

ORIGINAL ARTICLE

Health-Related Quality of Life and Associated Factors in People Undergoing Liver Transplantation

Fernanda Maria Sirtolli Stolf¹; Deisi Maria Vargas²
Carlos de Oliveira Nunes³; Luciane Coutinho de Azevedo⁴

Highlight:

1. The results reinforce the importance of continuous interprofessional support in the search for the physical and mental well-being of people undergoing liver transplantation, in order to improve their perception of quality of life after transplantation, especially in the quality of life domains that scored the lowest: Pain, Vitality and Physical Aspect.
2. The inclusion of a physical education professional in the multi-professional team to guide and monitor patients individually before and after the transplant is a unique way of helping patients recover after the procedure.
3. Preserving good mental health after transplantation is one of the determining factors in maintaining a good quality of life. Early identification and management of aspects that compromise the mental health of patients undergoing liver transplantation should be considered throughout treatment.

ABSTRACT

Objective: To analyze the quality of life (QoL) and associated factors in people undergoing liver transplantation in southern Brazil. *Methods:* Exploratory cross-sectional study. The dependent variables were the QoL domains collected through the Short Form Quality of Life questionnaire-36. The independent variables were sex, age, marital status, education, income, employability, physical exercise, and years since transplantation, etiology and comorbidities. In the analysis, $p < 0.05$ was considered. Results: The sample was made up of 226 people. The QoL domains that scored the most were Emotional Aspect, Social Aspect and Functional Capacity, and those that scored the least were Pain, Physical Aspect and Vitality. Being female was associated with lower scores in Functional Capacity, Vitality and Social Role. Lower income was associated with lower scores on the Emotional Aspect and being retired, the lowest score on Vitality. The number of comorbidities was negatively associated with the General State of Health and Vitality. Mental Health disease reduces the values of Vitality, Social Aspect, Emotional Aspect and Mental Health. Exercising after the transplant was associated with higher values for Pain, Physical Appearance, Functional Capacity, Vitality, Emotional Appearance and Mental Health. Conclusions: This sample presented a more satisfactory perception of the QoL Emotional and Social Aspect and Functional Capacity domains. Factors negatively related to the quality of life were being female, having an income of less than R\$ 3.000, not working, number of comorbidities present at the time of the interview, and diagnosing a mental health illness, on the other hand, practicing physical exercise after the transplant was positively related.

Keywords: quality of life; liver transplant; health; physical exercise; mental health.

¹ Universidade Regional de Blumenau – Furb. Programa de Pós-graduação em Saúde Coletiva. Blumenau/SC, Brasil. <https://orcid.org/0000-0001-8960-8474>

² Universidade Regional de Blumenau – Furb. Programa de Pós-graduação em Saúde Coletiva. Blumenau/SC, Brasil. <https://orcid.org/0000-0003-4389-2670>

³ Universidade Regional de Blumenau – Furb. Programa de Pós-graduação em Saúde Coletiva. Blumenau/SC, Brasil. <https://orcid.org/0000-0001-6301-4053>

⁴ Universidade Regional de Blumenau – Furb. Programa de Pós-graduação em Saúde Coletiva. Blumenau/SC, Brasil. <https://orcid.org/0000-0001-5574-9092>

INTRODUCTION

Health-related quality of life is understood as an individual's perception of their position in the context of life, culture, and values related to their goals, experiences, knowledge, expectations, and concerns that determine their standard of well-being^{1,2}. It is a multidimensional construct that reflects the physical, mental, psychological, and social dimensions of health³. It addresses issues such as improvement in the individual's living conditions, the presence of well-being, happiness, love, pleasure, personal fulfillment, health conditions, and the impact on the ability to live fully⁴.

Liver transplantation is a highly complex surgery that replaces the diseased organ with a graft taken from a living or deceased donor⁵. It is considered the treatment of choice for people with end-stage liver disease and selected cases of hepatocellular carcinoma^{6,7}. Often, when conservative treatments have not proved effective, it is the only form of treatment that can increase life expectancy^{8,9}. However, with the increase in survival rates and the reduction in complications after transplantation, health-related quality of life has become a post-transplant outcome^{10,11}.

Individual satisfaction after liver transplantation is an indicator of their ability to adapt to the new clinical condition, which will enable them to reinvest in their lives with greater confidence¹². Studies point to an improvement in the quality of life of people who have undergone liver transplantation at all ages, with gains in physical conditioning, engagement in social and leisure activities, and emotional aspects^{11,13-15}. However, there is no unanimous agreement that the quality of life of all people undergoing transplantation improves^{11,13-15} and it is unclear whether, when there is improvement, it occurs in all dimensions.¹⁶ and throughout the post-transplant period^{2,17}.

