the expanded disability qualification. Approximately 70 % of unemployed CCSs had some late effects; independent factors related to unemployed CCS were late effects (OR 6.22) and dropping out of school (OR 8.46). Most unemployed CCSs were likely to seek work, despite their health problems.

Acknowledgments We express our deep appreciation to all the CCSs and their families who participated in this survey. This work was supported by a research grant, "Child support in clinical cancer practice," from the Japanese Ministry of Health, Labour and Welfare. We thank Ms. Mizue Hayashi for secretarial assistance and data management.

Conflict of interest The all authors declare that they have no conflict of interest.

References

1. Maeda M (2008) Late effects of childhood cancer: life-threatening issues. J Nippon Med Sch 75(6):320–324
2. Ishida Y, Honda M, Ozono S et al (2010) Late effects and quality of life of childhood cancer survivors: part 1. Impact of stem cell transplantation. Int J Hematol 91(5):865–876
3. Hudson MM (2008) Survivors of childhood cancer: coming of age. Hematol Oncol Clin North Am 22(2):211–31, v-vi
4. Kirchhoff AC, Krull KR, Ness KK et al (2011) Occupational outcomes of adult childhood cancer survivors: a report from the childhood cancer survivor study. Cancer 117(13):3033–3044
5. Huh WW, Jaffe N, Ottaviani G (2006) Adult survivors of childhood cancer and unemployment: a metaanalysis. Cancer 107(12):2958–9; author reply 9
6. Kirchhoff AC, Leisenring W, Krull KR et al (2010) Unemployment among adult survivors of childhood cancer: a report from the childhood cancer survivor study. Med Care 48(11):1015–1025
7. Asami K, Ishida Y, Sakamoto N (2012) Job discrimination against childhood cancer survivors in Japan: a cross-sectional survey. Pediatr Int 54(5):663–668
8. Gurney JG, Krull KR, Kadan-Lottick N et al (2009) Social outcomes in the Childhood Cancer Survivor Study cohort. J Clin Oncol 27(14):2390–2395
9. Johannsdottir IM, Hjermstad MJ, Moum T et al (2010) Social outcomes in young adult survivors of low incidence childhood cancers. J Cancer Surviv 4(2):110–118
10. Heart Link mutual-aid health insurance program. 2013. http://hartlink.net/
11. Pediatric Brain Tumor Association. 2013. http://www2.pbtn.jp/
12. Oeffinger KC, Mertens AC, Sklar CA et al (2006) Chronic health conditions in adult survivors of childhood cancer. N Engl J Med 355(15):1572–1582
13. Ishida Y, Honda M, Kamibeppu K et al (2011) Social outcomes and quality of life (QOL) of childhood cancer survivors in Japan: a cross-sectional study on marriage, education, employment and health related QOL (SF-36). Int J Hematol 93(5):633–644
14. Boman KK, Lindblad F, Hjern A (2010) Long-term outcomes of childhood cancer survivors in Sweden: a population-based study of education, employment, and income. Cancer 116(5):1385–1391
15. Yagci-Kupeli B, Yalcin B, Kupeli S et al (2013) Educational achievement, employment, smoking, marital, and insurance statuses in long-term survivors of childhood malignant solid tumors. J Pediatr Hematol Oncol 35(2):129–133
16. de Boer AGEM, Verbeek JHAM, van Dijk FJH (2006) Adult survivors of childhood cancer and unemployment. Cancer 107(1):1–11
17. Kirchhoff AC, Krull KR, Ness KK et al (2011) Physical, mental, and neurocognitive status and employment outcomes in the childhood cancer survivor study cohort. Cancer Epidemiol Biomarkers Prev 20(9):1838–1849
18. Olson R, Hung G, Bobinski MA, Goddard K (2011) Prospective evaluation of legal difficulties and quality of life in adult survivors of childhood cancer. Pediatr Blood Cancer 56(3):439–443
19. Kunin-Batson A, Kadan-Lottick N, Zhu L et al (2011) Predictors of independent living status in adult survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. Pediatr Blood Cancer 57(7):1197–1203
20. Haupt R, Spinetta JJ, Ban I et al (2007) Long term survivors of childhood cancer: cure and care. The Erice statement. Eur J Cancer 43(12):1778–1780

Qual Life Res (2013) 22:185–201
DOI 10.1007/s11136-012-0137-3

Factors influencing self- and parent-reporting health-related quality of life in children with brain tumors

Iori Sato · Akiko Higuchi · Takaaki Yanagisawa · Akitake Mukasa · Kohmei Ida · Yutaka Sawamura · Kazuhiko Sugiyama · Nobuhito Saito · Toshihiro Kumabe · Mizuhiko Terasaki · Ryo Nishikawa · Yasushi Ishida · Kiyoko Kamibeppu

Accepted: 11 February 2012 / Published online: 3 March 2012

Abstract

Purpose Health-related quality of life (HRQOL) is not only a degree of health but also reflects patient perceptions and expectations of health. For children with brain tumors, better understanding of HRQOL requires the use of complementary reports from parents and interviewer-administered reports for children. Here, we aimed to test whether or not the trait anxiety of children and the psychological distress of their parents influence children's and parents' responses to HRQOL questionnaires, and whether or not the report-administration method for children influences children's responses to HRQOL questionnaires.

Methods One hundred and thirty-four children aged 5–18 with brain tumors and one of their parents completed the Pediatric Quality of Life Inventory™ (PedsQL™) Brain Tumor Module questionnaires. In addition, the children also completed the State-Trait Anxiety Inventory for Children (STAIC), and the parents also completed the

Electronic supplementary material The online version of this article (doi:10.1007/s11136-012-0137-3) contains supplementary material, which is available to authorized users.

I. Sato · A. Higuchi · K. Kamibeppu (✉)
Department of Family Nursing, Graduate School of Health Sciences and Nursing, Faculty of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan
e-mail: kkamibeppu-tky@umin.ac.jp

A. Higuchi
Children's Cancer Association of Japan, 1-3-12 Asakusabashi, Taito-ku, Tokyo 111-0053, Japan

T. Yanagisawa
Division of Pediatric Neuro-Oncology, Department of Neuro-Oncology/Neurosurgery, Comprehensive Cancer Center, International Medical Center, Saitama Medical University, 1397-1 Yamane, Hidaka-shi, Saitama 350-1298, Japan

A. Mukasa · N. Saito
Department of Neurosurgery, Faculty of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

K. Ida
Department of Pediatrics, Faculty of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

Y. Sawamura
Sawamura Neurosurgery Clinic, North-7, West-5, Kita-ku, Sapporo 060-0807, Japan

K. Sugiyama
Department of Neurosurgery, Graduate School of Biomedical Sciences, Hiroshima University, 1-2-3 Kasumi, Minami-ku, Hiroshima 734-8551, Japan

T. Kumabe
Departments of Neurosurgery, Tohoku University Graduate School of Medicine, 1-1 Seiryo-machi, Aoba-ku, Sendai 980-8574, Japan

M. Terasaki
Department of Neurosurgery, Kurume University School of Medicine, Asahimachi 67, Kurume-shi, Fukuoka 830-0011, Japan

R. Nishikawa
Department of Neuro-Oncology/Neurosurgery, Comprehensive Cancer Center, International Medical Center, Saitama Medical University, 1397-1 Yamane, Hidaka-shi, Saitama 350-1298, Japan

Y. Ishida
Department of Pediatrics, St. Luke's International Hospital, 9-1 Akashi-cho, Chuo-ku, Tokyo 104-8560, Japan

Kessler-10 (K10) and health and sociodemographic characteristics questionnaires. The child questionnaires were administered either by the child (self-administered) or an interviewer. Rater-dependent perceptions about HRQOL were derived from the subscales scores of the PedsQL™ Brain Tumor Module using structural equation modeling based on a multitrait-multimethod model. The STAIC trait-anxiety score, K10 score, report-administration method, and other health and sociodemographic factors related to each child's or parent's perceptions were identified through multiple linear regression analyses of the questionnaire responses. We used a path analysis to estimate the change in a PedsQL™ child-reported score that occurs when interviewer-administration changes the child's perception about HRQOL.

Results Surveys for 89 children were self-administered while those for 45 were interviewer-administered. The perceptions of the children and parents were calculated by fitting data to the model (chi-squared $P = 0.087$, normed fit index = 0.932, comparative fit index = 0.978, standardized root mean squared residual = 0.053, and root mean square error of approximation = 0.054). The children's perception of HRQOL was affected by their STAIC trait-anxiety score ($b = -0.43$, 95% CI [−0.60, −0.25]). The parent's perception was affected by their child's treatment status ($b = 0.26$, 95% CI [0.09, 0.43]), the parent's K10 score ($b = -0.21$, 95% CI [−0.37, −0.04]), and by education level ($b = 0.17$, 95% CI [0.00, 0.34]). The change in the child-reported PedsQL™ score in relation to the method of administration ranged from −1.1 (95% CI: −3.5, 1.3) on the procedural anxiety subscale to −2.5 (95% CI: −7.6, 2.6) on the movement and balance subscale.

Conclusion Child-reporting of HRQOL is little influenced by the method of administration. Children's perception about HRQOL tended to be influenced by their trait anxiety, while parents' perception was influenced by their psychological distress, academic background, and their child's treatment status.

Keywords Brain neoplasms · Child · Observer variation · Parents · Quality of life · Questionnaires

Abbreviations

AMOS	Analysis of moment structures
CCAJ	The Children's Cancer Association of Japan
CFI	Comparative fit index
CHQ	Child Health Questionnaire
CI	Confidence interval
HRQOL	Health-related quality of life
K10	Kessler-10
MID	Minimum clinically significant difference
MTMM	Multitrait-multimethod
NFI	Normed fit index
PedsQL™	Pediatric Quality of Life Inventory™
RMSEA	Root mean square error of approximation
SD	Standard deviation
SEM	Structural equation modeling
SPSS	Statistical package for social sciences
SRMR	Standardized root mean squared residual
STAIC	State-Trait Anxiety Inventory for Children
TACQOL	TNO/AZL Child Quality of Life

Introduction

Children with brain tumors often show symptoms, such as pain, nausea, and lack of energy [1]. Even after treatment has ended, they may experience neurological, endocrinological, and cognitive problems and difficulties with psychosocial adjustment [2–6]. Appropriate care of children with brain tumors can be enhanced by assessing the child's health-related quality of life (HRQOL).

