predictive control and interpretative control.

Medical data, concerning diagnosis, treatment and health problems, were obtained from the registry of the long-term follow-up clinic at The Emma Children's Hospital/Academic Medical Center in Amsterdam. The registry of health problems is based on the information the oncologist receives at the annual evaluation; the oncologist also noted down whether the patient reported psychosocial or cognitive problems. The health problems were categorized into 10 groups, based on Stevens et al. (1998): i.e. endocrine, organ toxicity, mobility/orthopaedic, infertility, sensory, cosmetic, fatigue, subsequent neoplasm, psychosocial/cognitive, and neurological. Apart from the registration at the long-term follow-up clinic all respondents were asked to fill in whether they had experienced health complaints in the last 4 weeks and whether they suffered from a chronic disease.

Statistical analysis

The Statistical Package for Social Sciences (SPSS), Windows version 11.5, was used for all analyses. Before conducting the final analyses several preparation analyses were conducted. Firstly, (sub)scales were constructed, on the basis of the guidelines of the questionnaires used, and the reliability of these (sub)scales was calculated. Secondly, we created three medical variables. We formed two dummy variables and took the first category of each dummy as reference for the analysis: diagnosis: leukaemia/lymphoma, solid tumours, brain tumours; treatment: surgery only, chemotherapy with or without surgery, radiotherapy with or without surgery, chemotherapy and radiotherapy with or without surgery. Survivors' health problems as registered (at any time) by the long-term follow-up clinic were divided into two variables: physical problems (yes or no) and psychosocial/cognitive/neurologic problems (yes or no). Thirdly, missing data were imputed at (sub)scale level. If less than half of the items of a (sub)scale was missing, the (sub)scale score was calculated on the basis of the items the respondent had completed. The percentage imputed RAND-scalescore ranged from 0.0 to 6.7

and the percentage imputed scalescore on the CSS ranged from 0.7 to 4.7. Finally, we compared survivors and comparisons with respect to their demographic characteristics in order to detect confounders. Therefore, we used Student's t-test and χ^2-tests.

After these preparation analyses, multivariate analysis of variance (MANOVA) and univariate analysis of variance (ANOVA) were conducted to test group differences on the RAND-36, corrected for age, sex and, if needed, other confounders. Effect sizes (d) were calculated by dividing the difference in mean score between survivors and comparisons by the standard deviation of the scores in the comparison group. We considered effect sizes up to 0.2 to be small, effect sizes about 0.5 to be moderate, and effect sizes about 0.8 to be large (Cohen, 1988).

To get an impression of the meaning of the scores on the subscales of the CCSS, the mean scores on the subscales were divided by the number of items of the subscale. This resulted in the mean item scores for the three cognitive control strategies. The higher the mean item score the more is the agreement with the statements, that is, the stronger the reliance on the cognitive control strategies. A mean item score 1 means total disagreement and a mean item score 4 means total agreement with all the items of the subscale.

We performed multiple linear regression analyses to investigate the predictive value of cognitive coping in relation to the RAND scores, and we corrected for (1) demographics, i.e. age and gender, (2) medical variables, i.e. diagnosis, treatment, age at first diagnosis, duration of treatment, and relapse or second malignancy, and (3) health status, i.e. current health complaints/disease, and health problems as registered (at any time) by the long-term follow-up clinic at The Emma Children's Hospital/Academic Medical Center in Amsterdam. The medical variables 'time since diagnosis' and 'time since end of treatment' were not entered into the model because of multicollinearity. These variables could be predicted by 'age', 'age at first diagnosis', and 'duration of treatment', variables which are represented in the model.

We limited the regression analysis to the two summary scales of the RAND-36 in order to minimize the number of statistical tests. All variables were presented in the final regression model for the physical summary score (PCS) and the mental summary score (MCS) of the RAND-36. In order to compare the strength of the association between the summary scores and the various groups of independent variables, we entered the variables stepwise into the regression model: (1) demographics, (2) medical variables, (3) health status, and (4) cognitive coping. After each step, the total variance explained by the included variables (R^2) was assessed, so that an increase in explained variance could be contributed to the added variables.