Relationships between quality of life and demographic, social, and clinical factors before and after transplantation have been pointed out^{2,11,12,18-21}. However, there is no uniformity in the results found^{11,12,18,19,21}. Some factors are positively associated with improving certain domains of quality of life^{18,20,21,23} and others are negatively associated^{19,20,24,25}. Given the variability of findings regarding the health-related quality of life of people who have undergone liver transplantation, there is still uncertainty as to which factors favor the achievement of better scores in all domains of quality of life assessment, regardless of the length of time since transplantation²⁶.

Identifying factors that interfere with quality of life broadens knowledge about the dimensions that are most affected and that require greater attention from the professionals involved in care, contributing to the planning of care geared towards the needs of people undergoing transplantation and the prevention of situations that can interfere with results²⁶. In view of the above, this study aims to analyze health-related quality of life and associated factors in people undergoing liver transplantation in a transplant service in southern Brazil.

METHODOLOGY

This is an exploratory, applied, quantitative, cross-sectional study of the health-related quality of life of people who have undergone liver transplantation in a reference service for liver transplantation in southern Brazil. This service provides initial consultations, surgery, post-operative care, and lifelong follow-up. People from the 293 municipalities of Santa Catarina and other states in Brazil are treated entirely by the SUS. Since it was set up in 2002 until January 2023, 1,650 transplants have been carried out²⁷.

The population of this study was made up of people of both sexes who had undergone liver transplantation in the last ten years and who met the inclusion and exclusion criteria. The sample size was defined based on the population information provided by the hospital's registration system, totaling 524 people. A 95% confidence interval, a 5% significance level, and a 5% sampling error were

used to calculate the sample. Thus, using the OpenEpi28 tool, the calculated sample required was 226 participants, considering that it was a finite population with common characteristics. The sample was non-probabilistic, and participants were selected sequentially according to the schedule of routine appointments at the transplant clinic.

The inclusion criteria were being over 18 years old, being followed up at the outpatient clinic, agreeing to take part in the study by signing the Informed Consent Form (ICF), and being able to answer the questionnaire. People who had been transplanted for less than six months or more than ten years, who had undergone retransplantation or double transplantation, and who were unable to answer the quality of life questionnaire were excluded.

The independent variables in this study were gender, age, marital status, schooling, income categories, employment, physical exercise, years since transplantation, etiology of liver disease, presence and number of comorbidities, and the Model for End-Stage Liver Disease (Meld) score before transplantation, collected in interviews and medical records. The dependent variables were the quality of life domains (pain, physical status, functional capacity, general health status, vitality, social status, emotional status, and mental health) collected using the Short Form Quality of Life (SF-36) questionnaire. The questionnaire and sociodemographic information were collected by two previously trained people in a private room on the day of the consultation at the Transplant Clinic. The questionnaires were collected between March and May 2022, and the average time taken to administer each questionnaire was around fifteen minutes.

The SF-36 is an instrument created in English²⁹ and later translated and validated into Portuguese³⁰. Its application is comprehensive, easy to understand, and has been used by several authors to assess quality of life^{11,14,19}, including those undergoing transplantation or those on the waiting list¹⁰. It is a generic questionnaire for assessing health status, made up of 11 questions and 36 items covering eight domains (components or dimensions), represented by functional capacity (ten items), physical aspect (four items), pain (two items), general health (five items), vitality (four items), social aspect (two items), emotional aspect (three items), and mental health (five items). The instrument generates a score for each domain ranging from 0 to 100, with 0 corresponding to the worst quality of life and 100 to the best 30.

Statistical Analysis

The qualitative variables were presented as absolute and relative frequencies and the quantitative variables as mean \pm standard deviation, median, minimum, and maximum. The normality of the quantitative variables was defined using the Kolmogorov-Smirnov test. The scores in the quality of life domains were compared between the categories of qualitative variables using the Mann-Whitney test for two groups and the Kruskal-Wallis test for three or more groups. Spearman's correlation was applied to identify associations between scores in the quality of life domains and participants' age, Meld, and number of comorbidities.

In the multiple regression analysis, the score for each quality of life domain was considered the dependent variable. Quantitative variables that correlated significantly with domain scores and qualitative variables that showed statistically significant differences in domain scores between categories were considered independent variables. Values of $p < 0.05$ were considered statistically significant. Statistical analyses were carried out using the statistical program SPSS 22.0 for Windows 31 and 32.

The study was approved by the Ethics Committee of the Barriga Verde University Center (Unibave) in Orleans, SC, Brazil (protocol approval number CAAE 53287821.8.0000.5598) and by the institutional committee. The individuals who agreed to take part in this study signed the informed consent form before data collection began.

