

## Sharing the Care of Mechanical Circulatory Support Collaborative Efforts of Patients/Caregivers, Shared-Care Sites, and Left Ventricular Assist Device Implanting Centers

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Left ventricular assist devices (LVADs) improve longevity, as well as functional capacity and quality of life in patients with medically refractory heart failure.<sup>1-5</sup> During the 6 years since the US Food and Drug Administration approval of the first commercially available continuous flow LVAD in 2008, the number of patients supported by these devices has grown exponentially. The most recent report from the Interagency Registry for Mechanically Assisted Circulatory Support recorded nearly 2500 North American LVAD implants in 2013 at >150 implanting centers.<sup>6</sup> Approximately 40% of LVADs are implanted as an indefinite form of support (ie, destination therapy [DT]), and nearly half of patients are surviving >4 years.<sup>6</sup> This combination of improved survival and evolving implant strategies has led to an increasing number of LVAD recipients being integrated into the community and we are observing the growth of an ambulatory LVAD population with a unique set of clinical needs.

There are 2 predominant strategies of LVAD implantation. Patients who are not eligible for transplantation because of issues such as advanced age may be considered for an LVAD as DT, implying that they will live the rest of their lives with the LVAD. This is in contrast to patients who undergo LVAD implantation as a temporary support device, to support them while awaiting transplantation. This later strategy is defined as a bridge-to-transplantation, following which, the device will be explanted. Centers implanting LVADs without concomitant transplant programs (designated DT centers) have emerged to provide this therapy, averting the need for travel to more distant transplant centers. Such DT centers operate

in conjunction with a VAD/transplant partner in the care of patients awaiting transplantation. Because LVAD implant centers are frequently remotely located from the patients that they serve, a model of shared-care has developed, whereby the continued care of these patients is shared between the implanting centers and local, shared-care sites. We define a shared-care center as a nonimplanting center that collaborates in the care of LVAD patients with the implanting center (Figure). Similarly, although heart transplant recipients also have clinical needs best cared for over time by providers knowledgeable in transplant medicine, once stable after the transplant procedure, much of their routine care is transitioned back to local providers. The International Society of Heart and Lung Transplantation guidelines for the care of the heart transplant recipients provide recommendations on the principles of shared care after heart transplantation.<sup>7</sup> Recommendations about the shared-care of LVAD recipients are not yet available.

The concept of shared care is grounded on a commitment to patient-centered, advanced heart failure care. Shared-care programs are typically led by a cardiologist with heart failure expertise in collaboration with an advanced practice nurse with subspecialty heart failure training similar to other disease management models.<sup>8,9</sup> Currently, there are no defined criteria for becoming a shared-care site, but basic requirements should include on-site training provided by the LVAD vendor, possessing the necessary equipment required to interrogate the LVAD, and the adoption of a collaborative protocol between the shared-care site and the implanting center. A coordinated effort is necessary to ensure that distribution

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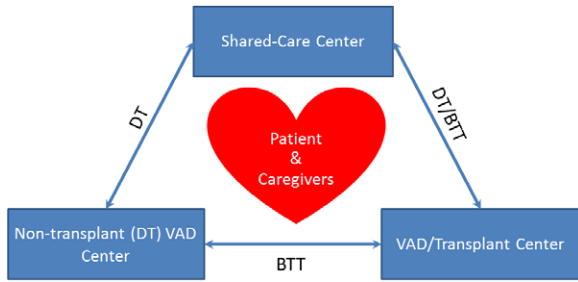
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**Figure.** Shared-care model of left ventricular assist device (LVAD) patient care. Shared-care sites comanage LVAD patients with nontransplant (destination therapy [DT]) as well as transplant/VAD centers. Nontransplant and transplant LVAD centers may comanage patients awaiting cardiac transplantation, whereas DT patients implanted at the nontransplant center are typically managed independently by their implanting center. BTT indicates bridge to transplant.

of care does not result in fragmentation of care. A carefully coordinated shared-care partnership seeks to improve patient access to care and quality of life, with the overarching goal of improving clinical outcomes. In this perspective, we discuss perceived advantages, as well as obstacles to the shared-care model from the view points of the implanting center, shared-care site, and patient (Table 1). We elaborate also on the infrastructure thought to be necessary for a successful shared-care program.