RESULTS

Participants

Survivors. A total of 499 consecutive young adult survivors were asked to take part in the cross-sectional part of the VOLG-study, 262 men (52.5%) and 237 women (47.5%). Three hundred and fifty-five questionnaires were returned (response 71.0%), two questionnaires could not be used for analysis because of not being filled in by the patient herself ($n = 1$) or returned too late ($n = 1$). Of the 144 survivors who did not complete the questionnaires 18 returned the non-response form. Most of these non-respondents reported that they did not have enough time or did not feel like taking part in the study ($n = 10$). Two non-respondents did not complete the questionnaire because they did not want to be confronted with cancer again; the other six refused for other reasons.

The data of 353 survivors could be used for the analyses: 175 (49.6%) men, 178 (50.4%) women. Their mean age was 24.3 years (S.D. = 4.0; range = 17.7–31.1) and the median age was 24.5 years (Table 1).

The respondents were older than the non-respondents at study (M = 23.2 years; S.D. = 3.9; range = 18.0–30.8) and at diagnosis (M = 6.3 years; S.D. = 4.7; range 0.0–17.0) ($p < 0.05$), and there was a higher percentage of women among the respondents than among the non-respondents (50.4 versus 40.4%, $p < 0.01$). No significant differences were found in diagnosis and treatment, time since first diagnosis, time since end of treatment, duration of treatment, having had a relapse or second malignancy, and health problems as registered at the long-term follow-up clinic.

Table 1. Demographic and medical characteristics of the survivors and the comparison group

	Survivors ($n = 353$)			Comparison group ($n = 507$)		
	M	S.D.	Range	M	S.D.	Range
Age at study (yr)	24.3	4.0	17.7–31.1	24.2	3.8	18.0–30.9
Age at first diagnosis (yr)	7.3	4.7	0.0–17.0			
Time since first diagnosis (yr)	17.02	6.0	6.2–30.7			
Time since end of last treatment (yr)	15.5	5.5	4.9–30.3			
Duration of treatment (month)	12.5	10.5	0.0–72.5			
	n		(%)	n		(%)
Gender						
Female	178		50.4	268		52.9
Male	175		49.6	239		47.1
Native country						
The Netherlands	338		96.6	487		96.1
Other	12		3.4	20		4.0
Religion						
Yes	164		47.1	218		43.2
No	184		52.9	287		56.8
Diagnosis						
Leukaemia/lymphoma	176		49.9			
Solid tumour	152		43.1			
Brain tumour	25		7.1			
Treatment						
Chemotherapy (with/without surgery)	199		56.4			
Radiotherapy (with/without surgery)	14		4.0			
Surgery alone	26		7.4			
Combination therapie (chemo + radio, with/without surgery)	114		32.3			
Health problems						
No problems	45		12.7			
Physical	299		84.7			
Psychosocial/cognitive/neurological	114		32.3			
Relapse or second malignancy						
Yes	43		12.2			
No	310		87.8			

Comparison group. A total of 264 general practitioners (GPs) were asked to recruit ten patients from their practice for the comparison group; 96 (36.4%) GPs agreed to take part in the study. From 82 general practices one ore more completed questionnaires were returned. So we concluded that in the end 82 GPs (31.0%) had participated in the study, whom we assumed to have recruited 820 patients. The investigators received 517 questionnaires (response rate 63.0%), of which 10 could not be used because of: the age of the patients at study being younger than 18 years or older than 30 years ($n = 5$), unknown age ($n = 1$), history of cancer ($n = 2$), RAND-36 not being completed ($n = 2$). So the final comparison group consisted of 507 respondents, 239 men (47.1%) and 268 women (52.9%), mean age 24.2 years (S.D. 3.8, range 18.0–30.9), median age 23.8 years.

Of the 303 non-respondents 50 returned the non-response form. They reported that they had no time ($n = 13$) or no interest ($n = 8$) to take part in the study. Ten possible respondents did not complete the questionnaires because they misunderstood the informative letter and supposed that they should have a history of cancer themselves. Eight questionnaires proved to be undeliverable, and the remaining 11 non-response forms mentioned other reasons. More men (70%) than women (30%) refused. Because the recruitment

by the GPs was strictly anonymous, we could not trace other characteristics of the non-response group, or the reasons for refusal.

Survivors versus comparison group. The characteristics of the survivors and the comparison group are listed in Table 1. No significant differences were found with respect to age, gender, native country, nationality, and religion.

Quality of life (RAND-36): survivors versus comparison group.