RESULTS

In this study, the sample consisted of 226 participants, most of whom were male and over 60 years old. Table 1 shows that most of the participants were married or in a stable union, had attended high school or had not studied, and had a family income of more than R\$3,000. At the time of the interview, more than half of the participants were retired. The average time the sample had been transplanted was 55.9 ± 33.6 months (approximately five years), most of whom had been transplanted for more than five years. Hepatocellular carcinoma, alcoholic cirrhosis, hepatitis C, and hepatitis B were the most frequent etiologies of liver disease. Most of the participants had comorbidities, either isolated or associated, the main ones being diabetes mellitus, hypertension, and mental health illnesses. After the transplant, most of them practiced physical exercise.

Table 1 – Demographic, socioeconomic and clinical characteristics of the participants.

Variables	N	%
Gender		
Female	65	28,8
Male	161	71,2
Age range		
Adult < 59 years	88	38,9
Elderly > 60 years	138	61,1
Schooling		
No schooling or elementary school	81	35,8
High school	96	42,5
Higher education / post-graduate	49	21,7
Marital status		
Single, widowed or divorced	57	25,2
Married or in a stable union	169	74,8
Income (reais)		
Less than R\$ 2,000	46	20,4
R\$ 2,000 to R\$ 3,000	57	25,2
R\$ 3,000 to R\$ 5,000	47	20,8
Over R\$ 5,000	76	33,6
Professional situation after transplant		
Retired	122	54,0
Not working	40	17,7
Working	64	28,3
Worked before transplant		
Yes	102	45,1
No	124	54,9
Returned to work after transplant		
Yes	75	33,2
No	151	66,8
Time since transplant		
< 1 year	23	10,0
1 to 2 years	54	24,0
3 to 5 years	41	18,0
5 to 10 years	108	47,0

Variables	N	%
Etiology		
Hepatocarcinoma	58	25,7
Hepatocarcinoma	57	25,2
Alcohol	55	24,3
Hepatitis C	31	13,7
Others	30	13,3
Hepatitis B	23	10,2
Cryptogenic	15	6,6
Non-alcoholic steatohepatitis		
MELD pre-transplant		
Up to 15 points	37	16,4
More than 15 points	189	83,6
Presence of comorbidities		
Yes	183	81,0
No	43	19,0
Comorbidities		
Diabetes mellitus	82	36,0
Hypertension	79	35,0
Mental Health Illness	22	9,6
Other	114	50,0
Physical exercise before transplant		
Yes	125	55,3
No	101	44,7
Physical exercise after transplant		
Yes	149	65,9
No	77	34,1

Caption: MELD = Model for End-stage Liver Disease.

Source: Prepared by the authors.

Figure 1 shows the median scores for the participants' quality of life domains. The domains with the highest scores were Emotional Aspect, Social Aspect and Functional Capacity, and those with the lowest scores were Pain, Physical Aspect and Vitality.

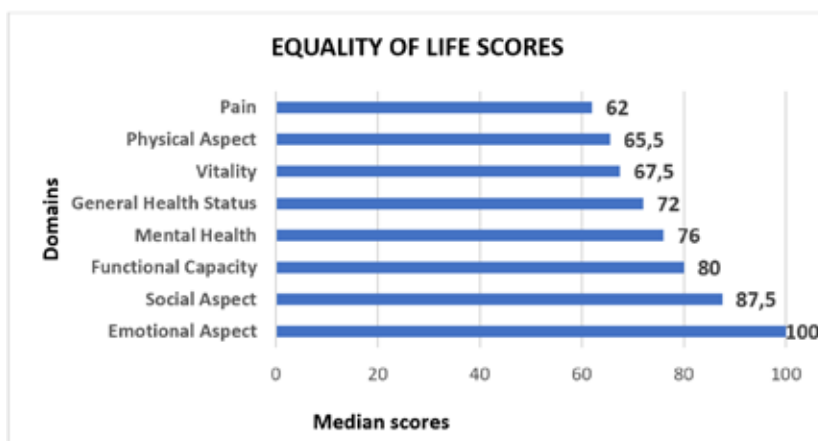


Figure 1 – Median scores for the domains of the Short Form-36 (SF-36) quality of life assessment questionnaire for people undergoing liver transplantation.

Source: Prepared by the authors.