HRQOL is a patient-based outcome measured as a continuum of the quality of health experienced by a patient in a variety of aspects, including physical, emotional, social, and cognitive domains. Each of these domains can be measured in two dimensions: by an objective assessment of function or health status and by a subjective perception of health [7]. As such, HRQOL is not only a degree of health but also reflects a patient's personal perception and expectations.

HRQOL questionnaires for children often use both child- and parent-reports, respectively, reflecting the child's and parent's perception of the child's HRQOL; as a result, scores on these reports may differ. Child- and parent-reports provide complementary interpretations of HRQOL [8, 9], and neither is clearly superior to the other [10].

Several standard HRQOL questionnaires have been established for use with children, including the Pediatric Quality of Life Inventory™ (PedsQL™) [11], the TNO/AZL Child Quality of Life (TACQOL) [12], and the Child Health Questionnaire (CHQ) [13]. Several factors need to be considered when choosing a questionnaire, but clinical practice requires that the HRQOL instrument chosen for children with brain tumors reflects the impact of the disease and treatment.

We chose the PedsQL™ because this questionnaire includes generic core and disease-specific modules suitable for use in assessing pediatric chronic health conditions. Further, the PedsQL™ can be administered by an interviewer, a particularly essential factor, as child-reporting by children with brain tumors may occasionally be constrained by complications, such as visual impairment, motor dysfunction, or cognitive deficit. In addition, the

PedsQL™ is the only questionnaire presently available in Japanese and has been used before for children with brain tumors.

Having selected an HRQOL instrument, we then addressed two further questions affecting the feasibility and interpretation of the HRQOL scores: First, what are the causes of any differences between child- and parent-reported scores derived from standard questionnaires? Second, are there any significant differences between self- and interviewer-administered child-reports?

Previous studies have found that questionnaire responses may vary with the personality of the child [14] or their parent's mental health [15]. Jurbergs et al. [14] indicated that children with lowered trait anxiety and elevated defensiveness reported a higher CHQ score for themselves than did their parents. In effect, the personality of the child influences his/her perception about HRQOL, such that the score for the child differs from that perceived by the parent. With regard to parents' reports, Davis et al. indicated that increased maternal psychological distress, as measured by the Kessler-6 questionnaire, lowered the mother-proxy reported PedsQL™ score. These authors further indicated that reduced income of the caregiver resulted in a lowered mother-proxy reported, but not father-proxy reported score [15]. Although these reports suggest that the gender and income of parents may also influence parent-reports on the child-HRQOL, these authors did not compare the parent and child self-reports, and no studies have been conducted on differences between child- and parent-reports for children with brain tumors.

Studies in other medical fields have also confirmed that perceptions of HRQOL are dependent on the reporter. For example, Tamim et al. [16] used a visual analog scale to compare agreement between the HRQOL reported by older people discharging from emergency departments with that reported by their caregivers. The agreement between reported HRQOL was significantly lower for caregivers who had less contact with their patients than for those who lived with or were in daily contact with older people. Similarly, Hays et al. [17] found that the degree of agreement between HRQOL self-assessed by adult epilepsy patients and proxy-reports (by a relative, friend, or other significant person) was related to educational attainment of the patients and the reporters.

HRQOL is also influenced by several factors. Predictors of HRQOL in children with brain tumors include the child's age, age at diagnosis, gender, tumor location, tumor malignancy, relapse, treatment intensity, treatment status, and time since diagnosis [18–22]. Several demographic characteristics (child's age, age at diagnosis, gender) may affect the child's personal perception and expectation about HRQOL but not their HRQOL directly. Similarly, current life status (treatment status, time since diagnosis) may affect the child's or parents' personal perception and expectation about HRQOL but not the child's HRQOL directly.

These studies indicate that reported HRQOL can be influenced by physical, psychological, and sociodemographic characteristics, which may be unrelated to the condition. Further, rater-dependent (of each child's and parent's) perceptions of HRQOL can be influenced by health and sociodemographic characteristics.

We define "children's or parents' perception about the child's HRQOL" as each child's or parent's reporting bias, which is measured as a rater-dependent variance of reported HRQOL scores. Children's or parents' perception is their personal tendency to score an HRQOL questionnaire higher or lower than their parents or child, irrespective of objective measures of the child health. As a result, a child or a parent may score the child's HRQOL differently, even though the child's health condition is the same.

However, which predictors influence the child's or the parent's perception about HRQOL in children with brain tumors remains unclear. A better understanding of the influence of perception would enable more relevant interpretation of the HRQOL score reported by children and parents.

At present, little data are available on the differences between self- or interviewer-administered child-reports for children with brain tumors. Ideally, a person surveying children should be able to choose freely between either method of administration: while self-administered child-reporting may be less expensive, interviewer-administered child-reporting may be useful for children with complications from brain tumors. If these methods can be shown not to differ, then either can be selected for use in measuring HRQOL.

In a previous study using the PedsQL™ Brain Tumor Module, Palmer et al. [23] found no statistically significant difference between self- and interviewer-administered PedsQL™ scores or between parent scores of self-administered children and interviewer-administered children. However, whether or not this finding was clinically significant remains unclear, as Palmer's study was not primarily aimed to compare self- and interviewer-administered scores. It is important to describe the difference between the PedsQL™ self- and interviewer-administered reports.

Here, we investigated the influence of child and parent health, parent socio-demographic characteristics, and report-administration method on the child and parent perceptions about HRQOL (Fig. 1). We hypothesized that a child's perception about their own HRQOL was related to trait anxiety, a parent's perception about their child's HRQOL was related to psychological distress, and a child's perception was not related to the report-administration method (child self- or interviewer administered-reporting).

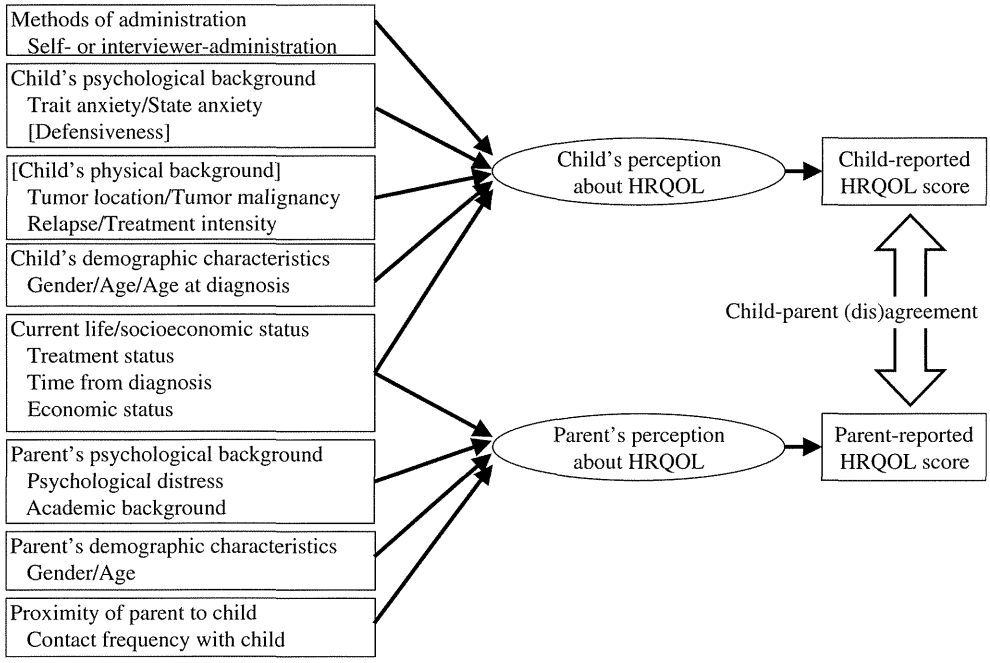

Fig. 1 Conceptual framework for organizing the factors that influence child and parent agreement. [Bracketed factors] were not measured in this study. *HRQOL* health-related quality of life

The following variables were considered as covariate to the above relationships: child's interviewer, state anxiety, age, gender, age at diagnosis, time from diagnosis, treatment status, and parent's age, gender, academic background, time with child per day, and subjective opinion regarding their economic status.

Methods

This study was conducted as part of the development of the Japanese version of the PedsQL™ Brain Tumor Module [24].

Study population

Children with brain tumors and their parents were recruited from six hospitals across Japan and from the Children's Cancer Association of Japan (CCAJ), a non-profit organization established in 1968, which supports children with cancer and their families, between September and December 2008. A child and one parent were included if the child was aged 5–18 years (age range covered by PedsQL™). Families were included if at least 1 month had passed since the child's brain tumor diagnosis and excluded if hospital doctors or social workers of the CCAJ determined that the family found the subject of the child's condition too uncomfortable to discuss.

Procedure

Researchers presented information about the study to 101 families in participating hospitals orally and in writing. Of these, 98 families elected to participate. At the CCAJ, a written description of the study was given to all families invited to a meeting regarding brain tumors, to which 45 families responded. In total, questionnaires were accordingly distributed to 143 families.

Parents were asked to determine, when providing informed consent, whether their child was able to self-administer the questionnaire. In accordance with the PedsQL™ administration guidelines [11], children aged 5–7 years and those determined to be incapable of self-administration were given the questionnaire by an interviewer, who was either a researcher or, if the child wanted the questionnaire to be administered at home, one of their parents. The parent-report questionnaires were self-administered by one of the parents, but we asked parents and children not to report in concert. If a child was administered the questionnaire by the parent, we asked the parent to complete the parent-report and then administer the child-report.

After distribution, 138 of the 143 families returned questionnaires. The background of the five families who did not respond is unknown. We excluded questionnaires from four families (four children and one parent) who answered less than 50% of items in one or more subscales.

The missing subscales were as follows: cognitive problems subscale for one child, pain and hurt for two children, movement and balance for two children, procedural anxiety for two children, nausea for two children and one parent, and worry for two children and one parent. Therefore, answers from a total of 134 families were analyzed. The children from the four excluded families were 3 boys and 1 girl aged 6–8 years who had been off treatment for 12-53 months.

Ethical considerations

This study was approved by the review boards of all seven participating institutions. For children aged 13 or over, informed consent from both the child and the parent was required prior to participation. For children aged 12 or under, informed verbal assent from the child and informed written consent from the parent was required.