The MANOVA for the RAND scales as a function of group, gender and age showed multivariate main effects for group ($F(8,835) = 2.8$, $p < 0.01$) and gender ($F(8,835) = 8.4$, $p < 0.001$). The results of the univariate F-tests according to MANOVA showed worse HRQoL among survivors than among the comparison group with respect to: Physical Functioning ($F(1,842) = 7.6$, $p < 0.01$), Social Functioning ($F(1,842) = 5.9$, $p < 0.05$), and Role limitations due to Physical problems ($F(1,842) = 8.3$, $p < 0.01$) (Table 2). ANOVA for the Physical Summary Scale confirmed these findings (Table 3): survivors scored significantly lower ($F(1,842) = 4.4$, $p < 0.05$) than the comparison group. All significant differences between survivors and comparisons were small: effect sizes ranged from 0.15 for PCS to 0.22 for Role limitations due to Physical problems.

Cognitive coping and HRQoL of survivors.

The scores on the subscales of the CCSS are presented in Table 4: predictive control, vicarious control, and interpretative control strategies. The scores in Table 4 indicate agreement with many statements of the three cognitive control strategies.

The results of the multiple regression analyses are presented in Table 5, including the total variance explained (R^2) after each step, so that the increase in R^2 represents the contribution of the variables added at that step.

Both PCS ($R^2 = 0.40$; $p < 0.001$) and MCS ($R^2 = 0.39$; $p < 0.001$) were reasonably well predicted by the regression model. Health status (step 3) was the best predictor of the PCS: it explained half (20%) of the total variance explained (40%). Health status (step 3) and cognitive coping (step 4) together contributed

almost equally to MCS, 12 and 14% of the total R^2 (39%), respectively.

Age and gender (step 1) explained 10% (PCS) and 8% (MCS) of the regression model, which was mainly due to gender. The mean HRQoL of women was worse than that of men; for both PCS and MCS $\beta = -0.13$ ($p < 0.01$). In step 2, i.e. the entrance of the medical variables, there was a small increase in R^2, i.e. 3% for PCS, and 5% for MCS. As shown in Table 5, the age of the survivor at diagnosis was negatively related to HRQoL: the older at diagnosis, the worse PCS and MCS ($\beta = -0.16$; $p < 0.01$ and $\beta = -0.19$; $p < 0.001$, respectively). Survivors who had been treated otherwise than with surgery alone reported better mental HRQoL (MCS) than survivors treated with surgery alone. Diagnosis, duration of treatment and the occurence of a relapse did not contribute to HRQoL. With regard to step 3, survivors with psychosocial/cognitive/neurological problems registered (at any time) at the long-term follow-up clinic had lower scores on PCS ($\beta = -0.19$; $p < 0.001$) and MCS ($\beta = -0.18$; $p < 0.001$) than survivors without these problems. Physical problems registered (at any time) at the long-term follow-up clinic did not contribute to the model. Current health problems (experienced health complaints in the last 4 weeks) were negatively associated with PCS ($\beta = -0.33$; $p < 0.001$) and MCS ($\beta = -0.21$; $p < 0.001$). Step 4, cognitive coping, showed that the more use of predictive control strategies, the better HRQoL, including the PCS ($\beta = 0.23$; $p < 0.001$) and the MCS ($\beta = 0.39$; $p < 0.001$). In contrast, more use of interpretative control strategies was associated with worse physical HRQoL (PCS: $\beta = -0.12$; $p < 0.01$). Reliance on vicarious control was not related to HRQoL.

DISCUSSION

The purpose of this study was (1) to assess the HRQoL of young adult survivors of childhood cancer in comparison with the HRQoL of peers without a history of childhood cancer, and (2) to explore the role of cognitive coping in relation to HRQol, independent of the impact of medical variables.

With regard to the first purpose we conclude that the hypothesis has been confirmed: the HRQoL of the survivors in our sample group

Table 2. Mean scores, S.D.s and differences between survivors and comparison group on the eight scales of the RAND-36, as a function of group by gender[a]