In the simple linear regression, the age in years of the participants correlated positively with the scores in the General Health Status ($R^2= 0.17$; $p=0.01$) and Mental Health ($R^2= 0.15$; $p=0.01$) domains, and the Meld score correlated positively with the Functional Capacity domain ($R^2= 0.16$; $p=0.01$). The scores for the variable number of comorbidities correlated negatively with the Physical ($R^2= - 0.24$; $p=0.00$), Functional Capacity ($R^2= -0.31$; $p=0.00$), General Health Status ($R^2= -0.20$; $p=0.00$), Vitality ($R^2= -0.25$; $p=0.00$), Social ($R^2= - 0.13$; $p=0.04$) and Emotional ($R^2 = -0.18$; $p=0.00$) domains. There was no significant correlation between the time after transplantation and the scores in the quality of life domains.

Table 2 shows that there was a difference in scores in the Pain domain for the variables age group, income, and work activity before the transplant and physical exercise afterwards. In the Physical Aspect domain, there were differences in terms of schooling, income, employment status before and after the transplant, presence of comorbidities and physical exercise afterwards. Presence of comorbidities, income, schooling, professional status before and after transplantation and physical exercise practice after transplantation were variables that showed differences in scores in the Functional Capacity domain. The score in the General Health Status domain differed according to age group. In the Vitality domain, there was a difference in the scores for the presence of comorbidities, income, and professional status before and after the transplant and physical exercise. Presence of comorbidities and practice of physical exercise were variables with differences in scores in the Social Aspect domain. In the Emotional Aspect, income, schooling, presence of mental health illness, professional situation before and after transplant and practice of physical exercise after transplant showed a difference in scores. In Mental Health, there was a difference in scores for age group, diagnosis of hepatocellular carcinoma, presence of mental health illness, professional situation and practice of physical exercise after the transplant.

Table 2 – Bivariate analysis between quality of life domain scores* and independent variables

Variables	PAIN	PA	FC	GH	VIT	SA	EA	MH
Gender								
Female	56,50 (0-100)	50,00 (0-100)	65,00 (10-100)	70,00 (25-100)	60,00 (15-90)	75,00 (12,5-100)	66,67 (0-100)	72,00 (16-100)
Male	72,00 (0-100)	75,00 (0-100)	80,00 (15-100)	77,00 (12-100)	70,00 (15-100)	100,00 (12,5-100)	100,00 (0-100)	76,00 (24-100)
P	0,00	0,00	0,00	0,01	0,00	0,00	0,16	0,01
Age group**								
Adult (< 60 years)	62 (0-100)	50 (0-100)	75 (0-100)	70 (12-100)	65 (15-100)	87,5 (12-100)	83,3 (0-100)	72 (24-100)
Elderly (> 60 years)	72 (0-100)	75 (0-100)	80 (0-100)	78,5 (27-100)	70 (15-100)	100 (12-100)	100 (0-100)	80 (16-100)
P	0,04	0,28	0,77	0,01	0,14	0,06	0,30	0,00
Schooling***								
Did not study	61 (0-100)	50 ^a (0-100)	65 ^a (0-100)	72 (12-100)	65 (15-100)	87,5 (12,5-100)	66,67 ^a (0-100)	72 (24-100)
High school	72 (0-100)	50 ^a (0-100)	80 ^{ab} (15-100)	72 (27-100)	70 (15-100)	87,5 (12,5-100)	100 ^a (0-100)	80 (16-100)
Higher education / post-graduate	72 (20-100)	100 ^b (0-100)	90 ^c (25-100)	75 (22-100)	70 (25-100)	87,5 (37,5-100)	100 ^b (0-100)	76 (32-100)
P	0,07	0,03	0,00,0	0,58	0,24	0,59	0,04	0,56

Income (reais) ***

Less than R\$ 2.000	56 ^a (0-100)	50 ^a (0-100)	70 ^{ab} (15-100)	71 (15-100)	62,5 ^a (15-95)	87,5 (12-100)	66,67 ^a (0-100)	74 (16-100)
From R\$ 2.000 to R\$ 3.000	62 ^a (0-100)	50 ^a (0-100)	65 ^{abc} (10-100)	72 (10-100)	60 ^a (15-100)	87,5 (12-100)	66,67 ^a (0-100)	72 (24-100)
From R\$ 3.000 to R\$ 5.000	72 ^{a b} (0-100)	75 ^{a b} (0-100)	85 ^{abc} (0-100)	72 (10-100)	65 ^{a b} (20-100)	100 (25-100)	100 ^b (0-100)	76 (40-100)
Less than R\$ 2.000	72 ^b (0-100)	100 ^b (0-100)	85 ^d (25-100)	80 (25-100)	75 ^b (20-100)	93,75 (25-100)	100 ^b (0-100)	78 (32-100)
p	0,03	0,00	0,00	0,06	0,03	0,33	0,00	0,06