Measurements

Child HRQOL was measured by the PedsQL™ Brain Tumor Module. The PedsQL™ Brain Tumor Module [23, 24] measures disease-specific HRQOL and comprises 24 items in six subscales: cognitive problems, pain and hurt, movement and balance, procedural anxiety, nausea, and worry. Children and parents were asked, on separate questionnaires, to describe the extent to which each item had troubled the child over the previous 7 days. For example: Item 1 of the child questionnaire stated "It is hard for me to figure out what to do when something bothers me," with the possible responses of 0 = never, 1 = almost never, 2 = sometimes, 3 = often, 4 = almost always. All subscale scores were calculated in reverse and linearly transformed so that the minimum score was 0 and maximum score was 100, with higher scores indicating a higher HRQOL. Cronbach's alpha coefficients [25] for the subscales for child- and parent-reports in the current study were 0.83 and 0.92 (cognitive problems), 0.52 and 0.78 (pain and hurt), 0.77 and 0.91 (movement and balance), 0.82 and 0.95 (procedural anxiety), 0.84 and 0.94 (nausea), and 0.75 and 0.86 (worry), respectively. Internal consistency in most subscales was considered sufficient, as Cronbach's coefficient alpha values exceeded 0.70 [25].

Global HRQOL was measured by the PedsQL™ Generic Core Scales [11, 26]. The instructions and scoring method are identical to the PedsQL™ Brain Tumor Module. Cronbach's alpha coefficients for the child- and parent-reports were 0.91 and 0.93, respectively.

State- and trait-anxiety of children were measured using the State-Trait Anxiety Inventory for Children (STAIC) [27, 28]. Children aged 8 years or over were asked to complete the questionnaire, with a higher score indicating increased anxiety. Cronbach's alpha coefficients for state- and trait-anxiety scales were 0.89 and 0.89, respectively.

Psychological distress of a parent was measured by the Kessler-10 (K10) questionnaire [29, 30]. The parent was asked to describe the frequency with which they experienced mood or anxiety symptoms over the past 30 days, with higher scores indicating higher psychological distress in relation to depression and anxiety. Cronbach's alpha coefficient for this questionnaire was 0.92.

The parent was also asked to describe their child's age, gender, tumor pathology, age at diagnosis, experience with treatment, their economic status, age, relationship to the child, academic background, and time spent with the child per day.

Statistical analyses: model for analysis

In the first step of the analysis, each child's perception, and each parent's perception about the child's HRQOL, was calculated by a multitrait-multimethod (MTMM) model [31].

MTMM models are used for quality of life research [32, 33] to test the validity of measures of multiple traits assessed by multiple raters. Here, we used a MTMM model to identify how child- and parent-reported scores of all six PedsQL™ Brain Tumor Module subscales differed. The MTMM model is known to be capable of separating variation in child- and parent-reported HRQOL scores into variation derived from the method and that derived from a trait [32]. The MTMM model also enables the division of HRQOL scores into rater-dependent perception and rater-independent condition. For example, a previous study of HRQOL using the TACQOL questionnaire with seven subscales found that children and parent scores were determined by rater-independent (38–73%) and rater-dependent (0–30%) latent factors [32].

In the present study, the HRQOL of each child was assessed by two raters: the child and one parent. The score for each HRQOL subscale was determined by two elements (Fig. 2) based on the perception of the child or the parent as well as the child's condition. Given that perceptions can differ between the child and parent, the child's perception is one element determining the child-reported scores of the six HRQOL subscales, while the parent's perception is one determining the parent-reported scores for the HRQOL subscales. The other element that determines both child-reported and parent-reported scores is the rater-independent condition, that is, a part of the child's function or health status that is recognized by both the child and the parent. These two elements—each rater's perception about HRQOL and the rater-independent condition of each aspect of HRQOL (for example, pain and hurt)—determine the rater reported score for each of the six subscales (Fig. 2).

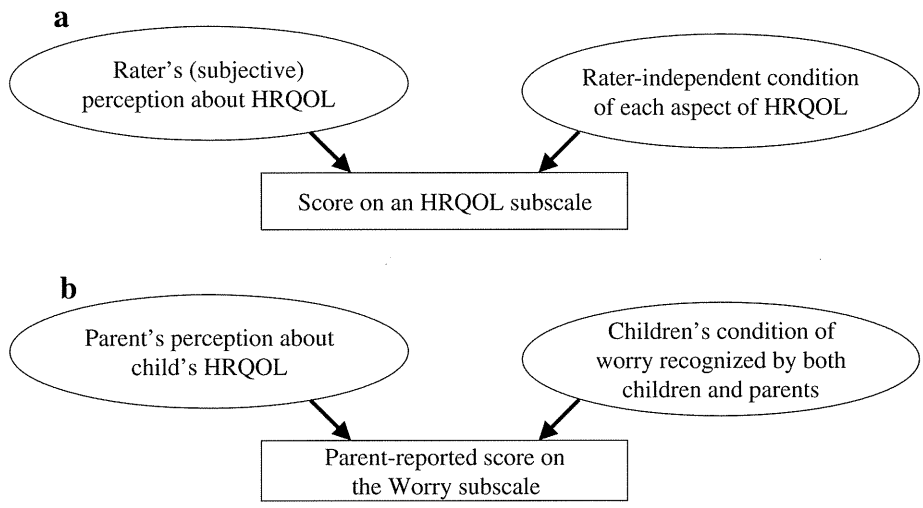

Fig. 2 **a** Two latent variables that determine the score on a health-related quality of life (HRQOL) subscale. **b** Example of two latent variables that determine parent-reported score on the Worry subscale in the Pediatric Quality of Life Inventory Brain Tumor Module

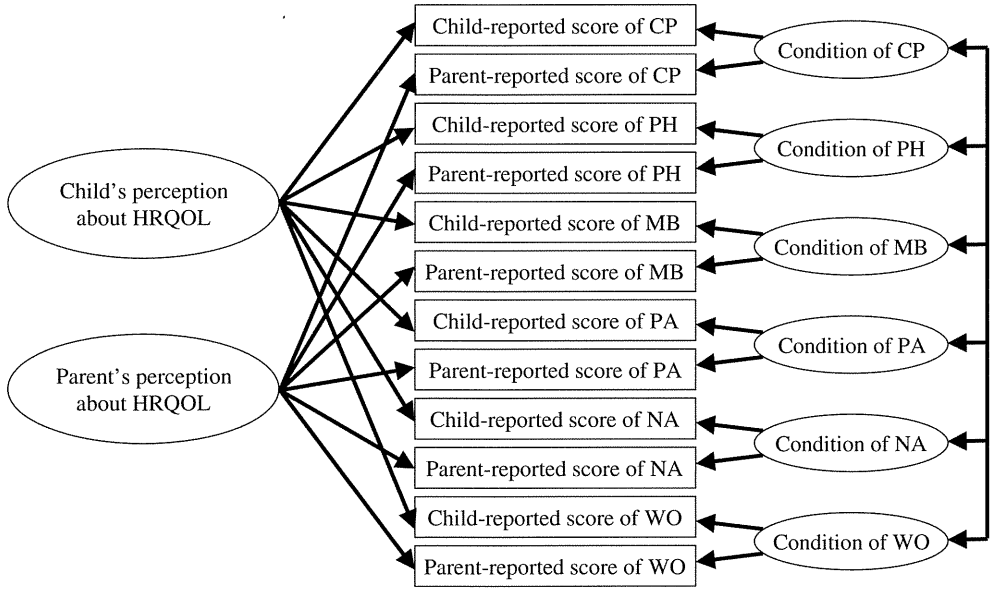

Fig. 3 Multitrait-multimethod model for Pediatric Quality of Life Inventory (PedsQL) Brain Tumor Module. Unique factors are not displayed. Pediatric Quality of Life Inventory (PedsQL) Brain Tumor Module has six subscales: *CP* cognitive problems, *PH* pain and hurt, *MB* movement and balance, *PA* procedural anxiety, *NA* nausea, *WO* worry

The MTMM model combines each subscale score (Fig. 3) into an independent element as either child's or parent's perception, thereby enabling calculation of perception from either child- or parent-reported scores. The MTMM model was tested via structural equation modeling (SEM) using a maximum-likelihood approach to derive parent and child perceptions from all six subscales in PedsQL™ Brain Tumor Module.

In previous research using an HRQOL measurement with seven subscales (the TACQOL), SEM confirmed that the MTMM model adequately explained child- and parent-reported scores [32]. We believe that SEM can also be used to validate the MTMM model for child- and parent-reported HRQOL scores and to calculate child- and parent-perception scores derived from the PedsQL™ Brain Tumor Module. Here, we tested the validity of the MTMM model via goodness-of-fit indices: model chi-squared $P > 0.05$, normed fit index (NFI) > 0.90, comparative fit index (CFI) > 0.90, standardized root mean squared residual (SRMR) < 0.06, and root mean square error of approximation (RMSEA) < 0.06 [34].

The latent scores of the child's and parent's perception about HRQOL were then estimated from the reported scores of each subscale and the factor score weight derived from the SEM. We decided to calculate the perception scores using PedsQL™ Brain Tumor Module. An exploratory factor analysis found that HRQOL derived from the PedsQL™ Brain Tumor Module may be separated into six

factors corresponding to the six subscales [24], and the total score of the brain-tumor subscales cannot be calculated. It follows then that the calculated perception scores indicate whether parents or children tend to score HRQOL high or low rather than the absolute value of children's HRQOL resulting from brain-tumor symptoms. In other words, the calculated perception scores are measuring perception, not HRQOL.

To confirm that the model effectively discriminates perception and condition, we assessed convergent and discriminant validity using the global HRQOL score of the PedsQL™ Generic Core Scales. Both the child- and parent-reported global HRQOL will be correlated with the children's HRQOL resulting from brain-tumor symptoms. The child-reported global HRQOL will also be correlated with child's reporting tendency, but uncorrelated with parent's tendency. Parent-reported global HRQOL will be correlated with parent's reporting tendency about their child's HRQOL, although uncorrelated with their child's tendency.

In the present study, the correlation of the calculated perception scores with the PedsQL™ Generic Core Scales (child's perception and self-reported global HRQOL; parent's perception and the parent-reported global HRQOL) was assessed using Spearman's rank correlation coefficient. We expected a correlation between the child's perception and the child-reported global HRQOL and a correlation between the parent's perception and the parent-reported global HRQOL, but did not expect a correlation between the parent's perception and the child-reported global HRQOL, or between the child's perception and the parent-reported global HRQOL. If there is a correlation between either reporter's (child or parent) calculated perception and the other reporter's (child or parent) reported HRQOL, we should conclude that the calculation cannot be estimating perception because the calculated scores may depend on the absolute value of the HRQOL.

