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Prevalence and Correlates of Loneliness and Social Isolation Among Liver Transplant Recipients: A Cross-Sectional Study

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ABSTRACT

Background & Aims
Liver transplant (LT) recipients undergo psychosocial evaluation, including assessment of social support, prior to listing. However, little is known about LT recipients' loneliness and social connectedness after transplant. This study evaluated the prevalence and correlates of loneliness and social isolation in LT recipients.

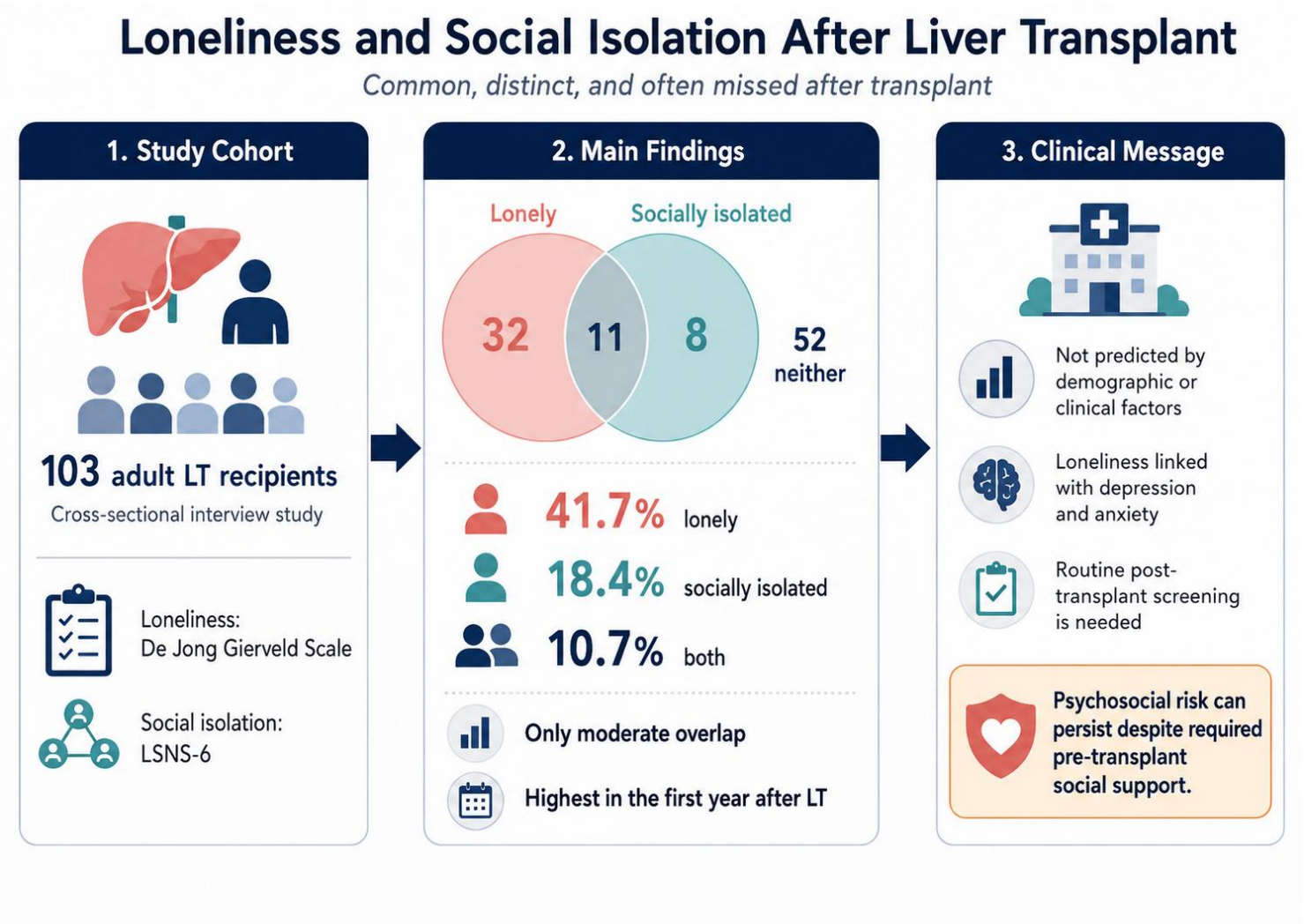
Methods
In this cross-sectional study, 103 adult LT recipients completed structured interviews using the De Jong Gierveld Loneliness Scale (DJG) and Lubben Social Network Scale (LSNS-6). Demographic, transplant-related, clinical, and laboratory characteristics were obtained from electronic medical records and analyzed according to loneliness and social isolation status.

Results
Loneliness was present in 43 recipients (41.7%), and 19 (18.4%) were at risk for social isolation. Only 11 (10.7%) LT recipients met the criteria for both measures, and the two measures were only moderately correlated (Spearman $r = -0.34$, $p<0.001$). Neither condition was associated with age, sex, race, marital status, education, non-psychiatric comorbidities, or time since transplantation. Within the first year post-LT, 58.3% of recipients met the criteria for loneliness and 25% met the criteria for social isolation. Loneliness was strongly associated with a history of depression (55.8% vs. 33.3%, $p<0.01$) and anxiety (65.1% vs. 38.3%, $p=0.01$).

Conclusions
Loneliness and social isolation are common among LT recipients and are not predictable from demographic or clinical characteristics. They occur despite pre-transplant psychosocial support, particularly within the first post-transplant year. These findings support incorporating routine loneliness and social isolation screening into long-term care of LT recipients.

Keywords
Loneliness; Social Isolation; Liver Transplantation; Transplant Survivorship; Psychosocial Health

Graphical Abstract



INTRODUCTION

All liver transplant (LT) recipients undergo detailed psychosocial assessment prior to LT, and robust social support is a prerequisite for transplant consideration. Without a reliable social support network, patients may struggle with treatment compliance and overall medical management [11]. Inadequate support has been linked to adverse health behaviors, including substance abuse and alcohol relapse, as well as difficulty coping with physical and emotional demands of the transplant process [2, 11]. If left unaddressed, these challenges can further contribute to the development of anxiety and depression, compounding the potential risks to transplant recipients.

Although pre-transplant psychosocial evaluation emphasizes caregiver adequacy and support through the immediate post-transplant period, few data examine the social support and connectedness of LT recipients in the longer term. Several factors specific to the post-transplant course may diminish recipients' social connectedness over time. Due to the impact of alcohol on liver graft health, alcohol use is discouraged after transplant, which can distance patients from social settings or friendships previously centered around that activity. Muscle loss, bone loss, and lower physical functioning may also limit the ability of LT recipients to engage with friends and social circles as they had done so prior to transplant [8]. Medically, the need for frequent follow-up due to higher burden of medical comorbidities (CKD, diabetes, CVD, etc.) and fear of infection can further restrict social interaction between LT recipients and their social network [18, 20]. Together, these factors can contribute to increased loneliness and reduced sense of social connectedness in LT recipients. While psychosocial support is emphasized in the short-term setting after LT surgery, its longer-term impact on loneliness and social connectedness after LT remains unknown.