Professional situation after the transplant ***

Retired	62 (0-100)	62,5 ^a (0-100)	75 ^a (15-100)	76 (22-100)	70 ^a (15-100)	87,5 ^a (12,5-100)	100 ^a (0-100)	80 ^a (28-100)
Not working	56,5 (0-100)	50 ^b (0-100)	67,5 ^a (10-100)	71 (12-97)	52,5 ^b (15-90)	62,5 ^b (12,5-100)	66,67 ^b (0-100)	64 ^b (24-100)
Working	72 (0-100)	100 ^a (0-100)	85 ^b (10-100)	77,5 (27-100)	70 ^{ac} (15-100)	100 ^{ac} (37,5-100)	100 ^{ac} (0-100)	76 ^{ac} (16-100)
p	0,08	0,01	0,00	0,16	0,00	0,00	0,01	0,03

Work before the transplant **

Yes	72 (0-100)	75 (0-100)	85 (15-100)	77 (12-100)	70 (15-100)	93,75 (12,5-100)	100 (0-100)	76 (24-100)
No	61 (0-100)	50 (0-100)	70 (10-100)	72 (25-100)	65 (15-100)	87,5 (12,5-100)	83,34 (0-100)	74 (16-100)
p	0,02	0,00	0,00	0,13	0,01	0,2	0,08	0,33

Returned to work after the transplant **

Yes	72 (0-100)	75 (0-100)	85 (10-100)	72 (27-100)	70 (15-100)	100 (37,5-100)	100 (0-100)	76 (16-100)
No	62 (0-100)	50 (0-100)	75 (10-100)	72 (12-100)	65 (15-100)	87,5 (12,5-100)	66,67 (0-100)	76 (24-100)
p	0,21	0,04	0,00	0,63	0,47	0,14	0,04	0,92

Etiology hepatocellular carcinoma **

Yes	72 (0-100)	50 (0-100)	77,5 (10-100)	82 (22-100)	70 (15-100)	87,5 (12-100)	100 (0-100)	80 (16-100)
No	62 (0-100)	75 (0-100)	80 (15-100)	72 (12-100)	65 (20-100)	87,5 (25-100)	100 (0-100)	72 (24-100)
p	0,29	0,40	0,79	0,12	0,39	0,77	0,59	0,02

Presence of comorbidities **

Yes	62 (0-100)	50 (0-100)	75 (10-100)	72 (12-100)	65 (15-100)	87,5 (12-100)	100 (0-100)	76 (16-100)
No	74 (0-100)	100 (0-100)	90 (20-100)	72 (42-100)	75 (15-100)	100 (37-100)	100 (0-100)	76 (36-100)
p	0,13	0,00	0,00	0,40	0,03	0,05	0,01	0,32

Diabetes Mellitus**								
Yes	62 (0-100)	50 (0-100)	65 (10-100)	72 (12-100)	65 (15-100)	87,5 (12-100)	66,67 (0-100)	76 (16-100)
No	72 (0-100)	75 (0-100)	80 (10-100)	77 (25-100)	70 (20-100)	100 (12-100)	100 (0-100)	76 (28-100)
p	0,10	0,04	0,00	0,08	0,04	0,31	0,09	0,49
Hypertension **								
Yes	72 (0-100)	50 (0-100)	65 (10-100)	72 (12-100)	65 (15-100)	87,5 (12-100)	100 (0-100)	78 (16-100)
No	62 (0-100)	75 (0-100)	80 (15-100)	72 (25-100)	70 (15-100)	87,5 (12-100)	100 (0-100)	74 (28-100)
p	0,20	0,42	0,00	0,41	0,10	0,53	0,89	0,22
Illness Mental Health **								
Yes	51,5 (0-100)	12,5 (0-100)	62,5 (15-100)	67 (27-97)	55 (15-80)	62,5 (12-100)	16,67 (0-100)	50 (28-96)
No	72 (0-100)	75 (0-100)	80 (10-100)	75 (12-100)	70 (15-100)	100 (12-100)	100 (0-100)	76 (16-100)
p	0,31	0,01	0,04	0,12	0,00	0,00	0,00	0,00
Physical exercise after transplantation **								
Yes	72 (0-100)	75 (0-100)	85 (0-100)	77 (15-100)	70 (15-100)	87,5 (12,5-100)	100 (0-100)	80 (16-100)
No	51 (0-100)	25 (0-100)	65 (0-100)	70 (10-100)	60 (15-100)	87,5 (12,5-100)	66,67 (0-100)	68 (24-100)
p	0,00	0,00	0,00	0,08	0,00	0,00	0,00	0,00

Legend: (*) Median (minimum- maximum); (**) Mann Whitney statistical test; (***) Kruskal Wallis statistical test; p = significance level. MELD = Model for End-stage Liver Disease; PA = Physical Aspect; FC = Functional Capacity; GH = General Health Status; VIT = Vitality; SA = Social Aspect; EA = Emotional Aspect; MH = Mental Health.