### Implanting Center Perspective

Given the substantial clinical resources used by this medically complex cohort during long-term follow-up, the dramatic and continued rise of the ambulatory LVAD population can

overextend the infrastructure of implanting centers. The multidisciplinary LVAD team personnel are frequently required to function not only as heart failure specialists but also as general cardiologists, primary care providers, and patient resource managers.<sup>10</sup> Thus, the adoption of a shared-care model can reduce the provider/center load of chronic LVAD care.

### Improving Quality of Care in the Early Period After LVAD Implantation

During the early period after LVAD implantation, clinical management of the patient involves optimizing cardiac hemodynamics and end-organ perfusion while simultaneously monitoring for adverse events, such as bleeding and thrombosis. However, a significant component of the index hospitalization is dedicated to patient and caregiver education about LVAD management after the transition to home. Despite significant time spent teaching LVAD-related competencies, anxiety frequently persists about this transition.<sup>11</sup> A shared-care partner with the ability to provide local support offers an additional layer of security for patients, caregivers, as well as providers at the implanting facility. The support of a shared-care site thus has the potential to reduce length of stay if a local team is available to assist in early device monitoring and continued education. Length of stay at the implanting center can also be significantly reduced if the shared-care partner is willing to accept the patient to a local rehabilitation facility where evaluation and teaching can continue. Reduction in length of stay as well as the partnering of ambulatory care allows greater resources at the implanting center to be focused on new evaluations and may increase capacity for new implants.

**Table 1. Potential Benefits and Perceived Concerns of the Shared-Care Model**

	Potential Benefits	Perceived Concerns
Implanting Centers	<ul style="list-style-type: none"> <li>• Extending quality care beyond the walls of the implanting center</li> <li>• Improved allocation of resources by distributing routine post-LVAD care to referring partners</li> <li>• Increase capacity and flexibility for the management of new evaluations and recent implantations</li> <li>• Potential to reduce hospital length of stay given local resources for early monitoring and continued patient education</li> <li>• Increase referral from shared-care sites</li> <li>• Ongoing education of community partners about appropriate patient selection, timing of referral, and pretransfer management preferences of the acutely ill patient</li> </ul>	<ul style="list-style-type: none"> <li>• Transfer of care to a less-experienced center may have a negative effect on institutional outcomes</li> <li>• Shift of revenue from ambulatory visits from implanting center to the shared-care site</li> </ul>
Shared-care Sites	<ul style="list-style-type: none"> <li>• Remain intimately involved in the care of their patients</li> <li>• Become resident experts in the management of patients with LVADs</li> <li>• Increased referral from regional cardiologists as a provider of advanced HF therapies</li> <li>• Maintaining revenue from increased ambulatory visits and potential hospitalizations</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of nurse coordinator (although likely HF nurse with other patient care responsibilities)</li> <li>• Need for repeated in-service training</li> <li>• Cost of LVAD-specific console and peripheral supplies</li> <li>• Perceived liability about practicing outside of scope of expertise for inpatient personnel beyond the core LVAD team</li> </ul>
Patients	<ul style="list-style-type: none"> <li>• Continuity of care and familiarity with the local providers at the shared-care center</li> <li>• Reduced anxiety about easy and immediate access to local experts in MCS care</li> <li>• Reduced financial burden relate to travelling to clinic appointments</li> <li>• Decreased burden of care placed on caregivers</li> </ul>	<ul style="list-style-type: none"> <li>• Initial separation anxiety from implanting LVAD team at time of discharge</li> <li>• Confidence in coordination of care among multiple providers</li> </ul>

HF indicates heart failure; LVAD, left ventricular assist device; and MCS, mechanical circulatory support.

