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Heikki Heinonen · Liisa Volin · Antti Uutela
Michael Zevon · Chris Barrick · Tapani Ruutu

Quality of life and factors related to perceived satisfaction with quality of life after allogeneic bone marrow transplantation

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Abstract The quality of life after bone marrow transplantation (BMT) was studied in 109 adult allogeneic BMT recipients transplanted on at the Helsinki University Central hospital for a haematological malignancy. Physical, functional, emotional and social well-being was measured on the Functional Assessment of Cancer Therapy Scale (FACT-BMT) and a shortened version of the Profile of Mood States Scale (POMS) and by the MOS social support survey and a Brief Measure of Social Support (SSQ6). The results of the present study replicate those of previous investigations by finding that physical well-being, educational level, age at BMT and social support have an impact on the perceived quality of life of BMT patients. Our results indicate that these factors have a varying impact at different time points during the post-BMT recovery process. During the first three years after BMT, physical well-being proved to be a highly significant ($P<0.001$) factor for perceived life satisfaction. Moreover, physical well-being showed an average significant improvement after the first post-BMT year. The percentage of the recipients experiencing the highest levels of satisfaction with life increased from 51% during the first year after BMT to 81% for those patients five years post-BMT. One year after BMT, 75.6% of the BMT recipients were able to work, 67.8% of the patients were actively participating in work/school and 7.8% were unemployed.

Keywords Bone marrow transplantation · Quality of life · Psychosocial factors

H. Heinonen (✉) · L. Volin · T. Ruutu
Department of Medicine, Helsinki University Central Hospital, Helsinki, Finland
e-mail: heikki.heinonen@ktl.fi
Tel.: +358 9 47448921, Fax: +358 9 47448338

H. Heinonen · A. Uutela
National Public Health Institute Helsinki, Mannerheimintie 166, 00300 Helsinki, Finland

M. Zevon · C. Barrick
Department of Psychology, Roswell Park Cancer Institute, Buffalo, N.Y., USA

Introduction

Allogeneic bone marrow transplantation (BMT) is a successful form of therapy in a number of malignant and non-malignant haematological disorders. It is the only curative therapy for patients with chronic myeloid leukaemia and often the best treatment of other forms of adult leukaemia is also obtained by BMT. Depending on the diagnosis and the stage of disease, approximately 40–80% of BMT recipients become long-term survivors.

With the improving outlook for BMT recipients, knowledge of post-BMT quality of life (QOL) has become increasingly important [4]. Health-related QOL is considered to be subjective reflecting the individual's assessment of his/her life at any one time relative to his/her previous state and prior experience [9]. QOL is generally recognised to be a multidimensional construct including four broad dimensions: (1) physical well-being or the patient's actual physical experience of a disease and/or side-effects of the treatment; (2) functional well-being or the patient's ability to engage in the usual basic activities of daily living; (3) mental or emotional well-being, referring not only to emotional distress but also to positive well-being or happiness in life; and (4) social well-being, encompassing activities and support from family and friends [8]. Recently, several studies have been conducted to investigate QOL after BMT. Unfortunately, some studies have combined the analyses of QOL of autologous and allogeneic BMT recipients, although patients undergoing these procedures are not comparable [26]. Studies concentrating on allogeneic patients only or with a subgroup of allogeneic patients large enough for a separate analysis are fewer in number. Schmidt et al. [21] reported that 78% of their adult allo-BMT recipients (at least one year after BMT) rated their QOL as 8 or higher, on a scale from 1 to 10. In a study by Sutherland et al. [24], allogeneic BMT recipients were indistinguishable from the population norms for physical functioning, emotional role functioning, physical role functioning, bodily pain and general health 3 years after

BMT. Several studies have reported good functional well-being among long-term allo-BMT survivors, with the majority of the recipients returning to work or school [7, 21, 24]. In spite of the overall positive picture, fatigue [7], lack of energy [3], sleep problems [3] and sexual dissatisfaction [27] have been found to affect QOL aversely among BMT recipients. Multivariate analyses have identified factors for the impairment of QOL after BMT, especially an older age at BMT and the presence of transplant-related complications such as acute and chronic graft versus host disease (cGVHD) [3]. A lower level of education [21, 1] and a more advanced disease [1] at BMT have also been shown to be risk factors for impaired QOL after BMT.

