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# Psychosocial assessment tools for use before transplantation are predictive of post-operative psychosocial and health behavior outcomes: a narrative review of the literature

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**Introduction:** In end-stage diseases, transplantation may be necessary. The limited number of donors led to the development of several pre-transplant psychosocial assessment tools. We summarized the predictive value of these tools before solid-organ transplantation.

**Methods:** The PRISMA search strategy and the MEDLINE database were used to review the literature. From 1,050 records, we found thirteen studies using four different scales (Millon Behavioral Health Inventory [MBHI], Psychosocial Assessment of Transplant Candidates [PACT], Stanford Integrated Psychosocial Assessment for Transplantation [SIPAT], and Transplant Evaluation Rating Scale [TERS]).

**Results:** TERS and MBHI were associated with the highest number of positive studies concerning pre-transplant scores and primary outcomes. Psychosocial scales predict in a systematic way psychosocial and health behavioural outcomes, but generated mixed results for mortality and rejection.

**Discussion:** This narrative review underlines the need for multidisciplinary evaluation and well-conducted clinical trials to assist transplant teams in utilizing psychosocial evaluation effectively during evaluation of candidates.

## KEYWORDS

transplantation, psychosocial assessment tools, post-transplant outcomes, narrative review, PRISMA (preferred reporting items for systematic reviews and meta-analyses)

## 1. Introduction

Solid-organ transplantation offers life-saving treatment to patients suffering from end-stage organ dysfunction. However, the growing number of patients on the waiting list largely outweighs the number of donors' organs available, a persistent concern in transplantation medicine. In the United States, although more than 40,000 transplants were achieved in 2022, the waiting list still comprised more than 100,000 candidates in need of an organ (1). In Canada, where our team is based, in 2021 alone, more than 4,000 patients were on a waiting list to receive a transplant, and 38% of them ultimately died while waiting (2, 3). The COVID pandemic, beginning in March 2020, has also had a negative impact on transplant success. Indeed, in Canada the total number of solid organ transplants has dropped by 14% from 2019 to 2020 (2, 3).

Due to the scarcity of resources and complexity of the treatment regimen surrounding transplant, potential candidates usually undergo a thorough preoperative screening. This allows for a precise understanding of the patient's global health status to determine whether they are suitable candidates for transplantation. Amongst these variables, psychosocial factors are now widely recognized health determinants (4), which are associated with transplantation outcomes (5, 6). Even though the Centers for Medicare & Medicaid Services (CMS) demands that a psychosocial examination is done before transplant (7), there is no solid research data supporting this practice. Different guidelines also agree on the necessity of screening patients for psychosocial risk factors before transplantation and this is usually done by a psychiatrist, psychologist and/or a social worker working as a part of the transplant team (8, 9). However, while the medical evaluation of transplant candidates is well standardized across hospitals, the evaluation method for psychosocial risk factors differs greatly. The instruments used for this psychosocial evaluation differ in their focus, with some assessing overall psychosocial functioning while others only measuring specific aspects (e.g., alcohol/drug use, depression, memory), providing a narrower focus. Nghiem et al.'s review of psychosocial assessment instruments for liver and kidney transplant candidates further confirms the scarcity of research on the psychometric properties of these tools and the need to investigate their effectiveness in predicting post-transplantation outcomes (6).

We thus conducted this narrative literature review to summarize the findings on psychosocial assessment tools used before either solid-organ (heart, lung, kidney, and liver) transplantation and their predictions of postoperative outcomes. Although transplant teams might use specific diagnostic tools for different conditions such as depression, substance use or other diseases that may impact transplant outcomes, these were not assessed in this study.

## 2. Methods

The PRISMA search strategy was used as a model to conduct this narrative review (10).