### Improving the Quality of Chronic Care

Shared-care allows the routine care of post LVAD patients to be coordinated between the implanting center and a committed partner in a locale that is usually more convenient for the patient and their caregivers. Once recovered from the surgical implant, this care involves regular visits to monitor for LVAD-specific adverse events and management of the patient's cardiovascular health, including residual heart failure, arrhythmias, and blood pressure. Regular assessment of device parameters, including power, flow and pulsatility, and review of the alarm history ensures proper LVAD function and early recognition of complications.

Nonroutine care can also be tailored between the implanting center and the shared-care site. Some subspecialty resources, however, such as an infectious disease service knowledgeable in the management of LVAD-related infections, are available primarily at the implanting center. Thus, for a problem-focused visit scheduled to evaluate complaints of an irritated driveline, a local mechanical circulatory support (MCS) expert can determine the need for inpatient therapy at the LVAD center versus ambulatory follow up in the infectious disease clinic. In an era where readmissions are a metric linked to performance and there is a necessary societal focus on decreasing the cost of care, local evaluation can obviate the need for distant travel and may avert potentially avoidable readmissions. Regularly scheduled conference calls can ensure that both teams are updated to these clinically relevant events and that all parties are kept abreast of treatment plans. E-mail distribution lists including each center's core team members can also facilitate the transfer of information when patient encounters are alternated between sites.

Beyond direct clinical care, there is additional value derived from the development of a collaborative care agreement between an implanting center and shared-care site. Expansion of these partnerships allows improved understanding of the capabilities and processes of care used by the shared care as well as implanting center. This model extends beyond the delivery of direct LVAD care and provides a framework for delivery of optimal care across the spectrum of advanced heart failure. Patients with advanced heart failure who are not yet in need of LVAD therapy or those who are postcardiac transplantation may also be comanaged in a shared-care program. Similarly, this model can extend the partnership such that the LVAD center serves as a support center for the management of acutely ill patients with cardiogenic shock. An example of this is the emergence of regional extracorporeal membrane oxygenation programs (ECMO), whereby local centers can deploy ECMO for hemodynamic stabilization before transfer to an LVAD facility where additional resources are available to support patients requiring temporary MCS. These partnerships can promote optimal timing of referrals for advanced therapies. Preferences in the management of the acutely ill patient before transfer, such as the initiation of vasoactive therapies or temporary support devices, can become more aligned between implanting and shared-care sites. In addition, open communication between sites may better establish patient and referring provider expectations before referral. This may be particularly important for patients who are not clear candidates for LVAD therapy. By solidifying this relationship, the

shared-care site is more likely to remain committed to referring patients to their shared-care partnered LVAD program as opposed to other regional programs.

Given the relative novelty of the shared-care concept, it is not surprising that providers at implanting centers have mixed opinions about the adoption of a shared-care model for LVAD patients. Some question the value, safety, and economic consequences of sharing care with other centers. Given the complex nature of the therapy, implanting center physicians may be uncomfortable with transferring care to a less-experienced center and may express concern about the programmatic effect of negative outcomes after sharing care. In addition, there is potential that shared-care could increase the cost of care at the implanting center by sharing care only during routine visits and shifting the longer, more complex hospitalizations to the implanting center. Revenue may also decrease via a reduction in office visits, diagnostic testing, and even hospitalizations that may become increasingly diverted to the shared-care sites.

### Shared-Care Center Perspective

For local care providers, teaming with a primary implant center allows them to remain intimately involved in the care of their patients after referral for advanced heart failure therapies including the opportunity to become resident experts in MCS. This has several potential benefits including (1) the ability to maintain continuity of patient care, (2) increase in local referral volume given their identification as an advanced heart failure specialist, (3) reimbursement for follow-up LVAD care, and (4) increased professional satisfaction.

### Partnering in Ambulatory Care

Continuity of care in the ambulatory setting is a patient-centered objective for all healthcare providers and few barriers exist for ambulatory shared-care. A dedicated heart failure specialist is necessary to serve as the local leader for the satellite MCS program. However, a successful shared-care site requires more than an enthusiastic physician-champion. Core to the management of LVAD patients are advanced practice nurse coordinators who form the front line of patient contact and clinical/device trouble shooting. The institution may need to invest in a nurse coordinator to serve as the primary liaison for this population if an advanced practice practitioner cannot otherwise be identified to serve in this role. Responsibilities may vary depending on protocols between implanting centers and shared-care sites. Examples include routine ambulatory LVAD care, management of anticoagulation, and supervision of cardiac rehabilitation. Beyond personnel investment and training, the shared-care site also needs to acquire LVAD-specific equipment to allow assessment of device-related complications (Table 2).