It has been suggested that there might be different subgroups of long-term survivors: those who adapt reasonably well shortly after transplantation, those who need 1–2 years for readjustment, and those who continue to have long-term psychosocial problems [11]. According to Hjermstad and Kaasa [11], the identification of these subgroups early during treatment can lead to therapeutic intervention for individuals at risk with a resulting improvement in their QOL.

The aim of the present study has been to document the current QOL of the allogeneic BMT recipients, to detect possible fluctuations in their QOL over time and to identify factors associated with post-BMT QOL.

Table 1 Patient characteristics

Characteristic	Mean (range)	*n* (%)
Age in years	42 (21–59)	
Age in years at BMT	38 (17–54)	
Months post-BMT	55 (4–171)	
Sex		
Male		48 (44)
Female		61 (56)
Education		
Under 10 years		22 (20.2)
10–12 years		36 (33.0)
Over 13 years		53 (46.8)
Married or living with mate		83 (76.1)
Diagnosis		
CML		32 (29.4)
AML		39 (35.8)
ALL		15 (13.8)
MDS		13 (11.9)
MM		5 (4.5)
NHL		2 (1.8)
AA		2 (1.8)
Myelofibrosis		1 (0.9)
Existence of cGVHD		
Extensive		17 (16)
Limited		26 (24)
Absent		65 (60)
Total no. of patients		109

Materials and methods

Patients

One hundred and sixty-two patients who had received an allogeneic bone marrow transplant in 1988–1997 at the Department of Medicine, Helsinki University Central Hospital, with a minimum follow-up of 4 months after BMT, aged over 18 years, alive and without a life-threatening relapse at the time of the study were addressed. All were Finnish citizens covered by the national health care system. The subjects received a letter describing the study and a consent form. One hundred and thirty-two patients expressed their willingness to participate in the study and questionnaires were sent to them accordingly. One hundred and nine patients completed and returned the questionnaires, making a response rate of 68%. The questionnaires were returned to an independent research centre not involved in the treatment of the patients. The patients who did not participate (*n*=53) were compared with the participants by using the following variables: age at BMT, time since transplantation, score on the Karnofsky performance scale [17] and diagnosis.

Characteristics of the patients

The characteristics of the patients studied are presented in Table 1. To explore more closely the relationship between the time since transplantation and QOL, the patients were stratified into groups according to the length of time after their BMT: 4–12 months, *n*=18; 13 months to 3 years, *n*=29; more than 3–5 years, *n*=25; and more than 5 years after BMT, *n*=37. Clinical experiences have shown changes in the emotional well-being and social relationships of patients after the first post-BMT year [13]). To detect these possible changes, we also compared a group of patients transplanted within one year with those having a follow-up time of more than one year.

Methods

The measurements completed by participants included the shortened version of Profile of Mood States (POMS) [14, 22], the Functional Assessment of Cancer Therapy BMT-version (FACT-BMT) [8, 15], activities of the daily living scale (ADL) [12], MOS Survey of Social Support [23], and a Brief Measure of Social Support (SSQ6) [20]. The internal consistency of the measurements was assessed by using Crohnbach's alpha. Alphas computed on the present sample are reported in parenthesis.

The shortened version of the POMS is a well-established 37-item adjective checklist that assesses affects during the preceding week. Higher values on the scale indicate worse emotional well-being. POMS yields a total disturbance score (TMD) and separate subscales for depression-dejection (POMS-DD; $\alpha=0.92$), tension-anxiety (POMS-TA; $\alpha=0.83$), confusion (POMS-C; $\alpha=0.66$), vigour (POMS-V; $\alpha=0.75$), fatigue (POMS-F; $\alpha=0.91$) and anger (POMS-A; $\alpha=0.74$). The scores on the anger, fatigue, depression-dejection, tension-anxiety, confusion and vigour subscales of POMS were combined to create a total mood disturbance score (POMS-TMD) by using the formula: A+F+DD+TA+C+(24-V).

FACT-BMT is a 46-item inventory. It produces a subscale for physical ($\alpha=0.87$), functional ($\alpha=0.82$), social ($\alpha=0.65$) and emotional ($\alpha=0.66$) well-being and for satisfaction with treatment relationship ($\alpha=70$), and the BMT subscale (BMT) with 12 items specifically designed to test QOL in BMT recipients ($\alpha=0.63$). The trial outcome index (TOI, $\alpha=0.87$) combines the physical well-being subscale, the functional well-being subscale and the BMT subscale. Higher scores in FACT reflect better QOL in the reported dimension.