Statistical analyses: regressions of perceptions about HRQOL

In the second step of the analysis, the factors that influence each child's or parent's perceptions were analyzed by multiple linear regression. Factors related to each child's perception about HRQOL and the parent's perception about their child's HRQOL were then identified by bivariate and multivariate correlation. The bivariate correlations were tested by Spearman's rank correlation coefficient, and the multivariate correlations were tested by the standardized partial regression coefficient from multiple linear regression analysis. A child's perception was treated as a dependent variable, and the following variables were treated as independent: method of administration, interviewer; child's trait anxiety, state anxiety, age, gender, age at diagnosis, time from diagnosis, and treatment status; and parent's subjective opinion regarding economic status and life. Given that we did not measure trait- or state-anxiety of children under 8 years of age, these data were not included in the multiple regression analysis, and regression for perception about children aged 5–7 years was recalculated excluding method of administration, child's trait anxiety, and state anxiety from independent variables.

In a second regression analysis, parents' perception was treated as a dependent variable, and the following variables as independent: parent's psychological distress, age, gender, academic background, time with child per day, subjective opinion regarding economic status and life, and child's treatment status. Missing values in the regression analyses were considered by list-wise case deletion, and independent variables were selected by a step-down procedure, mounted in SPSS software. This procedure was considered necessary, as when all independent variables were selected, the variables were multi-collinear and therefore regression could not be feasibly interpreted. Multi-collinearity was eliminated by removing causative variables one at a time. Regression analysis was then iterated, and after each successive calculation, the variable with the largest probability-of-F value was removed, until the probability-of-F value of all remaining variables was ≤ 0.1.

As a complementary step, we conducted a sensitivity analysis for the selected variables (related to child's or parent's perception) to assess the difference between child- and parent-reported HRQOL scores. Descriptive statistics (mean and standard deviation [SD]) of the differences between and Pearson's correlation coefficient for child- and parent-reported HRQOL were calculated for mean score of the six subscales of PedsQL™ Brain Tumor Module. We also conducted a multiple linear regression to confirm that the selected variables were related to the difference between child- and parent-reported HRQOL.

Statistical analyses: differences between self- and interviewer-administered child-reports

In the third step of the analysis, we used path analysis [35] to estimate the points difference between self- and interviewer-administered PedsQL™ child-reported scores. While ideally both types of administrations would be compared via a randomized sequence of administration, we considered this an excessive burden on the children with brain tumors. However, a simple comparison of self- and interviewer-administered HRQOL scores is likely to be biased; in that, interviewer-administered scores tend to be lower than self-administered scores because parents ask for interviewer-administration when their child presents with difficulties, such as visual impairment, motor dysfunction, or cognitive deficit.

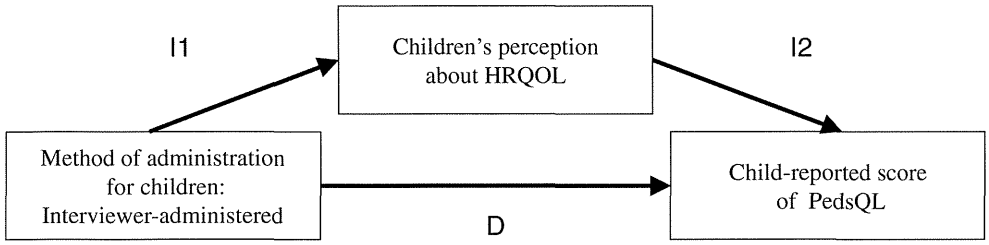

Fig. 4 Path analytic model to split the effect of the method of administration to child-reported HRQOL in two ways. Unique factors are not displayed. *D* direct effect; *I1*, *I2* subset of indirect effect

Bearing the above constraints in mind, we tested the direct and indirect effect of administration method on the children's perception about their own HRQOL (Fig. 4). An "indirect effect" was defined as a change in a child-reported HRQOL score that occurs when interviewer-administration changes the child's perception about HRQOL. A large indirect effect indicates a specific reporting bias by interviewer-administration that increases or decreases child-reported HRQOL. A "direct effect" was defined as a difference in child-reported HRQOL between self- and interviewer-administered scores, regardless of the perception. A larger direct effect indicates larger between-group differences in HRQOL condition, regardless of difference in perception.

For each PedsQL™ Brain Tumor Module subscale, we estimated three path coefficients and their standard error using path analysis [35]. The direct effect is the path from the method of administration to the child-reported scores of PedsQL™ (D in Fig. 4), and the indirect effect is the path from the method of administration to the children's perception about HRQOL (I1 in Fig. 4) times the path from the children's perception about HRQOL to the child-reported scores of PedsQL™ (I2 in Fig. 4). We also calculated 95% confidence intervals (CIs) for the direct and indirect effects [36].

All analyses were performed using SPSS software, version 12.0 J (SPSS, Inc., Chicago, Illinois, USA) and AMOS software, version 5.0 (SPSS, Inc., Chicago, Illinois, USA), and the level of significance was set at 0.05.

Results

Sample characteristics

The median age of the children was 11.0 years (Table 1). The sample was heterogeneous with respect to tumor pathology and treatment experience: the largest groups were embryonal tumors, germ cell tumors, and low-grade gliomas. Median time from diagnosis was 37 months, and 53 children (39.6%) were still under treatment. The other 81 children (61.8%) had completed treatment, and the interval from completion of treatment to the survey was 0.1–13.3 years. Of the responses from 106 children aged 8–18 years, 89 (84.0%) surveys were self-administered, and 17 (16.0%) were interviewer-administered (two with difficulty understanding the questionnaire, one with difficulty sustaining attention, two with difficulty reading, seven with optical impairment, two with difficulty writing by hand, one with both optical impairment and difficulty writing by hand, and two experiencing fatigue). All 28 children aged 5–7 years received interviewer-administered surveys.

Most parents were mothers ($n = 126$, 94.0%), with a median age of 41.0 years; 51 (38.9%) were high school graduates, and 80 (61.1%) were college or university graduates, while 84 (63.6%) considered their economic status to be affluent.

Measurement of HRQOL

The MTMM model for the PedsQL™ Brain Tumor Module was tested by the chi-squared $P = 0.087$ ($\chi^2 = 36.43$, degrees of freedom = 27), NFI = 0.932, CFI = 0.978, SRMR = 0.053, and RMSEA = 0.054, showing that the model was valid and enabling calculation of latent scores of children's and parent's perception about HRQOL. The child and parent scores were determined based on each child's or parent's perception (2–45%) and rater-independent condition (7–98%) (Table 2). A significant correlation was noted between the calculated scores of the children's perception about HRQOL and the child-reported—but not the parent-reported—global HRQOL ($r = 0.55$, $P < 0.001$ vs. $r = 0.07$, $P = 0.404$) (Table 3). Similarly, parents' perception about HRQOL was correlated with the parent-reported—but not the child-reported—global HRQOL ($r = 0.49$, $P < 0.001$ vs. $r = 0.10$, $P = 0.251$).

Factors related to children's and parent's perception

The difference in children's perception between self- and interviewer-administered reports was not significant ($P > 0.05$) (Table 4). In the multivariate analysis, the step-

Table 1 Subject characteristics ($N = 134$)

	Number of respondents (n)	% of total	Mean	SD	Median	Range
Age of children at survey (years)	134		11.1	3.7	11.0	5–18
Age at diagnosis (years)	134		7.3	4.5	7.0	0–18
Time from diagnosis (months)	134		45.8	41.6	37.0	1–202
Gender						
Male	73	54.9				
Female	60	45.1				
Tumor pathology						
Embryonal tumors	39	29.5				
Germ cell tumors	35	26.5				
Low-grade glioma	31	23.5				
High-grade glioma	15	11.4				
Other	12	9.1				
Treatment status						
On treatment	53	39.6				
Off treatment	81	60.4				
Time from treatment end (months)	79		44.7	37.1	34.0	1–160
Treatment received						
None	2	1.5				
Surgery (S)	15	11.2				
Radiation (R)	0	0.0				
Chemotherapy (C)	3	2.2				
$S + R$	13	9.7				
$S + C$	18	13.4				
$R + C$	4	3.0				
$S + R + C$	79	59.0				
Relationship of parent to child						
Mother	126	94.0				
Father	6	4.5				
Grandmother	1	0.7				
Grandfather	1	0.7				
Age of parents at survey (years)	133		41.0	5.5	41.0	26–63
Academic background of parents						
High schools						
Junior high school	1	0.8				
Senior high school	50	38.2				
Colleges and universities						
Vocational college	25	19.1				
Junior college	24	18.3				
University (undergraduate)	30	22.9				
University (graduate)	1	0.8				
Parents' time with children (hours per a day)	132		13.1	6.5	14.0	1–24
Subjective opinion regarding parents' own economic status and life						
Affluent	84	63.6				
Not affluent	48	36.4				
Method of administration for children						
Self-administered	89	66.4				
Interviewer-administered						
Interviewed by researcher	31	23.1				

Table 1 continued

	Number of respondents (*n*)	% of total	Mean	SD	Median	Range
Interviewed by parent	14	10.4				
State anxiety score of STAIC[a] (20–60)	104		29.9	7.8	29.0	20–52
Trait anxiety score of STAIC[a] (20–60)	97		34.9	8.8	36.0	20–52
K10[b] score (0–40)	132		7.7	7.0	6.0	0–31
PedsQL global HRQOL score[c] (0–100)						
Self-reported	132		77.7	17.2	80.4	11–100
Parent-reported	134		73.7	17.0	75.0	20–100

Missing data were excluded

HRQOL health-related quality of life, *SD* standard deviation

[a] State Trait Anxiety Inventory for Children. A higher score indicates that children have higher anxiety

[b] Kessler-10. A higher score indicates that parents have higher psychological distress

[c] Pediatric Quality of Life Inventory Generic Core Scales. A higher score indicates that children have higher quality of life

Table 2 Percentage-explained variance in an MTMM model of HRQOL ($N = 134$)

Subscales of PedsQL brain tumor module	Condition	Perception	Error
Cognitive problems			
Child	30	27	43
Parent	71	6	24
Pain and hurt			
Child	35	8	57
Parent	41	12	47
Movement and balance			
Child	45	23	32
Parent	96	3	1
Procedural anxiety			
Child	98	2	0
Parent	41	5	54
Nausea			
Child	95	5	0
Parent	43	19	37
Worry			
Child	48	14	38
Parent	7	45	48

HRQOL health-related quality of life, *MTMM* multitrait-multimethod, *PedsQL* Pediatric Quality of Life Inventory

down procedure excluded the method of administration as an independent variable related to the children's perception.