	Survivors			Comparison group			Effect size (*d*)
	Males (*n* = 144)	Females (*n* = 150)	Total (*n* = 294)	Males (*n* = 238)	Females (*n* = 262)	Total (*n* = 500)	Total
PF							
Mean	94.6	86.8	90.2[c]	94.6	91.7	93.1	0.21
S.D.	13.3	19.7	17.2	12.7	15.1	14.1	
SF							
Mean	90.4	78.2	84.2[b]	89.6	85.5	87.4	0.17
S.D.	16.9	24.0	21.6	17.1	19.4	18.4	
RP							
Mean	87.2	75.0	81.0[c]	90.4	83.7	86.9	0.22
S.D.	28.7	37.1	33.7	23.0	30.0	27.0	
RE							
Mean	89.6	79.5	84.5	89.5	85.5	87.4	0.10
S.D.	26.7	36.1	32.2	27.0	30.1	28.7	
MH							
Mean	77.6	71.2	74.4	77.3	74.8	76.0	0.11
S.D.	14.0	17.2	16.0	15.0	15.3	15.2	
VT							
Mean	69.2	58.4	63.7	67.5	63.1	65.2	0.09
S.D.	18.4	18.7	19.3	16.6	16.8	16.8	
BP							
Mean	93.4	81.4	87.3	91.4	82.5	86.8	0.03
S.D.	13.3	21.0	18.6	14.6	21.4	18.9	
GH							
Mean	77.6	70.9	74.2	76.1	74.4	75.2	0.06
S.D.	19.0	21.3	20.5	16.4	18.1	17.3	

[a] Multivariate effects were found on group ($p < 0.01$) and gender ($p < 0.001$).
[b] $p < 0.05$: difference between survivors and comparison group (based on univariate *F*-tests according to MANOVA, RAND Scales by group, gender, age).
[c] $p < 0.01$: difference between survivors and comparison group (based on univariate *F*-tests according to MANOVA, RAND Scales by group, gender, age).
PF: physical functioning; SF: social functioning; RP: role limitations due to physical problems; RE: role limitations due to emotional problems; MH: mental health; VT: vitality; BP: bodily pain; GH: general health perceptions.

Table 3. Mean scores, S.D.s and differences between survivors and comparison group on the PCS and MCS of the RAND-36, as a function of group by gender[a]

	Survivors			Comparison group			Effect size (*d*)
	Males (*n* = 170)	Females (*n* = 174)	Total (*n* = 334)	Males (*n* = 238)	Females (*n* = 264)	Total (*n* = 502)	Total
PCS							
Mean	51.9	45.4	48.6[b]	51.7	48.6	50.1	0.15
S.D.	8.8	13.2	11.7	7.7	11.4	9.9	
MCS							
Mean	51.8	46.0	48.9	51.2	49.1	50.1	0.12
S.D.	9.5	11.6	11.0	9.5	10.2	9.9	

[a] Univariate effects were found on group (PCS, $p < 0.05$) and gender (PCS and MCS, $p < 0.001$).
[b] $p < 0.05$: difference between survivors and comparison group.
PCS: Physical Component Scale; MCS: Mental Component Scale.

Table 4. Mean scores, S.D.s, ranges, and mean item scores on the subscales of the CCSS

	N	Mean	S.D.	Range	Mean item score
Predictive control (3 items)	351	9.5	1.6	4–12	3.2
Vicarious control (8 items)	351	22.5	3.2	10–32	2.8
Interpretative control (4 items)	352	12.0	2.3	5–16	3.0

Table 5. Standardized regression coefficients ß for the relationship between cognitive coping (CCSS) and HRQoL (RAND-36), corrected for demographics and medical variables

	Physical Component Scale ß	Mental Component Scale ß
Age	−0.04	0.00
Gender (female)	−0.13[a]	−0.13[a]
DF	2 341	2 341
Total R^2	0.10[b]	0.08[b]
Diagnosis (leukaemie/lymphoma = reference)		
Solid tumour	−0.10	−0.09
Brain tumour	0.01	0.04
Treatments (surgery only = reference)		
Chemo (with/without surgery)	0.05	0.31[a]
Radio (with/without surgery)	0.06	0.19[a]
Chemo + radio (with/without surgery)	0.03	0.25[a]
Age at first diagnosis (yr)	−0.16[a]	−0.19[b]
Duration of treatment (month)	−0.03	−0.03
Relapse or second tumour	−0.09	0.02
DF	10 333	10 333
Total R^2	0.13[a]	0.13[b]
Physical problems[c]	−0.00	0.01
Psychosocial/cognitive/neurological problems[c]	−0.19[b]	−0.18[b]
Current health complaints/disease[d]	−0.33[b]	−0.21[b]
DF	13 322	13 322
Total R^2	0.33[b]	0.27[b]
Predictive control	0.23[b]	0.39[b]
Vicarous control	0.08	−0.02
Interpretative control	−0.12[a]	−0.04
DF	16 316	16 316
Total R^2	0.40[b]	0.39[b]