FACT item no. 33 ("Right now I am satisfied with my current QOL") was considered to represent a person's overall assessment of QOL. There is evidence that supports the use of single-item measurements in QOL research [10].

The ADL scale ($\alpha=0.80$) is a 9-item scale that measures the need for assistance in daily activities. Higher scores indicate greater functional ability and lower scores the need for assistance.

The MOS social support survey contains 19 functional support items hypothesised to measure four dimensions of social support: affectionate support (involving expressions of love and affection; $\alpha=0.89$), emotional/informational support (offering of advice, understanding, information, guidance or feedback; $\alpha=0.92$), tangible support (the provision of material aid or behaviour assistance; $\alpha=0.82$), positive social interaction (the availability of other persons with whom to do enjoyable things; $\alpha=0.87$) and the overall support scale ($\alpha=0.85$). It also includes one single-item structural indicator of social support (e.g. the number of close friends and relatives). Higher scores on the MOS scales reflect greater support.

A Brief Measure of Social Support (SSQ6) measures perceived satisfaction with social support and the number of supportive people. It has six items measuring both the number of people providing support and perceived satisfaction with the support ($\alpha=0.92$). Higher scores on SSQ6 reflect enhanced satisfaction with the level of social support.

The descriptive data (age, education, marital status, work situation, number of children, family income, diagnosis) were assessed following Finnish epidemiological studies [18].

The research protocol was accepted by the Ethical Committee of the Department of Medicine at Helsinki University Central Hospital.

Statistics

Statistical analyses were performed to test the association between each demographic, personality, disease and transplant-related variable and QOL. For each bivariate patient characteristic, the one-way analysis of variance was used to test the differences by means of the QOL ratings. For each of the patient characteristics with three or more categories, the analysis of variance (*F*-statistic) was employed. The χ^2-test was carried out to analyse group differences in categorical variables. The multiple regression analysis was conducted in order to evaluate variables that significantly contributed to satisfaction with QOL. A set of five predictor variables was employed in these analyses, including gender, age at BMT, satisfaction with social support, education and physical well-being. The set of five predictor variables was force-entered into a regression model at a single step. The analyses also included effect-size statistics that described the magnitude of the observed relationship. The effect-size, expressed here as a proportion of variance (PV) statistically explained, provides an assessment of the importance of the observed result. A higher effect-size suggests an important difference. For the tests of the group differences, PVs less than 5% are generally considered small, PVs between 5% and 10% moderate, and PVs greater than 10% large and likely to be of clinical importance [7]. The statistical analyses were conducted with a Statistical Package for the Social Sciences (SPSS). The results were considered statistically significant if the probability of their occurrence was 0.05 or less.

Results

Respondents vs non-respondents

The non-respondents had on average a significantly longer follow-up time after BMT, viz. 77 vs 57 months ($P<0.001$), and were younger at BMT, viz. 34 vs 38 years ($P<0.05$), compared with the respondents. The non-respondents scored on average slightly higher on the Karnofsky performance scale (mean=96%) compared with the respondents (mean=94%) but the difference between the two groups was not statistically significant. The groups did not differ regarding the diagnosis.

Physical and functional well-being after BMT

The mean scores for the Karnofsky performance scale, the FACT physical, the FACT functional, the BMTS and the TOI scales after BMT are presented in Table 2.

The group differences were analysed by using the analysis of variance. On average, during the first year following BMT, the patients perceived their physical well-being as being worse than those in the other follow-up groups ($P=0.000$ and PV=20%). Analysis of the TOI scores revealed that the subjects' overall well-being during the first year after their BMT was significantly worse than that of the patients 1–3 years and over 5 years after BMT. This model explained 15% of the variance. The mean scores for all the measures of physical and functional well-being improved over time.

Individual items of FACT judged to be relevant to the physical and functional well-being of the BMT patients, i.e. lack of energy, side-effects and sleeping, were analysed separately (Table 3). Chi-square comparisons of lack of energy, side-effects and sleep quality ratings with time since BMT indicated statistically significant associations ($P<0.05$). Five years after BMT, only 2 (5.4%) out of 37 patients indicated much/very much lack of energy, sleeping problems and side-effects. Examination of the ADL scale scores revealed that most of the respondents could carry on with their daily activities without any help one year after BMT: 92% of the patients could walk outside, 96% could walk inside, 93% could do light work, 99% could climb the stairs, 93% could do their shopping and 72% of the patients were able to do heavy household work.