To address these gaps, the present study evaluates the prevalence and severity of loneliness and social isolation among LT recipients. Loneliness is defined as a subjective perception of social disconnection, distinct from objective social isolation [4]. Even patients surrounded by family and caregivers can experience loneliness if they perceive inadequate understanding or empathy from others [14]. In contrast, social isolation is the objective state of having few social relationships, infrequent social contact, or a small social network [9]. We hypothesize that LT recipients would be at greater risk of loneliness despite the psychosocial support required in the pre-transplant evaluation process. By identifying characteristics associated with higher psychosocial risk, the study aims to broaden understanding of LT survivorship and inform

strategies to improve care for this patient population.

METHODS

Study Design

This study is a cross-sectional analysis of a cohort of adult liver transplant (LT) recipients aged 18 or older enrolled at the Hume-Lee Transplant Center at Virginia Commonwealth University. The study was approved by the Virginia Commonwealth University Institutional Review Board (IRB; HM20029028). All study procedures were conducted in accordance with applicable institutional ethical guidelines. Informed consent was obtained from all participants prior to participation in the study.

Patient Population

This analysis included adult LT recipients aged 18 years or older who were interviewed at least 3 months post-transplantation. Eligible patients were recruited from the Hume-Lee Transplant Center and provided written informed consent before participation. Each participant completed up to a 60-minute structured interview consisting of validated questionnaires assessing loneliness and social support. Patients were excluded if they had cognitive impairments that prevented informed consent, were unable to communicate in English, had uncontrolled depression/anxiety, or a life expectancy of less than 6 months.

Interview Methodology

The surveys were administered to patients via phone interviews by two interviewers (NL and SJ) to minimize variations in administration. Informed consent was obtained before survey administration. The responses were collected confidentially using a standardized protocol. Each interview included the Lubben Social Network Scale (LSNS-6) and the De Jong Gierveld Loneliness Scale. The De Jong Gierveld Loneliness Scale measures both the social and emotional aspects of loneliness. Social loneliness (three items) reflects a perceived deficit of a reliable social network, while emotional loneliness (three items) represents the sense of missing close confiding relationships [6, 10]. The version used in this study is a 6-item questionnaire, with scores ranging from 0 to 6. Scores of 2 and higher indicate a high risk for loneliness [6, 10].

The LSNS-6 measures individuals' social network size and perceived social support across family and friend domains. The scale includes six questions (three related to family connections and three to friendships). Each item is rated from 0 to 5, reflecting the number and frequency of social contacts and perceived availability of support. Total scores are a sum ranging from 0 to

30, with scores of 12 or lower signifying high risk for social isolation [16, 17].

When video access was available, participants could either read the displayed questions or have them read aloud, after which they verbalized their responses. Responses were directly entered into Research Electronic Data Capture (REDCap). Participants were encouraged to ask for clarification at any point during the interview.

Data Collection and Definitions

A comprehensive review of each participant's electronic medical record was conducted to obtain relevant demographic, clinical, and laboratory information. Collected data included demographic characteristics, residential address, and social factors (employment status, educational attainment, marital status, and income level) as documented during social work assessments. Clinical data consisted of primary liver disease, weight, height, and laboratory parameters obtained within 1 month of the interview.

The main goal was to evaluate the demographics and clinical profile of LT recipients at the time of interview. Demographic characteristics included age, sex, race/ethnicity, employment status (currently employed or not working [retired, unemployed, or disabled]), education level (high school or less versus greater than high school education), marital status (married versus not married [single, divorced, widowed]), and time since LT. Clinical variables included primary liver disease etiology, immunosuppression regimen, medical comorbidities, and laboratory data. Depression and anxiety were defined based on use of medications prescribed for each condition.

Statistical Analysis

The primary outcome of this study was to characterize the demographic and clinical profiles of post-transplant patients at risk for loneliness and social isolation. Loneliness was assessed using the 6-item De Jong Giereveld Scale (DJG). Scores of 0-1 were classified as not lonely, 2-4 as moderately lonely, and 5-6 as severely lonely. For binary analyses comparing lonely and not lonely participants, DJG scores 2-6 defined loneliness. Social isolation was assessed using the LSNS-6 scale, with values of 12 or lower classified as at risk for social isolation, and values above 12 considered not at risk for social isolation.

Baseline demographic, clinical, laboratory, and socioeconomic characteristics of the study

cohort were summarized descriptively. We compared participants at risk for loneliness with those not at risk for loneliness, and individuals at risk for social isolation with those not at risk for social isolation. To further distinguish between these related but distinct constructs, we also compared characteristics between participants at risk for loneliness and those at risk for social isolation.

Normally distributed continuous variables were expressed as mean (standard deviation) and median (interquartile range) for non-normally distributed variables. Categorical variables were expressed as counts and percentages. Comparisons between groups were performed using a t-test for normally distributed continuous variables, a Wilcoxon rank-sum test for non-normally distributed continuous variables, and a chi-square test or Fisher's exact test for categorical variables as appropriate. A two-sided p-value of <0.05 was considered statistically significant. All statistical analyses were conducted using R version 4.5.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Description of the cohort

A total of 103 LT patients were included in the study, and the baseline characteristics of the study cohort are presented in **Table 1**. The mean age of participants was 65.5 (SD 6.79) years with near-equal sex distribution (50.5% male). Most participants were Caucasian (79.6%), married (68%), and not employed (63.1%). Most patients were more than 1 year post-transplant (88.3%). The most common primary liver etiology was metabolic dysfunction-associated steatohepatitis (MASH) (36.9%), followed by alcohol-associated liver disease (ALD) (28.2%) and viral hepatitis (13.6%). The prevalence of metabolic comorbidities was as follows: obesity (49.5%), diabetes (47.1%), hypertension (81.6%), dyslipidemia (45.6%), coronary artery disease (20.4%), depression (42.7%), and anxiety (49.5%).

Loneliness Profiles of LT patients

Loneliness was common among LT recipients, with 43 of 103 participants (41.7%) meeting criteria for moderate or severe loneliness (**Figure 1A**). Moderate loneliness was present in 37 participants (35.9%), while 6 participants (5.8%) met criteria for severe loneliness. Since older age may be associated with risk for loneliness, the distribution of loneliness by age was examined and demonstrated a relatively uniform dispersion across age groups (**Figure 1B**).

Patients transplanted for ALD had the highest prevalence of loneliness (55.6%), followed by viral hepatitis (50%), MASH (36.1%), and other primary liver disease (28.6%); however, this did not reach statistical significance (p=0.224) (**Figure 1C**). The prevalence of loneliness was highest among recipients less than 1 year post-transplant (58.3%), followed by those 1-3 years (43.5%), >5 years (41.9%), and 3-5 years (32%) post-transplant (**Figure 1D**).

Since loneliness encompasses both emotional (limited close relationships) and social (limited social network) loneliness, we quantified each. LT recipients also showed similar levels of emotional and social loneliness (**Figure 1E**). The comparable contribution of emotional and social loneliness subscales suggests that loneliness in this population reflects deficits in both close confiding relationships and broader social connectedness, rather than being driven by one dimension. Lonely and not lonely participants did not differ significantly in age, sex, marital status, education, employment status, time since transplantation, immunosuppressive regimen, or distance from the transplant center (**Supplemental Table 1**). However, participants at risk for loneliness were significantly more likely to have a documented history of depression than those

not at risk (55.8% vs 33.3%, p = 0.004). History of anxiety demonstrated a similar increase in loneliness risk (65.1% vs 38.3%, p=0.01) (**Supplemental Table 1**).

