



## Assessment of pre-operative psychosocial function among people receiving left ventricular assist devices: A national survey of US LVAD programs

Malachy J. Clancy <sup>a,d,\*</sup>, Amy B. Jessop <sup>b</sup>, Howard Eisen <sup>c</sup>

<sup>a</sup> Department of Health Policy, University of the Sciences in Philadelphia, 600 S. 43rd Street, Philadelphia, PA 19104, United States

<sup>b</sup> Department of Public Health, Western Michigan University, 1903 W. Michigan Ave, Kalamazoo, MI 49008, United States

<sup>c</sup> Division of Cardiology, Drexel University College of Medicine, 2900 W. Queen Lane, Philadelphia, PA 19129, United States

<sup>d</sup> Good Shepherd Penn Partners, 3400 Spruce Street, 1 White, Philadelphia, PA 19104, United States



### ARTICLE INFO

#### Article history:

Received 7 October 2018

Received in revised form 14 February 2019

Accepted 23 February 2019

Available online 22 March 2019

#### Keywords:

Left ventricular assist device (LVAD)

Psychosocial assessment

Heart failure

Health policy

### ABSTRACT

**Background:** The International Society for Heart & Lung Transplantation (ISHLT) guidelines for Mechanical Circulatory Support (MCS) includes assessment of four elements of psychosocial functioning prior to Left Ventricular Assist Device (LVAD) implantation. Information about the practices and impact of assessments of psychosocial functioning are limited.

**Objective:** To describe the psychosocial function assessment practices used within US LVAD programs and the influence of psychosocial assessment results on clinical decisions for LVAD patient selection.

**Methods:** In 2017, a cross-sectional survey of LVAD programs listed in the Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) ( $N = 164$ ) was conducted to understand practices used for and the influence of psychosocial assessments for post-operative care planning decisions.

**Results:** Respondents included representatives of 69 LVAD programs from throughout the U.S. that implanted 64.8% of all U.S. LVADs in 2016. More than 39 psychosocial screening instruments were used. Assessment of family, social and emotional support occurred most frequently (84.1% ( $n = 58$ ) of programs assessed 100% of patients), but assessment was least likely to be conducted with standardized instruments (36.2%). Cognitive dysfunction was the least likely characteristic to be assessed (26.1% ( $n = 18$ ) of programs assessed 100% of patients), but was most often conducted with standardized instruments (53.8% of programs). Twenty seven percent of programs used non-standardized instruments or patient observation. The influence of assessments on clinical decisions to implant an LVAD was most influential in the bridge to transplant pathway with 60% ( $n = 39$ ) of respondents rating it very influential and least influential for patients in the destination therapy pathway with 39.4% ( $n = 26$ ) of respondents.

**Conclusions:** Current psychosocial assessment practices in LVAD programs vary widely and often yield non-standardized, non-comparable data that may lead to variations in care and limit generation of an evidence base for decision making regarding psychosocial eligibility for LVAD implantation.

© 2019 Elsevier Inc. All rights reserved.

### Introduction

Orthotopic heart transplantation remains the gold standard for treatment of patients with advanced heart failure (HF).<sup>1</sup> However, its use is limited by the scarcity of available organs.<sup>2</sup> The increase in the prevalence of HF in the US (approximately 1000,000 new cases each

year)<sup>3</sup> is reflected in increased demand for alternative treatment modalities such as mechanical circulatory support (MCS) systems, including left ventricular assist devices (LVADs). In the US, use of LVADs increased 30-fold between 2006 and 2016.<sup>4</sup> Originally used to bridge patients to transplant, centers now implant LVADs to assist in transplant candidacy determination, and increasingly, for destination therapy.<sup>4,5</sup> This expanded use has raised clinical and ethical concerns regarding the influence of patient selection criteria on clinical outcomes and quality of life.<sup>6,7</sup>

Several studies suggest that psychosocial characteristics of HF and LVAD patients (e.g., depression, functional status, and self-care abilities) contribute to post-operative outcomes including readmission risk and long-term survival,<sup>8–13</sup> but others report little or no impact.<sup>14–16</sup> Despite this discrepancy, many researchers, practitioners

**Abbreviations:** HF, Heart failure; MCS, Mechanical circulatory support; LVAD, Left ventricular assist device; ISHLT, International Society for Heart & Lung Transplantation; INTERMACS, Interagency registry for mechanically assisted circulatory support; SIPAT, Stanford integrated psychosocial assessment for transplantation; PHQ, Patient health questionnaire; BTT, Bridge to transplant; BTC, Bridge to candidacy; DT, Destination therapy

\* Corresponding author at: 2230 Ritter Street, Philadelphia, PA 19125, United States.