The skill set of ambulatory LVAD patient care requires the intellectual investment of the shared-care team. Physicians and nurses must devote time to become knowledgeable in the monitoring of LVAD recipients, their equipment, and their associated comorbidities/complications. With growing experience, heart failure physicians and advanced practice practitioners can become comfortable with the care of this patient population; however, competencies can be challenging to maintain particularly if LVAD patient encounters are

**Table 2. Potential Criteria for Partners in Shared-Care**

General	<ul style="list-style-type: none"> <li>• Commitment of a designated LVAD team that includes a supervising cardiologist and an advanced practice nurse coordinator</li> <li>• Purchase and maintenance of equipment               <ul style="list-style-type: none"> <li>◦ System monitor, batteries, controller, and power cable</li> <li>◦ Driveline management (dressing) supplies</li> </ul> </li> <li>• Regular, easily accessible bidirectional communication between implant center and the shared-care site</li> </ul>
Education	<ul style="list-style-type: none"> <li>• Initial training in the LVAD evaluation and patient management               <ul style="list-style-type: none"> <li>◦ Preceptorship at implanting center</li> <li>◦ Industry sponsored in-servicing</li> <li>◦ On-line LVAD training modules</li> </ul> </li> <li>• Ongoing education that may include:               <ul style="list-style-type: none"> <li>◦ Periodic symposium whereby the shared-care team observes care at the implanting center with didactic training sessions</li> <li>◦ The implant team travels to the shared-care site for collaborative clinics of shared patients and to provide updates about changes in best practice</li> <li>◦ Annual skills day at the implanting center</li> </ul> </li> <li>• Regular participation in CME activity related to MCS with attendance at scientific meetings focused on the care of LVAD recipients</li> </ul>
Maintenance	<ul style="list-style-type: none"> <li>• Established protocols about routine management practices as well as emergency evaluation</li> <li>• Written policies for common device related complications specific for the implanting site; ie, driveline infection, gastrointestinal bleeding, and arrhythmia</li> <li>• Regular quality assessment of the shared-care patients</li> </ul>

CME indicates continuing medical education; LVAD, left ventricular assist device; and MCS, mechanical circulatory support.

infrequent. Thus, it takes effort and energy to become and remain facile with the device and patient management skills necessary to ensure optimal quality of chronic LVAD care.

The bulk of LVAD patient care is delivered through monitoring visits, where device parameters can be screened, blood pressure managed, and a pertinent review of systems elicited focusing on LVAD alarms, driveline site management, gastrointestinal bleeding, arrhythmias, heart failure, and neurological symptoms. Visits may also be necessary for LVAD-related (but not LVAD specific) cardiac issues including the assessment and management of arrhythmias and right heart failure, which the local heart failure specialist or cardiology team can manage in collaboration with the implanting center. Finally, many ambulatory appointments address common non-LVAD-related complaints that may include problems such as diabetes mellitus management, which could be expertly managed by a generalist with questions directed to the implant team or local MCS specialist as appropriate.

Although the implanting center will often remain the primary contact for after-hours calls and emergencies, in nonemergent cases, patients can usually be safely evaluated by local LVAD experts to aid in the evaluation of common LVAD alarms and complications. LVAD-related adverse events are not infrequent<sup>12</sup>; however, with the exception of neurological events, most are not immediately life threatening and allow time for transfer after local evaluation when necessary. Although LVAD thrombosis can eventually progress to become a life threatening complication, the initial presentation of this adverse event is typically subacute and without evidence of end-organ dysfunction or overt LVAD malfunction.<sup>13,14</sup> Similarly, gastrointestinal bleeding rarely presents with hemodynamic compromise and has not been associated with increased mortality.<sup>15</sup>