Social Isolation Profiles of LT patients

Social isolation was less prevalent than loneliness among LT recipients. 19 of 103 participants (18.4%) met criteria for social isolation (**Figure 2A**). Social isolation scores were distributed across the scale, with most participants scoring below the social isolation threshold. Similar to loneliness, social isolation had a relatively uniform distribution across all age groups and etiologies of liver disease (**Figure 2B and 2C**).

Social isolation was most prevalent among recipients less than one year post-transplant (25%) and decreased across subsequent time-from-transplant groups (p=0.4) (**Figure 2D**). Because social isolation comprises contributions from family and friends, we further examined each contribution. Among socially isolated participants, the greatest contribution was from connections with friends compared with family members (**Figure 2E)**. This pattern suggests that post-transplant social contraction may occur preferentially at the level of friendships and broader community ties, rather than family relationships, consistent with the observation that intact caregiver support does not preclude social isolation. There were no significant differences between socially isolated participants and not socially isolated participants in terms of age, sex, race/ethnicity, employment status, marital status, education, time since transplantation, immunosuppressive regimens, metabolic comorbidities, depression, anxiety, laboratory values, distance from transplant center, or neighborhood social deprivation (**Supplemental Table 2**).

Relationship Between Loneliness and Social Isolation

Eleven participants (10.7%) met criteria for both loneliness and social isolation (**Figure 3**). Loneliness scores demonstrated a weak-to-moderate inverse correlation with social isolation scores (Spearman's $r = -0.34$, $p < 0.001$), indicating that greater loneliness was associated with lower perceived social support. Direct comparisons between participants with loneliness and those with social isolation showed no significant differences in demographic characteristics, transplant-related variables, primary liver disease etiology, immunosuppressive regimens, comorbidities, or laboratory variables (**Supplemental Table 3**).

DISCUSSION

As survival after LT has continued to improve with medical management, a key question that remains unaddressed is ‘how well do LT recipients live’. Social connection is a core part of long-term well-being, yet whether LT recipients remain socially connected once intensive support around transplant surgery recedes is not well established. This study addresses that gap and shows that loneliness and social isolation are common among LT recipients. Both were widespread rather than confined to a subgroup defined by demographic, socioeconomic, or clinical characteristics that distinguished affected recipients from other patients. This absence of an identifiable risk profile underscores the key finding of the study that loneliness and social isolation represent important and underrecognized components of long-term transplant survivorship.

Loneliness, Social Isolation, and Health in Context of Published Literature

Loneliness and social isolation are common in the general population and are increasingly recognized as important determinants of health, not merely an uncomfortable subjective state [3]. National survey data estimate that 19% of the US adult population experience social isolation, a prevalence that has risen steadily since the COVID-19 pandemic, similar to the 18.4% social isolation we observed among LT recipients [7, 14]. Loneliness, however, is reported in 28.5% of the general population, well below the 41.7% seen in LT recipients [1]. This gap indicates that transplantation carries meaningful additional risk for loneliness specifically, beyond what social isolation alone would predict. The stakes are high as loneliness and social isolation are associated with increased all-cause mortality comparable to other significant risk factors such as obesity or smoking, as with cardiovascular disease, cognitive decline, and depression, independent of other risk factors [3]. For LT recipients, who already carry substantial comorbidity and psychiatric burden, this evidence base means unaddressed loneliness likely compounds risk for depression and anxiety, reduces adherence to medications, and diminishes long-term quality of life [5, 7, 15].

Loneliness and Isolation Despite Pre-Transplant Social Support Requirements

Study findings are particularly striking given that psychosocial evaluation, including assessment of an adequate caregiver and social network support (i.e., backup caregivers), is a required component of transplant candidacy [21]. Yet loneliness and social isolation were highly prevalent within the first year after transplant surgery, precisely the window when caregiver and transplant-specific support is typically at its peak. Pre-transplant assessment of social support,

in other words, is necessary for surgical candidacy but not sufficient to protect recipients from loneliness or isolation once they leave the hospital.

Although loneliness and social isolation were moderately correlated, only 1 in 10 patients met criteria for both. Most LT recipients classified as lonely were not objectively socially isolated. Thus, many LT recipients experience subjective disconnection despite an intact social network. This matters for transplantation specifically, where candidates must demonstrate a reliable support network to be registered on the LT waitlist. However, satisfying that requirement does not guarantee a lasting sense of connectedness, just as recipients with more limited networks do not necessarily feel lonely. Social networks are also dynamic in the sense that caregiver fatigue, shifting relationships, and the withdrawal of support once acute recovery ends can erode connectedness. Moreover, LT recipients are constrained by lifestyle restrictions (i.e., alcohol, physical ability), immunosuppression, and chronic illness, which may further limit their ability to maintain connectedness and therefore may be less able to offset this compared to the general population. Assessing the presence of a social network alone, therefore, does not capture a recipient's social well-being after LT.

Several transplant-specific mechanisms may contribute to loneliness even when a social network is normally intact. Lifelong alcohol abstinence, which is required regardless of the etiology of liver transplant, can subtly exclude recipients from social settings organized around drinking. Moreover, the daily burden of immunosuppression, including scheduling, food and infection precautions, and adverse effects of immunosuppression such as tremors and sleep disturbances, creates a persistent experiential difference from healthy peers that patients often describe as difficult to convey [19]. Within the household, the caregiver-recipient dynamic that supports acute recovery can produce a lasting role imbalance in which recipients feel guilt about the burden they have imposed and reluctance to voice ongoing distress, which may help explain why marital status did not distinguish lonely from non-lonely recipients in our cohort. Finally, loss of the pre-transplant patient community removes a source of shared understanding that families cannot fully replicate.

Clinical Implications

These findings have direct implications for post-transplant clinical care. Depression and anxiety demonstrated the strongest association with loneliness among LT recipients. Depression and anxiety are well-documented burdens in LT recipients, encompassing both pre-existing

psychiatric illness and new post-transplant diagnoses [20]. Our findings parallel the general population, where loneliness is closely linked to depression and generalized anxiety, and higher loneliness severity tracks with greater depressive symptom burden, though this relationship has not been well characterized in LT recipients [13]. Importantly, the presence of a history of depression or anxiety in our cohorts does not necessarily indicate evidence of active psychiatric illness, as all participants underwent psychosocial evaluation as part of the transplant process and received treatment when indicated. Moreover, patients with uncontrolled anxiety and depression were excluded from the study as they could confound study results; therefore, the study cohort consisted only of patients with well-controlled anxiety and depression. Instead, a history of depression or anxiety may identify recipients with greater underlying psychosocial vulnerability to loneliness even when their psychiatric conditions are being managed. The relationship is likely complex and potentially bi-directional, and the cross-sectional design of this study prevents determination of the direction of the relationships.