Source: Elaborated by the authors.

Table 3, summarizing the multiple regression analyses, shows that all the regression models generated were significant, in order to identify potential predictor variables for the quality of life domains assessed by the SF-36 in this sample. In the Pain and Physical Aspect domains, the practice of physical exercise after transplantation appeared as a potential positive predictor. In the Functional Capacity domain, being female was a negative predictor and practicing physical exercise after transplant was a positive predictor. In the General Health Status domain, the number of comorbidities was a negative predictor. Being female, not working, number of comorbidities and having a mental illness were potential negative predictors, while practicing physical exercise was a positive predictor of the Vitality domain. In the Social Aspect domain, being female and having a mental illness were negative predictors. Lower income and mental illness were negative predictors, while practicing physical exercise after the transplant was positive in the Emotional Aspect domain. In the Mental Health domain, physical exercise was a positive predictor and having a mental illness was a negative predictor.

Table 3 – Multiple regression analysis between the scores of the domains of the Short Form-36 (SF-36) quality of life assessment questionnaire and the independent sociodemographic and clinical variables

	Pain		PA		FC		GH		VIT		SA		EA		MH	
	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p
Sex (female)	-7,85	0,06	-10,10	0,08	0,00	0,00	-3,00	0,31	-7,77	0,00	-9,93	0,00				
Age (years)																
Age group (adult)	-4,99	0,19														
Schooling																
Doesn't study / elementary			-0,48	0,95	-5,37	0,26							-1,56	0,85		
High school / college			-2,93	0,69	-0,61	0,89							2,59	0,72		
Income (reais)																
Less than R\$ 2,000	-8,71	0,10	-12,09	0,15	-8,40	0,07			-3,26	0,37			-17,09	0,03		
from R\$ 2,000 to R\$ 3,000	-6,17	0,20	-14,55	0,07	-7,57	0,09			-4,00	0,25			-16,31	0,03		
from R\$ 3,000 to R\$ 5,000	-1,74	0,74	-4,31	0,57	0,54	0,89			0,98	0,78			4,26	0,56		
Work before TH (no)	0,97	0,84	0,25	0,97	1,45	0,71			0,47	0,89						
Return to work after HT (no)			1,32	0,88	-5,27	0,28							0,47	0,95		
Current work situation																
Retired			-4,36	0,64	1,66	0,74			1,65	0,58			-0,27	0,97	0,48	0,87
Not working			-10,79	0,31	-4,33	0,46			-8,58	0,03			-10,0	0,33	-6,13	0,09
Physical exercise after HT (yes)	10,93	0,03	18,36	0,01	14,78	0,00			9,63	0,00			13,83	0,01	6,29	0,01
Comorbidity (yes)			-8,11	0,35	1,67	0,72			4,12	0,32			-5,91	0,48		
Comorbidity (number)			-5,81	0,09			-5,22	0,00	-5,47	0,00	-2,22	0,151	-3,21	0,30		
Diabetes mellitus (yes)			-1,00	0,87	-1,07	0,75	-1,60	0,59	-0,04	0,98						
Hypertension (yes)					-1,87	0,59										
Mental health illness (yes)			-13,70	0,12	-6,29	0,21			-9,21	0,03	-15,80	0,00	-35,06	0,00	-17,56	0,00
Hepatocellular carcinoma (yes)															4,54	0,11
MELD (points)																
R ²	0,076		0,137		0,304		0,097		0,206		0,089		0,173		0,139	
P	<0,01		<0,01		0,01		0,01		0,01		<0,01		<0,01		<0,01	

Legend: p = significance level. MELD = Model for End-stage Liver Disease; PA = Physical Aspect; FC = Functional Capacity; GH = General Health Status; VIT = Vitality; SA = Social Aspect; EA = Emotional Aspect; MH = Mental Health. HT = Liver Transplant.

Source: Prepared by the authors.

DISCUSSION

This is the first study carried out in this service to assess the health-related quality of life of people undergoing liver transplantation. The use of the SF-36 instrument made it possible to identify that this public perceives their quality of life as more satisfactory in the emotional aspect, social aspect, and functional capacity domains and less satisfactory in the pain, physical aspect, and vitality domains. Gender, income, professional status, number of comorbidities, presence of mental health illness, and physical exercise after transplant were the variables related to quality of life, the latter being the only one that was positively associated with most of the quality of life domains.