### 2.1. Eligibility criteria

The study sample included adults (age  $\geq 18$ ), solid-organ (heart, lungs, liver, or kidney) recipients and had to assess psychosocial functioning before transplantation. Psychosocial assessment tools had to be clearly and accurately specified. **Table 1** represents an overview of the psychosocial assessment tools used to evaluate potential transplantation candidates. Scales used were Millon Behavioral Health Inventory (MBHI) (11, 12), Millon behavioral medicine diagnostic Instrument (MBMD) (12, 13), Psychosocial Assessment of Transplant Candidates (PACT) (14, 15), Stanford Integrated Psychosocial Assessment for Transplantation (SIPAT) (16), Structured Interview for Renal Transplantation (SIRT) (17), and Transplant Evaluation Rating Scale (TERS) (18). We excluded studies or publications that were literature or systematic reviews.

### 2.2. Search strategy and study selection

We identified publications through a search of MEDLINE and restricted results to publications in English or French. We present the exact search strategies and details as **Supplementary Material**. We performed the first search on July 28, 2020, with updates performed on June 09, 2021, and February 02, 2022. **Figure 1** represents the PRISMA flow diagram illustrating the study selection process (10). Among the articles, we examined literature reviews and meta-analyses for valuable references. Titles and abstracts retrieved were then screened for eligibility by authors S.T., K.P. and S.C. using the established criteria. Publications with an unclear inclusion status after screening were discussed by authors S.T., K.P. and S.C. and either included or excluded.

### 2.3. Quality assessment

Authors S.T., K.P. and S.C. independently assessed the risk of bias for each study using the National Institute of Health's Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Institutes of Health [NIH] & National Heart, Lung, and Blood Institute [NHLBI] (19)). This tool consists of 14 criteria answered using Yes/No/Other (cannot determine, not applicable, not reported) that lead to the study's overall quality rating (good/fair/poor). There is no NHLBI consensus on classifying articles into different categories. The authors subsequently discussed each article for classification. All thirteen articles were deemed to be of good quality and thus included.

## 3. Results

### 3.1. Study selection and characteristics of included studies

We found a total of 1,050 articles through the searches of the MEDLINE database. We retrieved five articles with literature reviews references, increasing the number to 1,055 potential articles, of which 1,049 remained after removing duplicates. Eight hundred ninety-one studies (84.9%) were excluded based on the title and abstract, and 145 (13.8%) were further excluded after a full-text examination using the established eligibility criteria. Our narrative literature review is thus including thirteen articles (1.2%). The selected items were either retrospective or prospective cohort studies.

### 3.2. Psychosocial assessment tools and post-transplantation outcomes

**Table 2** summarizes the current state of knowledge on the ability of psychosocial tools to predict post-transplantation outcomes based on the thirteen accepted studies. We identified studies for only four of the six questionnaires presented in **Table 1**. It implies that two questionnaires, the MBMD and the

TABLE 1 Psychosocial pre-transplant assessment tools.