Unlike routinely monitored post-transplant variables, loneliness and social connectedness do not currently arise in clinical conversations and are not captured in the electronic medical record. LT recipients, therefore, may experience substantial loneliness without their transplant team recognizing or documenting it. As noted above, because this affects medical, psychosocial, and quality-of-life care, a deeper understanding of these factors can improve clinical care and outcomes among LT recipients. Screening alone, however, is unlikely to be sufficient without an established pathway for supporting those who screen positive [12]. Cognitive and behavioral interventions have shown benefit for loneliness and similar approaches, alongside transplant-specific support groups, warrant further study in LT recipients [9]

Strengths and Limitations

This study has several strengths. Loneliness and social isolation were assessed using well-validated instruments capturing related but distinct psychosocial constructs, allowing us to show that the two frequently do not co-occur and that the presence of a social network does not necessarily indicate an absence of loneliness. Surveys were administered using a standardized interview protocol limiting variability in survey administration and allowing participants to request clarification when needed. We studied recipients ranging from early post-transplant to many years after LT, allowing us to examine social well-being across many stages of transplant survivorship. The study results must be interpreted in the context of study limitations. Our

cross-sectional study design cannot establish causality within this cohort, but the general population evidence leaves little doubt that loneliness deserves the same clinical attention as other modifiable risk factors in long-term transplant care [9]. The limited sample size can impact clinically significant associations that may not be statistically significant, and future studies with large, multicenter cohorts are necessary to truly understand which patients are at greatest risk. Depression and anxiety were measured by assessing relevant medications, which may misclassify patients whose medications are prescribed for other indications and those with clinical depression or anxiety who are not receiving pharmacotherapy. Patients with uncontrolled depression or anxiety were excluded, which likely biases loneliness prevalence estimates downward by removing patients at highest risk. Recruitment was restricted to English-speaking patients at a single center with a predominantly Caucasian cohort, limiting generalizability to more diverse LT populations. These studies require longitudinal assessment to demonstrate how loneliness and social connectedness change over time to help develop and guide a thoughtful clinical approach.

In conclusion, loneliness and social isolation are common after LT and cannot be predicted from a recipient's clinical or demographic profile. Moreover, they are present in patients who satisfied pre-transplant social requirements, underscoring that psychosocial risks extend beyond the criteria currently used to evaluate potential transplant candidates. Recognizing and addressing this risk through routine post-transplant screening may represent an important, currently missed opportunity to improve recipients' long-term well-being.

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Table 1: Description of the Cohort

n = 103	Count (%)
Age (years) $\bar{x}$ (SD)	65.5 (6.79)
Males n (%)	52 (50.5)
ETHNICITY n (%)	
Caucasian	82 (79.6)
African American	17 (16.5)
Hispanic	3 (2.9)
Asian	1 (1.0)
SOCIAL PARAMETERS	
MARITAL STATUS n (%)	
Married	70 (68)
Not Married	33 (32)
EMPLOYMENT STATUS n (%)	
Employed	38 (36.9)
Not Employed	65 (63.1)
EDUCATIONAL ATTAINMENT n (%)	
≤ High School	43 (44.8)
> High School	53 (55.2)
TIME FROM LT n (%)	
≤ 1 year	12 (11.7)
> 1 year	91 (88.3)
IMMUNOSUPPRESSION n (%)	
Calcineurin Inhibitor	98 (95.1)
Other	5 (4.9)
PRIMARY LIVER DISEASE n (%)	
MASH	38 (36.9)
ALD	29 (28.2)
Viral Hepatitis	14 (13.6)
Cholestatic	11 (10.7)
Autoimmune	3 (2.9)
Cryptogenic	4 (3.9)
Other	4 (3.9)
COMORBIDITIES n (%)	
Obesity	51 (49.5)
Diabetes	48 (47.1)
Hypertension	84 (81.6)
Dyslipidemia	47 (45.6)

CAD Depression Anxiety	21 (20.4) 44 (42.7) 51 (49.5)
LABORATORY median (IQR) ALT (U/L) AST (U/L) ALP (mg/dL) T Bilirubin (mg/dL) Creatinine (mg/mL) HbA1C	 31 (19–44.5) 29.5 (23–41.75) 108 (78–147.5) 0.6 (0.4–0.9) 1.19 (0.99–1.46) 5.5 (5.1–6.1)

Table 1. Baseline Characteristics of Liver Transplant Recipients. Continuous variables are reported as means (standard deviation [SD]) if normally distributed, or as median (interquartile range [IQR]) if non-normally distributed. Categorical variables are presented as n (%). Percentages are calculated using the total study cohort n=103 as the denominator.

Abbreviations: ALD, alcohol-related liver disease; ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CAD, coronary artery disease; HbA1c, hemoglobin A1c; MASH, metabolic dysfunction-associated steatohepatitis.

FIGURE LEGEND

Figure 1A

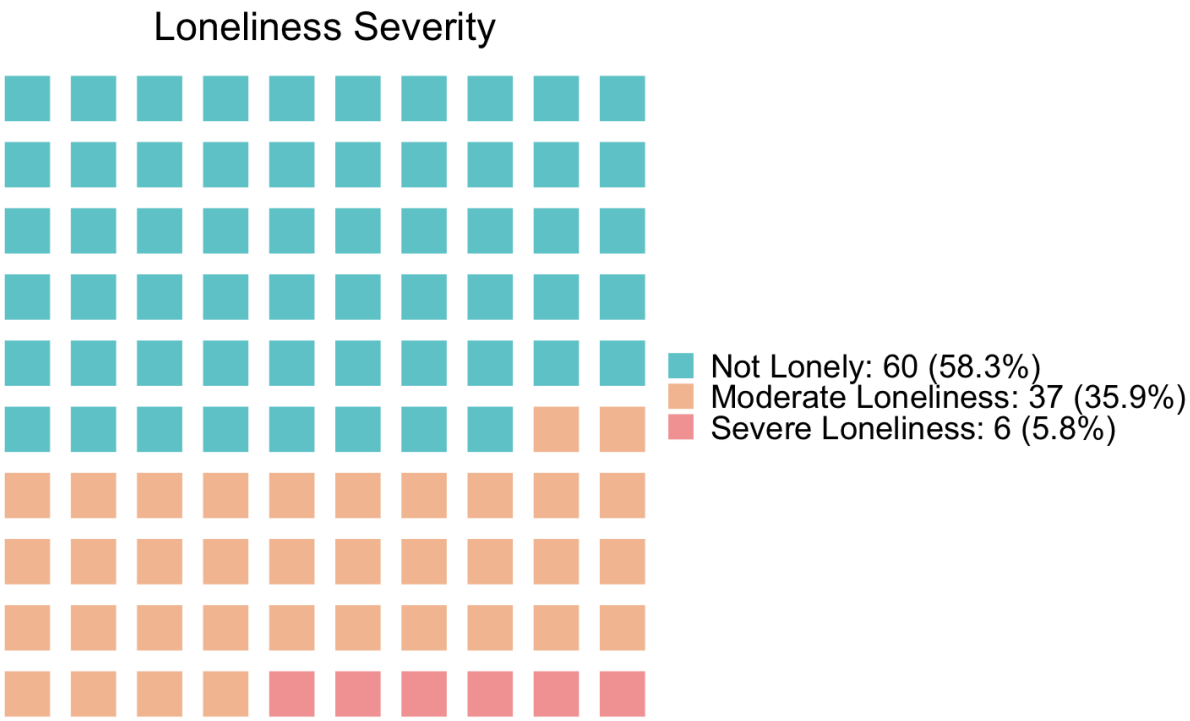


Figure 1B.