Independent of shared-care partnerships, in the event of a medical emergency, patients are typically instructed to present to the nearest emergency department. A local shared-care partner can assist in the education of regional emergency departments as well as first responders. He/she may also be available to assist in the care of the patient presenting to their affiliated emergency

department. Shared-care centers can thus function in a partnering role of extending care, providing focused assessments in consultation with the implanting center. Local experts can recognize markers of abnormal function, including hemolysis, recurrence of heart failure, or aberrancies from baseline parameters. If there are concerns about device function or clinical stability, patients could be transferred to the implanting facility for further management. Rapid local evaluation and transfer in the setting of a malfunctioning LVAD may reduce delays in therapeutic interventions and improve the quality of care for shared patients, although this concept requires prospective study.

Another potential benefit of a shared-care partnership is the care of patients approaching end-of-life. A local MCS partner can serve as an advocate and resource to facilitate the transition to home or to a regional inpatient hospice facility. When a long-term relationship has been established, these providers offer additional support and reassurance to patients and caregivers during this difficult period. In addition, visiting nurses may be unfamiliar with LVADs and a local MCS expert is a valuable liaison to nursing agencies to guide care as patients are transitioned home.

### Partnering in Inpatient Care

A major hurdle to the inpatient care of a shared-care patient is the training of additional nurses, physicians, and ancillary staff who may participate in the care of these patients. The initial training as well as maintenance of competencies requires the financial support of the institution. In addition, despite best efforts, in the absence of continuous application of skills, there may be attrition in knowledge given the lower volume of patients seen at shared-care facilities. Thus, the ability of a shared-care facility to admit an LVAD patient for evaluation requires additional layers of commitment and resources that may not be uniformly available at all shared-care centers. The Joint Commission provides guidelines to implanting centers about the necessary criteria to maintain competency in the care of LVAD recipients. Language is used to identify healthcare providers as VAD-competent versus VAD-aware

depending on the level of care provided. For example, a nurse directly caring for an LVAD patient needs to be competent in device management. However, a physical therapist does not need the same in depth knowledge of device management, but does require an awareness of the device and how its components affect exercise therapy. The Joint Commission does not provide certification to shared-care centers, although site surveyors may ask implanting centers how they ensure competency of their shared-care partners. To ensure patient safety, it should be expected that all providers caring for LVAD recipients be held to a similar knowledge, skill set, and training standard independent of the location of care. Because shared care is an emerging model, it remains undefined whether a threshold volume of encounters in either the acute care or ambulatory setting is necessary to maintain competency in this unique population. In the present era, it remains likely that most acute care will be referred to the implanting center.

However, assuming intact cognition in the setting of an acute illness, LVAD patients are able to independently manage their device and expected to be more knowledgeable about device operation than most healthcare providers outside of the LVAD team. It is possible that the shared-care hospital inpatient team could manage the non-LVAD-related medical issues necessitating hospital admission, whereas the patient and caregivers accept responsibility for the LVAD—a practice already performed at several hospitals across the United States. This is not anticipated to lead to safety concerns given that LVAD recipients are able to live independently at home. Current devices are mechanically reliable and LVAD patients are typically more stable than other patients with advanced heart failure who would not be transferred under similar circumstances.

Avoidance of inpatient transfer may allow increased revenue of the local health system and its providers, particularly for non-LVAD-related conditions. This may be most pertinent for diagnoses that are anticipated to result in brief, uncomplicated hospitalizations or periods of observation. Noncardiac surgical procedures may also be safely accomplished locally depending on the training, comfort, and preferences of the partnering teams and institutions. The majority of LVAD readmissions are because of bleeding (primarily gastrointestinal), cardiac causes (heart failure and arrhythmia), and infection.<sup>16–18</sup> The decision on whether to attempt to manage such complications locally or at the implanting center can be made between the partnering sites and occasionally, transfer may be avoidable. Future society guidelines may define criteria for shared-care competency and the resources necessary to perform noncardiac procedures on LVAD patients.