Questionnaire	#Items	Domains	Method of administration	Scoring
<b>MBHI</b> Millon Behavioral Health Inventory	150	1. Personality style 2. Psychogenic attitude 3. Psychosomatic correlate 4. Prognostic index	Self-report	Coping style scales: Conversion of raw scores into base rate scores using prevalence data. Score above 74 indicated the presence of the particular characteristic that each scale represents. Psychogenic attitude scales: Transformed prevalence data into classical T scores.
<b>MBMD</b> Millon behavioral medicine diagnostic Instrument	165	1. Response Patterns 2. Negative Health Habits 3. Psychiatric Indications 4. Coping Styles 5. Stress Moderators 6. Treatment Prognostics 7. Management Guides	Self-report	Raw scores are converted to initial prevalence scores. Adjustment to the initial prevalence scores are then calculated to determine the final prevalence scores to plot on the patient's profile sheet.
<b>PACT</b> Psychosocial Assessment of Transplant Candidates	8	1. Social support 2. Psychological health 3. Lifestyle factors 4. Comprehension of transplant and follow-up	Clinician interview	Eight items rated on a five-point scale plus the evaluator's integration of all items into one final score: 0 (poor candidate), 1 (borderline candidate), 2 (acceptable candidate), 3 (good candidate), and 4 (excellent candidate). The final rating involving clinical judgement can overrule the total score.
<b>TERS</b> Transplant Evaluation Rating Scale	10	1. Prior psychiatric history with axis 1 disorders 2. Prior psychiatric history with axis 2 disorders 3. Substance use/abuse 4. Compliance 5. Health behaviors 6. Quality of family and social supports 7. Prior history of coping 8. Coping with disease and treatment 9. Quality of affect 10. Mental status (past and present)	Clinician interview (Typically 2 separate examiners)	Ten items rated on a three-point scale with a relative weight attributed to each item for calculation of a final weighted summary score. Higher score indicates lower level of psychosocial functioning. Individual sub scales results can also be reported. Higher score indicates lower level of psychosocial functioning.
<b>SIPAT</b> Stanford Integrated Psychosocial Assessment for Transplantation	18	1. Patient's Readiness Level and Illness Management 2. Social Support System Level of Readiness 3. Psychological Stability and Psychopathology 4. Lifestyle and Effect of Substance Use	Clinician interview	Candidates divided into 5 groups based on total score: Excellent (0–6), Good (7–20), Minimally Acceptable (21–39), Poor (40–69), and High Risk (70). Certain items more heavily weighted based on evidence that they are more predictive of clinical outcomes.
<b>SIRT</b> Structured Interview for Renal Transplantation	93	1. Background/ Demographics 2. Understanding of Illness 3. Education/Socioeconomic Status 4. Brief Family History 5. Coping/Personality Style 6. Psychiatric History 7. Mental Status Exam	Clinician interview	The SIRT is not used as a stand-alone assessment tool. Clinicians review the patient's clinical chart, administer the SIRT and other psychometric testing (PACT) to write a final report about the patient's psychiatric appropriateness for transplantation.

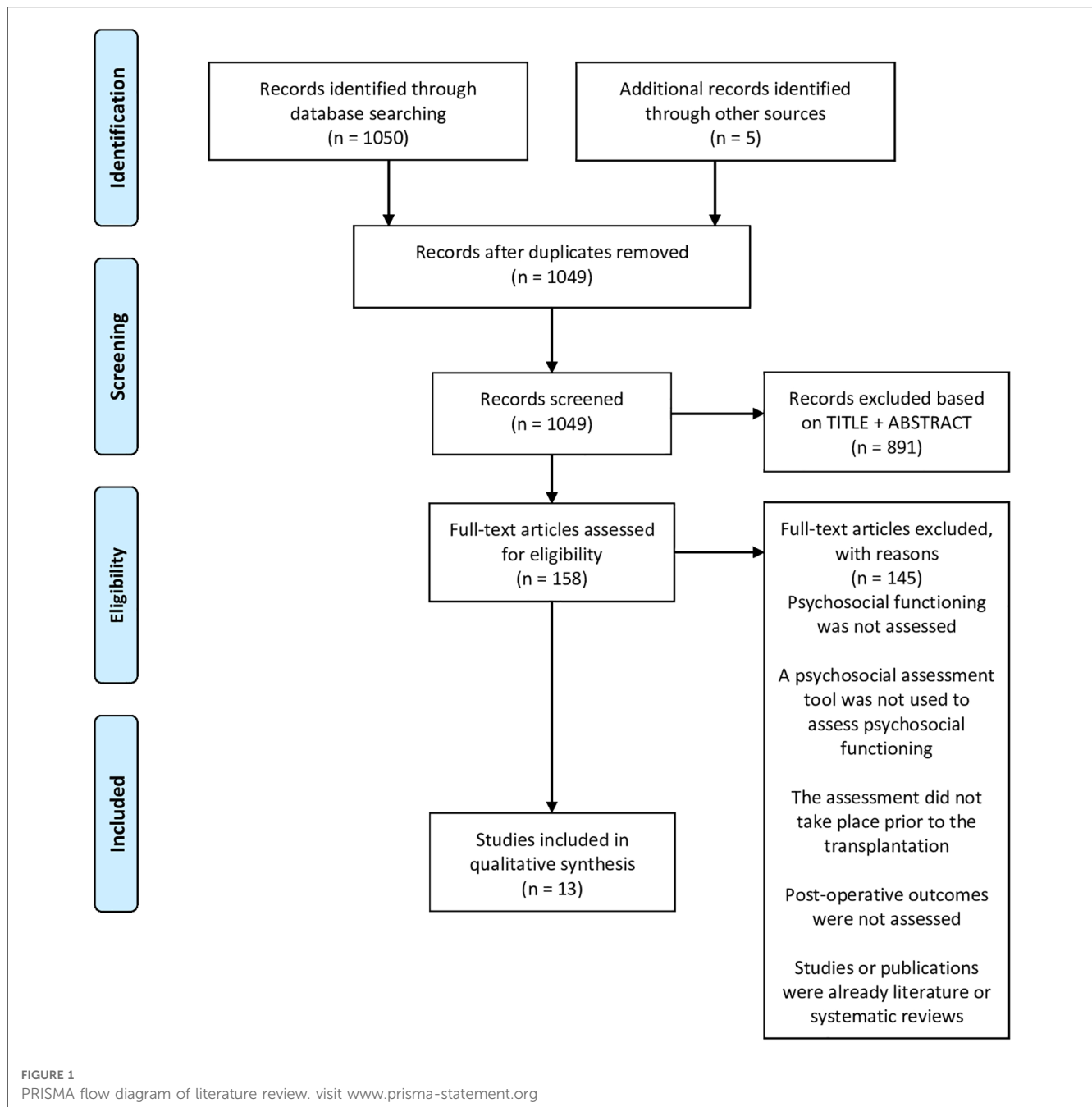
SIRT, had not been studied in the current literature research in terms of outcome prediction.

### 3.3. Million behavioural health inventory (MBHI)

Four of thirteen studies (20–23) used the MBHI for evaluation of heart transplant candidates. This makes it the most studied

psychosocial scale, tied with the SIPAT. In all of them, the MBHI was treated as a categorical variable, with low or high-risk groups.

All studies assessed either post-transplant survival/mortality or survival time as a primary outcome, with three out of four reporting MBHI as a significant predictor (20, 21, 23). Indeed, Chacko et al. (20) showed that the specific factor-analyzed composite measure of vulnerability for the Millon scale significantly predicted the survival time ( $\chi^2 = 12.53, df = 1,$



$p = 0.0004$ ). In another study, Harper et al. (21) also showed the ability of the MBHI to predict longer survival time in participants in the low-risk group ( $\chi^2 = 7.24$ ,  $df = 1$ ,  $p = 0.007$ ). Brandwin et al. (23) identified a significant association between mortality and the high-distress cluster over a 5-year period (status after 1 year:  $\chi^2 = 8.93$ ,  $df = 1$ ,  $p < 0.005$ /status after 5 years:  $\chi^2 = 8.16$ ,  $df = 1$ ,  $p < 0.005$ ). Coffman & Brandwin (22) was the only team that did not find a significant association between MBHI and mortality between groups ( $\chi^2 = 2.35$ ,  $df = 1$ ,  $p > 0.01$ ).

### 3.4. Psychosocial assessment of candidates for transplant (PACT)

Three out of thirteen studies used the PACT to assess psychosocial functioning in lung (15), heart (24), and liver (25) transplant candidates. The PACT was treated as only a categorical variable in one (13), and both a categorical and continuous variable in the two other studies (24, 25).

Three studies assessed survival/mortality as a primary outcome. A clear association between PACT score and higher mortality after

TABLE 2 Information about included studies by pre-transplant psychosocial assessment tool.

Study Design, N	Variable type	Organ	Demographics	F-up period (Median) Mean ± SD	Primary outcome(s); main results
<b>MBHI</b>					
Chacko et al. (20) Prospective f-up, N = 94	<b>Categ.:</b> Composite score of vulnerability using subscales	Heart	54 ± 12 y. 86% male	56 months	↓Survival time; p = 0.0004
Harper et al. (21) Prospective cohort, N = 90	<b>Categ.:</b> High- vs. low-risk based on the median split of ranked MBHI score	Heart	53 ± 11 y. 86% male	56 months	↓Post-transplant survival time; p = 0.007
Coffman et al. (22) Prospective cohort, N = 103	<b>Categ.:</b> Cut-off of 70, <i>Life Threat Reactivity</i>	Heart	–	5 y.	↔Mortality; p > 0.01
Brandwin et al. (23) Prospective cohort, N = 103	<b>Categ.:</b> High- vs. low-distress	Heart	49 ± 10 y. 82% male	1–5 y.	↑Mortality; 5-year point: p < 0.005
<b>PACT</b>					
Hitschfeld et al. (15) Retrospective cohort, N = 110	<b>Categ.:</b> <2 vs. ≥2	Lung	56 ± 11 y. 48% male	12-y. (3.6)	↑Mortality; aHR <sup>a</sup> = 2.73 [95% CI: 1.07–7.01, p = 0.04]
Schneekloth et al. (24) Retrospective cohort, N = 164	<b>Categ.:</b> <2 vs. ≥2	Heart	53 ± 11 y. 72% male	12-y. (7)	↔Survival HR = 1.42; p = 0.6 HR = 0.80; p = 0.3
	<b>Cont.:</b> 0–4				
Schneekloth et al. (25) Retrospective cohort, N = 538	<b>Categ.:</b> <2; 2–3; ≥3	Liver	54 ± 9 y. 70% male	4–16 y.	↔Survival overall PACT (categorized; PACT ≥3 as reference); p = 0.4 PACT < 2; HR = 1.13 [95% CI: 0.78–1.65, p = 0.5] PACT 2–3; HR = 1.25 [95% CI: 0.89–1.77, p = 0.2] HR = 0.90 [95% CI: 0.77–1.05, p = 0.2]
	<b>Cont.:</b> 0–4				
<b>SIPAT</b>					
Maldonado et al. (5) Prospective cohort, N = 217	<b>Cont.:</b> Total SIPAT score	Solid	52 ± 13 y. 60% male	341 ± 80 days	↔Organ failure; HR = 0.98 [95% CI: 0.92–1.06, p = 0.7] <sup>b</sup> ↔Mortality; HR = 0.99 [95% CI: 0.96–1.04, p = 0.8] <sup>b</sup>
Deutsch-Link et al. (26) Retrospective cohort, N = 61	<b>Categ.:</b> <21; ≥21	Liver	–	(38 months IQR: 24–56)	↑Alcohol relapse; HR = 6.40 [95% CI: 1.36–30.18, p = 0.02]
Deutsch-Link et al. (27) Retrospective cohort, N = 371	<b>Categ.:</b> <21; ≥21	Liver	59 y. [IQR 52; 64] 72% male	2–5 y.	↑Immunosuppression nonadherence; aOR = 2.92 [95% CI: 1.69–5.03, p < 0.001] ↑Biopsy-proven rejection; aOR = 2.66 [95% CI: 1.20–5.9, p = 0.02]
	<b>Categ.:</b> Patient's Readiness Level				
Becker et al. (28) Retrospective cohort, N = 182	<b>Cont.:</b> SIPAT total score	Liver	56 ± 11 y. 67% male	3 ± 1 y.	↔Rejection of transplant; OR = 1.01 [95% CI: 0.97–1.06, p = 0.7]
<b>TERS</b>					
Twillman et al. (18) Retrospective f-up, N = 35	<b>Cont.:</b> Total TERS score	Liver	48 ± 10 y. 25% male	1–3 y.	5 subscales of Visual Analogue Scale <sup>b</sup> ↓Compliance r = –0.636; p < 0.001 ↑Substance use r = 0.643; p < 0.001 ↓Health behaviours (exercise, no smoking, diet, etc.) r = –0.671; p < 0.001 ↓Quality of life r = –0.415; p = 0.03 ↔success of orthotopic liver transplant r = –0.227; p = 0.2
Baranyi et al. (29) Retrospective f-up, N = 123	<b>Cont.:</b> Total TERS score	Solid	53 ± 12 y. 70% male	25 ± 12 months	↑Level of overall mental distress; p = 0.03

†, Significant increase in variable/outcomes measure; ↓, Significant decrease in variables/outcome measure; ↔, No significant association; 95% CI, 95% confidence interval; Coef., Coefficient; f-up, follow-up; HR/aHR, hazard ratio/adjusted hazard ratio; IQR, interquartile range; MBHI, millon behavioral health inventory; MR, mean ratio; OR/aOR, odds ratio/adjusted odds ratio; PACT, psychosocial assessment of transplant candidates; SE, standard error; SIPAT, stanford integrated psychosocial assessment for transplantation; Solid organ includes heart, liver, lung/heart and lung; TERS, transplant evaluation rating scale; y., years.

<sup>a</sup>Adjusted for sex, age, pulmonary vascular disease, and bilateral lung transplantation.

<sup>b</sup>Despite the presence of multiple primary outcomes, the authors do not mention any control for type I error rate (alpha partition).

lung transplantation was only found by Hitschfeld et al. (15), after adjustment with sex, age, pulmonary vascular disease, and bilateral lung transplantation (aHR = 2.73 [95% CI: 1.07–7.01,  $p = 0.04$ ]). In contrast, two studies from Schneekloth et al., (one in heart transplant and the other with liver transplant), reported no association between categorical and continuous PACT scores and survival (24, 25). However, in their liver transplant study (25), when studying a multivariable model with age at liver transplant, pre-transplant BMI, and marital status, women with a lower PACT score had significantly worse survival (HR = 0.64 [95% CI: 0.47–0.86,  $p = 0.003$ ]).

### 3.5. Stanford integrated psychosocial assessment for transplantation (SIPAT)

Four out of thirteen studies employed the SIPAT to assess psychosocial functioning in heart, lung, liver, and kidney (5), and liver (26–28) transplant. This makes it the most studied psychosocial scale, on par with the MBHI. The SIPAT was interpreted as either a continuous or a categorical variable, with a higher score representing a higher psychosocial risk.

Mortality was assessed as a primary outcome in a study by Maldonado et al. (5), but no association with pre-transplant SIPAT score was found [HR = 0.99 (95% CI: 0.96–1.04,  $p = 0.8$ )]. While three studies looked at graft failure or rejection, only Deutsch-Link et al. (27) found an association between the specific subdomain 1 (Patient's Readiness Level) and a higher risk of rejection after 3 months [aOR = 2.66 (95% CI: 1.20–5.91,  $p = 0.02$ )]. Maldonado et al. (5) [HR = 0.98 (95% CI: 0.92–1.06,  $p = 0.65$ ) and Becker et al. [OR = 1.01 (95% CI: 0.97–1.06,  $p = 0.66$ )] did not find any significant association.

Deutsch-Link et al. (26) showed that a SIPAT score  $\geq 21$  (minimally acceptable to poor psychosocial risk) was significantly associated with post-transplant alcohol relapse [HR 6.40 (95% CI: 1.36–30.18,  $p = 0.02$ )] following liver transplantation and a SIPAT score  $\geq 21$  was significantly associated with lower adherence to immunosuppressive regimen [aOR 2.92 (95% CI: 1.69–5.03,  $p < 0.001$ )] in cardiac recipients (27).

### 3.6. Transplant evaluation rating scale (TERS)

The TERS was used to evaluate the psychosocial functioning of transplant candidates [liver (18) and heart, liver, or lung (29)] in two of the thirteen studies. The studies treated TERS score as a continuous variable.

Baranyi et al. showed that higher pre-transplant TERS score was associated with overall significant mental distress post-transplantation [Mann-Whitney-U = 1.255;  $p = 0.033$ ] (29). In addition, Twillman et al. revealed that pre-transplant TERS score significantly correlated with levels of compliance, substance abuse, health behaviours, and quality of life when measured 1–3 years after transplant (18).

## 4. Discussion

We reviewed the literature on psychosocial questionnaires used to assess preoperatively solid-organ and their potential utility in predicting different post-transplantation outcomes. We herein outlined the different tools available and summarize the results of published studies on their predictive ability.

The first observation is the relative scarcity of available data on this topic despite the almost universal use of these surveys in clinical practice, a finding that has also been previously recognized by Nghiem et al. (6). Indeed, out of the six psychosocial questionnaires presented in Table 1, only four had available evidence on their pre-transplant use and association with postoperative outcomes. Consequently, two potentially relevant scales, the MBMD and the SIRT, could not even be included in this narrative review. Although these two older questionnaires, from the early 2000s, may be considered outdated compared to newer tools such as the SIPAT or the PACT, described in the late 2010s, it is still noteworthy that no investigator has ever focused on their predictive aspect. Also, of the remaining four questionnaires ultimately included in this literature review, we found an average of only three reports per questionnaire (ranging from two to four), highlighting the need for more research on this understudied field despite its wide clinical acceptance.

Overall, as summarized in Table 3, of the thirteen studies included, nineteen primary outcomes were verified, and twelve were significantly associated with the results of the pre-transplant evaluation, demonstrating that the predictive capacity of psychosocial scales is good but somewhat imperfect. However, it is worth noting various elements of these included articles that may have an impact on their conclusions. First, it should be noted that the various studies included did not have a standardized methodology, which also limits the conclusions that can be drawn from them. Also, the calculation of the sample size necessary to observe a significant difference (the power) was not presented in many of the different studies, which render difficult the determination of whether the absence of significance is due to a lack of power or to a real lack of predictive capacity of the scale. Furthermore, despite the recognition that choosing a threshold that maximizes sensitivity and selectivity is paramount for identifying patients at risk (30), evidence for the choice of the threshold is not always mentioned. An inadequate threshold could therefore weaken prediction of post-transplant outcomes.

Interestingly, all the outcomes that were nonsignificant were medical in nature (the breakdown between medical and psychosocial outcomes is shown in Table 3). It is not surprising that some of these scales were able to predict psychosocial outcomes following transplantation but were somewhat imperfect for assessing medical outcomes. These results reinforce the idea that medical outcomes are not necessarily related to psychosocial behaviour, but more importantly to other outcomes, such as hospitalizations or recurrent illnesses. This finding also highlights the importance of the multidisciplinary evaluation of the transplant candidates.

TABLE 3 Summary of the different assessed primary outcomes with emphasis on statistical significance.

Medical outcomes			Psychosocial and health behaviours outcomes		
Mortality			Overall mental distress		
MBHI Brandwin et al. (23)	S $p < 0.005$	Heart	TERS Baranyi et al. (29)	S $p = 0.03$	Solid organ (heart, liver, lung/heart and lung)
MBHI Coffman et al. (22)	NS $p > 0.01$	Heart			
PACT Hitschfeld et al. (15)	S $p = 0.04$	Lung			
SIPAT Maldonado et al. (5)	NS $p = 0.8$	Solid organ (heart, lung, liver, kidney)			
Survival time/Survival/Days to death			Quality of life		
MBHI Chacko et al. (20)	S $p = 0.0004$	Heart	TERS Twillman et al. (18)	S $p = 0.03$	Liver
MBHI Harper et al. (21)	S $p = 0.007$	Heart			
PACT Schneekloth et al. (24)	NS Categorical: $p = 0.6$ Continuous: $p = 0.3$	Heart			
PACT Schneekloth et al. (25)	NS Categorical: $p = 0.4$ Continuous: $p = 0.2$	Liver			
Rejection			Health behaviours		
SIPAT Deutsch-Link et al. (27)	S $p = 0.02$	Liver	TERS Twillman et al. (18)	S $p < 0.001$	Liver
SIPAT Becker et al. (28)	NS $p = 0.7$	Liver			
Organ failure			Alcohol relapse/Substance use		
SIPAT Maldonado et al. (5)	NS $p = 0.7$	Solid organ (heart, lung, liver, kidney)	SIPAT Deutsch-Link et al. (26)	S $p = 0.02$	Liver
			TERS Twillman et al. (18)	S $p < 0.001$	Liver
Transplantation success			Compliance		
TERS Twillman et al. (18)	NS $p = 0.2$	Liver	TERS Twillman et al. (18)	S $p < 0.001$	Liver
			Immunosuppressant nonadherence		
			SIPAT Deutsch-Link et al. (27)	S $p < 0.001$	Liver

Grey background; S, statistically significant; MBHI, millon behavioral health inventory; NS, statistically nonsignificant; PACT, psychosocial assessment of transplant candidates; SIPAT, stanford integrated psychosocial assessment for transplantation; TERS, Transplant Evaluation Rating Scale.

Nevertheless, it is still impressive that almost half the studies had significant association with medical outcomes. We are not aware of a reverse situation, in which a physical health scale would predict psychosocial outcomes. Anyhow, future studies are necessary to refine and maximize the predictive aspect of these tools, possibly by using specific psychosocial domains rather than total scores, as suggested by Olt et al. (31) to assess the association with post-transplant outcomes. However, it should be noted that an inherent limitation of the included studies and study populations is that post-transplant outcomes are only assessed in patients who have effectively received the transplant. Thus, investigators are testing the predictive powers of the scales in those who probably had higher scores at baseline, which may underestimate their efficacy. It is also worth mentioning that some follow-up times, such as that for SIPAT, with patients followed for one year, may be insufficient to capture certain medical outcomes, such as mortality/survival. Other teams, such as the ones evaluating TERS, have followed patients for up to 5 years, with significant results for these medical outcomes.

With these results in mind, it is clear that the involvement of a trained clinical psychologist within the transplant team remains the standard of care considering the complexity of each and every person's life conditions and preferences. The use of psychosocial questionnaires may be considered as a screening tool which helps the transplant team regarding the care of each patient. These questionnaires can be helpful in revealing major contraindications to transplant, thus guiding the need for different interventions with certain populations in order to determine if certain patients may benefit from early interventions which could result in eventual transplantation.

#### 4.1. Limitations

This narrative literature review has some limitations. First, at the methodological level and inherent to our narrative design, the literature search was limited to a single database, and some relevant studies may therefore have been potentially missed.

Secondly, our comparison between the different studies and scales included is limited, mainly due to differences in primary and secondary outcomes, contrastive designs (prospective vs. retrospective), marked dissimilarity in study populations (types of transplantation, demographic distributions), length of follow-up periods, types of variables and scoring (continuous vs. categorical, thresholds) and statistical analyses used to test the associations. Although we did not combine the results of the different studies as in a meta-analysis, the numerous disparities must still be considered in interpreting the results. Finally, the small number of studies per psychosocial tool assessment also calls for caution in interpreting the results, especially regarding the generalizability of the findings.

## 5. Conclusion

This narrative literature review evaluated different widely used scales assessing the psychosocial characteristics of the patients, which is an integral part of the transplantation candidacy process for solid organ transplantation, and their predictive value on postoperative outcomes. Regarding our initial interrogation as if psychosocial assessment tools for use before transplantation or mechanical circulatory support were predictive of postoperative outcomes, the definite answer should be “yes” for what they are deemed to measure, i.e., psychosocial and health behavior outcomes, and indeterminate for the physical health outcomes. Of the thirteen articles included, an association with pre-transplant scores could be found for more than half of the nineteen postoperative primary outcomes tested, with TERS and MBHI having the higher number of positive (statistically significant) studies. The overall mixed evidence towards the predictive value of the different scales remains a real challenge for transplantation teams, given the limited number of donors and the need to allocate this resource to the most suitable candidates. Consequently, evidence from well conducted clinical trials are urgently needed to empower the transplantation teams worldwide in their predictive capacity during the evaluation of the transplant candidates; our review suggests that this may only come through a multidisciplinary lens.

## Author contributions

AD, JB: Conceptualization; ST, SC, KP, JB: Data curation; ST, SC, KP, JB: Formal analysis; JB: Funding acquisition; ST, SC, KP,

JB: Investigation; SC, JB: Methodology; JB: Project administration; JB: Resources; SC, JB: Supervision; JB: Validation; SC, AD, JB: Visualization; All: Roles/Writing—original draft; All: Writing—review and editing. All author contributed to the article and approved the submitted version.

## Conflict of interest

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The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frtra.2023.1250184/full#supplementary-material>

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