Trait anxiety was the strongest factor related to children's perception ($r = -0.46$, $b = -0.43$). Children with higher trait anxiety had lower perception about HRQOL ($P < 0.05$). Older children or children from less affluent families also had a lower perception, but these results were not statistically significant. Bivariate analysis showed that children with higher state anxiety had a lower perception about HRQOL; however, this result was not confirmed on multivariate analysis and was therefore determined to be a spurious correlation. This indicates that the relationship between state anxiety and a child's perception is superficial. This relationship was clarified by conducting a staged analysis to identify which covariates attenuated the relationship (Table 5), which found that trait anxiety attenuated the relationship.

With regard to children aged 5–7 years, none of the variables tested were found to be significantly correlated with the children's perception; the strongest relationship was "interviewer" ($r = -0.27$, $P = 0.162$, $n = 28$). Children interviewed by a parent tended to have a lower perception about HRQOL than children interviewed by researcher.

The strongest factor influencing a parent's perception was treatment status (Table 6). The parents of children on treatment had a tendency to report that their child had a

Table 3 Correlation between calculated scores of perception and reported global HRQOL ($N = 134$)

	Child-reported global HRQOL		Parent-reported global HRQOL	
	r	*P*	*r*	*P*
Calculated scores of child's perception about HRQOL	0.55	<0.001	0.07	0.404
Calculated scores of parent's perception about HRQOL	0.10	0.251	0.49	<0.001

HRQOL health-related quality of life, *r* Spearman's rank correlation coefficient

Table 4 Factors related to calculated scores of children's perception about HRQOL ($N = 134$)

	n	*r*	95% CI	*b*	95% CI
Trait anxiety score of STAIC[a]	97	−0.46*	(−0.60, −0.29)	−0.43*	(−0.60, −0.25)
State anxiety score of STAIC[a]	104	−0.27*	(−0.44, −0.08)	–	
Age at survey	133	−0.14	(−0.30, 0.03)	−0.17	(−0.35, 0.01)
Age at diagnosis	134	0.01	(−0.16, 0.18)	–	
Time from diagnosis	134	−0.09	(−0.26, 0.08)	–	
Gender (0: Male, 1: Female)	133	0.02	(−0.15, 0.19)	–	
Treatment status (0: on treatment, 1: off treatment)	134	−0.06	(−0.23, 0.11)	–	
Subjective opinion regarding parents' own economic status and life (0: not affluent, 1: affluent)	132	0.07	(−0.10, 0.24)	0.16	(−0.01, 0.34)
Method of administration for children (0: self-administered, 1: interviewer-administered)	134	−0.06	(−0.23, 0.11)	–	
Dummy-coded variable for comparison between researcher interviews and parent interviews					
Researcher interviews[b]	134	0.03	(−0.14, 0.20)	–	
Parent interviews[c]	134	−0.13	(−0.29, 0.04)	–	

HRQOL health-related quality of life, *CI* confidence interval, *r* Spearman's rank correlation coefficient, *b* Standardized partial regression coefficient by multiple linear regression analysis ($n = 96$, $R^2 = 0.264$)

* $P < 0.05$

– variables not selected by step-down procedure

[a] State Trait Anxiety Inventory for Children. A higher score indicates that children have higher anxiety

[b] 0: self-administered or parent-administered, 1: researcher-administered

[c] 0: self-administered or researcher-administered, 1: parent-administered

Table 5 Factors that attenuate the relationship between children's state anxiety and lower perception about HRQOL ($N = 96$)

	b	*b*	*b*	*b*	*b*
State anxiety score of STAIC[a]	−0.29*	−0.12	−0.24*	−0.26*	−0.06
Trait anxiety score of STAIC[a]		−0.40*			−0.39*
Age at survey			−0.17		−0.17
Subjective opinion regarding parents' own economic status and life (0: not affluent, 1: affluent)				0.11	0.14

HRQOL health-related quality of life, *b* Standardized partial regression coefficient by multiple linear regression analysis

* $P < 0.05$

[a] State Trait Anxiety Inventory for Children. A higher score indicates higher anxiety

lower HRQOL than those of children who were off treatment. The parents with higher K10 scores who were high school graduates also had a lower perception about their child's HRQOL lower than those parents with lower K10 scores who were college or university graduates. Other variables (age, gender, time with the child per day, and subjective opinion regarding economic status and life) had no influence on a parent's perception about HRQOL.

The sensitivity analysis identified significant differences in the following parameters between child- and parent-reported scores: trait anxiety, parent's psychological distress, treatment status, or academic background of parents (Table 7). Children with elevated trait anxiety rated their HRQOL much lower on average, thereby reducing the difference between child- and parent-reported scores (Fig. 5). Parents with elevated K10 scores, those of children on treatment, and those who were high school graduates also scored their child's HRQOL much lower than did their children themselves, thus increasing the difference between child- and parent-reported scores. Multiple regression analysis also demonstrated that the child's trait anxiety and parent's K10 score were related to the differences between child- and parent-reported HRQOL (Table 8). The relationship between these differences and the child's treatment status and parent's academic background was not statistically significant.

Differences between self- and interviewer-administered child-reports

The method of administration induced indirect effects, which resulted in a decrease of 1.1–2.5 points in child-

Table 6 Factors related to calculated scores of parents' perception about child's HRQOL ($N = 134$)

	n	*r*	95% CI	*b*	95% CI
K10 score[a]	132	−0.24*	(−0.40, −0.07)	−0.21*	(−0.37, −0.04)
Treatment status (0: on treatment, 1: off treatment)	134	0.36*	(0.20, 0.50)	0.26*	(0.09, 0.43)
Gender of parents (0: Male, 1: Female)	134	0.05	(−0.12, 0.22)	–	
Age of parents at survey	133	−0.14	(−0.30, 0.03)	–	
Academic background of parents (0: high schools, 1: colleges and universities)	131	0.16	(−0.01, 0.32)	0.17*	(0.00, 0.34)
Parents' time with children per a day	132	−0.04	(−0.21, 0.13)	–	
Subjective opinion regarding parents' own economic status and life (0: not affluent, 1: affluent)	132	0.14	(−0.03, 0.30)	–	

Missing data were excluded

HRQOL health-related quality of life, *CI* confidence interval, *r* Spearman's rank correlation coefficient, *b* Standardized partial regression coefficient by multiple linear regression analysis

* $P < 0.05$

– variables not selected by step-down procedure

[a] Kessler-10. A higher score indicates that parents have higher psychological distress

Table 7 Descriptive statistics of the differences and correlation between child- and parent-reported HRQOL ($N = 134$)

	n	HRQOL[a]				Difference[b]	95% CI		Pearson's correlation coefficient
		Child-reported		Parent-reported					
		Mean	SD	Mean	SD				
Trait anxiety score of STAIC[c]									
Less than 36 (median)	48	85.8	10.2	77.1	14.9	8.7	4.3	13.2	0.30*
36 or over	49	77.3	12.9	72.2	15.7	5.2	1.9	8.5	0.69*
K10 score[d]									
Less than 6 (median)	65	83.0	12.7	79.2	12.2	3.8	0.6	6.9	0.47*
6 or over	67	75.7	15.6	65.9	15.9	9.8	6.3	13.3	0.58*
Treatment status									
On treatment	53	75.5	15.4	66.2	15.2	9.4	5.5	13.3	0.57*
Off treatment	81	81.5	13.6	76.9	14.6	4.6	1.5	7.7	0.52*
Academic background of parents									
High schools	51	79.1	13.9	70.1	14.9	9.0	2.0	13.0	0.53*
Colleges and universities	80	78.9	15.2	74.3	15.7	4.6	1.7	7.5	0.64*

Missing data were excluded

HRQOL health-related quality of life, *CI* confidence interval, *SD* standard deviation

* $P < 0.05$

[a] Mean of six subscale scores of PedsQL Brain Tumor Module

[b] "child-reported mean HRQOL score" minus "parent-reported mean HRQOL score"

[c] State Trait Anxiety Inventory for Children. A higher score indicates higher anxiety

[d] Kessler-10. A higher score indicates that parents have higher psychological distress

reported scores for the PedsQL™ Brain Tumor Module (Table 9). For all subscales, interviewer-administration scores were lower than child-reported scores. However, given that the 95% CIs included values of zero, the method of administration appears to have little effect on children's perception. This result was similar to that obtained on