[a] $p < 0.01$.
[b] $p < 0.001$.
[c] Health problems as registered (at any time) by the long-term follow-up clinic at The Emma Children's Hospital/Academic Medical Center in Amsterdam.
[d] Health complaints experienced in the last 4 weeks as reported by the respondents.

was worse than the HRQoL of the comparison group of peers without a history with cancer. The two groups differed significantly on the Physical Component Scale (PCS) of the RAND-36, and on the scales Physical Functioning, Social Functioning, and Role limitations due to Physical pro-blems. However, the differences were small ($d \leqslant 0.22$) according to classification of Cohen (1988). The findings of our present study are in accordance with the results of other recent studies on HRQoL and psychosocial outcome of young adult survivors of childhood cancer, in most of

which small differences, or no differences at all, were found between survivors and healthy controls or normdata (Pastore et al., 2001; Veenstra et al., 2000; Zebrack et al., 2002; Zebrack and Chesler, 2002; Zebrack et al., 2004). However, this is not what we would have expected considering the stressful experience of childhood cancer and treatment.

The good adjustment we found could have been a result of the process of response shift, which has been described in adults with cancer (Sprangers and Schwortz, 1999). Response shift means that the experience with cancer changes the internal standards of survivors, resulting in changes in the meaning of their self-evaluation and hence in a possibly different experience of problems. It is plausible to suppose that the more severe disease and treatment are, the more this mechanism applies. This could explain why 'the surgery only survivors' in the current paper reported worse mental HRQoL than survivors having been treated with radiotherapy and/or chemotherapy.

The good adjustment of the survivors could also have been achieved as a result of personal growth or the availability of social support systems, or as a result of adequate coping with the stresses of the long-term consequences of childhood cancer. In the current study we explored the role of cognitive coping in relation to the adjustment of (now-healthy) survivors, the second purpose of the study. But first we looked at the impact of medical variables.

Although we traced several medical variables that were significantly associated with HRQoL (such as age at diagnosis), their contribution was not substantial, i.e. only a few percent of the explained variance. That is not surprising, given the fact that the medical variables in the current study were limited to diagnosis and treatment, without taking into account the severity of the diagnosis and treatment. In contrast, health status explained a great part of the PCS and MCS: addition of the variables concerning health status caused a considerable increase in explained variance. As expected, current health complaints (e.g. influenza) decreased HRQoL. The psychosocial/cognitive/neurological problems registered by the long-term follow-up clinic were also negatively related to HRQoL. Physical problems appeared not to be associated with HRQoL. This could be a consequence of taking together all physical problems in the analyses, regardless of the type and severity. When we introduced 'amputation' in the

regression model this aspect of 'physical problems' turned out to be a predictor of the physical component of HRQoL. It was not the purpose of the study to investigate the impact of medical variables. However, that does not alter the fact that it would be relevant to investigate the impact of diagnosis and treatment more thoroughly than we did, in order to be able to trace risk factors and to improve the care during the treatment and afterwards. Anyway, the results indicate that, from a HRQoL point of view, clinicians should pay attention to psychosocial functioning of survivors, because 'psychosocial/cognitive/neurological problems' appeared to be significantly correlated with HRQoL, in contrast to 'physical problems'.

The finding that health status was the best predictor of the Physical Summary Scale (PCS) of the RAND, explaining half of the total R^2, is not surprising. The independent impact of cognitive coping on physical HRQoL was considerably lower (7% of the 40% total variance explained); its impact on the Mental Summary Scale (MCS) was almost equal to the contribution of health status, i.e. 12 and 14% of the total R^2 (39%), respectively.

The results show the influence of current cognitive coping independently of the health status of the survivors. Only a weak correlation was found between reliance on predictive coping and health status: survivors who reported no health problems tended to rely a little more on predictive coping than survivors suffering from one or more health problems (Pearson's correlation 0.12, $p < 0.05$).

The explanatory value of cognitive coping can mainly be attributed to the use of predictive control strategies. Survivors who were optimistic about the course of the disease (agreeing with statements such as: I am sure everything will work out right for me, and When I think about my illness I assume all will go well) at the time of the study were found to have a better HRQoL, especially better mental HRQoL. The positive relationship between predictive control strategies and a patient's adjustment was found in previous studies among adolescents with inflammatory bowel disease (IBD) and among children with cancer (Grootenhuis and Last, 2001; van der Zaag-Loonen et al., 2003). Another study about the role of optimistic beliefs and adaptation showed that positive outcome expectancies were specifically beneficial when (adult) patients suf-

fered from a chronic disease that is uncontrollable to a considerable extent (Fournier *et al.*, 2002).