E-mail address: [mclancy@mail.usciences.edu](mailto:mclancy@mail.usciences.edu) (M.J. Clancy).

and professional associations consider psychosocial assessment critical in determining candidacy for LVAD therapy.<sup>5,17–19</sup> In 2013, the International Society for Heart and Lung Transplantation (ISHLT) published guidelines for MCS that included four key recommendations for psychological and psychiatric evaluation: “1. All patients should have a screen for psychosocial risk factors prior to MCS 2. All patients should have a screen for cognitive dysfunction prior to MCS; 3. Family, social, and emotional support must be assessed prior to MCS; 4. Patients with a history of significant psychiatric illness who are considered for MCS should undergo a thorough psychiatric and psychological evaluation to identify potential risk factors. (Feldman, et al. 2013, p. 162)”<sup>20</sup>

ISHLT and other organizations provide little guidance on how to conduct psychosocial assessments nor do they provide consensus on what level of impairment in psychosocial functioning or support negatively influences patient outcomes in the LVAD setting. Systematic, robust studies reporting use of psychosocial assessments in LVAD settings are rare, and include many limitations, including abstracts publications with partial description of methods used, descriptions of program specific means to collect assessment data, complication of data retrospectively after implant decisions were made, or were studies conducted for the purpose of evaluating assessment instruments for use in LVAD settings.<sup>8,19,21</sup> Limited information is available on how LVAD programs assess psychosocial function, the ways in which these assessments are used and the impact of these assessments on implantation and postoperative care decisions.<sup>22</sup> Therefore, the purposes of this study were to examine the processes used by US-based LVAD programs to assess the four elements of psychosocial functioning included in the ISHLT guidelines and the effects of psychosocial assessment results on implantation and post-operative care planning decisions.

## Methods

We conducted a cross-sectional survey to obtain information from LVAD programs regarding patient psychosocial assessment practices. Each of the 164 US-based adult LVAD programs listed in the Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) in 2016 was included in our study population. Non-US programs were excluded due to potential regulatory influences and our need to conduct the survey in English. The study protocol was approved by the Institutional Review Board of NAME WITHHELD.

### Questionnaire development

We developed a questionnaire that elicited the credentials of the respondent and the personnel who conducts the assessments, the number of LVAD implanted in adults during 2016 at their center,

the presence of formal (written) or informal (unwritten) policies to guide psychosocial assessment, and the questionnaires/instruments used for assessment (a list of five standardized instruments was provided along with space to add the names of additional instruments used). We also elicited perspectives on the influence of assessment data on implantation decisions for each LVAD treatment pathway (bridge to transplant - BTT, bridge to candidacy - BTC, and destination therapy - DT), using a likert scale and if assessment of psychosocial dysfunction contraindicated LVAD implantation. We also elicited responses to the four psychosocial elements included in the 2013 ISHLT guidelines including the proportion of candidates assessed for psychosocial dysfunction, the importance of assessment results in clinical decisions, usefulness of assessment results in decision-making, barriers to assessment, and if standardized instruments were used for the assessments. The questionnaire was organized into three sections, with fixed choice and fill-in-the-blank questions, as well as likert scale options, and then was reviewed for face and content validity by health care professionals engaged in MCS and HF patient care. Items were adjusted for clarity based on the reviewer's comments. The questionnaire is available in Appendix A. At the conclusion of the survey we provided respondents the opportunity to provide additional comments.

Survey packets including a cover letter, the questionnaire, an incentive (\$10 gift card), and a postage-paid return envelope were mailed to the “LVAD Coordinator” at program addresses listed in INTERMACS. After 4 weeks, packets (without incentive) were re-mailed to non-responding facilities.

### Data analysis

We entered survey responses into SPSS version 24.0 (IBM Corporation, Somers, NY) and computed frequencies, percentages, measures of central tendency, and bivariate statistics. Responses to fill-in the blank questions (position, degrees, instruments) were reviewed and discussed by two researchers to categorize responses. Comments added to the survey are presented in their entirety in this report.

## Results

The sixty-nine programs (42.1% of the 164 programs listed in INTERMACS) that completed questionnaires implanted 1595 LVADs (64.8% of all LVADs implanted in the US) in 2016.<sup>4</sup> Implants per program ranged from 0 to 114 (median: 14). **Table 1** presents the distribution of responding programs by geographic region, presence of Medicare-approved transplant or destination therapy programs, and number of LVADs implanted in 2016.<sup>23,24</sup> We received responses from 29 states and the District of Columbia and each region of the U.