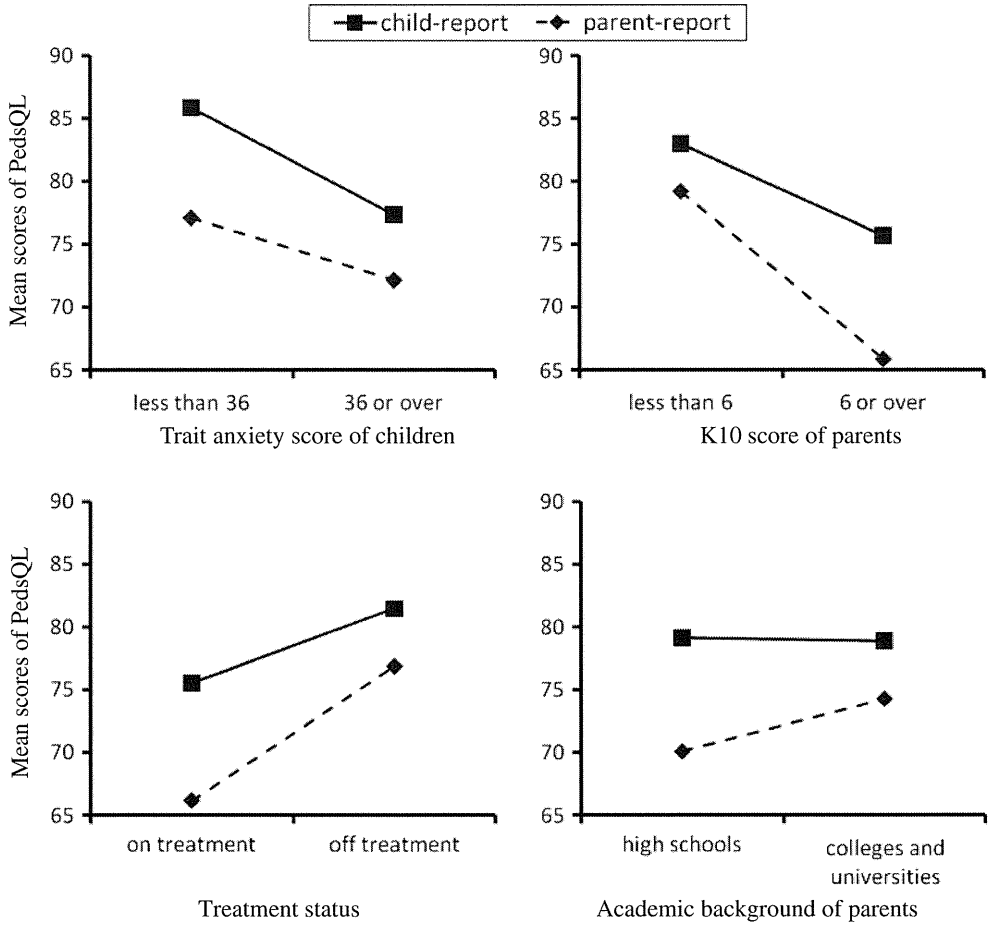

Fig. 5 Differences between child- and parent-reported mean scores of six subscales of PedsQL Brain Tumor Module by socio-demographic and health characteristics

Table 8 Regression of the differences[a] between child- and parent-reported HRQOL[b] ($N = 134$)

	n	*r*	95% CI	*b*	95% CI
Trait anxiety score of STAIC[c]	97	−0.21*	(−0.39, −0.01)	−0.27*	(−0.47, −0.07)
K10 score[d]	132	0.21*	(0.04, 0.37)	0.29*	(0.09, 0.49)
Treatment status (0: on treatment, 1: off treatment)	134	−0.15	(−0.31, 0.02)	−0.13	(−0.33, 0.06)
Academic background of parents (0: high schools, 1: colleges and universities)	131	−0.14	(−0.30, 0.03)	−0.13	(−0.33, 0.06)

Missing data were excluded

CI confidence interval, *HRQOL* health-related quality of life, *r* Spearman's rank correlation coefficient, *b* Standardized partial regression coefficient by multiple linear regression analysis ($n = 93$, $R^2 = 0.168$)

* $P < 0.05$

[a] "child-reported mean HRQOL score" minus "parent-reported mean HRQOL score"

[b] Mean of six subscale scores of PedsQL Brain Tumor Module

[c] State Trait Anxiety Inventory for Children. A higher score indicates higher anxiety

[d] Kessler-10. A higher score indicates that parents have higher psychological distress

analysis of factors related to children's perception (Table 4).

In contrast, children receiving interviewer-administered surveys had significantly lower scores for cognitive problems, pain and hurt, and movement and balance subscales than those who were self-administered (Table 9).

Discussion

We show that the response of children aged 5–18 to questions on HRQOL was altered by trait anxiety, while a parent's perception about their child's HRQOL was affected by the child's treatment status and the parent's

Table 9 Changes in child-reported HRQOL score based on method of administration ($N = 134$)

	Direct effect		Indirect effect			
	D	95% CI	*I*	95% CI	I1	I2
Cognitive problems	−6.4	(−12.0, −0.8)	−2.5	(−7.5, 2.5)	−0.14	18.1
Pain and hurt	−7.9	(−13.8, −1.9)	−1.3	(−3.8, 1.3)	−0.14	9.2
Movement and balance	−12.6	(−19.3, −6.0)	−2.5	(−7.6, 2.6)	−0.14	18.3
Procedural anxiety	−8.8	(−19.4, 1.8)	−1.1	(−3.5, 1.3)	−0.14	8.1
Nausea	−2.6	(−9.8, 4.6)	−1.1	(−3.5, 1.2)	−0.14	8.2
Worry	−0.6	(−8.0, 6.8)	−2.1	(−6.4, 2.2)	−0.14	15.3

CI confidence interval, *HRQOL* health-related quality of life, *D* path coefficients from the method of administration to child-reported HRQOL, *I* indirect effect from the method of administration to child-reported HRQOL, *I1* path coefficients from the method of administration to children's perception, *I2* path coefficients from the children's perception to child-reported HRQOL

own psychological distress and academic background. Interestingly, children's HRQOL scores from self- and interviewer-administered reports were comparable, showing that the results from bivariate and multivariate analyses were not biased by the method of administration. This important result suggests interviewer measurement of HRQOL for children who are unable to self-administer the questionnaire is valid.

The correlation coefficient between the method of administration and tendency for children to score their own HRQOL highly was −0.06 (95% CI −0.23 to 0.11). Given that correlation coefficients >0.1 are regarded as small, >0.3 as medium and >0.5 as large [37], this finding suggests that the method of questionnaire administration has only a small effect on the assessment of children's perception.

All scales of PedsQL™ were scored from 0 to 100, and the actual difference in child-reported score resulting from administration method ranged from −2.5 to −1.1 points. The US Department of Health suggests methods for inferring minimum clinically significant difference (MID) [38]. Using an empirical rule (e.g., 8% of the theoretical range of scores), the MID in a PedsQL™ score is 8 points. Using a distribution-based approach (e.g., defining the MID as 0.5 times the standard deviation), the MID in the PedsQL™ Brain Tumor Module scores reported a range from 9.2 to 17.2 points [24]. Other authors used a standard error of measurement approach to determine the MID for the PedsQL™ Generic Core Scales child-report was 4.4 [39]. Taken together, these previous findings suggest that the difference in child-reported score resulting from administration method in the present study, while not negligible, is not comparatively significant. As such, we feel confident in adopting an administration method for monitoring HRQOL in clinical settings best adapted to the environment.

Similarly, results for previous comparisons of administration methods show small differences albeit in opposing directions. Huguet and Miro, using a Catalan version of PedsQL™, reported that interviewer-administered scores were 2 points higher than self-administered scores [40]. In their assessment of very low birth weight children aged 14 years by the TACQOL, Verrips et al. [41] found that the interviewer-administered scores were 2 points lower than the self-administered score, whereas Tsakos et al. [42] found no significant difference between self- and interviewer-administered scores for oral HRQOL. Taken together, the findings from the present and previous studies suggest little difference between self- and interviewer-administered scores for child-reporting. Differences between findings for these present and previous studies may be due to differing criteria for HRQOL measured or differences in the children's diseases. To our knowledge, our present study is the first to report that the scores of self- and interviewer-administered questionnaires for HRQOL in children with brain tumors using PedsQL™ are comparable.

Consistent with results for other children with cancer [14], we also found that trait anxiety alters children's own perception about HRQOL. As trait anxiety has a greater effect than the other factors, it should be considered in the interpretation of child-reported scores. Given that trait anxiety is one personality characteristic that does not vary substantially over time [28], if self-reported scores from repeated measurements of a child with a brain tumor are consistently lower than parent-reported scores, the measured result may be attributed to high trait anxiety of the child.

The effect of treatment status on a parent's perception about their child's HRQOL has not been previously investigated. Parents of children on treatment tended to have a lower perception about their child's HRQOL than those of children off treatment, whereas treatment status had no influence on children's perception. As a result, clinical practice or research should use both child- and parent-reports whenever possible, particularly when

HRQOL questionnaires are needed to assess HRQOL variations during the course of treatment, changes in environment, or psychosocial intervention. For example, HRQOL reports from parents and children changed at 1, 6, and 12 months after diagnosis of brain tumor [19]. The pattern of child-reported HRQOL was different from parent-reported HRQOL over time indicating the importance of using use both child- and parent-reports.

Parents may feel a stronger impact of their child's illness than the child himself or herself [43]. In previous studies, parent-reported HRQOL scores were higher than child-reported scores for children without health problems and lower than child-reported scores for children with health problems. Our study also suggests that parents are more aware of their child's treatment through knowledge of tumor symptoms and treatment pain. In other words, the parents may feel a stronger impact of their child's treatment than the child himself or herself and accordingly tend to score the HRQOL of these children lower than the parents of children off treatment.

Vance et al. [44] suggested that parent-reported HRQOL was not influenced by parent's depression. The present study, however, which had a larger sample size than previous studies, found that the parent-reported HRQOL was affected by the parent's own psychological distress. This suggests that the parent's own prospects and cognitive tendency influence their perception about their child's HRQOL.

The present study is the first to use an MTMM model to identify factors that influence child or parent perception about HRQOL. This knowledge will be useful in interpreting the discordance between child- and parent-reports of HRQOL in children with brain tumors. In clinical settings, this finding will allow clinicians to take high trait anxiety in the child or high psychological distress in the parent into account. For example, when the child is off treatment, it will be less surprising that child-reported HRQOL score is low and parent-reported HRQOL score is high if the child has low trait anxiety. Routine measurements in clinical settings thus have the potential to allow the monitoring of both the child's personality and the mental state of his/her parents. This finding will also improve the selection of children for comparison of HRQOL among multiple groups. For example, in non-randomized controlled trials, children may be allocated among groups with consideration to equality of anxiety in children and mental health in parents. Our findings also suggest that single group studies should collect information on parents' academic background as well as other demographic characteristics, such as gender, age, race, etc., that influence selection bias.

Several limitations to our study warrant mention. First, as a cross-sectional study, changes in perception over time were not tested. Accordingly, we cannot conclude that the perception of a parent or child with a brain tumor will change at the end of treatment. Clarification of intrapersonal change in perception or response shift of children with brain tumors and their parents will require a longitudinal study.

Second, we did not conduct an a priori sample size calculation because this study is a part of another study [24] that has a predetermined sample size. The effect of sample size was calculated by G*Power software [45]. If a characteristic that has a medium effect ($f^2 \geq 0.15$ [37]) on either children's or parents' perception is added to a multiple linear regression model with 3 variables, a sample of 55 would enable detection of the characteristic as the 4th independent variable with 80% power and a 5% alpha error. Similarly, a sample of 395 would be required to detect a characteristic that has a small effect ($f^2 \geq 0.02$ [37]) as the 4th independent variable. It follows that the sample size of the present study was sufficient to detect factors having a medium effect. A larger sample might discriminate additional characteristics that were not found to be statistically significant in the present study, such as children's age and economic status.