### Patient Perspective

LVAD patients frequently express that they feel beholden to both their local healthcare team as well as to their new providers at the implanting center. Among the greatest benefits for the LVAD patient in a shared-care program is the ability to receive expert care locally. A local expert knowledgeable in LVAD management and a willing participant in LVAD care can instill confidence in a patient and family during the transition to home. Patient familiarity with the shared-care facility, as well as its proximity to family, friends, and the community in which they live may be a major psychological advantage

that could reduce stress and improve quality of life—assumptions that require prospective investigation. A potential limitation, however, is that after a prolonged hospitalization at the implant center, there may be apprehension on behalf of patients and caregivers about a transition to a less-experienced LVAD team. As appropriate, patients require reassurance about the skill set and LVAD competency of the local team as well as reassurance about the collaborative sharing of patient information and ongoing partnership in medical decision making.

Moreover, there may be increased willingness on behalf of the ambulatory patient to seek medical attention if concerns arise. Given the time and economic burden frequently required to travel to the implanting center, the threshold to seek help may be reduced if a local expert provider is available. Travel expenses include the cost of gas, parking, lodging, and lost wages from missed work on behalf of patients and caregivers. Furthermore, the majority of patients with advanced heart failure have been dependent on family and friends for the many years that they have had chronic illness.<sup>11,19,20</sup> Consequently, patients have a strong desire to regain independence and to reduce the burden on caregivers. Thus, with improvement of their heart failure syndrome after LVAD placement, the ability to independently travel short distances to their clinic appointments is often welcomed. It is plausible that some patients could delay or even entirely avoid seeking care if travel time is exorbitant. Similarly, realizing that the patient has spent significant periods of time hospitalized and are frequently apprehensive about readmission, caregivers may be more likely to suggest a visit to the local LVAD team should they have concerns about a problem such as an irritated driveline.

Finally, a shared-care program creates a local community of patients with advanced heart failure, enabling patients to form regional support networks. Because the density of LVAD patients in a given location is likely to be small, a regional hub for MCS makes it easier for patients to meet other LVAD recipients during clinical encounters. Shared-care centers can thus facilitate communication between patients so that they can share their experiences about living with heart failure, LVADs, and subsequent transplantation. These conversations can help to further guide the shared decision-making process before LVAD implantation.

### Proposed Criteria for Shared-Care Programs

Currently, there are no data about the effect of the shared-care model on clinical outcomes, including death, rehospitalization, or LVAD-related complications. The concept of improving patient satisfaction and quality of life while maintaining optimal clinical outcomes should be a common goal for implanting and shared-care centers. To ensure optimal delivery of care, it will be necessary to define criteria for being a partner in a shared-care model (Table 2). The role and expectations of the implanting center as a support structure for the satellite MCS team, the requirements of the shared-care site, and the criteria for maintaining competency all require clear definition that ideally will be supported by society guidelines. Mutually agreed on protocols should be established to ensure consistency of care as well as open, bidirectional flow of information.

### Personnel

Shared-care centers should have a designated cardiologist to centralize the care of LVAD patients at that site. Although it is anticipated that the local LVAD specialist will be a cardiologist with expertise in heart failure, formal training in advanced heart failure and transplant cardiology (AHFTC American Board of Internal Medicine certification) is not a Joint Commission requirement for LVAD cardiologists at DT-certified implanting centers. A primary heart failure nurse coordinator is another essential member of the shared-care site team. This individual typically serves as the primary point of communication for both patients as well as providers at the implanting center.

### Education

Before engaging in shared care, training is necessary to learn the principles of management of LVAD patients and their devices. Initial training typically includes a preceptorship at the implanting institution and it is recommended that the shared-care team spend time monitoring the care of LVAD patients in both the inpatient and outpatient settings. Observing care in both clinical settings provides exposure to routine LVAD management as well to the diagnosis and troubleshooting of complications. This time spent observing care at the implant center is valuable in preemptively answering questions that may arise for a team not yet experienced with LVAD management. In addition, these visits should be used to review and develop shared-care protocols. Preceptorships serve to engender mutual trust as well as teamwork and collaboration between shared-care partners. To further bolster knowledge, the LVAD vendor should provide on-site training at the shared-care center reviewing topics that include device monitoring and equipment management. On-line training modules are additionally available for clinicians through vendor Websites to reinforce understanding of patient monitoring and alarm troubleshooting.