Table 2 Means (standard deviations) of physical and functional well-being after BMT

Well-being Dimension	Time after BMT (months)				*P*-value	R^2	Pairwise contrasts
	≤12	12 to ≤36	36 to ≤60	>60			
Physical well-being	18.5 (6.5)	23.3 (4.9)	23.2 (4.5)	25.4 (3.3)	0.00	0.20	1 vs 2, 3, 4
Functional well-being	17.6 (5.2)	19.4 (3.2)	19.4 (3.7)	20.1 (3.1)	0.15	0.05	
Karnofsky scale	91.1 (12.3)	93.7 (9.2)	97.1 (4.6)	94.3 (17.1)	0.48	0.02	
BMT-subscale	33.9 (7.1)	37.9 (4.6)	36.8 (5.7)	37.4 (5.4)	0.10	0.05	
Trial outcome index	72.7 (18.5)	83.8 (11.6)	82.3 (12.4)	86.2 (10.5)	0.01	0.15	1 vs 2, 1 vs 4
Number of patients	18	29	25	37	Total *n*=109		

Table 3 Frequencies (percentages) of comments of BMT recipients regarding "feeling lack of energy", "bothered by side-effects", "sleeping well" after BMT

	Time after BMT (months)				
	≤12	12 to ≤36	36 to ≤60	>60	Total
"Feeling lack of energy"					
Not at all/a little	7 (38.9)	17 (58.6)	16 (69.6)	28 (75.7)	68 (63.6)
Somewhat	5 (27.8)	9 (31.0)	6 (26.1)	7 (18.9)	27 (25.2)
Much/very much	6 (33.3)	3 (10.3)	1 (4.3)	2 (5.4)	12 (11.2)
"Bothered by side-effects"					
Not at all/a little	8 (44.4)	22 (75.9)	16 (69.9)	33 (89.2)	79 (73.8)
Somewhat	3 (16.7)	4 (13.8)	4 (17.4)	2 (5.4)	13 (12.1)
Much/very much	7 (38.9)	3 (10.3)	3 (13.0)	2 (5.4)	15 (14.9)
"Sleeping well"					
Not at all/a little	4 (22.2)	2 (6.9)	1 (4.3)	2 (5.4)	9 (8.4)
Somewhat	4 (22.2)	2 (9.9)	4 (17.4)	6 (16.2)	16 (15.0)
Much/very much	10 (55.6)	25 (86.2)	18 (78.4)	29 (78.4)	82 (76.6)
Total	18 (16.8)	29 (27.1)	23 (21.5)	37 (34.6)	107 (100)

Table 4 Emotional and social well-being during and after the first year following BMT (*ns* not significant)

Measurement	Time after BMT (months)		*F*-value
	≤12 Mean (SD)	Over 12 Mean (SD)	
Emotional well-being (FACT)	15.7 (2.3)	16.5 (2.9)	1.0^{ns}
Depression (POMS-DD)	7.2 (7.1)	4.9 (4.7)	2.8^{ns}
Tension-anxiety (POMS-TA)	9.8 (5.0)	7.6 (4.2)	4.1*
Total mood (POMS-TMD)	49.1(25.0)	38.0 (18.5)	4.8*
Social well-being (FACT)	22.5 (2.5)	21.6 (4.3)	0.7^{ns}
Measure of social support (MOS)	81.9 (8.2)	78.2 (12.6)	1.5^{ns}
A Brief Measure of Social Suppor (SSQ6)	32.6 (2.1)	32.2 (4.0)	2.0^{ns}
Total *n*=109	*n*=18	*n*=91	

*$P<0.05$

After one year, 61 (67.8%) patients were actively participating in work, school or household activities, 23 (23.3%) were on a pension, seven (7.8%) were unemployed, and one (1.1%) was on sick leave. The manual workers ($n=34$) were less likely to return to work than the office workers ($n=55$; $\chi^2=12.8$, $P<0.01$). Eighty-four per cent of the office workers and 47% of the manual workers were currently working or studying. There were no statistically significant differences between the manual and office workers in physical well-being (FACT-P) or on the Karnofsky performance scales.

Need for occupational rehabilitation

Seventy-three per cent of the manual workers answered "yes" to the question, "Do you think that you would have benefited from vocational rehabilitation?" compared with 37% of the office workers. The patients ($n=42$) who believed that vocational rehabilitation would have been beneficial had a significantly ($F=8.64$ $P=0.004$) lower educational level compared with those ($n=48$) who did not believe in benefits of rehabilitation.