A larger sample size would also enable simultaneous modeling of responses (MTMM model, Fig. 3) and predictors (predictor model, Tables 4, 6, and Fig. 1), which might then detect any correlation between the predictors and the latent variables of rater-independent assessments of the child's condition. Further, a larger sample size should enable researchers to detect the effect of interviewer type (e.g., parent or researcher interviewer) on a child's perception. Among children aged five-to-seven and eight or more years, those interviewed by a parent tended to have a lower perception about HRQOL than those interviewed by a researcher, although this result was not statistically significant.

Third, we were unable to measure all possible factors that might influence child-parent agreement. We limited the length of our questionnaires to avoid placing further stress on the children, and therefore, measurements of the child's psychological background were limited to anxiety. Other aspects of a child's personality, such as defensiveness [14], might also influence the results, and future research should therefore investigate different personality traits. We also omitted measurements of the child's physical background, such as tumor location, tumor malignancy, relapse history, or treatment intensity [18–22]. All data in the present study were collected not from medical experts but from the children and their parents; as such, obtaining accurate, detailed answers about medical information was somewhat difficult. Additional information derived from patients with specific tumors or under specific treatment regimens will be required to identify residual confounders.

An additional constraint arises from the sample type. The present study collected data from a broad spectrum of children who had experienced brain tumors and included, for example, children diagnosed from 1 month to 17 years before the study. We could cover the broad spectrum to make up the study sample of the two subsamples. The hospitals subsample included more children with short time since diagnosis, young at survey, and on treatment than the CCAJ subsample did. To provide further insight into self- or parent-perceptions about HRQOL, further studies should focus on children at different phases of treatment or follow-up.

Families were excluded if the doctors or social workers determined that the family found the subject of the child's condition too uncomfortable to discuss. Although the number of such excluded families was not recorded, this exclusion may have limited data collection to more well-adjusted families and thereby limited the generalizability of the conclusions as well.

Finally, independent variables identified in this study accounted for 26.4% of the children's perception and 17.3% of the parents' perception. Other independent factors were not identified.

Conclusion

The method of administration—self- or interviewer-administered—had little influence on child-reporting of HRQOL. Children's perception of their own HRQOL was influenced by their trait anxiety, while parents' perception was influenced by their psychological distress, academic background, and their child's treatment status. These factors underlie the difference between child- and parent-reported HRQOL scores.

Acknowledgments This work was supported by a Grant-in-Aid for Pediatric Cancer Treatment and Research from the CCAJ 2008 and a Grant-in-Aid for Cancer Research from the Ministry of Health, Labour and Welfare of Japan (No. 18-14) 2008.

References

1. Collins, J. J., Byrnes, M. E., Dunkel, I. J., Lapin, J., Nadel, T., Thaler, H. T., et al. (2000). The measurement of symptoms in children with cancer. *Journal of Pain and Symptom Management, 19*(5), 363–377.
2. Sugiyama, K., Yamasaki, F., Kurisu, K., & Kenjo, M. (2009). Quality of life of extremely long-time germinoma survivors mainly treated with radiotherapy. *Progress in Neurological Surgery, 23*, 130–139.
3. Ribi, K., Relly, C., Landolt, M. A., Alber, F. D., Boltshauser, E., & Grotzer, M. A. (2005). Outcome of medulloblastoma in children: Long-term complications and quality of life. *Neuropediatrics, 36*(6), 357–365.
4. Poretti, A., Grotzer, M. A., Ribi, K., Schonle, E., & Boltshauser, E. (2004). Outcome of craniopharyngioma in children: Long-term complications and quality of life. *Developmental Medicine and Child Neurology, 46*(4), 220–229.
5. Sønderkær, S., Schmiegelow, M., Carstensen, H., Nielsen, L. B., Muller, J., & Schmiegelow, K. (2003). Long-term neurological outcome of childhood brain tumors treated by surgery only. *Journal of Clinical Oncology, 21*(7), 1347–1351.
6. Fuemmeler, B. F., Elkin, T. D., & Mullins, L. L. (2002). Survivors of childhood brain tumors: Behavioral, emotional, and social adjustment. *Clinical Psychology Review, 22*(4), 547–585.
7. Testa, M. A., & Simonson, D. C. (1996). Assessment of quality-of-life outcomes. *New England Journal of Medicine, 334*(13), 835–840.
8. Sherifali, D., & Pinelli, J. (2007). Parent as proxy reporting: Implications and recommendations for quality of life research. *Journal of Family Nursing, 13*(1), 83–98.
9. Pickard, A. S., & Knight, S. J. (2005). Proxy evaluation of health-related quality of life: A conceptual framework for understanding multiple proxy perspectives. *Medical Care, 43*(5), 493–499.
10. Erhart, M., Ellert, U., Kurth, B. M., & Ravens-Sieberer, U. (2009). Measuring adolescents' HRQoL via self reports and parent proxy reports: An evaluation of the psychometric properties of both versions of the KINDL-R instrument. *Health and Quality of Life Outcomes, 7*, 77.
11. Varni, J. W., Seid, M., & Kurtin, P. S. (2001). PedsQL 4.0: Reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. *Medical Care, 39*(8), 800–812.
12. Verrips, E. G. H., Vogels, T. G. C., Koopman, H. M., & Theunissen, N. C. M. (1999). Measuring health-related quality of life in a child population. *The European Journal of Public Health, 9*, 188–193.
13. Landgraf, I., Abetz, L., & Ware, I. (1997). *Child Health Questionnaire (CHQ): A user's manual.* Boston: The Health Institute Press.
14. Jurbergs, N., Russell, K. M. W., Long, A., & Phipps, S. (2008). Adaptive style and differences in parent and child report of health-related quality of life in children with cancer. *Psychooncology, 17*(1), 83–90.
15. Davis, E., Davies, B., Waters, E., & Priest, N. (2008). The relationship between proxy reported health-related quality of life and parental distress: Gender differences. *Child: Care, Health and Development, 34*(6), 830–837.
16. Tamim, H., McCusker, J., & Dendukuri, N. (2002). Proxy reporting of quality of life using the EQ-5D. *Medical Care, 40*, 1186–1195.
17. Hays, R. D., Vickrey, B. G., Hermann, B. P., Perrine, K., Cramer, J., Meador, K., et al. (1995). Agreement between self reports and proxy reports of quality of life in epilepsy patients. *Quality of Life Research, 4*, 159–168.
18. Aarsen, F. K., Paquier, P. F., Reddingius, R. E., Streng, I. C., Arts, W. F. M., Evera-Preesman, M., et al. (2006). Functional outcome after low-grade astrocytoma treatment in childhood. *Cancer, 106*(2), 396–402.
19. Penn, A., Lowis, S. P., Hunt, L. P., Shortman, R. I., Stevens, M. C. G., McCarter, R. L., et al. (2008). Health related quality of life in the first year after diagnosis in children with brain tumours compared with matched healthy controls; a prospective longitudinal study. *European Journal of Cancer, 44*(9), 1243–1252.
20. Meeske, K. Katz., Katz, E. R., Palmer, S. N., Burwinkle, T., & Varni, J. W. (2004). Parent proxy-reported health-related quality of life and fatigue in pediatric patients diagnosed with brain tumors and acute lymphoblastic leukemia. *Cancer, 101*, 2116–2125.
21. Bhat, S. R., Goodwin, T. L., Burwinkle, T. M., Landsdale, M. F., Dahl, G. V., Huhn, S. L., et al. (2005). Profile of daily life in

children with brain tumors: An assessment of health-related quality of life. *Journal of Clinical Oncology, 23*, 5493–5500.
22. Gerber, N. U., Zehnder, D., Zuzak, T. J., Poretti, A., Boltshauser, E., & Grotzer, M. A. (2008). Outcome in children with brain tumours diagnosed in the first year of life: Long-term complications and quality of life. *Archives of Disease in Childhood, 93*, 582–589.
23. Palmer, S. N., Meeske, K. A., Katz, E. R., Burwinkle, T. M., & Varni, J. W. (2007). The PedsQL brain tumor module: Initial reliability and validity. *Pediatric Blood & Cancer, 49*(3), 287–293.
24. Sato, I., Higuchi, A., Yanagisawa, T., Mukasa, A., Ida, K., Sawamura, Y., et al. (2010). Development of the Japanese version of the Pediatric Quality of Life Inventory Brain Tumor Module. *Health and Quality of Life Outcomes, 8*(1), 38.
25. Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297–334.
26. Kobayashi, K., & Kamibeppu, K. (2010). Measuring quality of life in Japanese children: Development of the Japanese version of PedsQL™. *Pediatrics International, 52*(1), 80–88.
27. Soga, S. (1983). A study on standardization of Japanese version of the STAIC [Japanese]. *The Japanese Journal of Psychology, 54*(4), 215–221.
28. Spielberger, C. D., Edward, C. D., Lushene, R. E., Montouri, J., & Platzek, D. (1973). *STAIC preliminary manual for the State-Trait Anxiety Inventory for Children ("How I feel questionnaire")*. California: Consulting Psychological Press Inc.
29. Furukawa, T. A., Kawakami, N., Saitoh, M., Ono, Y., Nakane, Y., Nakamura, Y., et al. (2008). The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. *International Journal of Methods in Psychiatric Research, 17*(3), 152–158.
30. Furukawa, T. A., Kessler, R. C., Slade, T., & Andrews, G. (2003). The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. *Psychological Medicine, 33*(2), 357–362.
31. Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56*(2), 81–105.
32. Theunissen, N. C., Vogels, T. G., Koopman, H. M., Verrips, G. H., Zwinderman, K. A., Verloove-Vanhorick, S. P., et al. (1998). The proxy problem: Child report versus parent report in health-related quality of life research. *Quality of Life Research, 7*(5), 387–397.
33. Hadorn, D. C. M. D., & Hays, R. D. P. (1991). Multitrait-multimethod analysis of health-related quality-of-life measures. *Medical Care, 29*(9), 829–840.
34. Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1–55.
35. Duncan, O. D. (1966). Path analysis: Sociological examples. *American Journal of Sociology, 72*, 1–16.
36. Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13*, 290–312.
37. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New Jersey: Lawrence Erlbaum Associates.
38. U.S. Department of Health and Human Services FDA Center for Drug Evaluation and Research, U.S. Department of Health and Human Services FDA Center for Biologics Evaluation and Research, & U.S. Department of Health and Human Services FDA Center for Devices and Radiological Health. (2006). Guidance for industry: Patient-reported outcome measures: Use in medical product development to support labeling claims: Draft guidance. *Health and Quality of Life Outcomes, 4*, 79.
39. Varni, J. W., Burwinkle, T. M., Seid, M., & Skarr, D. (2003). The PedsQL 4.0 as a pediatric population health measure: Feasibility, reliability, and validity. *Ambulatory Pediatrics, 3*, 329–341.
40. Huguet, A., & Miro, J. (2008). Development and psychometric evaluation of a Catalan self- and interviewer-administered version of the Pediatric Quality of Life Inventory version 4.0. *Journal of Pediatric Psychology, 33*(1), 63–79.
41. Verrips, G. H., Vogels, A. G., den Ouden, A. L., Paneth, N., & Verloove-Vanhorick, S. P. (2000). Measuring health-related quality of life in adolescents: Agreement between raters and between methods of administration. *Child: Care, Health and Development, 26*(6), 457–469.
42. Tsakos, G., Bernabe, E., O'Brien, K., Sheiham, A., & de Oliveira, C. (2008). Comparison of the self-administered and interviewer-administered modes of the child-OIDP. *Health & Quality of Life Outcomes, 6*, 40.
43. Eiser, C., & Morse, R. (2001). Can parents rate their child's health-related quality of life? Results of a systematic review. *Quality of Life Research, 10*(4), 347–357.
44. Vance, Y. H., Morse, R. C., Jenney, M. E., & Eiser, C. (2001). Issues in measuring quality of life in childhood cancer: Measures, proxies, and parental mental health. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 42*, 661–667.
45. Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175–191.