**Table 1**  
Region, annual implants, type of responding LVAD Programs (N = 69).

	U.S. census region			
	Northeast N	South N	Midwest N	West N
Programs listed in INTERMACS	40	56	40	28
Respondeda	18 (45%)	23 (41%)	16 (40%)	12 (43%)
Annual number of implants <sup>b</sup>				
Very low (<10)	10	4	6	7
Low (10–30)	6	9	5	2
Medium (31–50)	1	5	0	2
High (>50)	1	4	3	1
Destination therapy program <sup>a</sup>	17	22	15	11
Heart transplant program <sup>d</sup>	14	19	10	7

<sup>a</sup> No significant difference response by region ( $X^2 = 0.241$ ,  $df=3$ ,  $p = .97$ ), Medicare-approved heart transplant program ( $X^2=3.36$ ,  $df=1$ ,  $p=.08$ ), or Medicare-approved destination therapy program ( $X^2=0.740$ ,  $df=1$ ,  $p=.56$ ).

<sup>b</sup> Category definitions as published by Cowger et al. JACC: Heart Fail 2017;5(10):691–699.<sup>26</sup>

S. No statistically significant difference was noted between responding and non-responding programs by primary U.S. Census Bureau geographic region<sup>25</sup> ( $X^2=0.241$ ,  $df=3$ ,  $p=.97$ ), designation as a heart transplant program ( $X^2=3.36$ ,  $df=1$ ,  $p=.08$ ), or destination therapy program ( $X^2=0.740$ ,  $d=1$ ,  $p=.56$ ). Most respondents self-identified as LVAD/MCS coordinators or directors (65.8%), social workers (12.6%), or “others” (21.6%).

Using the definitions of Cowger et al.,<sup>26</sup> we categorized programs by number of implants performed. Nine (13.6%) were “high”, implanting >50 LVADs per year, eight (12.1%) were “medium” (31 to 50 per year), 22 (33.3%) were “low” (10–30/year), and 27 (40.9%) implanted a “very low” number (<10/year). Thirty-eight respondents (55.1%) reported having written policies to guide psychosocial assessment in their programs. Most assessments were conducted by social workers (75.1%) or psychologists (14.3%), and 10.6% were conducted by other types of healthcare professionals. When conducting assessments, 81.2% of programs used one or more of 39 standardized instruments (Table 2). One program used 10 assessment instruments and several (6.9%) used 3 to 6 instruments, but most used just one. The Stanford Integrated Psychosocial Assessment for Transplantation (SIPAT) was most frequently used (36%), followed by the Patient Health Questionnaire (PHQ) (11.6%), and the General Anxiety Disorder (GAD) (10.1%). Less than a quarter (11.6%) of programs used a structured chart review checklist or system developed within their facilities. Some instruments, like the SIPAT or Psychosocial Assessment of Candidates for Transplant (PACT) are were designed to assess overall psychosocial functioning, others were designed for assessment of specific

**Table 2**  
Instruments used for psychosocial assessment of LVAD candidates as reported by LVAD programs (N = 69)<sup>a,b</sup>.

Selections included by authors on questionnaire	n (%) of programs reporting use
Stanford Integrated Psychosocial Assessment for Transplant (SIPAT) or adapted SIPAT	25 (36%)
Psychosocial Assessment of Candidates for Transplant (PACT)	6 (8.7%)
Psychosocial Levels System (PCS)	2 (2.9%)
Structured Chart Review Checklist	8 (11.6%)
Items added to the questionnaires by respondents	
Patient Health Questionnaire (PHQ) (any version)	8 (11.6%)
Generalized Anxiety Disorder (GAD) (any version)	7 (10.1%)
Montreal Cognitive Assessment (MOCA)	6 (8.7%)
Beck Anxiety Inventory (BAI)	2 (2.9%)
Beck Depression Inventory (BDI)	2 (2.9%)
Society for Transplant Social Work (STSW) Assessment	2 (2.9%)
Trail Making Tests A & B	2 (2.9%)
Transplantation Evaluation Rating Scale (TERS)	2 (2.9%)
Alcohol Use Disorders Identification Test (AUDIT)	1 (<1%)
Boston Animal Naming	1 (<1%)
Brief Coping Scale	1 (<1%)
Category Test	1 (<1%)
Depression in Medically Ill (DMI-10)	1 (<1%)
Duke-UNC Functional Social Support Questionnaire (FSSQ)	1 (<1%)
Hospital Anxiety and Depression Scale (HADS)	1 (<1%)
Millon Behavioral Medicine Diagnostic (MBMD)	1 (<1%)
Mini-Cog	1 (<1%)
Opioid Risk Tool (ORT)	1 (<1%)
Psychosocial Risk Profile Tool	1 (<1%)
Psychosocial Evaluation for LVAD-DT	1 (<1%)
Rapid Estimate of Adult Literacy in Medicine-Revised (REALM-R)	1 (<1%)
Repeatable Battery for Assessment of Neuropsychological Status (RBANS)	1 (<1%)
Stroup Color Word Test	1 (<1%)
Test of Nonverbal Intelligence (TONI)	1 (<1%)
Wechsler Adult Intelligence or Memory Scale (III or IV)* (or one of 7 subscales)	7 (10.1%)
Wide Range Achievement Test (WRAT) (4th edition)	1 (<1%)