The current study does not answer the question of causality: does optimism lead to better HRQoL, or vice versa. In addition, we do not know to which extent a survivor's coping changed since the cancer diagnosis because only current coping strategies were measured. Although a longitudinal study design is needed to be able to answer these questions, results of previous studies suggested that cancer patients can, indeed, improve their HRQoL by cognitive behaviour therapy (Edelman and Kidman, 2000). At risk of labouring the obvious, it should be stressed that this does not mean that cognitive behaviour therapy can improve health. The results indicated that cognitive coping can change the patient's perception of health or the impact of the disease on the patient's emotional well-being.

Another question is whether the strong relationship between the cognitive coping style 'predictive control' and mental HRQoL is a matter of measuring the same concept, namely emotional functioning. We consider this not to be plausible because the items of the Predictive Control Scale are formulated without the description of emotional functioning in the items, and are, therefore, not mixed up with outcome. Besides, we found predictive control also to be positively associated with physical HRQoL. Interpretative control seemed to be negatively associated with physical HRQoL. This means that if survivors relied more on interpretative control strategies, they reported worse physical HRQoL. The question of causability is also under discussion here. It seems reasonable to assume that experiencing bad physical HRQoL brings someone to rely on interpretative control strategies, such as searching for meaning and information. On the other side, searching for information could imply focusing on threatening aspects of the disease, which in turn could lead to negative emotions and more negative evaluation of their social and physical functioning.

The small differences that we found between the HRQoL of the survivors and the HRQoL of their peers, can, we think, be partly attributed to methodological limitations. Firstly, more cancer-specific instruments are needed to assess the impact of childhood cancer. Secondly, survivors of brain tumours were under-represented in the current study, and survivors with serious cognitive problems were not represented at all because they were not able to fill in the questionnaires. Thirdly,

the instrument used, the RAND-36, measures HRQoL roughly and is typically health-related. For example, the score on the domain Social Functioning does not say anything about survivors' real social functioning (such as their social skills and number of friends), but refers to the respondents' perceived limitations in social activities due to health problems. Therefore, specific questionnaires are needed to investigate the functioning of survivors more thoroughly, which is of great interest. Furthermore, there are other important aspects of the functioning of survivors, concerning educational achievement, employment, marital status, and so on. Previous research concerning these aspects points out inconsistent differences between survivors and controls (Allen *et al.*, 1990; Byrne *et al.*, 1989; Green *et al.*, 1991; Kingma *et al.*, 2000; Langeveld *et al.*, 2002, 2003; Mäkipernaa, 1989; Nagarajan *et al.*, 2003; Pastore *et al.*, 2001; Pui *et al.*, 2003; Rauck *et al.*, 1999; Stam *et al.*, 2005; Zebrack *et al.*, 2002; Zevon *et al.*, 1990).

As far as we know, this is the first study describing the association between styles of disease-related cognitive coping and HRQoL of survivors of childhood cancer. Cognitive coping seems to play an important role in relation to HRQoL because it increases the explained variance of HRQoL considerably. The strong association between predictive coping and HRQoL stresses the importance of having positive expectations with respect to the course of the disease. We feel that the knowledge of this association could be useful in clinical practice because coping can be considered as a relative stable but changeable characteristic, responsive to intervention. Health care providers who know more about disease-related coping are better able to help patients to cope with the consequences of their disease. It is important that health-care providers understand emotional and behavioural reactions as an outcome of a coping process, so that they are able to respond more appropriately (Last and Grootenhuis, 1998). For instance, the oncologist's attitude about the course of the disease may influence a patient's expectations. Furthermore, interventions for survivors focusing at positive thinking could be useful. A review of 35 studies on the impact of interventions aimed at improving coping on the QoL of adult chronically ill patients showed positive results (de Ridder and Schreurs, 2001). de Ridder and Schreurs (2001) argued that greater and more explicit consideration should be given to

the potential of the coping concept for intervention in the chronically ill. In our opinion, cognitive coping is also a useful concept for psychosocial interventions for survivors of childhood cancer but more insight is needed into the way individual coping styles can be improved by interventions.

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