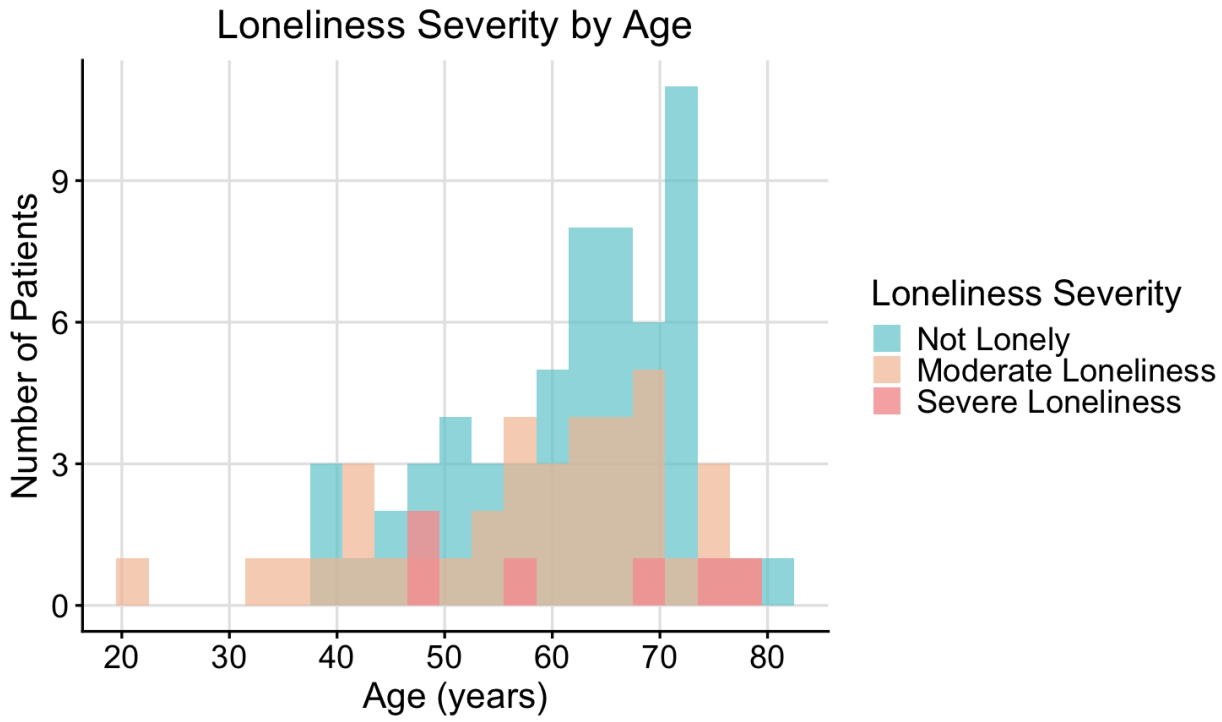

Loneliness Severity by Age
Number of Patients
0
3
6
9
20
30
40
50
60
70
80
Age (years)
Loneliness Severity
Not Lonely
Moderate Loneliness
Severe Loneliness

Figure 1C.

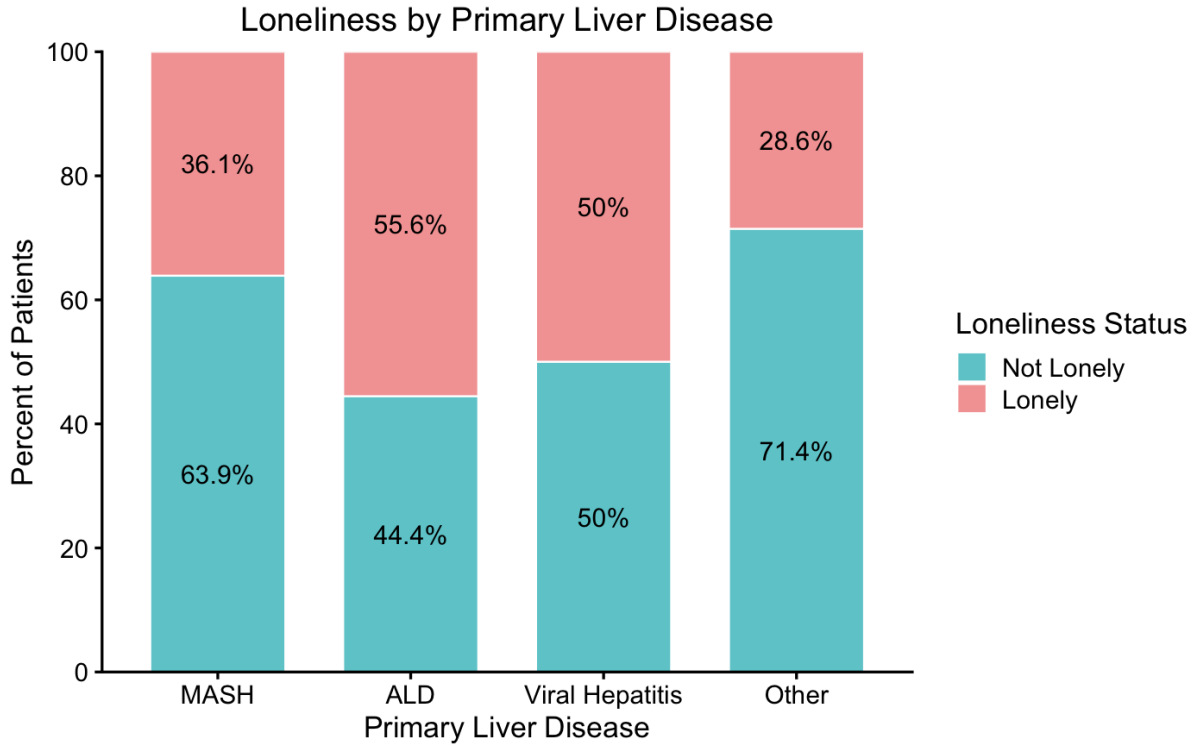

Loneliness by Primary Liver Disease
Percent of Patients
0
20
40
60
80
100
36.1%
63.9%
55.6%
44.4%
50%
50%
28.6%
71.4%
MASH
ALD
Viral Hepatitis
Other
Primary Liver Disease
Loneliness Status
Not Lonely
Lonely

Figure 1D.