A high value in the emotional aspect represents the absence of difficulties in carrying out daily activities due to emotional problems. The median attributed to this aspect was similar to that found in other groups of people who underwent liver transplantation in Brazil and around the world at different times post-transplant^{11,19,33,34}. The second domain of quality of life with the highest score was the social aspect. Transplant patients at an organ transplant service in São Paulo/Brazil³⁵ and Mexico¹⁸ also scored better in this aspect. It seems that physical health or the presence of emotional problems has little effect on the quality of participants' social activities in relation to family, friends, or social groups.

The functional capacity domain scored third highest. Similar results were found in other studies^{19,22}, pointing to fewer difficulties in carrying out daily activities. Regardless of the time since transplantation, it can be seen that people with chronic diseases who undergo liver transplantation show functional gains, which are reflected in significant benefits in health-related quality of life and the ability to return to a normal lifestyle. Reduced limitations in social activities, more disposition, and less discomfort seem to be present^{14,36,37}.

Similar to other groups of patients undergoing liver transplantation^{19,21,22,34}, Pain, Physical (34), pain, physical appearance, and vitality were the domains that scored the lowest. The presence of pain can limit the performance of domestic and work tasks that require greater physical effort a good part of the time. People with pain may experience emotional, behavioral, or social changes, depending on each individual's adaptive process³⁸. Lower scores in the vitality domain also indicate a feeling of tiredness or exhaustion or a loss of strength or energy, which makes it difficult to fulfill vital needs^{39,40}. It is understood that rehabilitation after transplantation is essential, since, as well as aiming for graft survival and preventing complications, it also improves the individual's quality of life⁴¹.

The improvement in quality of life after transplantation is not homogeneous between the different domains^{11,12,19-22,33,42} as it depends on the individual's perception of life and the influence of different factors^{18,23}. Studies point to the influence of sociodemographic factors on the quality of life of people undergoing liver transplantation^{10,14,15,43}. In this study, gender, professional status, income, number of comorbidities, presence of mental health illness, and physical exercise were all aspects that were shown to be potential predictors of quality of life domains.

Practicing physical exercise after the transplant was a factor that interacted positively with most of the domains, proving to be an aspect of strong influence. The inclusion of physical activities, even the lightest domestic tasks, brings benefits to individuals by helping with physical, psychological, and social recovery, maintaining functional capacity, and improving quality of life⁵³. Although patients need to go through a period of physical restriction in the post-operative period and the presence of pain can be a limiting factor, especially in the first year⁵⁴, physical rehabilitation after transplantation is essential for physical recovery and metabolic control, prevention of complications, prolonging graft survival, and improving quality of life^{20,41,55,56}. In addition, the practice of physical exercise, started when the individual is still on the waiting list for the transplant, through participation in prehabilitation programs, can combat the deterioration of their aerobic and functional capacity⁵⁷.

In this study, the presence of mental health illness interacted negatively with the vitality, social aspect, emotional aspect, and mental health domains and was the factor that showed the greatest variable strength according to the beta value results. The presence of anxiety, fear, depression, and difficulty in psychosocial adaptation after transplantation are factors that can impair quality of life^{19,51}. In addition, the presence of pre-transplant anxiety⁵³, comorbidities, complications and side-effects of immunosuppressants¹⁹⁻⁴⁹, changes in life routine, such as frequent consultations with the health team and tests, changes in lifestyle⁴⁹ and the individual's difficulty in assuming a "new identity" after the transplant⁵² are all factors that contribute to impaired mental health. Even when the transplant is successful, the individual may find it difficult to identify themselves, not recognizing the graft as their own³⁵. In addition, there is a great expectation of an improvement in quality of life, which can lead to frustration, especially when physical and social limitations are present, which can hinder social readaptation and have a negative impact on mental health^{15,51}. Psychosocial support for people undergoing liver transplantation, including therapeutic measures, is an important factor in rehabilitation and improving quality of life^{19,21}. Thus, our results reinforce the importance of psychological support for this population in order to detect any emotional discomfort early on and help with psychosocial adaptation after transplantation.

Participants' income was strongly associated with the emotional aspect domain, where people with low incomes had lower scores. Low income, difficulty maintaining work activities, and the need for continuous monitoring or possible hospitalizations are some of the stressors⁴⁶. A study carried out in Canada points out that the difficulty of returning to work and meeting extra treatment costs can increase the worry of patients and their families⁴⁴. Furthermore, low income is related to higher mortality rates in people who have undergone transplantation⁴⁷.

Alongside income, professional status was also correlated with quality of life. Those who were not working had lower scores in the vitality domain compared to those who were working. The resumption of work activities and social life after transplantation indicates a better quality of life^{10,23} and favors higher scores in the Vitality, Functional Capacity, and Social Aspect domains^{22-24,39} and the recovery of independence to carry out activities of daily living⁴². However, less than half of liver transplant recipients return to their activities within a year^{13,22}. The presence of weakness and fatigue²² and negative attitudes from employers²³ can make it difficult to re-enter the job market and improve income⁴⁴. Depressive symptoms and feelings of helplessness experienced after transplantation are related to concerns about employability⁴⁵.