Emotional and social well-being after BMT

We analysed the psychological well-being of the BMT recipients by using the FACT emotional well-being scale and the POMS depression (POMS-DD) and anxiety scales (POMS-TA) and the total score of the POMS (POMS-TMD).

Two statistically significant differences between the post-BMT groups were found. The mean scores of the POMS-TA and POMS-TMD scales showed that the group of the patients within the first year after BMT experienced more anxiety and total mood disturbance compared with those with a longer follow-up time. The mean scores of the FACT emotional well-being scale and POMS depression scale (Table 4) also showed a consistent trend towards improved emotional well-being after the first year following BMT.

Evaluation of the mean scores on scales of social well-being, satisfaction with social support and availability of support did not reveal any statistically significant differences between the groups (Table 4). On average, the availability of social support (MOS) and satisfaction with social support (SSQ6) declined after the first year post-BMT.

Factors associated with perceived satisfaction with QOL

The participants' satisfaction with their current QOL is presented in Table 5. Satisfaction was measured by the subject's response to the following item: "I am content with the quality of my life right now" (scale 0–4: from not at all to very much). On average, the perceived contentment with QOL did not differ between the groups. However, only 50% of the recipients with a follow-up time of one year or less responded "quite a lot", or "very much" to the question, compared with 81.1% of the patients with a follow-up time of more than five years.

A multiple regression analysis was used to examine the association between the demographic variables and satisfaction with current QOL in the groups. Five predictor variables were used in the analyses: gender, age at BMT, education, physical well-being and satisfaction with social support (Table 6). Physical well-being proved to be a significant ($P<0.001$) predictor of satisfaction with QOL until three years from BMT.

Among the respondents with 1–3 years of follow-up, the age at BMT also proved to be a significant predictor ($P<0.05$), indicating that the patients receiving a transplant at an older age perceived more satisfaction with their QOL than those at a younger age. We compared patients under 40 years with those of 40 years old or more by means of multivariant analysis, with perceived physical well-being as a covariant in the group 1–3 years post-BMT. The patients under 40 years of age were found to be less satisfied with their current QOL compared with the patients of more than 40 years of age with respect to physical well-being.

Table 5 Frequencies (percentages) of BMT recipients experiencing "satisfaction with current QOL" after BMT

"Satisfaction with current QOL"	Time after BMT (months)			
	≤12	12≤36	36≤60	>60
Not at all/a little	3 (16.7)	3 (10.7)	1 (4.3)	3 (8.1)
Somewhat	6 (33.3)	3 (10.7)	3 (13.0)	4 (10.8)
Much/very much	9 (50.0)	22 (78.6)	19 (82.6)	30 (81.1)
Total	18	28	23	37

Number of missing observations: 3 (χ^2=8.47, d.f.=6, *P*=0.80 not significant)

After 5 years, satisfaction with social support and education proved to be significant predictors of the contentment of life. The accounted variance for the model was 51%. Patients with good perceived social support and good education experienced greater satisfaction with their QOL.

Diagnoses, cGVHD and well-being

The three largest diagnosis groups and groups according to the extent of cGVHD were compared on the FACT well-being scales by using the oneway analysis of variance. There were no differences between the CML, AML, or ALL patients with regard to physical, social, functional or emotional well-being. Regarding the impact of cGVHD, one statistically significant difference between the groups defined by the existence of cGVHD was found. Patients with extensive cGVHD indicated on average worse physical well-being compared with those patients with limited or without cGVHD ($F=4.8$, $P<0.05$).

Discussion

The present study revealed specified information on factors associated with QOL during the post-transplant period. The present results showed that, at various time points during the post-BMT recovery process, the factors that significantly impacted on perceived life satisfaction changed. During the first three years after BMT, physical well-being proved to have a highly significant ($P<0.001$) relationship with QOL. We found that the physical and emotional status showed on average significant improvement after the first post-BMT year. One year after BMT, 76% of the BMT recipients were able to work, 68% of the patients were actively participating in work/school, and 8% were unemployed. The present finding is similar to those of some earlier studies [7, 21]. The educational level [2], age at BMT [24, 2] social support [16] have been shown to have an impact on the QOL outcomes of BMT recipients. The present study indicates that these factors have importance at various points of time during the recovery process after BMT. One to three years after

