Psychosocial Burden in Parents of Pediatric Liver Transplant Recipients

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Article

Psychosocial Burden in Parents of Pediatric Liver Transplant Recipients

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Highlights

- Parents of pediatric liver transplant recipients experienced substantial psychosocial burden, including stress, sleep disturbance, depressive symptoms, and anxiety.
- Perceived stress was positively correlated with sleep problems, depressive symptoms, and anxiety, indicating a closely interconnected psychosocial profile.
- Shorter time since transplantation was independently associated with higher depression and anxiety scores.
- Early psychosocial assessment and mental health support may improve parental adaptation after pediatric liver transplantation.

What are the main findings?

- Pediatric liver transplantation was associated with a considerable psychosocial burden in parents, reflected by stress, sleep problems, depression, and anxiety.
- Perceived stress emerged as an independent predictor of depressive and anxiety symptoms, while longer time since transplantation was associated with lower psychological distress.

What are the implications of the main findings?

- Psychosocial screening and mental health support should be considered as part of routine follow-up for parents of pediatric liver transplant recipients.
- Early identification and management of parental stress may improve family adaptation and overall post-transplant care.

Abstract

Aim: To evaluate anxiety, depression, perceived stress, and sleep quality in the parents of children who underwent liver transplantation in Turkey. The impact of other factors on mental health status were also examined. **Method:** This was a single-center, cross-sectional study including the parents of 50 children after liver transplantation. Major sociodemographic variables included parental age, sex, education, chronic disease, and immigration status. We also recorded children's demographics, transplant-related data, follow-up findings, and mental health status. Instruments for psychiatric assessment included the Generalized Anxiety Disorder 7-item scale (GAD-7; anxiety), Patient Health Questionnaire-9 (PHQ-9; depression), Perceived Stress Scale-10 (PSS-10; stress), and Pittsburgh Sleep Quality Index (PSQI; sleep quality).**Results:** We enrolled 50 parents of 50 pediatric liver transplant recipients (28 fathers, 22 mothers, mean age: 40.10 ± 6.65). Time since transplantation showed weak negative correlations with PHQ-9 and GAD-7. Stress (PSS) levels had weak to strong positive correlations with PSQI, PHQ-9, and GAD-7. Sleep quality (PSQI) was positively correlated with PHQ-9 and GAD-7. Depressive findings (PHQ-9) were strongly and positively correlated with GAD-7. High PHQ-9 scores were found to be independently associated with shorter time since transplant (p=0.006) and high PSS (p=0.011). High GAD-7 scores were independently associated with shorter time since transplant (p=0.034) and high PSS (p=0.005).**Conclusion:** The parents of pediatric liver transplant recipients experience high levels of stress, sleep issues, depression, and anxiety, which demonstrate multiple correlations.

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1. Introduction

Liver transplantation is a life-saving procedure for end-stage liver disease, including biliary atresia, metabolic disorders, and acute liver failure [1]. Advances in surgical techniques, immunosuppression, and perioperative care have greatly increased survival rates in both adults and children [2,3]. Improved survival has redirected clinical emphasis from solely transplant success to other outcomes such as psychiatric, developmental, and psychosocial well-being [4,5]. Despite these improvements, the transplant process places significant psychological stress on families, especially parents, who must manage uncertainties regarding their child's prognosis, potential complications, medication adherence, frequent follow-ups, infection risks, and demanding caregiving responsibilities [6,7].

The experience of liver transplantation is frequently described as a traumatic life event that significantly affects parental mental health, resulting in increased anxiety, depression, post-traumatic stress disorder, sleep disturbances, and perceived stress [8,9]. Research demonstrates that acute post-transplant phases, characterized by intensive care admissions, life-threatening issues, and fears of organ rejection, increase parental distress [2,5]. Parental mental health is also crucial to ensure better transplant outcomes since elevated parental anxiety and depression are associated with poor mental health, treatment non-adherence, and complications [1,10]. As such, it is evident that systematic evaluations of parental psychosocial status can improve clinical care. However, current research primarily utilizes scale-based assessments with restricted samples and frequently omits analysis of social vulnerabilities, including immigration status [3,11].