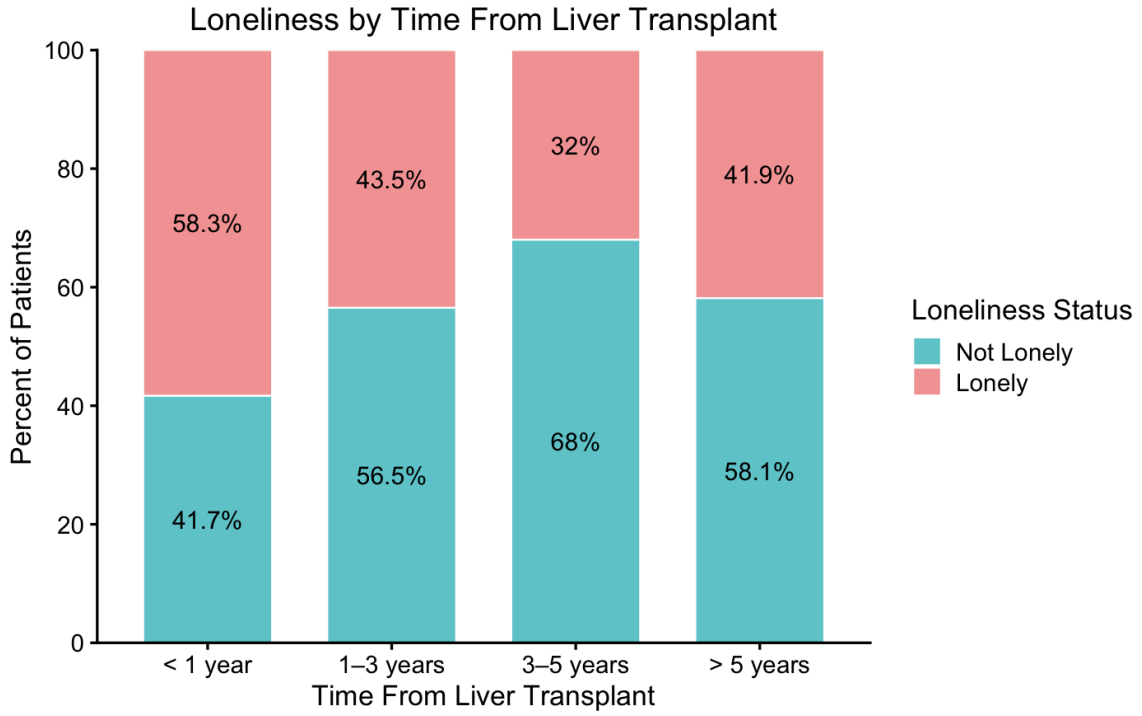


Figure 1E.

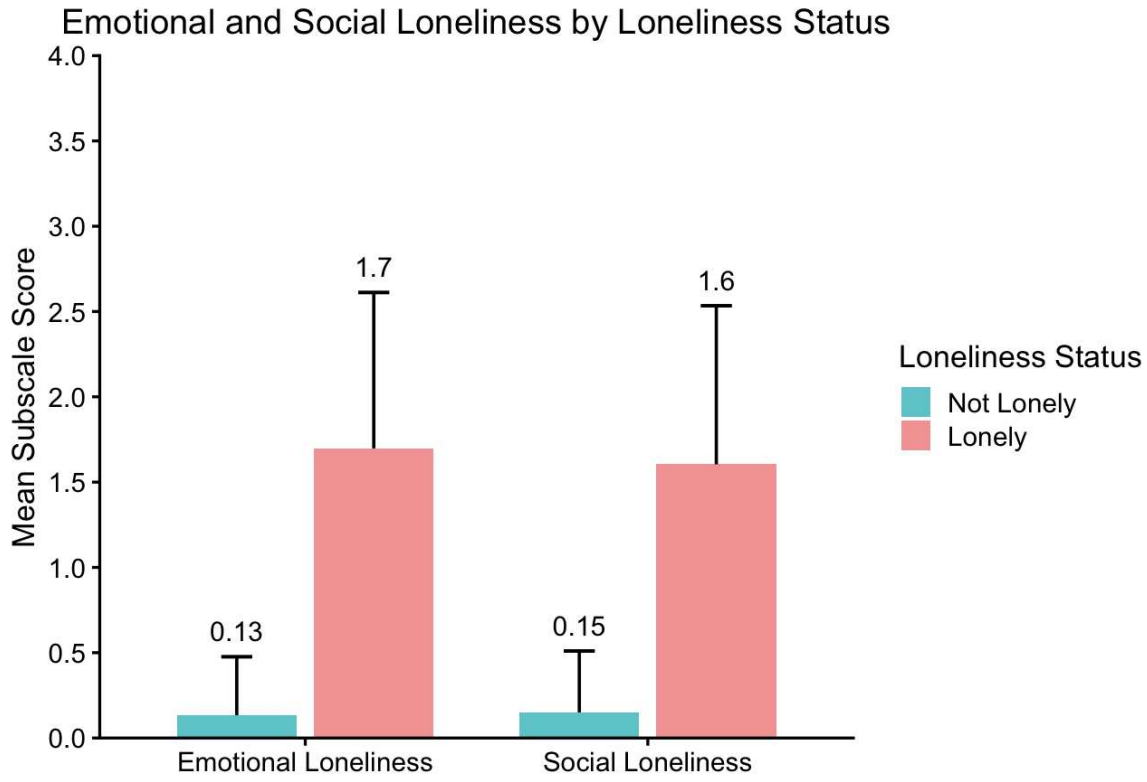


Figure 1. Distribution and characteristics of loneliness among liver transplant recipients. **(A)** Waffle plot depicting the proportion of LT recipients classified by DJG scores into three groups [not lonely (0-1), moderate loneliness (2-4), and severe loneliness (5-6)]. (**B**) Distribution of loneliness severity across recipient age. (**C**) Prevalence of loneliness severity risk by primary liver disease. (**D**) Prevalence of loneliness by time from LT. Percentages represent proportions of all LT recipients within each time-from-transplant group grouped by loneliness status. (**E**) Mean emotional and social loneliness subscale scores according to overall loneliness status, with error bars representing +1 standard deviation.

Figure 2A.

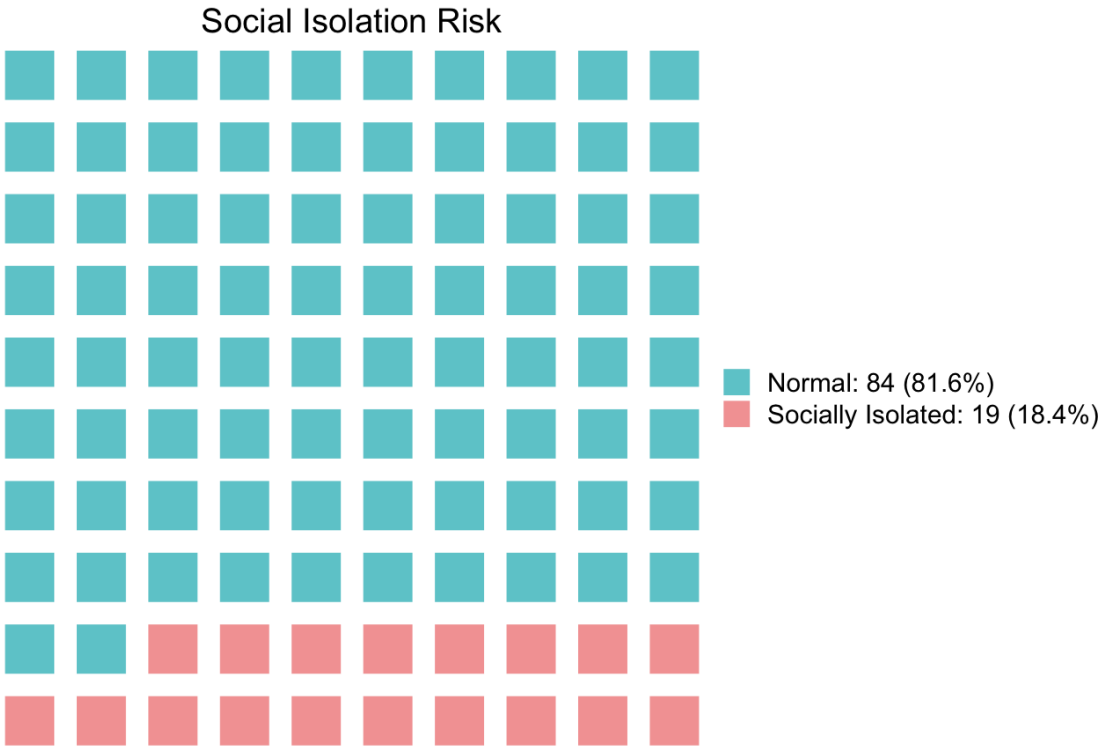


Figure 2B.