Table 6 Beta weights for multiple regression analysis of satisfaction of life after BMT (*ns* not significant)

Predictor variable	Time after BMT (months)			
	≤12	12≤36	36≤60	>60
Gender[a]	0.19	0.26	–0.03	0.03
Age at BMT	0.09	0.33*	–0.13	0.14
No. of years of education	0.12	–0.13	–0.17	0.59***
Physical well-being (FACT)	0.93***	0.72***	0.59*	0.04
Satisfaction with social support (SSQ6)	–0.28	0.04	0.18	0.47***
Multiple R	0.89	0.76	0.62	0.72
Variance accounted for	79.4%	0 58.4%	38.0%	51.0%
F-value	9.26***	5.90**	2.25^{ns}	6.56***
Degrees of freedom	5, 12	5, 21	5, 18	6, 31

***$P<0.001$, **$P<0.01$, *$P<0.05$

[a] Coded as male=1

BMT, the age at transplantation also has a significant relationship with QOL. The patients receiving a transplant at a younger age (<40 years) indicated worse life satisfaction than those at an older age (over 40 years). It can be assumed that, shortly after BMT, younger patients find themselves more impaired in comparison with others in their age-group than the older recipients [e.g. 19]. When 5 years had passed since BMT, social support and education proved to be the most important factors for life satisfaction. Andrykowski et al. [2] concluded that more educated patients were employed in less physically demanding occupations, thus reducing the likelihood of post-BMT occupational difficulties. The present study has confirmed these results by finding that manual workers return to work less often than office workers despite the absence of a significant difference in the physical well-being scores of these two groups. It can be concluded, therefore, that education is a mediating factor in the QOL of the BMT recipients. Barofsky [6] noted the importance of work in the QOL of cancer patients. Based on our results and the prior literature [5], therefore, vocational rehabilitation services would seem to be an important component of post-BMT treatment programs, particularly for patients with a background of manual work and a low educational level.

QOL and psychosocial distress have been reported to improve over the first three years post-BMT [25]. The present study indicates that the greatest improvement in the physical and emotional well-being can be expected after the first year following BMT. In the prospective study of Syrjälä et al. [25], one third of the patients reported elevated levels of emotional distress throughout the first year after BMT. The present results confirm their findings. A small proportion of the patients examined herein continued to have physical problems for years after BMT. Depending on the symptom evaluated, 1–8% of the patients often or very often experienced some physical symptoms. This result is in accordance with some other studies. Bush and colleagues [7] found that 5% of the survivors reported their QOL and health status as poor. In the study of Andrykowski et al. [3], 6% of the patients complained of severe energy problems and 8% severe sleep problems.

Selection bias and its potential impact on results is a concern when evaluating the results of this study and other follow-up studies that focus on psychological/emotional functioning. The failure to capture patients functioning poorly, for example secondary to depression, may affect the results [26]. In the present study, it was possible to compare the non-respondents and the respondents. The non-respondents where characterised by better functional status, had a longer follow-up time ($P<0.001$) and were younger at the time of their BMT ($P<0.05$). These findings lessen the risk that the current results are the product of a significant bias towards poorer QOL among the non-respondents.

Patient reluctance to reveal negative feelings about their treatment or outcomes to the hospital personnel who had cared for them is another potential source of response bias. Therefore, the questionnaires in the present study were sent to a research centre not involved with their treatment. Additional biasing factors, such as those associated with the quality or availability of care resulting from unequal financial resources or insurance coverage, were also minimised in the present investigation, because of the uniform availability of treatment guaranteed by the Finnish public health care system.

Whereas our results reveal important information about the course of recovery from BMT, our conclusions are limited by the cross-sectional nature of our design and the single assessment point. Prospective and longitudinal designs are needed in order to provide a more detailed perspective of the course of recovery from BMT.

Our results do, however, support the premise that the large majority of long-term allogeneic BMT patients express satisfaction with their QOL and describe themselves as living without significant physical, functional, emotional and social problems related to their disease or BMT treatment. Nevertheless, a number of dimensions were identified that deserve attention during the post-transplant treatment phase. Patients receiving a transplant at a younger age appear to need more emotional guidance and counselling, even years after their BMT. The need to incorporate vocational rehabilitation as part of post-BMT treatments is particularly striking given the absence of such efforts in the majority of treatment programs. By increasing the focus on the important psychosocial dimensions identified herein, the enhancement of the QOL of BMT patients becomes an attainable goal.

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