<sup>a</sup> Programs may report use of more than 1 instrument.

<sup>b</sup> Instruments presented as written by respondents.

**Table 3**

Reported influence of psychosocial factors on LVAD implant decisions by treatment pathway (N = 69).

Treatment Pathway	Level of influence				
	None-----Strong				
	1	2	3	4	5
	n (%)	n (%)	n (%)	n (%)	n (%)
Bridge to Transplant (n = 65)	0 (0%)	1 (1.5%)	7 (10.7%)	18 (27.7%)	39 (60%)
Bridge to Candidacy (n = 64)	1 (1.6%)	4 (6.3%)	10 (15.6%)	23 (35.9%)	26 (40.6%)
Destination Therapy (n = 66)	0 (0%)	4 (6.1%)	18 (27.3%)	18 (27.3%)	26 (39.4%)

aspects of psychosocial functioning such as depression, anxiety, substance use, or memory in transplant or other settings. In addition to the standardized tools, 27.5% of programs used informal processes (chart review, conversation or observation) alone or in combination with a standardized instrument. Aspects or elements of the informal assessments are unknown.

Table 3 presents the level of influence of the psychosocial assessment results on LVAD implantation decisions by treatment pathway. Assessment results influenced decisions for both BT and DT this influence was strongest for the bridge to transplant pathway. Poor psychosocial assessment results were considered a contraindication for LVAD implantation at 65.2% of programs and 65.8% reported denying an implant for at least one patient due to psychosocial factors. The number of implant denials due to psychosocial factors is unclear. Many programs reported estimates or ranges (i.e. <5) totaling between 133 and 155 denials. We are uncertain how many assessments were completed or if reported denials were due to psychosocial factors alone or a combination of factors. Increasing number of denials was correlated with increasing number of LVADs implanted ( $r=0.416$ ,  $p=.001$ ).

Table 4 summarizes responses to questions specific to the psychosocial elements noted in the 2013 ISHLT recommendations. When asked to report the percentage of patients assessed for each element, many respondents offered rounded (i.e., 10%, 20%) rather than specific values. We categorized the responses and present frequencies and median values in categories. Most candidates were assessed for psychosocial and family, social, and emotional support (73.9% and 84.1%, respectively assessed 100% of patients), but fewer were assessed for cognitive and psychiatric/psychological functioning (26.1% and 30.4%, respectively). Use of formal, standardized instruments for assessment varied by element from 36.2%–53.8%, as did reasons for not completing assessments. The most commonly selected reason for not completing assessment were “patient too ill” followed by “staff shortage” and “physician deferral,” although several respondents mentioned a lack of assessment tools. Generally, respondents strongly agreed or agreed that assessment results impacted implant decisions, with some variation by psychosocial element. They also generally considered assessment outcomes as very important or important in patient selection and post-operative care decisions.

Additional comments added to the end of the survey by respondents addressed struggles to assess psychosocial function, “can’t wait to see final results - something I think we all struggle with”, with another expressing concerns interpreting assessment results: “I would love to validate an assessment in the LVAD population (no smoking contraindication, etc.). This is a major issue at our organization to effectively quantify social risk. Also, we use MOCA (Montreal Cognitive Assessment) & MMSE (Mini Mental State Exam). I think it is difficult to define meaningful relation to low scores.” They also expressed concerns about safety of implanting LVADs when