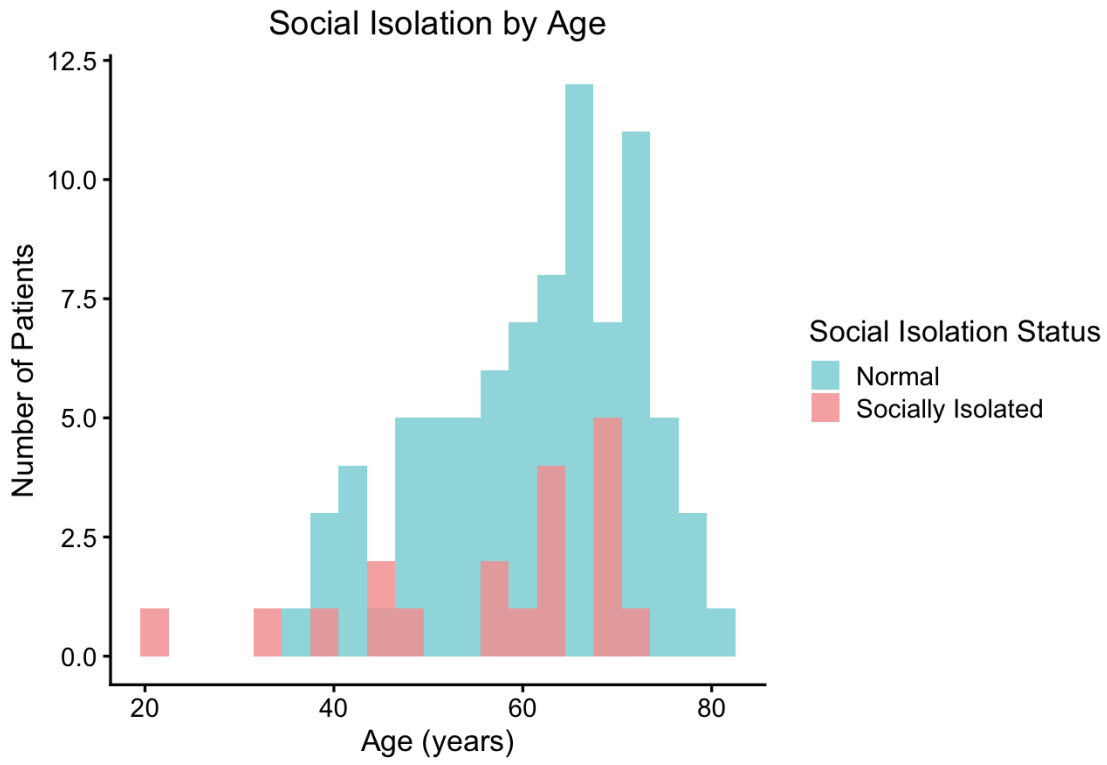


Figure 2C.

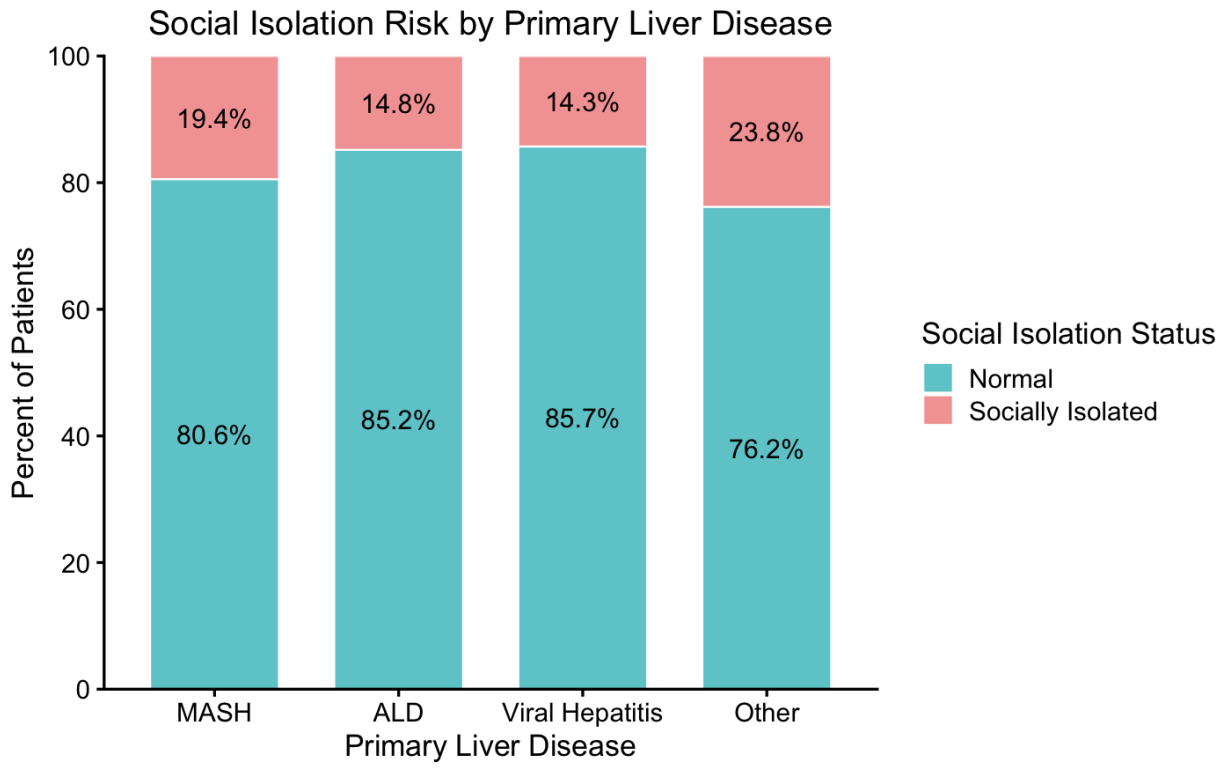


Figure 2D.