Turkey is home to more than 3.5 million Syrians, many of whom are children [12,13]. Immigration status exacerbates psychiatric risks for parents due to war-related trauma, socioeconomic difficulties, housing instability, financial stress, language barriers, healthcare access issues, and insufficient social support [7,14]. Immigration also complicates health service utilization and disrupts family dynamics, which adversely impact management of chronic illnesses [15,16]. Evidence is limited regarding the relationships between immigration and pediatric liver transplantation [17]. To our knowledge, there are no studies that have investigated parental mental health in the post-transplant period within the context of immigration status, which may be crucial due to increasing emigration throughout the world [18,19].

With this cross-sectional study we sought to assess anxiety, depression, perceived stress, and sleep quality among the parents of children who underwent pediatric liver transplantation. Our secondary aim was to compare the experiences of Syrian immigrant parents to those of Turkish citizens.

2. Materials and Methods

2.1. Population and Setting

The study population consisted of parents of children who had received pediatric liver transplantation at our center. The inclusion criteria were established as follows: parents aged 18 years or older whose child had undergone a liver transplant at any phase of the process (including acute post-transplant periods); proficiency in Turkish or Arabic for effective communication; voluntary participation; and willingness to undergo evaluation irrespective of the duration since transplantation. Exclusion criteria encompassed: severe psychotic symptoms that hindered the capacity to complete assessments; substantial cognitive impairment obstructing informed consent or questionnaire completion; active suicidal ideation necessitating immediate intervention; and insurmountable language or cultural barriers that could not be mitigated through Arabic translation assistance offered by trained research personnel. Due to the scarcity of the pediatric liver transplant population and the emphasis on a vulnerable subgroup (including immigrant families), purposive

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consecutive sampling was employed to recruit 50-70 parents, comprising both Turkish citizens and Syrian immigrants.

2.2. Study Design and Ethics

This study utilized a single-center, cross-sectional, descriptive design, conducted at the Liver Transplantation Institute, İnönü University Faculty of Medicine, in Malatya, Turkey. Data collection continued from January 2025 to January 2026, during standard outpatient follow-up appointments or inpatient admissions at the transplant center. Ethical approval was obtained from the local ethics committee (Date: 02-12-2025, No: 2025/8674) based on the ethical standards described in the Declaration of Helsinki. Before enrollment, all parents who took part in the study had to sign written informed consent forms. The study's purposes, procedures, potential risks, and benefits were explained to all participants and they were informed of their right to withdraw at any time.

2.3. Demographics and Clinical Data

The data collection was carefully planned in two stages to obtain self-reported psychological measures and important clinical and sociodemographic variables. All procedures were conducted by trained research personnel in person at the transplant center, with Arabic translation assistance provided for Syrian immigrant parents to alleviate language barriers and improve accuracy. When needed, questionnaires were given verbally to illiterate individuals, and forms were checked right away to ensure completeness. Parental reports and electronic medical records were used to double-check clinical information.

A researcher-created clinical information form was used to record sociodemographic and clinical data. This included the age and sex of the parent, their level of education (literate, primary school, secondary school, high school, associate degree, or bachelor's degree), whether they had a chronic disease, the child's age and sex, any comorbidities in the child, the age at transplantation, the time since transplantation, type of donor (living or deceased), the immunosuppressive therapy (e.g., tacrolimus or everolimus), transplantation-related complications, rejection events, hospitalizations, psychiatric follow-up and diagnoses of the child, and immigration status (Turkish citizen or Syrian immigrant). It was also noted that economic status and access to health services could be stressors. These variables were documented via a combination of parental self-report during interviews and the examination of hospital records, ensuring consistency and comprehensiveness.

2.4. Evaluation of Psychological Outcomes

The Generalized Anxiety Disorder 7-item scale (GAD-7) was used to measure parental anxiety. This is a validated 7-item self-report tool that grades anxiety symptoms experienced in the past two weeks. The total score ranges from 0 to 21 points, with each item scored on a 4-point Likert scale (0 = not at all, 3 = nearly every day). The following cut-off points were used: 0–4 (minimal anxiety), 5–9 (mild), 10–14 (moderate), and 15–21 (severe) [20].

The Patient Health Questionnaire-9 (PHQ-9) was used to measure depression. It is a 9-item scale that follows DSM criteria for major depressive disorder and evaluates symptoms from the past two weeks. Each item is on a Likert scale from 0 to 3 points. Total scores range from 0 to 27 points, with classification into five groups: 0 to 4 (minimal depression), 5 to 9 (mild), 10 to 14 (moderate), 15 to 19 (moderately severe), and 20 to 27 (severe) [21].

The 10-item Perceived Stress Scale (PSS-10) was used to measure stress. This scale questions individuals to assess how stressful they think their life has been in the past month. Responses for each item are scored from 0 (never) to 4 (very often), and total scores range from 0 to 40 points. A score of 0-13 indicates low stress, 14-26 indicates moderate stress, and 27-40 indicates high stress [22].

The Pittsburgh Sleep Quality Index (PSQI) is a 19-item questionnaire that asks about seven aspects of sleep over the past month (subjective sleep quality, latency, duration, efficiency,

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disturbances, medication use, and daytime dysfunction). Scores on a global scale go from 0 to 21, and scores exceeding 5 indicate poor sleep quality [23].

2.5. Statistics

IBM SPSS Statistics for Windows, Version 27 was used for all analyses (IBM Corp., Armonk, NY, USA). The accepted value for statistical significance was $p<0.05$. The Shapiro-Wilk test was used to check normality. Descriptives for numerical variables were provided as mean ± standard deviation (parametric) or median (25th–75th percentile) (non-parametric). Categorical variables were described with absolute and relative frequency. The Student's t-test or Mann-Whitney U test was used to compare continuous variables between groups, depending on the assumption of normality. We used the Fisher's exact or the Fisher-Freeman-Halton tests to analyze categorical variable distributions. To assess the relationships between continuous variables, Pearson or Spearman correlation coefficients were computed. Univariable and multivariable logistic regression analyses (multivariable model based on univariate significances) were conducted to identify factors independently associated with PHQ-9 and GAD-7 scores.

3. Results

There were 50 parents in the study. Forty-three (86%) were Turkish citizens and 7 (14%) were Syrian immigrants. The mean age of the parents was 40.10 ± 6.65 years, with similar ages for the two groups (40.47 ± 6.37 years vs. 37.86 ± 8.36 years; $p = 0.341$). There were 22 (44%) mothers and 28 (56%) fathers in total, and sex distribution was similar ($p = 0.684$). The median age of the children was 14 years (11-16 years), showing similar age distributions with regard to both parent groups ($p = 0.703$). The children's sex distribution with regard to parent groups was also similar ($p = 0.684$). There were no significant differences between non-immigrant and immigrant groups in PSS, PSQI, PHQ-9, or GAD-7 scores, nor in their respective categorical distributions or any other variables included in the study (Table 1).

Parental education level was positively correlated with PSQI score ($r = 0.349$, $p = 0.013$). Time elapsed since transplant was negatively correlated with both the PHQ-9 score ($r = -0.357$, $p = 0.011$) and the GAD-7 score ($r = -0.328$, $p = 0.020$). The PSS score had a positive correlation with the PSQI score ($r = 0.346$, $p = 0.014$), the PHQ-9 score ($r = 0.521$, $p < 0.001$), and the GAD-7 score ($r = 0.636$, $p < 0.001$). The PSQI score exhibited a positive correlation with the PHQ-9 score ($r = 0.343$, $p = 0.015$) and the GAD-7 score ($r = 0.331$, $p = 0.019$). The PHQ-9 scores were strongly and positively correlated with the GAD-7 score ($r = 0.787$, $p < 0.001$) (Table 2).

The results of the multivariable logistic regression analysis showed that a shorter time interval since transplantation (OR: 0.666, 95% CI: 0.499–0.888, p=0.006) and a high PSS score (OR: 1.421, 95% CI: 1.083–1.864, p=0.011) were independently associated with high (≥5) PHQ-9 score (Table 3).

Additionally, shorter time interval since transplantation (OR: 0.762, 95% CI: 0.593–0.980, p=0.034) and an elevated PSS score (OR: 1.577, 95% CI: 1.151–2.161, p=0.005) were independently associated with a high (≥5) GAD-7 score (Table 4).

Table 1. Summary of variables with regard to immigrant status.

		Immigrant		
	Total (n=50)	No (n=43)	Yes (n=7)	p
Parent				
Mother	22 (44.00%)	18 (41.86%)	4 (57.14%)	0.684§
Father	28 (56.00%)	25 (58.14%)	3 (42.86%)	
Age of parent, years	40.10 ± 6.65	40.47 ± 6.37	37.86 ± 8.36	0.341†
Education status of parent				
Literate	10 (20.00%)	7 (16.28%)	3 (42.86%)	0.571¶

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Primary school	17 (34.00%)	16 (37.21%)	1 (14.29%)	
Secondary school	12 (24.00%)	10 (23.26%)	2 (28.57%)	
High school	6 (12.00%)	5 (11.63%)	1 (14.29%)	
Associate degree	2 (4.00%)	2 (4.65%)	0 (0.00%)	
Bachelor degree	3 (6.00%)	3 (6.98%)	0 (0.00%)	
Chronic disease in parent	10 (20.00%)	9 (20.93%)	1 (14.29%)	1.000§
Age of child, years	14 (11–16)	14 (11–16)	14 (8–16)	0.703‡
Sex of child				
Male	28 (56.00%)	25 (58.14%)	3 (42.86%)	0.684§
Female	22 (44.00%)	18 (41.86%)	4 (57.14%)	
Comorbidity in child	2 (4.00%)	2 (4.65%)	0 (0.00%)	1.000§
Age at transplantation, years	5 (2–11)	4 (2–10)	7 (3–13)	0.201‡
Time since transplantation, years	7.44 (2.25–11.67)	9.07 (3.18–11.85)	4.58 (0.50–6.91)	0.091‡
Type of donor				
Living	44 (88.00%)	37 (86.05%)	7 (100.00%)	0.576§
Deceased	6 (12.00%)	6 (13.95%)	0 (0.00%)	
Immunosuppressive drug				
Tacrolimus	43 (86.00%)	37 (86.05%)	6 (85.71%)	1.000§
Everolimus	7 (14.00%)	6 (13.95%)	1 (14.29%)	
Transplantation complication	0 (0.00%)	0 (0.00%)	0 (0.00%)	N/A
Rejection attack, last year	0 (0.00%)	0 (0.00%)	0 (0.00%)	N/A
Hospitalization, last year	2 (4.00%)	2 (4.65%)	0 (0.00%)	1.000§
Psychiatric follow-up for child	1 (2.00%)	1 (2.33%)	0 (0.00%)	1.000§
Psychiatric diagnosis in child	0 (0.00%)	0 (0.00%)	0 (0.00%)	N/A
PSS score	15.20 ± 5.64	14.79 ± 5.55	17.71 ± 5.94	0.207†
Low stress (0-13)	16 (32.00%)	15 (34.88%)	1 (14.29%)	0.117¶
Moderate stress (14-26)	33 (66.00%)	28 (65.12%)	5 (71.43%)	
High stress (27-40)	1 (2.00%)	0 (0.00%)	1 (14.29%)	
PSQI score	5 (3–8)	5 (3–8)	6 (2–7)	0.736‡
Normal (0-5)	27 (54.00%)	25 (58.14%)	2 (28.57%)	0.225§
High (>5)	23 (46.00%)	18 (41.86%)	5 (71.43%)	
PHQ-9 score	1 (0–8)	1 (0–8)	0 (0–12)	0.930‡
Minimal (0-4)	32 (64.00%)	28 (65.12%)	4 (57.14%)	0.326¶
Mild (5-9)	12 (24.00%)	11 (25.58%)	1 (14.29%)	
Moderate (10-14)	6 (12.00%)	4 (9.30%)	2 (28.57%)	
Moderately severe (15-19)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
Severe (20-27)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
GAD-7 score	0 (0–5)	0 (0–5)	0 (0–12)	0.791‡
Minimal (0-4)	35 (70.00%)	30 (69.77%)	5 (71.43%)	0.125¶
Mild (5-9)	9 (18.00%)	9 (20.93%)	0 (0.00%)	
Moderate (10-14)	4 (8.00%)	2 (4.65%)	2 (28.57%)	
Severe (15-21)	2 (4.00%)	2 (4.65%)	0 (0.00%)	

Descriptive statistics are presented using mean ± standard deviation for normally distributed continuous variables, median (25th percentile–75th percentile) for non-normally distributed continuous variables and

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frequency (percentage) for categorical variables. † Student's t test, ‡ Mann Whitney U test, § Fisher's exact test, ¶ Fisher-Freeman-Halton test. Abbreviations: GAD-7: Generalized Anxiety Disorder 7-item, N/A: Non-applicable, PSS: Perceived Stress Scale, PSQI: Pittsburgh Sleep Quality Index, PHQ-9: Patient Health Questionnaire 9-item.

Table 2. Correlations between demographics and assessment scores

		PSS score	PSQI score	PHQ-9 score	GAD-7 score
Age of parent, years	r	0.037†	0.038‡	-0.164‡	0.020‡
	p	0.798	0.795	0.254	0.888
Education status of parent	r	0.117‡	0.349‡	0.221‡	0.268‡
	p	0.418	**0.013**	0.123	0.060
Age of child, years	r	-0.105‡	-0.090‡	-0.271‡	-0.171‡
	p	0.466	0.534	0.057	0.235
Age at transplantation, years	r	0.082‡	-0.040‡	0.160‡	0.197‡
	p	0.571	0.781	0.266	0.171
Time since transplantation, years	r	-0.168‡	0.036‡	-0.357‡	-0.328‡
	p	0.244	0.805	**0.011**	**0.020**
PSS score	r		0.346‡	0.521‡	0.636‡
	p		**0.014**	**<0.001**	**<0.001**
PSQI score	r			0.343‡	0.331‡
	p			**0.015**	**0.019**
PHQ-9 score	r				0.787‡
	p				**<0.001**

† Pearson correlation coefficient, ‡ Spearman correlation coefficient. Statistically significant p values are shown in bold. Abbreviations: GAD-7: Generalized Anxiety Disorder 7-item, PSS: Perceived Stress Scale, PSQI: Pittsburgh Sleep Quality Index, PHQ-9: Patient Health Questionnaire 9-item, r: Correlation coefficient.

Table 3. Odds ratios for high (≥5) PHQ-9 score, logistic regression analysis results.

	Univariable		Multivariable	
	OR (95% CI)	p	OR (95% CI)	p
Immigrant, Yes	1.400 (0.276–7.096)	0.685		
Parent, Mother	1.462 (0.457–4.674)	0.522		
Age of parent, years	0.996 (0.913–1.088)	0.936		
Education status of parent	1.585 (1.002–2.507)	**0.049**	1.470 (0.755–2.864)	0.257
Chronic disease in parent, Yes	2.077 (0.510–8.466)	0.308		
Age of child, years	0.829 (0.680–1.011)	0.065		
Sex of child, Male	0.972 (0.304–3.110)	0.962		
Comorbidity in child, Yes	1.824 (0.107–31.031)	0.678		
Age at transplantation, years	1.107 (0.980–1.251)	0.101		
Time since transplantation, years	0.812 (0.704–0.937)	**0.004**	0.666 (0.499–0.888)	**0.006**
Type of donor, Deceased	1.933 (0.347–10.769)	0.452		
Immunosuppressive drug, Everolimus	2.762 (0.543–14.057)	0.221		
Hospitalization, last year	0.000 (0.000–N/A)	0.999		
Psychiatric follow-up for child, Yes	0.000 (0.000–N/A)	1.000		

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PSS score	1.343 (1.112–1.622)	**0.002**	1.421 (1.083–1.864)	**0.011**
PSQI score	1.283 (1.053–1.564)	**0.014**	1.325 (0.945–1.858)	0.102
Nagelkerke R^2	-		0.666	

Statistically significant p values are shown in bold. Abbreviations: CI: Confidence interval, GAD-7: Generalized Anxiety Disorder 7-item, N/A: Non-applicable, OR: Odds ratio, PSS: Perceived Stress Scale, PSQI: Pittsburgh Sleep Quality Index, PHQ-9: Patient Health Questionnaire 9-item.

Table 4. Odds ratios for high (≥5) GAD-7 score, logistic regression analysis results.

	Univariable		Multivariable	
	OR (95% CI)	p	OR (95% CI)	p
Immigrant, Yes	0.923 (0.158–5.388)	0.929		
Parent, Mother	1.714 (0.507–5.802)	0.386		
Age of parent, years	1.001 (0.913–1.097)	0.981		
Education status of parent	1.457 (0.927–2.290)	0.103		
Chronic disease in parent, Yes	1.758 (0.415–7.441)	0.444		
Age of child, years	0.910 (0.746–1.109)	0.349		
Sex of child, Male	0.583 (0.172–1.974)	0.386		
Comorbidity in child, Yes	2.429 (0.142–41.601)	0.540		
Age at transplantation, years	1.087 (0.960–1.231)	0.188		
Time since transplantation, years	0.874 (0.763–1.000)	**0.049**	0.762 (0.593–0.980)	**0.034**
Type of donor, Deceased	2.667 (0.472–15.078)	0.267		
Immunosuppressive drug, Everolimus	1.937 (0.376–9.974)	0.429		
Hospitalization, last year	0.000 (0.000–N/A)	0.999		
Psychiatric follow-up for child, Yes	0.000 (0.000–N/A)	1.000		
PSS score	1.543 (1.191–1.998)	**0.001**	1.577 (1.151–2.161)	**0.005**
PSQI score	1.336 (1.082–1.651)	**0.007**	1.328 (0.986–1.790)	0.062
Nagelkerke R^2	-		0.654	

Statistically significant p values are shown in bold. Abbreviations: CI: Confidence interval, GAD-7: Generalized Anxiety Disorder 7-item, N/A: Non-applicable, OR: Odds ratio, PSS: Perceived Stress Scale, PSQI: Pittsburgh Sleep Quality Index, PHQ-9: Patient Health Questionnaire 9-item.

4. Discussion

The present study indicated that parents of children who underwent pediatric liver transplantation experienced significant psychological distress, in almost all examined parameters. These included perceived stress, sleep disturbance, depression, and anxiety; however, no substantial differences were observed between immigrant and non-immigrant groups. The main results showed that there were positive links between parental education and sleep quality problems, as well as strong links between stress, sleep, depression, and anxiety measures. Moreover, we found that longer time elapsed since transplantation was associated with lower levels of depression and anxiety, whereas increased perceived stress independently forecasted heightened depression and anxiety scores in multivariable analyses.

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Immigrant families often face greater levels of psychosocial stress that arise from migration-related traumas and systemic obstacles, as demonstrated by previous research on refugee populations [18]. Existing research indicates increased mental health risks among immigrant caregivers; however, our findings offer a more complex perspective within the context of pediatric liver transplantation. We found similar psychological outcomes in immigrant and non-immigrant parents, perhaps in relation with the greater severity and complexity of transplant experiences relative to other pediatric chronic illnesses. Immigrant parents, especially Syrian refugees in Turkey, frequently face war-related trauma, socioeconomic instability, language barriers, and limited access to healthcare [18,24]. Eruyar et al. [7] found that Syrian refugee children in Turkey exhibited significant mental health issues influenced by parental factors, with relational dynamics being a crucial determinant of child outcomes. Yayan et al. [11] noted increased post-traumatic stress, depression, and anxiety in Syrian refugee children, linking these conditions to familial stressors that indirectly impact parental well-being. In our cohort, despite the limited immigrant subsample, the absence of differences indicates that the transplant process is a heavy burden on parents regardless of immigration-specific effects. It is also possible that the availability of translation services in hospitals and the amount of time dedicated to transplantation patients may remedy the adverse impacts of immigration [16]. This finding adds to the body of research by showing that immigration status alone may not be a good predictor of psychosocial burden in specialized pediatric liver transplantation settings [2].

Studies on caregivers of children with chronic conditions, including organ transplants, consistently demonstrate bidirectional relationships between perceived stress and disturbances in sleep and emotional well-being [25]. These related domains impact individual well-being, family functioning, and child outcomes, thereby requiring a comprehensive analysis of their interactions [4]. The positive correlations between perceived stress, sleep quality, depression, and anxiety are evidence for the overarching mental burden experienced by parents, which is also consistent with evidence indicating that chronic caregiving adversely affects various health domains. Our analysis revealed positive correlations between PSS scores and PSQI, PHQ-9, and GAD-7. Additionally, PSQI was associated with both PHQ-9 and GAD-7, and PHQ-9 was linked to GAD-7. These relationships reflect the findings of Andersen et al. [5], who identified correlations between child sleep disturbances and diminished parental health related quality of life in liver transplant families, with sleep issues identified to be a mediator for emotional distress. In a similar study, Savsar et al. [25] found that 65% of adults who had liver transplants had trouble sleeping, which was linked to anxiety about the future. Our results indicate that caregivers suffer from similar problems. Forner-Puntonet et al. [4] conducted a study indicating that families of pediatric solid organ transplant recipients experienced elevated anxiety and avoidance coping, with elevated stress worsening outcomes. In our mixed cohort of immigrant and non-immigrant parents we show that high PSS is an independent predictor of increased PHQ-9 and GAD-7 scores. This interaction shows that combined efforts to manage stress could help with sleep and mental health problems, which would make families stronger after a liver transplant.

The temporal aspect of recovery in chronic pediatric conditions frequently indicates gradual enhancements in caregiver mental health as medical stability improves; however, socioeconomic factors, such as education, can create variability in adaptation processes [3,9]. The inverse relationship between time elapsed since transplantation and depression/anxiety scores, coupled with the association of parental education with sleep quality, indicates that mental challenges decline over time –possibly due to psychosocial adjustment. Indeed, we also show that shorter time since transplant was independently linked to elevated PHQ-9 and GAD-7 scores. Interestingly, Duvant et al. [9] reported that transplanted children and parents had better quality of life than those with other chronic conditions, which we believe supports our data regarding the gradual decline in healthcare-related stressors after successful transplants. In partial support, Parmar et al. [3] found that older age at transplantation was linked to worse health related quality of life, while Miserachs et al. [2] reported that improved coping and adaptation were fundamental to better outcomes. Parental education

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exhibited a positive correlation with the PSQI, indicating that caregivers with higher education levels may encounter increased sleep disturbances due to heightened risk awareness, which is in line with prior evidence regarding the effects of cognitive impairment among pediatric transplant recipients [26].

There are a number of important limitations. The small sample size, especially the immigrant subgroup (n=7), significantly diminishes statistical power, increasing the possibility of Type II errors and potentially obscuring differences in psychosocial outcomes between groups. This imbalance is due to the convenience sampling at a single center, which may not reflect the diversity of experiences in larger or multicenter cohorts, particularly among Syrian refugees encountering distinct barriers such as language and access [13]. The results do not yield any causal interpretations, as is the case for all cross-sectional studies. Dependence on self-report instruments could have introduced bias, including recall bias and desirability bias, especially in the context of the stigma associated with mental health problems –which could disproportionately affect immigrants [14]. The lack of child-reported data neglects possible discrepancies between parental perceptions and child experiences [7]. Additionally, unmeasured confounders, such as pre-transplant psychiatric history or socioeconomic changes resulting from migration, may have caused undetected biases. There is a need for extensive, longitudinal, multicenter studies employing objective metrics and a variety of instruments to effectively examine both parental and child experiences before, during and after liver transplantation.

5. Conclusions

This study illustrates that parents of children who underwent pediatric liver transplantation experience psychosocial challenges, including stress, sleep disturbances, depression, and anxiety. These challenges are not influenced by immigration status but are significantly affected by several factors, including parental education and the duration since transplantation, especially for depression and anxiety scores which declined in parallel with elapsed time since the transplant procedure. Crucially, shorter time since transplantation independently predicted elevated scores. Strong positive connections between stress, sleep, depression, and anxiety show how these problems might impact each other. We believe there is a need to improve mental health interventions for the parents of children scheduled for liver transplantation to ensure that the psychiatric burdens do not progress into overt disease. Such interventions have the possibility to improve adaptation and long-term outcomes in children as well as parents.

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Data Availability Statement: The data presented in this study are available from the corresponding author upon reasonable request due to privacy and ethical restrictions.

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Abbreviations

LT — Liver Transplantation
GAD-7 — Generalized Anxiety Disorder 7-item scale
PHQ-9 — Patient Health Questionnaire-9
PSS-10 — Perceived Stress Scale-10
PSQI — Pittsburgh Sleep Quality Index
SPSS — Statistical Package for the Social Sciences

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