In this study, only a third of the participants were working at the time of the interview, and more than 80% had comorbidities. Many liver transplant recipients are unable to return to work due to the possible progression of the chronic disease⁴⁸. Knowing the difficulties that patients encounter in the phase of reintegration into work activities after transplantation can help transplant teams design social and psychological support programs that help them achieve full functional rehabilitation⁴⁹. It is therefore recommended that the health service team identify the needs of these people at an early stage and provide appropriate assistance to transplant patients⁴⁶. Policies that help with this transition, starting while the patient is still on the waiting list for the transplant, are welcome for recovering the economic status of these individuals⁴⁴.

Other potential predictors of quality of life domains identified in this study were gender and the number of comorbidities. Being male was associated with higher scores in the functional capacity, vitality, and social aspect domains. Similar results identified a better perception of men in the social aspect and functional capacity domains (18, 20–23), influenced by different levels of education, employment, and access to health services²³. The number of different comorbidities was negatively related to quality of life scores in the Vitality and General Health Status domains. Participants with diabetes mellitus had lower scores in physical aspects, functional capacity, and vitality, and participants

with hypertension had lower scores in functional capacity. Studies show that people undergoing liver transplantation with diabetes mellitus have lower scores in Physical Aspect²⁰, as do people with systemic arterial hypertension in General Health Status and in the sum of the physical components²⁵. It should also be noted that prolonged use of immunosuppressants can compromise the musculoskeletal system and favor the presence of metabolic disorders⁵⁰, and that high doses of immunosuppressants can result in lower quality of life scores¹⁸.

This study has some limitations that should be considered when interpreting the results. Firstly, the cross-sectional design makes it impossible to define cause and effect. Secondly, although the SF-36 instrument is often used to assess the quality of life of people undergoing transplantation, it is not specific to people with liver disease²³. Thirdly, although patients with a post-transplant time of less than or equal to six months or more than ten years were excluded, there was heterogeneity in the participants' post-transplant time. In addition, although the multiple regression model showed variables that could potentially predict the dimensions of quality of life in this group, the R-squared (R²) results were modest. It is believed that there are other independent variables, not included in this study, that also influence the quality of life domains.

Positive aspects include the fact that this study was the first to assess the quality of life of patients treated at this transplant reference center in southern Brazil. In addition, the results of this study may be representative of Brazilian reality, as this service welcomes people from all states of the federation. The identification of potential positive and negative factors in the health-related quality of life of people who have undergone liver transplantation at the service will also enable the multi-professional team to broaden their view of the needs of these people and outline assisted and individualized health care.

CONCLUSÕES

In this sample, emotional and social aspects and functional capacity were the domains of quality of life that showed the most satisfactory perception. Being female, having a lower income, not working after the transplant, having comorbidities at the time of the interview, and, especially, mental illness were potential negative predictors of various quality of life domains. On the other hand, practicing physical exercise after the transplant was the only aspect that proved to be a positive predictor.

The results reinforce the importance of early and continuous multi-professional follow-up in the search for the physical and mental well-being of people undergoing liver transplantation in order to improve their perception of quality of life after transplantation, especially in the quality of life domains that scored the lowest: pain, vitality, and physical aspect. The inclusion of a physical education professional in the multidisciplinary team to provide guidance and individualized monitoring of the patient from pre-transplant onwards is a possible intervention. Early identification and treatment of mental illness should also be considered throughout the process. In addition, it is recommended to take a closer look at aspects related to the quality of life of women undergoing transplantation.

The results also point to the need for new studies investigating other aspects that may interfere with quality of life, as well as further study into the aspects that have shown an association here.

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Author contributions:

Fernanda Maria Sirtolli Stolf: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Deisi Maria Vargas: Conceptualization, Methodology, Resources, Redação, Writing – review & editing.

Carlos de Oliveira Nunes: Data curation, Formal analysis, Methodology, Resources, Validation, Redação, Writing – review & editing.

Luciane Coutinho de Azevedo: Conceptualization, Data curation, Formal analysis, Methodology, Project administration Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Corresponding author:

Fernanda Maria Sirtolli Stolf

Regional University of Blumenau – Furb

R. Antônio da Veiga, 140 – Itoupava Seca, Blumenau/SC, Brazil. ZIP Code 89030-903

E-mail: nandasirtolli@gmail.com

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Editor-in-chief: Dr. Adriane Cristina Bernat Kolankiewicz

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