To maintain competency during the chronic phase of LVAD care, the local institution should invest in the annual education of their MCS team. Cardiologists and nurses engaged in LVAD care should participate regularly in MCS-related continuing medical education activities, including conferences focused on LVAD management: examples include the Heart Failure Society of America and International Society of Heart and Lung Transplantation annual scientific sessions. Many implanting centers also offer annual continuing medical education programs focused on advanced heart failure therapies in collaboration with their shared-care partners. Clinical specialists from industry vendors can be further used to provide annual in-servicing to LVAD teams.

Other models that aid in the maintenance of competency include scheduling of periodic seminars at the implanting facility, whereby the shared-care team can again directly observe care or participate in VAD skills day training sessions. Alternatively, an arrangement whereby a team from the implanting center regularly costaffs a clinic at the shared-care site may be beneficial. These collaborative clinics provide updates about shared patients and provide opportunity to review protocols or changes in clinical practice. In addition, arranging for shared-care patients to be seen during these

collaborative visits allows patients to witness their care teams working collaboratively. Some centers report cross-credentialing of shared-care providers, whereby the local VAD cardiologist attends on the inpatient service at the implanting center, thus allowing a regular rotation on a higher volume LVAD service. These models serve to solidify relationships between the shared-care partners and to foster communication between teams.

### Equipment

Shared-care sites should be able to interrogate and troubleshoot simple device-related alarms. Basic interrogation requires a device console, as well as spare controller, power cable, batteries, and battery charger. The number of required units should be determined by the number of patients followed at the shared-care site as well as the level of care provided at that center. For sites participating in both inpatient as well as ambulatory care, additional equipment will be necessary for the inpatient setting. Other supplies are necessary for driveline management.

### Limitations

The viewpoints in this article represent the experience of its authors and require confirmation through prospective study. Despite the lack of data available to guide best practices, shared-care is being actively delivered across the United States. The effect of shared care on clinical outcomes including quality of life as well as adverse events requires systematic investigation. Data are not available on the financial implications of this model to the implanting center, shared-care site, or patient/caregiver. Whether legal ramifications exist for this model of care has also not yet been defined. We hope that this article serves as a stimulus to promote outcomes research into this disease management model and provokes discussion at the society level to provide guidance on how to best deliver shared care.

### Summary

Implant center clinical resources are becoming taxed by the growing volume of ambulatory LVAD patients and the rapid growth of this unique population has led to the emergence of MCS shared-care centers. The successful sharing of care with local MCS providers is necessary to allow the continued expansion of this technology to a broader patient population that may otherwise lack adequate access to this life-saving technology. These satellite partnerships facilitate the care of LVAD patients who may be unduly burdened by the distance separating their homes from the implanting centers. This model also allows for a more confident transition from hospital to home.

Sharing of care, however, is unlikely to end at the ambulatory level. Because clinical experience grows, common inpatient diagnoses may eventually be comfortably managed by local sites. Implanting centers that develop a solidified partnership with an experienced shared-care center could be anticipated to increasingly promote specialized care such as endoscopy services being delivered locally, thus avoiding unnecessary readmissions. Providing these resources in closer proximity to home would be expected to improve both patient

and caregiver's quality of life. Collaborative efforts are necessary to monitor outcomes to ensure that these assumptions are correct. Pivotal to the success of any shared-care relationship is transparent communication that allows identification of potential barriers to care and facilitates the shared objective of improving outcomes. Commitment to a shared-care model by all parties, including patients/caregivers, local providers, and the implanting team, empowers a model of patient-centered, advanced heart failure care focused on quality of life in addition to quality of care.

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KEY WORD: ambulatory care ■ disease management ■ left ventricular assist device ■ shared care

### Sharing the Care of Mechanical Circulatory Support: Collaborative Efforts of Patients/Caregivers, Shared-Care Sites, and Left Ventricular Assist Device Implanting Centers

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