日本小児科学会雑誌　118巻1号　65～74（2014年）

論　策

小児がん経験者に対する社会的偏見の実態調査

聖路加国際病院小児科[1)]，新潟県立新潟がんセンター小児科[2)]
石田也寸志[1)]　浅見　恵子[2)]

要　旨

本邦において小児がん経験者に対する進学・就職時の学校や企業側の意向と小児がん経験者自身の経験の実態を探り，問題点を明確にすることを目的に調査を実施した．

無作為抽出した全国の高校/大学計200校，企業計200社，1975年4月～2007年3月までに新潟県立がんセンターで治療を終了し，病名告知を受けている18歳以上で同意を得られた小児がん経験者138名へアンケートを郵送して回答を回収した．回収率は，それぞれ54.5%，37%，65.2%であった．

その結果「小児がんは現在では約80%が治癒する疾患である事」は未だ学校の半数および企業の4分の3は認知していなかった．進学時には小児がん既往は特に問題とならないが，むしろ小児がん経験者及び主治医が，この事実を知らず「不利になる」と思い込んでいる可能性が高いこと，就職時も全体的には既往歴は問題にならない傾向であったが，1.8%の学校と5%の企業で不合格とすると答えたものがあり，既往歴と現病歴の違いを広く社会に啓発する必要があると考えられた．病名記載率や上司への説明率，異性との交際経験割合やハートリンク共済の認知度に関して女性の方が有意に高く，経験者本人の調査では恋愛結婚で病気のことを話していれば，特にトラブルは生じていなかった．

キーワード：小児がん，小児がん経験者，社会的偏見，進学，就労

はじめに

小児がん治療の飛躍的進歩により，治癒率はめざましく向上し，約80%が治癒し，成人となる長期生存者が年々増加し，現在では数万人に達している[1)]．小児がんは身体的・精神的に成長途上に発病するため，成人のがんとは違い疾患のみの影響だけではなく治療の影響を強く受けることが予想される[2)]．また治療終了後にも数十年にわたる長期の生命予後が期待され，進学・就労・結婚・出産などを含めた数多くのイベントを迎えるため自立支援を含めた長期経過観察の重要性が高まっている[3)]．

しかし，このような本邦の成人に達した小児がん経験者が社会生活（学校進学，職業，結婚など）において，どのような偏見と立ち向かっているかは明らかではない．また本邦において小児がん経験者に対する進学時の学校側の姿勢や就職に関しての雇用者側の意向がどのようなものであるかに関する報告はこれまでみられない[4)]．

今回，学校や企業側の意向と小児がん経験者自身の経験からこの点についての実態を知り，現状を把握し，問題点を明確にすることを目的にアンケート調査を実施した．

対象と方法

1）対象

学校については，全国学校協会に登録されている国公立大学177校より50校，私立大学711校より50校，国公私立高校5,395校より100校を無作為抽出した．企業に関しては，全国企業として東京証券取引場一部上場銘柄1,668社の中から業種に偏りなく100社無作為抽出し，中小企業として新潟県の資本金1,000万円以上の大中小企業でホームページを作成している企業より100社を無作為抽出した．小児がん経験者については，1977年4月～2007年3月（30年間）に新潟県立がんセンター小児科に入院し，治療を終了しかつ病名告知を受けている18歳以上の小児がん経験者138名を抽出した．

2）方法

研究方法は横断的アンケート調査で，学校は各入試課，企業は各本社総務人事課宛に，厚労省がん研究助成金研究班名でアンケート調査票を送付し，無記名で回答を依頼した．小児がん経験者に対しては，共著者

（平成25年8月6日受付）（平成25年10月16日受理）
別刷請求先：（〒790-0024）松山市春日町83
愛媛県立中央病院小児医療センター
石田也寸志
E-mail: yaishida2009@yahoo.co.jp

の主治医から該当者にアンケートを送付し，調査研究の趣旨を説明し協力を依頼した．

3）調査内容

①学校と企業に対して：現在小児がんは約80％が治癒する病気である事を認知しているか，小児がん経験者は社会的偏見を受けている可能性はどうか，入学/入社試験健康診断書に既往歴として，小児がんの病名が記載されていたらどのように対応するか，小児がん経験者の入学/入社に対する意見をたずねた．また企業に対しては上記に加えて，入社後小児がん経験者であることが判明した場合にはどう取り扱うかをたずねた．

②小児がん経験者に対して：調査内容は表1にまとめて示した．

4）倫理的配慮

本研究は新潟県立がんセンターの倫理委員会で，平成19年10月に承認を受けた（平成19年度受付番号第33号）．アンケートは無記名とし，回答の任意性を担保し，調査用紙の返送をもって同意とみなした．

5）統計学的な方法

各項目について，アンケート集計を行い，各質問事項に対して学校と企業の比較をχ^2乗検定またはFisher検定（期待値が5未満のマスがみられた時）で有意差検定を行った．すべての統計解析は，SPSS Statistics Ver.19日本語版（日本IBM社，東京）を用いた．

結　果

（1）アンケート回収率

①学校200校中109校で54.5％，②企業200社中74社で37.0％，③小児がん経験者138名中88名で65.2％であった．

（2）学校と企業との比較（表2）

「小児がんは医学的に現在では約80％が治癒する疾患となっている」に関しては，学校（高校・大学）の38％，企業の22％が「はい」と答えていたが，有意に企業の認知度が低かった（p＝0.001）．社会的偏見を受けていると思うかどうかに関しては，いずれも70％以上が「いいえ」と答えており両者には差はなかった．

既往歴として，小児がんという病名が記載されていた時の対応としては，「既往歴は合否に関係ない」が一番多かったが，企業では「面接官や管理者の判断による」とする割合が有意に多かった．「書類審査で不合格とする」と答えた学校が2施設（1.8％），企業が4施設（5.4％）見られた．

企業側の入社後「小児がん経験者」ということが判明した時の対応に関しては，「有給休暇を認める」「敬意を表する」など肯定的・支持的な意見が多かったが，「多忙な部署」「エリートコースから外す」「同僚から特別視されることもあり得る」などの意見も見られた．

（3）小児がん経験者の背景因子（表3）

回答時の年齢は18歳から34歳（中央値24歳）で，原疾患は白血病が多く，一人暮らし，両親と同居がほぼ同数，結婚同居が15％で男女差は見られなかった．学歴は大卒・大学在学が40％，常勤勤務が50％で，病気のため就職不能は0人であったが，男性で大卒以上の割合が多かった．常勤勤務が52％を占めていたが，職業では男性で会社員や製造販売，女性で医療関係者が多かった．未婚が83％で，社会適応に困っている症例はほとんどなく，この点についても男女差は見られなかった．

A．進学時の病名記載に関して（図1と表4）

高校進学時は74人中33人（45％），専門学校進学時35人中14人（40％），大学進学時42人中13人（31％）と大きな差はなく，3〜4割が病名を記載していた．表4に示したように全体には男女差はあまり見られなかったが，専門学校進学時には女性で病名記載をした割合が有意に多かった（p＝0.019）．病名を記載した人で，面接時に嫌な思いをしたと答えたのは40人中3人，合否に不利であったと考えていたのは40人中1人であった．病名記載で「いいえ」とした理由としては，「記載欄がなかった」とするものが55％と最も多かったが，「不利になると考えた」者も20％いた．その他（自由記載）としては，告知の前だったため4人，書く必要が無いと考えたため3人，完治したから，治療終了後10年以上経っているから各1人，覚えていない1人などであった．健康診断作成での主治医の意見としては，「本人にまかせた」が約半数で，記載をすすめたものはなかった．以上に関して男女差は見られなかった（データ省略）．

B．就職時に病名記載に関して（図2と表4）

病名を記載したと答えたのは29％で進学時より少なかったが，男性（13％）に比べて女性では半数が病名を記載していた（p＝0.001）．病名を記載したことで，面接時に嫌な思いをしたと答えたのは21人中2人，合否に不利であったと考えていたのは20人中3人であった．病名を知ったときの面接官の反応に関しては，「難病を克服したことに好意的」だったものが6人（30％），「治癒に対して懐疑的」が2人（10％）であったが，「全くふれられなかった」者が11人と半数以上を占めた（男女差なし）．

病名記載で「いいえ」とした理由としては，「記載欄がなかった」とするものが48％と最も多かったが，「不利になると考えた」者も30％おり進学時よりも高率であった．健康診断作成に際しての主治医の意見としては，「本人にまかせた」が44％で，記載をすすめたものはなかった．定期健診を受ける必要があることを理解