**Table 4**  
Reported actions and beliefs regarding ISHLT psychosocial assessment guidelines (N = 69).

Questionnaire item	Response options	ISHLT psychosocial element			
		Psychosocial	Cognitive Dysfunction	Family, Social, Emotional Support	Psychiatric and Psychological
<i>Assessment completed prior to implant</i>	100%	51 (73.9%)	18 (26.1%)	58 (84.1%)	21 (30.4%)
	76–99%	10 (6.9%)	10 (6.9%)	5 (7.2%)	13 (18.8%)
	51–75%	3 (4.3%)	9 (13.0%)	0 (0%)	4 (5.8%)
	26–50%	2 (2.9%)	8 (11.6%)	1 (1.5%)	8 (11.6%)
	0–25%	1 (1.5%)	19 (27.5%)	3 (4.3%)	19 (27.5%)
	Missing	2 (2.9%)	5 (7.2%)	2 (2.9%)	4 (5.8%)
<i>Standardized tool use</i>	Yes	34 (49.3%)	37 (53.8%)	25 (36.2%)	35 (50.7%)
<i>Rationale for not completing assessment, if any:</i>	Lack of time	1 (1.5%)	5 (7.2%)	1 (1.5%)	4 (5.8%)
	Staff shortage	2 (2.9%)	4 (5.8%)	1 (1.5%)	10 (6.9%)
	Patient too ill	13 (18.8%)	24 (34.8%)	6 (8.7%)	18 (26.1%)
	Physician defers	0 (0%)	13 (18.8%)	0 (0%)	8 (11.6%)
	Patient poor candidate	3 (4.3%)	1 (1.5%)	1 (1.5%)	3 (4.3%)
	No tool available	0 (0%)	8 (11.6%)	2 (2.9%)	2 (2.9%)
<i>Assessment outcome impacts implant decision in our facility</i>	Strongly agree	21 (30.4%)	16 (23.2%)	27 (39.1%)	19 (27.6%)
	Agree	29 (42.0%)	24 (34.8%)	20 (30.0%)	25 (36.2%)
	Undecided	9 (13.0%)	15 (21.7%)	12 (17.4%)	14 (20.3%)
	Disagree	3 (4.3%)	3 (4.3%)	2 (2.9%)	2 (2.9%)
	Strongly disagree	1 (1.5%)	1 (1.5%)	0 (0%)	0 (0%)
	No response	6 (8.7%)	10 (6.9%)	8 (11.6%)	9 (13.0%)
<i>Importance in decision making regarding patient selection for implant</i>	Very Important	31 (44.9%)	21 (30.4%)	38 (55.1%)	24 (34.8%)
	Important	23 (33.3%)	22 (31.9%)	19 (27.5%)	23 (33.3%)
	Moderately important	5 (7.2%)	11 (15.9%)	4 (5.8%)	13 (18.8%)
	Slightly important	4 (5.8%)	2 (2.9%)	2 (2.9%)	2 (2.9%)
	Not important	0 (0%)	4 (5.8%)	0 (0%)	0 (0%)
	Missing	6 (8.7%)	9 (13.0%)	6 (8.7%)	7 (10.1%)
<i>Improves decision making for patients' post-operative care</i>	Always	25 (36.2%)	18 (26.1%)	32 (46.4%)	33 (46.4%)
	Usually	31 (44.9%)	29 (42.0%)	23 (33.3%)	19 (27.5%)
	Half the time	2 (2.9%)	5 (7.2%)	4 (5.8%)	4 (5.8%)
	Seldom	2 (2.9%)	5 (7.2%)	3 (4.3%)	4 (5.8%)
	Never	1 (1.5%)	1 (1.5%)	0 (0%)	0 (0%)
	No response	8 (11.6%)	11 (15.9%)	7 (10.1%)	9 (13.0%)

psychosocial issues arose: “We have found that even with eval, our medical team will place VAD even if social red flags. This leads to difficult situations that (most times) the VAD coordinator has to deal with or work through to make it safe for the patient who has the VAD.”

## Discussion

Psychosocial assessment practices vary widely among and within LVAD programs. Despite the variation and expressed concerns about the appropriateness of instrumentation and interpretation of results, professionals in these programs value psychosocial assessments and use the results in implant decisions and post-operative care planning. However, there was little standardization and the criteria for psychosocial dysfunction that warrants a decision not to implant an LVAD are not consistently identified.

Use of numerous assessment instruments, including some that are some standardized and others that are components of standardized instruments, as well some developed for use in a single program or institution compromises the ability to determine the validity of the assessment and to compare data across settings. These limitations limit the ability to build a strong evidence base for guideline development, clinical decision making, and post-operative planning. More robust, multicenter data would assist in determining the psychosocial parameters relevant for LVAD patients and if parameters should differ based on treatment pathways. These findings suggest the importance of standardizing these assessments across sites.

Although our respondents considered psychosocial assessment results valuable to patient selection and influential in implantation and post-operative care decisions, completion of assessments, use of standardized instruments, and the impact and influence of

assessment results varied widely according to whether participants were considered for destination therapy or bridge to transplant and by the psychosocial elements listed in the 2013 ISHLT guidelines. Cognitive dysfunction and psychiatric/psychological assessments were the least likely of the psychosocial components to be assessed and the data were the least likely to influence implant and post-operative care decisions. Severity of patient illness and physician deferral were the most commonly cited reasons for omitting these assessments. A large proportion of patients with HF (25–75%) present with some pre-existing cognitive dysfunction.<sup>27–29</sup> A few studies reported that 20%–60% of LVAD patients experienced a rise in neurocognitive function post-implant.<sup>30–32</sup> Although it is not well documented if LVAD staff expect a rise in cognitive functioning, but if they do, perhaps it is a reason for less assessment of cognitive function among our respondents.

The influence of psychosocial assessment results on clinical decisions also varied by treatment pathway (BTT, BTC, & DT) and were deemed most influential for BT (bridge to transplant) candidates, perhaps because of the strong value placed on pre-transplant assessments, the limited supply of organs, and the availability of assessment tools developed for use in the context of transplant decisions.<sup>11,33</sup> Assessment results were deemed less influential in implant decisions for “destination therapy” pathway patients, possibly because the supply of LVADs is not as limited as transplantable organs, few assessment instruments have been evaluated for use in the LVAD setting, and limited guidance on what is considered acceptable psychosocial risk.<sup>11</sup> Discussion and debate about the ethical issues resulting from this therapy (particularly about benefit versus harm) continues and may influence consideration of psychosocial functioning in decisions about such implants.<sup>7,34–36</sup>

In this study, the staff reported an estimated cumulative 133 to 155 (approximately 8–10% of implants) denials due, at least in part, to patients' psychosocial functioning. Published literature regarding the impact of psychosocial factors on denials for LVAD implants is scarce. Future research should identify the processes and criteria for decision making in this area.

Our respondents placed a high value on psychosocial assessment, but several reported frustration with the lack of consensus about how to interpret findings or the level of influence assessments have on implant decisions in specific centers. This, along with lack of agreement among professional organizations or in published guidelines on how to complete or interpret assessments in the LVAD setting leaves each program to define their own standards and practices. As a result, patients with HF presenting to LVAD programs may be more or less likely to receive a life-saving or life-extending device based solely on somewhat arbitrary, program-based practices.

The variations in practice were most evident in the use of standardized assessment instruments. Forty-six percent of our respondents did not use standardized instruments. Among those that did, many (>39) different instruments were used, few of which were developed for use in the context of LVAD decision-making, and many of which assess only specific components of psychosocial functioning (such as alcohol/drug use, memory, and intelligence), which provides a narrow focus of assessment. Programs appear to rely on assessment instruments or practices designed for use in transplant programs. However, increasing use of LVADs in non-transplant pathways<sup>4,5</sup> suggests that further research to examine both the impact of psychosocial function and assessment tools to assess future LVAD candidates.

Several factors limit our study and interpretation of its findings. We limited our study population to US programs operating in 2016. We did not have a listing of coordinators by name or email address which prohibited distribution by email or personalized mailings. The generic program address coupled with the complexity of hospital departments likely influenced receipt of our survey packets) and, therefore, our response rate. Although our response rate was lower than desired, the respondents did represent those programs conducting a majority of LVAD implants in 2016. Response and reporting bias is possible, but we did receive responses from each region of the country and from large and small programs and some programs reported practices that diverged from the professional guidelines, suggesting that bias may be minimal. We did not include the bridge to recovery or other LVAD treatment pathways in the questionnaire, as the number of such implants was small.<sup>4</sup> We did not collect results of individual patient assessments or patient outcomes and are therefore, unable to report on the impact of psychosocial functioning on patient outcomes. Even if we had collected such data, given the variation in practices, processes, and instrumentation used among our respondents, it is unlikely we could have completed such analysis. We chose not to define what constitutes a "poor" psychosocial assessment and therefore respondents used their programs' definitions when answering our questions. Finally, in the time since our data were collected, a new set of ISHLT/APM/AST/ICCAC/STSW recommendations for psychosocial evaluation, including a core set of content and domains for patient assessment for MCS/LVAD support, was established.<sup>37</sup> Our findings do not represent adoption, implementation, or impact of the new recommendations.

## Conclusion

We determined that the US-based LVAD programs vary widely in the psychosocial assessment practices for LVAD candidates. Variation was present among institutions and also within institutions with regard to the four principle psychosocial elements included in the 2013 ISHLT guidelines and by the three major treatment pathways (bridge to transplant, bridge to candidacy, and destination therapy).

The variations in practice produce limit our ability to develop a robust evidence base from which to examine the influence of elements of psychosocial functions on patient outcomes and guide programs as they make determinations about individual LVAD candidates.

## Acknowledgments

We thank the donors to Mayes College at University of the Sciences for funding of the Dean's research Grant program, Audrey Holmes, MA, from Edanz Group for editing a draft of this manuscript, and the LVAD coordinators who participated in this study.

Financial support was received from a Dean's research support grant from Mayes College at University of the Sciences.

## Disclosure statement

The authors have no conflicts of interest to disclose.

## Supplementary materials

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.hrtlng.2019.02.003>.

## References

- Korewicki J. Cardiac transplantation is still the method of choice in the treatment of patients with severe heart failure. *Cardiol J*. 2009;16(6):493–499.
- Stewart GC, Stevenson LW. Keeping left ventricular assist device acceleration on track. *Circulation*. 2011;123:1559–1568.
- Benjamin EJ, Virani SS, Callaway CW, Chamberlain AM, Chang AR, Cheng S, et al. Heart disease and stroke statistics – 2018 update: a report from the American Heart Association. *Circulation*. 2018;137:e67–e492.
- University of Alabama at Birmingham, The Data Collection and Analysis Center. Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS): Quarterly statistical report 2016 Q4. [http://www.uab.edu/medicine/intermacs/images/Federal\\_Quarterly\\_Report/Federal\\_Partners\\_Report\\_2016\\_Q4.pdf](http://www.uab.edu/medicine/intermacs/images/Federal_Quarterly_Report/Federal_Partners_Report_2016_Q4.pdf). Accessed 1 May 2017.
- Kirkpatrick J, Wieselthaler G, Strueber M, St John Sutton M, Rame J. Ventricular assist devices for treatment of acute heart failure and chronic heart failure. *Heart*. 2015;101:1091–1096.
- Rizzieri AG, Verheijde JL, Rady MY, McGregor JL. Ethical challenges with the left ventricular assist device as a destination therapy. *Philos Ethic Humanit Med*. 2008;3(20):1–15.
- Cai A, Eisen HJ. Ethical considerations in the long-term ventricular assist device placement. *Curr Heart Fail Rep*. 2017;14(7):1–6.
- Maltby M, Flatterly M, Burns B, Salyer J, Weinland S, Shah K. Psychosocial assessment of candidates and risk classification of patients considered for durable mechanical circulatory support. *J Heart Lung Transplant*. 2014;33(8):836–841.
- Zipfel S, Schneider A, Wild B, Lowe B, Junger J, Haass M, et al. Effect of depressive symptoms on survival after heart transplantation. *Psychosom Med*. 2002;64:740–747.
- Farmer SA, Grady KL, Wang E, McGee EC, Cotts WG, McCarthy PM. Demographic, psychosocial, and behavioral factors associated with survival after heart transplantation. *Ann Thorac Surg*. 2013;95:876–883.
- Snipelisky D, Stulak J, Schettle S, Sharma S, Kushwaha S, Dunlay S. Psychosocial characteristics and outcomes in patients with left ventricular assist device implanted as destination therapy. *Am Heart J*. 2015;170(5):887–894.
- Smedira N, Hoercher K, Lima B, Mountis M, Starling R, Thuita L, et al. Unplanned hospital readmissions after Heartmate II implantation. *JACC: Heart Fail*. 2012;1(1):31–39.
- Akhter S, Macrangelo M, Valeroso T, Singh A, Rich J, et al. Psychosocial risk as a predictor of survival following LVAD implant. *J Heart Lung Transplant*. 2013;32(4S):S132.
- Rodriguez A, Wehbe R, Anderson A, Ghafourian K, Okwuosa I, Wilcox J, et al. Impact of psychosocial characteristics on survival in patients undergoing left ventricular assist device (LVAD) implantation. *J Cardiac Fail*. 2018;24(8):S123–S124.
- Lundgren S, Lowes B, Zolty R, Burdorf A, Raichlin E, Um J, et al. Do psychosocial factors have any impact on outcomes after left ventricular assist device implantation? *ASAIO*. 2018;64(4):e43–e47.
- Bui Q, Braun OO, Brambatti M, Gernhofer YK, Hernandez H, Pretorius V, et al. The value of Stanford integrated psychosocial assessment for transplantation (SIPAT) in prediction of clinical outcomes following left ventricular assist device implantation. *Heart & Lung* 2018; in press.
- Coglianesi E, Samsi M, Liebo M, Heroux A. The value of psychosocial factors in patient selection and outcomes after heart transplantation. *Curr Heart Fail Rep*. 2014;12:42–47.

18. Petty M, Bauman L. Psychosocial issues in ventricular assist device implantation and management. *J Thorac Dis.* 2015;7(12):2181–2187.
19. Yost G, Bhat G, Ibrahim K, Karountzos A, Chandrasekaran M, Mahoney E. Psychosocial evaluation in patients undergoing ventricular assist device implantation using the Transplant Evaluation Rating Scale. *Psychosomatics.* 2016;57(1):41–46.
20. Feldman D, Pamboukian S, Teuteberg J, Birks E, Lietz K, Moore S, et al. The 2013 International Society for Heart and Lung Transplantation Guidelines for mechanical circulatory support: executive summary. *J Heart Lung Transplant.* 2013;32(2):157–187.
21. Maldonado JR, Dubois H, David E, et al. The Stanford Integrated Psychosocial Assessment Tool (SIPAT): a new tool for the psychosocial evaluation of pre-transplant candidates. *Psychosomatics.* 2012;123–132.
22. Bruce C, Delgado E, Kostick K, Grogan S, Ashrith, Trachtenberg B, et al. Ventricular assist devices: a review of psychosocial risk factors and their impact on outcomes. *J Card Fail.* 2014;20(12):996–1003.
23. Centers for Medicare & Medicaid Services. *Medic-Approv Transplant Prog 2018*; <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandCompliance/Downloads/ApprovedTransplantPrograms.pdf>. Accessed 1 December.
24. Centers for Medicare & Medicaid Services. *VAD Destinatio Therap Facilit 2018*; <https://www.cms.gov/Medicare/Medicare-General-Information/MedicareApprovedfacilitie/VAD-Destination-Therapy-Facilities.html>. Accessed 1 December.
25. United States Census Bureau. *Geography Atlas – Regions - Geography.* 2015. <https://www.census.gov/geo/reference/webatlas/regions.html>. Accessed 8 December 2018.
26. Cowger J, Stulak J, Shah P, Dardas T, Pagani F, Dunlay S, et al. Impact of center left ventricular assist device volume on outcomes after implantation. *JACC: Heart Fail.* 2017;5(10):691–699.
27. Vogels RL, Scheltens P, Schroeder-Tanka JM, Weinstein HC. Cognitive impairment in heart failure: a systematic review of the literature. *Euro J Heart Failure.* 2007;9:440–449.
28. Dodson JA, Truong TN, Towle VR, Kerins G, Chaudhry SI. Cognitive impairment in older adults with heart failure: prevalence, documentation, and impact on outcomes. *Am J Med.* 2013;126:120–126.
29. Pressler SJ, Subramnian U, Kareken D, Perkins SM, Grdus-Pizlo I, Sauve MJ, et al. Cognitive deficits and health related quality of life in chronic heart failure. *J Cardio Nurs.* 2010;25:189–198.
30. Petrucci RJ, Rogers JG, Blue L, Gallagher C, Russell SD, Dordunoo D, et al. Neurocognitive function in destination therapy patients receiving continuous-flow vs. pulsatile-flow left ventricular assist device support. *J Heart Lung Transplant.* 2012;31:27–36.
31. Shapiro PA, Levin HR, Oz MC. Left ventricular assist devices: psychosocial burden and implications for heart transplant programs. *Gen Hosp Psychiatry.* 1996;18S:30–35.
32. Petrucci R, Kushon D, Inkle R, Fitzpatrick J, Twoney C, Samuels L. Cardiac ventricular support considerations for psychiatry. *Psychosomatics.* 1999;40:298–303.
33. Favaloro RR, Perrone SV, Moscoloni SE, et al. Value of pre-heart-transplant psychological evaluation: long-term follow-up. *Transplant Proceed.* 1999;31(7):3000–3001.
34. Bruce CR, Brody B, Majumder MA. Ethical dilemmas surrounding the use of ventricular assist devices in supporting patients with end-stage organ dysfunction. *Meth DeBakey Card Jour.* 2013;9(1):11–14.
35. Rizzieri AG, Verheijde JL, Rady MY, McGregor JL. Ethical challenges with the left ventricular assist device as destination therapy. *Philos Ethics Humanit Med.* 2008;3:20.
36. Vitale CA, Chandekar R, Rodgers PE, Pagani FD, Malani PN. A call for guidance in the use of left ventricular assist devices in older adults. *J Am Ger Soc.* 2012;60:145–150.
37. Dew MA, DiMartini AF, Dobbels F, Grady KL, Jowsey-Gregoire SG, Kaan A, et al. The 2018 ISHLT/APM/AST/ICCAC/STSW recommendations for the psychosocial evaluation of adult cardiothoracic transplant candidates and candidates for long-term mechanical circulatory support. *J Heart Lung Transplant.* 2018;37(7):803–823.