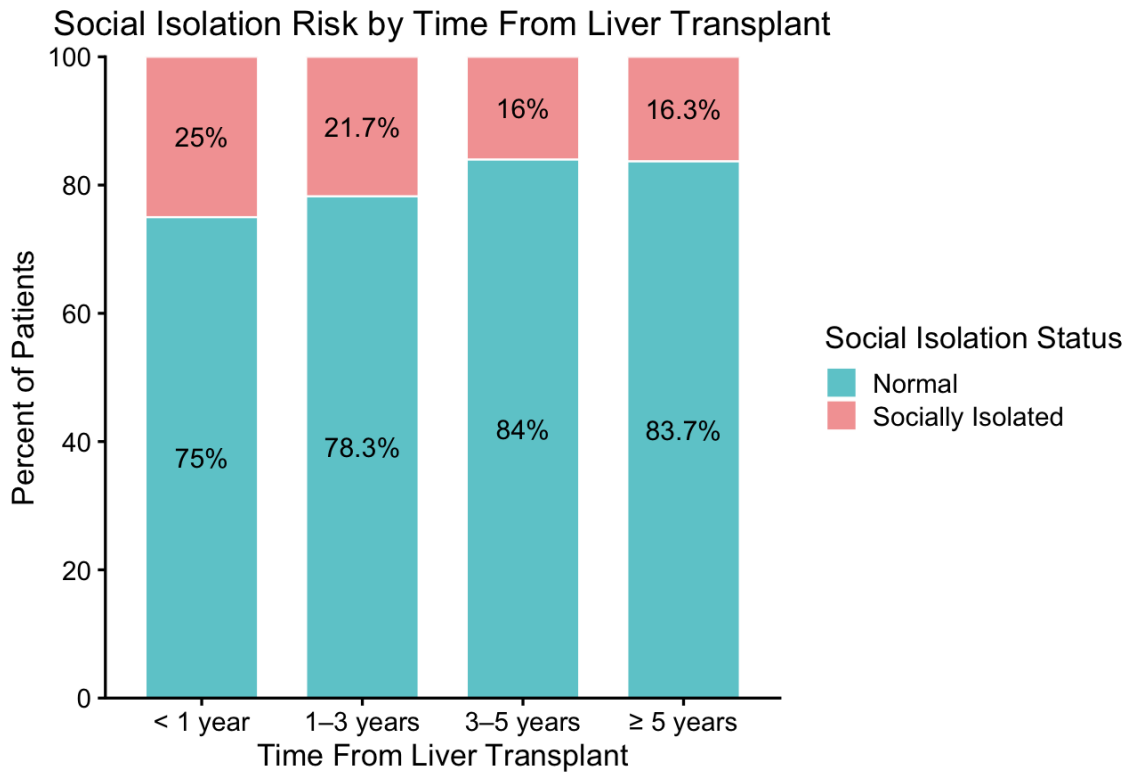


Figure 2E.

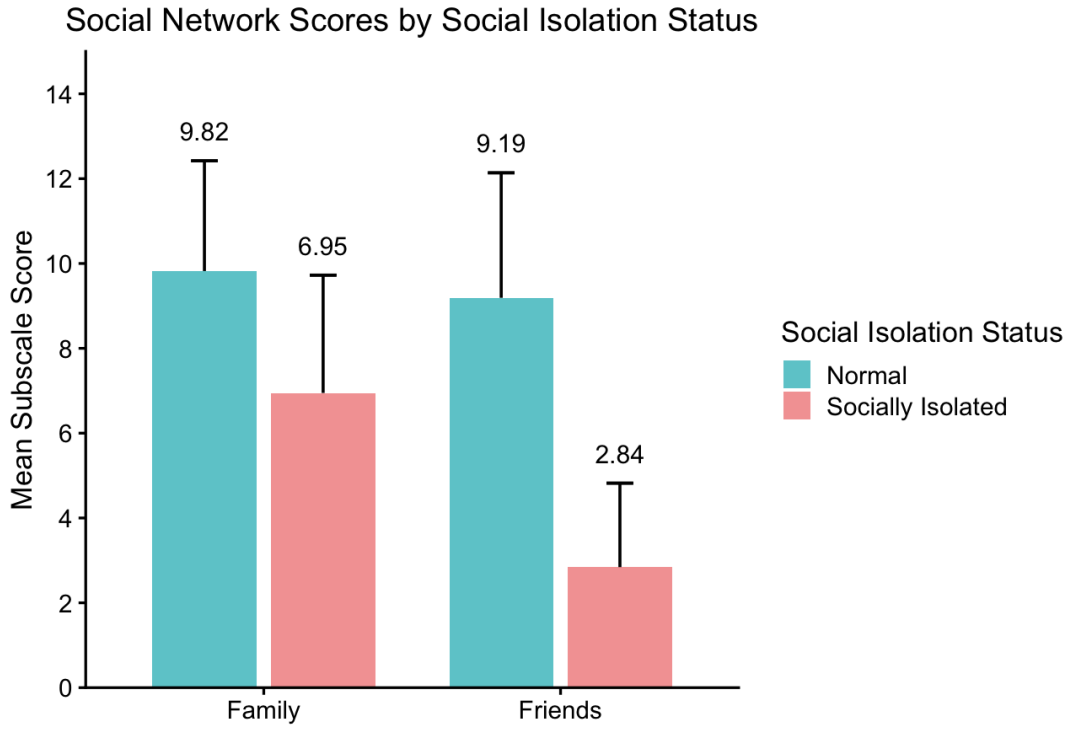


Figure 2. Distribution and characteristics of social isolation among liver transplant recipients. (A) Waffle plot depicting the proportion of LT recipients classified as socially

isolated or normal. Scores ≤ 12 are classified as socially isolated and scores >12 as normal. (**B**) Distribution of social isolation status across recipient age. (**C**) Prevalence of social isolation status by primary liver disease. (**D**) Prevalence of social isolation status by time from LT. Percentages represent proportions of all LT recipients within each time-from-transplant group grouped by social isolation status. (**E**) Mean social isolation family and friend subscale scores according to social isolation status, with error bars representing standard deviations.

Figure 3.

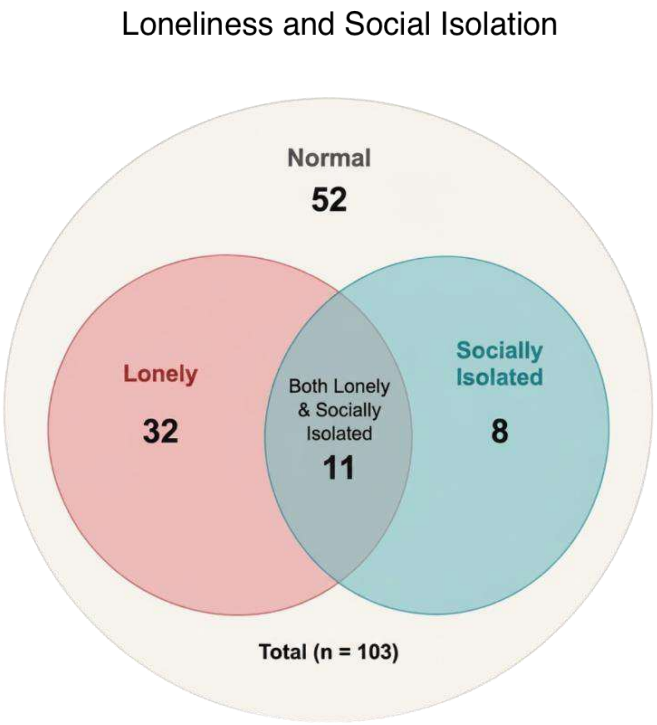


Figure 3. Overlap between loneliness and social isolation among liver transplant recipients. Venn diagram showing overlap between participants with loneliness (De Jong Gierveld Loneliness Scale >1) and those with social isolation (LSNS-6 ≤12). Eleven participants (10.7%) met criteria for both loneliness and social isolation.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementalTablesLonelinessBMCGastro.docx