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Topics and Trends in the Evolving Field of Preventive Cardiology

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This themed issue of the *Rhode Island Medical Journal* highlights ongoing activities in the evolving field of Preventive Cardiology. The section was developed by Guest Editor **DR. WEN-CHIH (HANK) WU**, Chief of Cardiology at the Providence VA Medical Center (VAMC) and Medical Director of the Miriam Hospital Cardiovascular Rehabilitation Center. In 2008, under Dr Wu's guidance, the Division of Cardiology at the Alpert Medical School of Brown University launched one of the first preventive cardiology fellowships in the United States, which, since its inception, has graduated 18 physicians, some of whom remain in Rhode Island and have joined the ranks of the Alpert Medical School.

The program, which is described in the theme's opening article, **The Landscape and Trends in Preventive Cardiology and its Training,** focuses on training in cardiac rehabilitation, the application of exercise physiology and stress testing towards disease detection, risk stratification, and exercise prescription and the skills required to perform population-based outcomes' research towards the prevention of heart disease.

Ambulatory Intravenous Diuretic Clinic Associated with Short-Term Risk Reduction in Mortality and Rehospitalizations in Patients Discharged with Heart Failure is a non-randomized retrospective study which reviews the format and benefits of an outpatient IV diuretic clinic for heart-failure patients staffed by a multi-disciplinary team, including cardiology fellows, RNs, PharmDs, and clinical social workers.

Telehealth has been a long-standing feature of VA care, especially in underserved areas and even before the COVID-19 pandemic. **Review of Telehealth Solutions for Outpatient Heart Failure Care in a Veterans Health Affairs Hospital in the COVID-19 Era** describes the well-established and varied telehealth options for cardiac care within the VA system and which is especially suited to the present pandemic situation.

Home-based cardiac rehab is a unique aspect of VA rehab programs. **Important Personal Values of Veterans Enrolled in Home-Based Cardiac Rehabilitation** describes the motivational factors that contribute to a successful home-based rehab experience.

Taking a page from the VA playbook during the recent shutdown, **Transition to Home-Based Treatment Plans for Center-Based Cardiac, Pulmonary, and Vascular Rehabilitation during COVID-19** describes the successful transformation of the Lifespan center-based program to a home-based plan for a period of two months, until the shutdown was lifted.

Promoting Social Connectedness among Cardiac Rehabilitation Patients During the COVID-19 Pandemic and Beyond explores efforts to mitigate the effects of social distancing through home-based programs which offer remote coaching, supervised exercise training, and support to cardiac patients during the COVID-19 crisis.

Finally, a brief rundown of the varied list of authors and contributors for this themed issue underscores the multidisciplinary nature of Preventive Cardiology, which includes physicians, nurses, exercise physiologists, pharmacists, behavioral psychologists, nutritionists and substance abuse experts, all working together to provide a comprehensive approach to complex cardiac patient care.

Author

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The Landscape and Trends in Preventive Cardiology and its Training

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KEYWORDS: ASCVD, congestive heart failure, pulmonary hypertension, curriculum development, preventive cardiology

INTRODUCTION

Atherosclerotic cardiovascular disease (ASCVD) is the leading cause of death independent of gender and ethnicity in the United States (US) and is estimated to result in a staggering $273 billion economic burden annually.[1] Guideline-directed medical therapy (GDMT) in the primary and secondary prevention of ASCVD has afforded our aging population with increased survival times. Nonetheless, the epidemiology of cardiovascular disease is transitioning from ASCVD alone to include the growing prevalence of heart failure.[2] Despite advances in GDMT, the mortality from heart failure remains high.[3] The traditional model of prevention focusing on ASCVD is insufficient to meet our current needs and highlights the need for innovative training regimens within preventive cardiology.

In light of this public health priority, the opportunities to train in preventive cardiology continue to grow. Fifteen programs were first identified in 2012[4], with an additional 4 programs in 2017 for a total of 19.[5] We sought to provide an updated list of programs that also included their core focus. A total of 24 programs were identified utilizing the search methods as described by Pack et al.[4] Even with the continuous growth of cardiovascular disease, the Accreditation Council for Graduate Medical Education and American Board of Medical Specialties do not officially recognize preventive cardiology as a subspecialty. Without accreditation, preventive cardiology fellowships lack a standardized curriculum which has created heterogeneous training experiences.

It is critical that preventive cardiologists are adept in interpreting research outcomes from different disciplines that span from mental health, behavioral change, nutrition, exercise science, substance abuse, clinical pharmacology and population health, among others; and translate them into clinical practice for the benefit of their patients. Programs tend to fall into one of two dichotomies, either blending clinical and research training or solely focused on research typically in one of the disciplines of prevention such as hypertension, lipidology, atherosclerosis, subclinical atherosclerosis imaging or cardiac rehabilitation (**Table 1**).

DIVISION OF CARDIOLOGY AT BROWN ONE OF FIRST TO LAUNCH PREVENTIVE FELLOWSHIP

In 2008 the Cardiology division at the Alpert Medical School of Brown University launched one of the first preventive cardiology fellowships in the US. In collaboration and support with the Brown University's general cardiology fellowship, the preventive cardiology fellowship offers two tracks. One is a 2+2 track where the fellow is trained for 2 years in preventive cardiology and related research, and another 2 years in general cardiology. To date, 2 physicians have graduated under this track. The second track offers preventive cardiology training alone, either for 2 years of training in preparation for a future general cardiology fellowship or 1 extra year of training after the general cardiology fellowship. To date, the second track has graduated a total of 18 physicians. Some graduates have continued to serve the Rhode Island community as cardiology faculty within the Alpert Medical School.

At the inception of the fellowship the vision was to equally emphasize the clinical and research components of preventive cardiology. The core of the fellowship was structured around a robust clinical experience where the fellows rotate in general cardiology, heart failure and pulmonary hypertension clinics. As our population ages, patients are at an increased risk of cardiopulmonary co-morbidities which may lead to underdiagnosed pulmonary hypertension. The fellows are actively involved in a multi-specialty pulmonary hypertension clinic staffed by both pulmonary and cardiology. Studies have shown that these combined efforts lead to improved diagnosis and supportive care measurements in this patient population with high mortality.[6]

CARDIAC REHABILITATION TRAINING PROGRAMS

The fellows also staff one of the largest center-based cardiac rehabilitation facilities in the Northeast that is comprised of two geographically and structurally distinct programs. One follows the standard cardiovascular rehabilitation curriculum set forth by the American Association of Cardiovascular

Table 1. Cardiovascular Disease Prevention Fellowships in the United States

Program	Training Experience	Research Focus	Prerequisite
Baylor College of Medicine Houston, Texas	Clinical / Research	Lipid and Atherosclerosis	Internal Medicine
Brigham and Women's Hospital /West Roxbury Veterans Affairs Medical Center, Boston, MA	Clinical / Research	Aspirin for primary prevention, Cardiovascular genetics	Internal Medicine
Brown University / Providence Veterans Affairs Medical Center Providence, RI	Clinical / Research	Diabetes, Heart Failure, Cardiovascular Rehabilitation and Imaging	Internal Medicine
Cedars-Sinai, Los Angeles, CA	Clinical / Research	Women's Heart Disease and Health	Internal Medicine, OB/GYN, Family Medicine
Cedars-Sinai, Los Angeles, CA	Clinical / Research	Hypertension and Vascular Biology	Internal Medicine
Emory University, Atlanta, GA	Clinical / Research	Lipid, Diabetes, Nutrition, Metabolic Syndrome	Internal Medicine
Hartford Hospital, Hartford, CT	Clinical / Research	Exercise Physiology, Sports Medicine, Statin Myopathy, Cardio-oncology	Internal Medicine, Cardiology
Mayo Clinic, Rochester, MN	Clinical / Research	Pulmonary Hypertension, Heart Failure, Cardiovascular Rehabilitation	Cardiology
New York University, New York City, NY	Clinical / Research	Lipid, Diabetes, Atherosclerosis	Internal Medicine
Saint Luke's Mid America Heart Institute, Kansas City, KS	Clinical / Research	Lipid, Diabetes, Hypertension, Exercise Physiology, Atherosclerosis	Internal Medicine, Cardiology
Bronx Hospital Veterans Affairs New York City, NY	Clinical / Research	Hypertension, Metabolic Syndrome, Vascular Dementia	Internal Medicine
University of Minnesota Minneapolis, MN	Clinical / Research	Lipid, Women's Health, Biomarkers of vascular structure and function	Cardiology
UT Southwestern Dallas, Texas	Clinical / Research	Premature and familial cardiovascular disease, primary and secondary prevention	Internal Medicine
Brigham and Women's Hospital/Harvard Medical School, Boston, MA	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
Johns Hopkins Bloomberg School of Public Health, Baltimore, MD	Research	Epidemiology of Cardiovascular Disease	Doctoral, Non-clinical Postdoctoral Fellowship
Northwestern University Chicago, IL	Research	Epidemiology and Preventive Cardiology	Doctoral, Non-clinical postdoctoral fellowship
Oregon Health and Science University, Portland, Oregon	Research	Lipid, Atherosclerosis	Non-clinical postdoctoral Fellowship
Stanford Hospital, Stanford, CA	Research	Epidemiology of Cardiovascular Disease	Internal Medicine, Preventive Medicine, Psychiatry, Pediatrics
Texas Heart Institute Houston, Texas	Research	Atherosclerosis and Vulnerable Plaque	Non-clinical Postdoctoral Fellowship
University of California San Diego San Diego, CA	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
University of North Carolina Chapel Hill, NC	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
University of Pittsburgh Medical Center, Pittsburgh, PA	Research	Epidemiology of Cardiovascular Disease	Non-clinical Postdoctoral Fellowship
University of Wisconsin Madison, WI	Research	Atherosclerosis Imaging	Internal Medicine, Family Medicine, Cardiology
Wake Forest University Winston-Salem, NC	Research	Epidemiology of Cardiovascular Disease	Doctoral, Non-clinical Postdoctoral Fellowship

and Pulmonary Rehabilitation (AACVPR)[7], and the other executes the intensive cardiac rehabilitation curriculum from Dean Ornish Heart Disease Reversal® program.[8] The breadth of experience allows exposure to varied program structures and settings, nuanced exercise prescriptions and the physical and mental improvements made possible, which is invaluable when evaluating the natural history of cardiovascular disease.

INTRAVENOUS DIURETIC CLINIC

One unique feature of the fellowship is that each fellow is also responsible for an Intravenous Diuretic clinic. The clinic is modeled after the outpatient Oncology infusion suite for chemotherapy and tailored to the goal of administering same-day ambulatory intravenous diuretics. In this way, heart failure patients receive frequent volume assessments with the goal of averting an emergency room visit or heart failure hospitalization. The benefit of this experience is clinically meaningful for both the patient and the trainee, since hospitalizations for heart failure have a cumulative risk in mortality for these patients.[9]

PERFORMANCE AND INTERPRETATION OF STRESS TESTING

An integral part of preventive cardiology is the application of exercise physiology and stress testing towards prevention, disease detection, risk stratification or exercise prescription. Therefore, fellows receive extensive training in the performance and interpretation of stress testing, both pharmacologic and exercise, with and without imaging. Furthermore, some fellows undergo additional instruction in the quantification of coronary artery and aortic valve calcification by Computed Tomography or interpretation of cardiac MRI as part of their research. The imaging opportunities within the program continue to expand with the addition of cardiac pyrophosphate nuclear imaging to diagnosis cardiac amyloid, an increasingly common finding in the heart failure clinic.

POPULATION-BASED OUTCOMES RESEARCH

Fellows are rigorously trained in the scientific method in order to conduct population-based outcomes research. Every fellow is taught how to independently create statistical models that demonstrate which factors have relationships with exposure and outcomes of interest. Fellows routinely conduct analysis using national databases such as the Coronary Artery Risk Development in Young Adults (CARDIA), Jackson Heart Study and the registry of the AACVPR, to name a few. The goal is to nurture physicians who can critically examine the current medical literature and weigh the risks and benefits of current preventive cardiology practices to improve patient outcomes.

Lastly, the epidemiological trends of cardiovascular pathologies and preventive practices require a multidisciplinary approach. The fellows are trained in an inclusive ethos and learn to work with nursing, exercise physiologists, pharmacists, behavioral psychologists, nutritionists and substance abuse experts to provide comprehensive care. Bi-weekly multi-disciplinary research conferences are held to learn the viewpoints from different disciplines. Multidisciplinary clinical heart failure meetings occur to review all heart failure discharges, staffed by cardiology, home care nursing, home-based cardiac rehabilitation, and palliative care, to coordinate the needs and address the underlying pathophysiology of heart failure patients to prevent future hospitalizations.

CONCLUSION

As the need of our aging patient population becomes more complex, the need for a balanced clinical and research training in preventive cardiology continues to grow. Until a standardized curriculum is enacted, training programs have to evolve and adapt to the change of disease patterns and population health. As preventive cardiology programs strive to equip the modern physician with the knowledge and skills to comprehensively serve our patients with cardiovascular disease, it is necessary that the current and future preventive cardiology fellowships incorporate both clinical and research aspects in the curriculum to experience further growth and success.

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Conflicts of Interest

The authors have no disclosures to declare.

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Ambulatory Intravenous Diuretic Clinic Associated with Short-Term Risk Reduction in Mortality and Rehospitalizations in Patients Discharged with Heart Failure

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ABSTRACT

BACKGROUND: Data on effectiveness of ambulatory intravenous (IV) diuretic clinics for volume management in patients with heart failure to prevent rehospitalization and mortality are limited. Therefore, the primary goal of this research is to evaluate the effectiveness of an outpatient multidisciplinary IV diuretic clinic versus standard observational hospitalizations of less than 48 hours for decompensated heart failure on the time to rehospitalization or death.

METHODS: A retrospective cohort study of patients with heart failure (n=90) at the Providence Veterans Affairs Medical Center was conducted. Patients were included in the analyses if they received at least one ambulatory IV diuretic clinic visit or an observational hospitalization of less than 48 hours for decompensated heart failure between January 1, 2014 and June 30, 2016. Using Cox proportional hazards modeling, we compared the time to any hospitalization or death between the IV clinic and the observational hospitalization cohort over 180 days of follow-up.

RESULTS: In the ambulatory IV diuretic clinic group, 27 patients (mean age 78.3 ± 8.3 years) received a median of 3 (interquartile range [IQR] 2-12), IV diuretic treatments. In the comparison group, 63 patients (mean age 80.3 ± 11.0 years) were hospitalized for observation for 48 hours or less during the same time period. Adjusting for age and imbalances in baseline characteristics, left ventricular ejection fraction and enrollment in hospice care, the hazards of any hospitalization or death (HR 0.39, 95% confidence interval 0.19 to 0.83) were reduced for patients in the ambulatory IV diuretic clinic versus those in the observational hospitalization cohort.

CONCLUSIONS: In patients with decompensated heart failure, an ambulatory IV diuretic clinic was associated with risk reduction of any rehospitalization or death over 180 days of follow up when compared to a strategy of observational hospitalization for less than 48 hours. Future research should prospectively analyze outpatient IV therapy in a larger and more diverse population.

INTRODUCTION

An estimated 6.2 million Americans reported having a diagnosis of heart failure.[1] Heart failure accounts for 809,000 hospitalizations annually in the United States.[1] Approximately 21.4% of patients admitted to the hospital with a primary diagnosis of heart failure were readmitted within 30 days and 53.2% of patients were readmitted within 180 days of discharge.[2] More than half of these readmissions were determined to be preventable.[3]

Ambulatory intravenous (IV) diuretic clinics for volume management in patients with heart failure have been found safe and effective at promoting significant urine output,[4,5] weight loss[6] and improvement in dyspnea.[7] This strategy may provide an alternative to hospitalization for the management of heart failure patients. Data on the effectiveness of this strategy to prevent rehospitalization and mortality are limited, especially as compared to standard observational hospitalization care admissions. Therefore, the primary goal of this research is to evaluate the effectiveness of an outpatient multidisciplinary IV diuretic clinic versus standard observational hospitalizations of less than 48 hours for decompensated heart failure on the time to rehospitalization or death.

METHODS

Study Design

A retrospective analysis of consecutive patients treated for heart failure in either the ambulatory IV diuretic clinic or by way of an observational hospitalization of 48 hours or less at the Providence Veterans Affairs (VA) Medical Center between January 1, 2014 and October 1, 2016 was conducted.

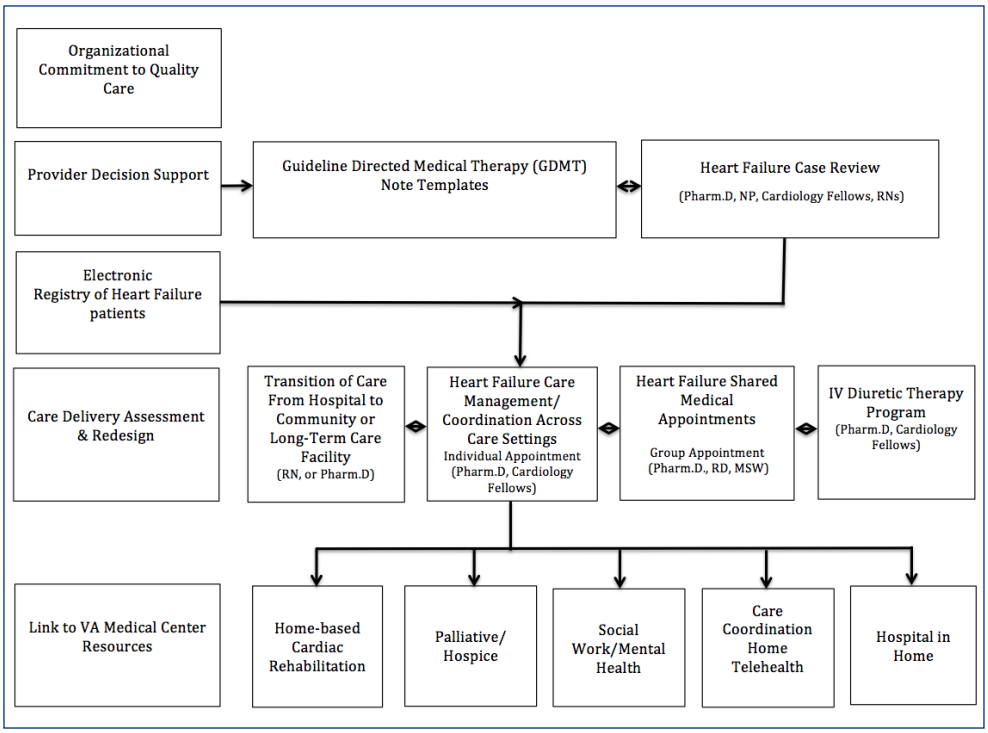
Study Patients

Patients were included in the analyses if they were previously discharged from the Providence VA Medical Center with a primary diagnosis of decompensated heart failure and had a least one treatment in the ambulatory IV diuretic clinic or were re-admitted for a less than 48 hours observation period for treatment of decompensated heart failure after their heart failure discharge. Time "0" was set at the moment the patient required one of the two interventions (IV diuretic clinic or observational hospitalization of <48 hours). Each patient was followed for 180 days since the moment they received the intervention.

Setting

The organization of the heart failure care program at the Providence Veterans Affairs Medical Center is shown in **Figure 1**. The goal of the heart failure care program is to improve health status and to decrease hospitalizations and death for patients with an established history of heart failure. The heart failure care team was designed using the tenets of the chronic care model and is comprised of a cardiologist, cardiology fellows, nurse practitioners, registered nurses and clinical pharmacists who provide medication optimization, self-management education, disease state monitoring and care coordination.[8] As per local VA policy all patients who were hospitalized with a primary diagnosis of heart failure were referred to the heart failure care program by cardiology or the inpatient treatment team. Prior to discharge the patient would receive an inpatient transition of care appointment by either the heart failure nurse or clinical pharmacist trained in heart failure care management. The transition of care appointment consisted of brief heart failure education and medication reconciliation. An appointment in either the individual heart failure care program, shared medical appointment group program or outpatient IV diuretic program would be scheduled depending upon the individual patient's needs. Patients who were assigned to receive heart failure care management in the individual clinic received a 30-minute face to face appointment with a clinical pharmacist or cardiology fellow if they refused to be seen in a group setting or did require immediate post-discharge diuresis. Each visit included patient education, behavioral modification, disease state monitoring and medication optimization. The shared medical appointment program consisted of 2-hour group sessions that met weekly for 4 weeks.[9] The first half of each session focused on self-management education provided by a nurse, registered dietician, social worker or clinical pharmacist. During the second half of each session the clinical pharmacist performed a brief physical exam to assess volume status and provided medication optimization. The ambulatory IV diuretic was staffed by cardiology fellows or a clinical pharmacist and provided an alternative to inpatient admission for IV diuretic therapy for patients with mild to moderate decompensated heart failure. Patients could also be referred to the IV diuretic clinic from the individual heart failure clinic appointment or the heart failure shared medical appointment program at the discretion of the heart failure provider. The frequency of outpatient IV diuretic treatment was determined at the discretion of the treating provider but was generally held once weekly. Providers in the heart failure individual clinic, heart failure shared medical group appointment program and IV diuretic program also provided care coordination and referred patients to home-based cardiac rehabilitation, palliative or hospice care, social work or mental health, home telehealth monitoring or the hospital in-home program on an as needed basis.

Figure 1. Heart Failure Program Overview



Interventions

Ambulatory IV diuretic clinic: Patients in the IV diuresis cohort received IV loop diuretics for hypervolemia in the outpatient setting. As per the Providence VA Medical Center's protocol, the following items were assessed: vital signs, weight, EKG, laboratory values (basic metabolic panel, heparinized potassium, brain natriuretic peptide (BNP), digoxin levels [if indicated], and magnesium levels). Urine output was recorded hourly and upon the conclusion of IV diuresis therapy. Referral to self-care education, advanced care planning and palliative care were made when applicable.

Observation admission cohort: The observation admission cohort received an evaluation and initial treatment for hypervolemia in the emergency room followed by an inpatient hospitalization of less than 48 hours in duration as per the discretion of the treating emergency

room physician. Emergency room physicians did not have the ability to directly refer to the ambulatory IV diuretic clinic but could refer to the heart failure clinic program for further follow-up and subsequent diuresis.

End Points

Electronic medical records were reviewed for patient outcomes. The primary endpoint was the time to all-cause rehospitalization or death. The secondary endpoint was the time to heart failure rehospitalization or death.

Covariates

Patient demographics, comorbidities and laboratory values were also abstracted from the electronic medical record. Patients were considered to have a history of hypertension, hyperlipidemia, chronic obstructive pulmonary disease, pulmonary hypertension, atrial fibrillation, type 2 diabetes mellitus, obstructive sleep apnea, or stroke if it was documented in the medical record prior to the index event or the patients were receiving active treatment specific for the disease states. Patients were considered to have a history of coronary artery disease if they had documented evidence of a myocardial infarction, prior cardiac stent, or a prior cardiovascular bypass graph. Blood pressure, heart rate and body mass index (BMI), BNP, estimated glomerular filtration rate (eGFR) and potassium and serum creatinine values were abstracted upon presentation to the initial index event and again within seven days post completion or discharge. Patients were considered to be current users if active tobacco use was documented during the index event encounter. The most recent low-density lipid profile level prior to the patients index event was abstracted for the analysis. Antihypertensive medication use was ascertained at the initial ambulatory care IV diuretic visit or upon presentation for an observational hospitalization admission. Antihypertensive medications were categorized into the following classes: angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, β-adrenergic blockers, calcium channel blockers, thiazide diuretics, loop diuretics, and potassium sparing diuretics.

Statistical Analysis

The baseline characteristics of patients who were seen in the ambulatory IV diuresis clinic and those admitted for an observational heart failure hospitalization of less than 48 hours were compared using a t test for continuous variables and Chi-square test for categorical variables. Cox proportional hazards modeling was used to compare the time to all-cause rehospitalization or death and the time to heart failure rehospitalization or death adjusting for variables imbalanced at baseline (BMI, obstructive sleep apnea, COPD, use of loop diuretics), as well as, age, eGFR, left ventricular ejection fraction (LVEF), and hospice enrollment. Our result model had adequate discrimination and calibration for the study population (Harrell C=0.62). Kaplan-Meier curves were used to estimate freedom of hospitalization or death between the two cohort arms. We tested the proportionality of hazards assumptions for the Kaplan-Meier curves by visual inspection and analysis of the Schoenfeld residuals.[10] The proportional hazards assumption was confirmed for the primary analysis (P=0.39).

RESULTS

Between January 1, 2014 and June 30, 2016, 167 patients were discharged from the Providence VA Medical Center with a primary diagnosis of decompensated heart failure. Of those patients, 77 were excluded from our analyses because they did not receive a follow-up treatment in either the outpatient IV diuretic clinic or an observational hospitalization of <48 hours. A total of 27 unique patients received a median of 3 interquartile range (IQR 2–12) diuretic treatments in the ambulatory IV diuretic program. The median total urine output for those treated in the ambulatory IV diuretic clinic was 2525.0 mL (IQR 1075-9830mL). Over the same time period 63 patients were admitted for an observational hospitalization of <48 hours with a primary diagnosis of decompensated heart failure (**Figure 2**). Seven of the patients in the observational hospitalization of <48 hours cohort were subsequently referred by a heart failure clinic providers to receive ambulatory IV diuretic treatment and received an average of 12.3 ± 12.1 treatments over the 180 days of follow-up.

Baseline characteristics were similar between the two cohorts; however, patients in the observational admission of <48 hours group tended to be older, had significantly lower BMI levels and were less likely to have a diagnosis of chronic obstructive pulmonary disease (COPD) or Obstructive Sleep Apnea (**Table 1**).

When compared to those patients in the observational admission cohort, those patients in the ambulatory IV diuretic cohort had a lower unadjusted hazard ratio of

Figure 2. Consort Study Flow Diagram

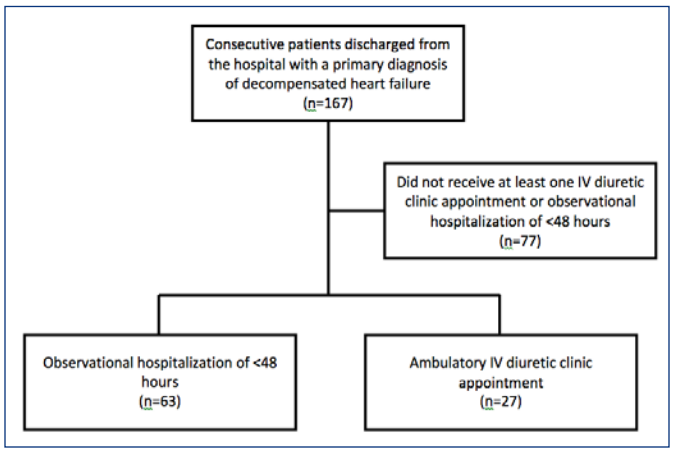


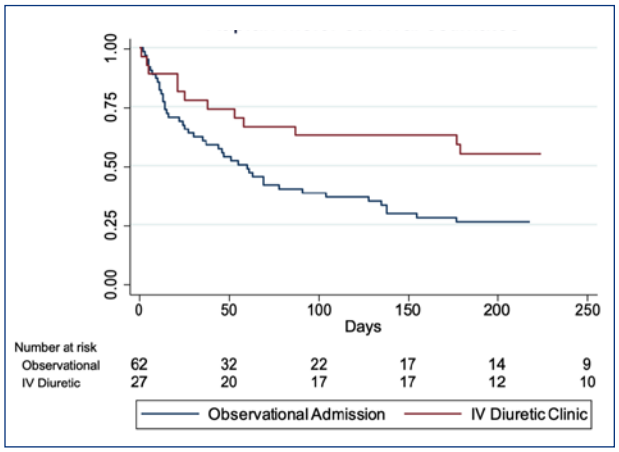
Table 1. Baseline Characteristics

	Admitted for Observation (n = 63)	IV Diuresis (n = 27)	P value
Age (years)	80.3 ± 11.0	78.3 ± 8.3	0.40
Male Sex, n (%)	61 (96.8)	27 (100.0)	0.35
Caucasian, n (%)	60 (95.2)	27 (100.0)	0.25
Ejection Fraction at Discharge (%)	45.4 ± 14.2	46.1 ± 12.7	0.82
HFrEF, n (%)	18 (28.6)	10 (37.0)	0.43
Coronary Artery Disease, n (%)	49 (77.8)	22 (81.5)	0.69
COPD, n (%)	18 (28.6)	14 (51.9)	0.03
Atrial Fibrillation, n (%)	44 (69.8)	17 (63.0)	0.52
Type 2 Diabetes Mellitus, n (%)	32 (50.8)	15 (55.6)	0.68
Obstructive Sleep Apnea, n (%)	16 (25.4)	16 (59.3)	<0.01
Pulmonary Hypertension (%)	10 (15.9)	9 (33.3)	0.06
Hypertension, n (%)	58 (92.1)	25 (92.6)	0.93
Hyperlipidemia, n (%)	56 (88.9)	24 (88.9)	1.00
Depression, n (%)	20 (31.8)	16 (59.3)	0.02
Current Tobacco User, n (%)	7(11.1)	4(14.8)	0.62
BMI (kg/m2)	28.8 ± 5.7	32.6 ± 7.9	0.01
Systolic Blood Pressure (mmHg)	126.3 ± 20.9	120.1 ± 19.7	0.19
Diastolic Blood Pressure (mmHg)	70.0 ± 10.2	66.7 ± 10.8	0.17
Low Density Lipoprotein (mg/dL)[a]	84.1 ± 34.6	78.0 ± 19.7	0.41
eGFR (mL/min/1.73m2)	49.5 ± 22.7	40.3 ± 15.7	0.06
Serum Creatinine at Discharge	1.7 ± 1.0	2.1 ± 1.4	0.21
BNP(pg/mL)	965.7 ± 814.5	664.7 ± 940.5	0.13
Hospice, n (%)	10 (15.9)	3 (11.1)	0.56
ACEi or ARB, n (%)	39 (61.9)	15 (55.6)	0.57
Beta Blockers, n (%)	(82.5)	23 (85.2)	0.76
Loop Diuretics, n (%)	49 (77.8)	26 (96.3)	0.03
Calcium Channel Blocker, n (%)	17 (27.0)	5 (18.5)	0.39
Spironolactone, n (%)	6 (9.5)	4 (14.8)	0.46
Isosorbide Mononitrate, n (%)	8 (12.7)	5 (18.5)	0.47
Hydralazine, n (%)	5 (7.9)	4 (14.8)	0.32
Thiazide Diuretic, n (%)	3 (3.5)	4 (14.8)	0.10
Statin, n (%)	49 (77.8)	23 (85.2)	0.42
Fish Oil, n (%)	3 (4.8)	0	0.25
Aspirin, n (%)	50 (79.4)	20 (74.1)	0.58
Warfarin, n (%)	21 (33.3)	8 (29.6)	0.73
Direct Oral Anticoagulants, n (%)	3 (4.8)	1 (3.7)	0.82
Antiarrhythmic, n (%)	4 (6.40	1 (3.7)	0.62
Digoxin, n (%)	3 (4.76)	2 (7.4)	0.62
Magnesium Oxide, n (%)	1 (1.6)	3 (11.1)	0.05

All values expressed as mean ± standard deviation unless indicated otherwise
a = (n=58 Observation, n=25 IV Diuretic Clinic)

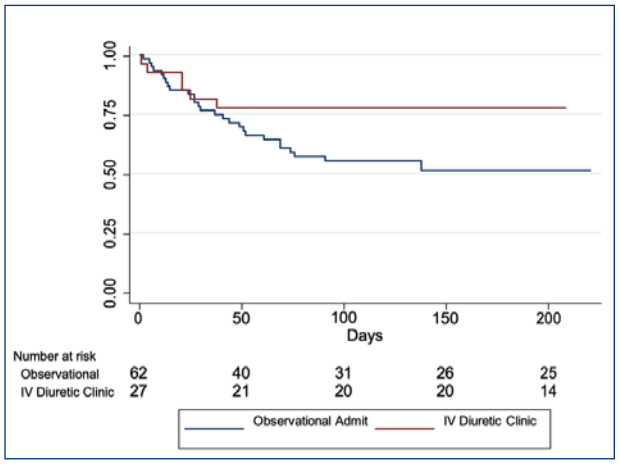
any-rehospitalization or death 0.43 (95%CI 0.23–0.81). After adjustment for age, BMI, diagnosis of OSA, COPD, eGFR, loop diuretic use, LVEF, and hospice enrollment, the adjusted hazard ratio for any rehospitalization or death was 0.43, 95% CI (0.21–0.88) for those who received treatment in the ambulatory IV diuretic therapy as compared to those in the observational admission cohort. **Figure 3** shows the unadjusted Kaplan-Meier survival curves of those in the observational admission cohort and the ambulatory IV diuretic therapy cohorts over 180 days of follow-up. The median number of days to any rehospitalization or death was 38.0, (IQR 21–87 days) for those who received ambulatory IV diuretic therapy as compared with a median of

Figure 3. Kaplan-Meir Survival Curves for Time to All Cause Rehospitalization or Death



Kaplan-Meier curves showing the proportion of individuals without all cause hospital readmission or death over 180 days of follow-up (red curve = Ambulatory IV Diuretic Clinic; blue curve = Observational Admission <48h).

Figure 4. Kaplan-Meir Survival Curves for Time to Heart Failure Rehospitalization or Death



Kaplan-Meier curves showing the proportion of individuals without heart failure hospital readmission or death over 180 days of follow-up (red curve = Ambulatory IV Diuretic Clinic; blue curve = Observational Admission <48h).

27, (IQR 11–68 days) for those in the observational admission cohort. A total of 4 (6.4%) patients in the observational cohort and 2 (7.4%) from the IV diuretic therapy clinic died during the 180 days of follow-up, (p=0.85).

There was also a significant improvement in the risk of heart failure rehospitalization or death, adjusted HR 0.32 (95% CI 0.12–0.84) (**Figure 4**).

DISCUSSION

In patients with mild to moderate decompensated heart failure within the 6-month follow-up period of their previous heart failure hospital discharge, ambulatory IV diuretic clinic was associated with a reduced risk of all cause rehospitalization, heart failure hospitalization or death over 180 days of follow-up when compared to patients who had an observational hospitalization of 48 hours or less during the same time period.

This finding is important because beginning on October 1, 2012, Section 3025 of the Affordable Care Act added section 1886(q) to the Social Security Act establishing the Hospital Readmissions Reduction Program (HRRP). The HRRP requires the Centers for Medicare and Medicaid Services (CMS) to reduce payments to Inpatient Prospective Payment System (IPPS) hospitals with excess heart failure readmissions.[11] Thus, the American College of Cardiology Foundation/ American Heart Association Task Force on Practice Guidelines added a Class I recommendation to utilize multidisciplinary heart failure disease management programs to facilitate implementation of guideline-directed medical therapy, to address barriers to behavioral modification, and to reduce the risk of subsequent rehospitalization for HF for patients at high risk of hospital readmissions.[12]

This work builds on a limited number of studies evaluating the safety and effectiveness of outpatient IV diuretic programs demonstrating symptomatic improvements in dyspnea, hypervolemia with low to non-existent rates of serious adverse events and has the potential to reduce hospitalizations.[4,5,13] Priors studies demonstrating safety and reduction of rehospitalizations utilized board certified cardiologists to perform IV medication managment.[5,13] However, our study is unique in that the providers of the outpatient IV diuretic treatment team could be comprised of a physician, a nurse practitioner or a clinical pharmacist trained in heart failure care management interchangeably to provide IV therapy medication treatments.

There has been a push to provide novel treatment strategies of more complex patients to the ambulatory care setting. The clinical implications of the present study demonstrates the feasibility and safety of a multidisciplinary care providers to prescribe intravenous diuretic therapy and is an attractive alternative to emergency department utilization or observational hospitalizations for patients with mild to moderate decompensated heart failure. It opens up possibilities of different setting for IV diuretic clinic depending on institutional needs. The current study setting is within the outpatient oncology infusion center of the hospital. Possibilities exist for the IV therapy to be provided in a completely outpatient clinic setting or a carved-out section of an emergency room, similar to a "chest pain unit."

There are several limitations to this study. The basic assumption of the current study is that patients who required IV diuretic therapy were similar in disease severity whether they were seen in the ambulatory IV diuretic clinic or hospitalized for 48h observation. The results remained significant despite adjustments for age, BMI and COPD which were different at baseline. However, given the retrospective nature of this study, patients were not randomly allocated to the treatment interventions for which the possibility of residual confounding exists and alternative explanation to study findings cannot be excluded.

The intervention took place at a single center within the Veterans Health Administration and the absolute number of patients is small and relatively homogenous (mostly men). Additionally, heart failure hospitalization information was unavailable for private payer non-VA admissions unless records were forwarded by a non-VA provider. Therefore, it is possible that not all hospitalizations occurring outside of the Veterans Health Administration were fully captured in our data.

CONCLUSIONS

In patients with mild to moderate decompensated heart failure, ambulatory IV diuretic clinic was associated with risk reduction of any rehospitalization or death over 180 days of follow-up when compared to a strategy of observational hospitalization for less than 48 hours. However, future research should prospectively analyze outpatient IV therapy in a larger and more diverse population.

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Review of Telehealth Solutions for Outpatient Heart Failure Care in a Veterans Health Affairs Hospital in the COVID-19 Era

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KEYWORDS: telehealth, veterans health affairs, heart failure, telecardiology

INTRODUCTION

Telemedicine encompasses methods to deliver care using medical devices to collect and transmit health information and has become a key medium to deliver healthcare in the COVID-19 pandemic. The Veterans Health Administration (VA) was an early adapter of telehealth services starting in 2003.[1] Prior to the pandemic, the VA had already established the nation's largest telehealth system. The VA reports over 900,000 veterans used VA telehealth services in 2019 encompassing 2.29 million episodes of telehealth care.[2]

The VA hospital employs a multidisciplinary chronic care model for Outpatient Heart Failure management. Important elements of this model include: 1.) Transition of Care consultation for transition between hospital and home, 2.) IV Diuretic Clinic to provide volume assessment and aggressive diuresis as indicated 3.) Shared Medical Visits to provide self-management education and pharmacologic treatment for heart failure by a multi-disciplinary team, 4.) Heart Failure Clinics to provide close follow-up to veterans at risk for re-hospitalization, 5.) Telemonitoring of weight and vital signs for patients at high risk of decompensation.

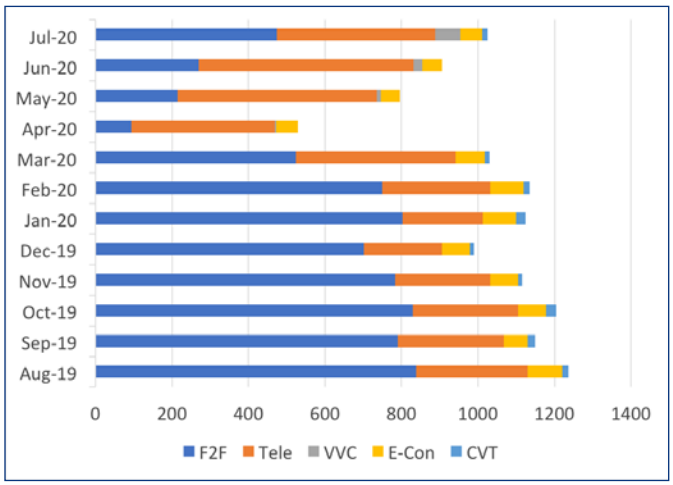
The VA has established several formats for administering care via telecardiology that are now being used increasingly under Centers for Disease Control (CDC) guidance to limit community exposure to SARS-CoV-2. We provide an example of telecardiology using heart failure management at a VA Hospital in New England.

E-CONSULT (ELECTRONIC CONSULT)

If the referral is for a clinical question not requiring face-to-face interaction, it is completed via an e-consult in an asynchronous fashion. A response is provided by the e-consult team within 72 hours. This is performed through a standard clinical workstation with a desktop computer.

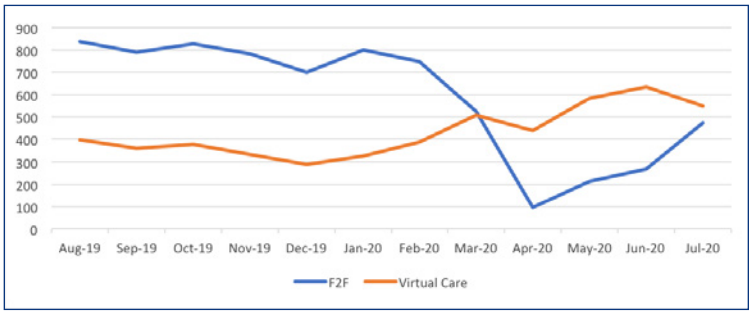
In contrast to other forms of telecardiology, e-consultations have seen a decline since the pandemic. The monthly average fell from 78 encounters to 58 encounters after March 2020. (**Figures 1 and 2**) We suspect that with all non-essential medical procedures and clinic visits on hold, there were fewer referrals from Primary Care and Surgical Services.

Figure 1. Total cardiology encounters by encounter type.



F2F = face to face visit, Tele = telemonitoring, VVC = VA Video Connect, E-Con = e-consult, CVT = clinic video telehealth

Figure 2. Trends for face-to-face (F2F) visits vs virtual care visits.



Sample e-consult:

Mr. C is a 67-year-old male who lives over 40 miles away from the VA with a past medical history of hypertension, hyperlipidemia, diabetes, coronary artery disease and heart failure with reduced ejection. He has gained 10 lbs. and has worsening shortness of breath for the last week, please provide recommendations.

Chart was reviewed and recommendations made for the patient to be worked up with echocardiogram and nuclear stress test. Will provide follow-up in satellite clinic through CVT.

CLINIC VIDEO TELEHEALTH (CVT)

If the patient requires evaluation but is unable to come in for a face-to-face visit, a CVT visit may be scheduled. This is a synchronous method of telecardiology that utilizes an audio-visual (AV) interface to communicate with a satellite VA clinical location.

Providers are equipped with Globalmed® telemedicine stations that run Cisco® software that allow for more streamlined communication with remote sites. (**Image 1**) At the off-site locations an electronic stethoscope is used with Care Tone® IP Management System software (product of AmericanTeleCare®) to transmit heart and lung sounds in real time. A high-definition camera "wand" allows attachments of lenses and to examine the integumentary system in greater detail. (**Images 2,3,** and **Audio file**). Some locations feature the Eko Duo® that allows transmission of heart sounds and a single lead EKG in real time. (**Image 4**).

Image 1. A work station equipped with a Globalmed® telemedicine station that runs Cisco® software, Cisco IP® telephone, a desktop computer, a mouse, keyboard, speakers, and a webcam with a microphone.

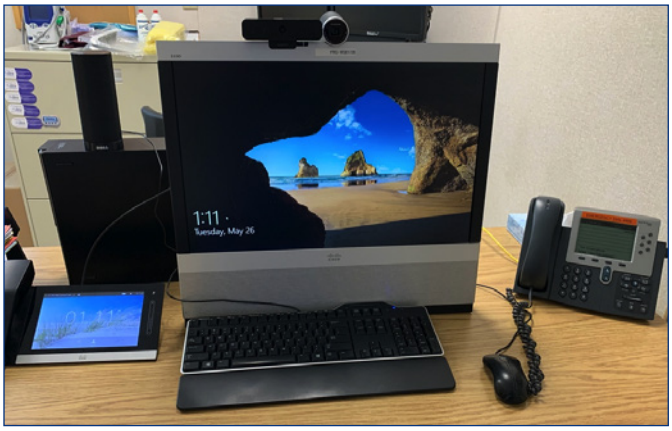


Image 2. A remote workstation equipped with two monitor screens, a desktop computer, a mouse, keyboard, speakers, and a webcam with a microphone. In addition, tools such as an electronic stethoscope and a wand with attachments to examine skin in detail and an otoscope are shown in more detail in Image 3.

Image 3. A closer view of the electronic stethoscope is used with Care Tone® IP Management System software and the high-definition camera "wand" allows attachment with lenses and otoscope.

Image 4. The Eko Duo® that allows transmission of heart sounds and a single lead EKG in real time.

After registering at the off-site location, the patient is accompanied to the exam room by a CVT technician who assists with the physical exam, and cardiac and pulmonary auscultation. The physician then discusses the assessment and plan with the patient and documents the visit.

This format of telecardiology has also seen a decline following implementation of community exposure precautions as it involves the patient visiting the satellite clinic in person. The monthly average has gone from 17 visits to 5 visits since March 2020 (**Figures 1 and 2**).

Sample CVT visit:

Mr. C chose to be seen in the satellite clinic via CVT as he lived greater than 40 miles away from the main VA hospital. The cardiology provider observed that Mr. C was dyspneic walking into the exam room. Testing results were reviewed with Mr. C, which showed a reduced left ventricular ejection fraction and myocardial scar with no ischemia. A physical exam was performed with the assistance of the CVT technician using the electronic stethoscope and camera wand. Bi-basilar crackles and 2+ pitting edema were noted. Guideline-directed medical therapy for heart failure with reduced ejection fraction was started, including oral diuretics. He was further scheduled for an outpatient appointment at the IV diuretic clinic the same week, where he received 1 dose of IV diuretic with 650 cc of urine output and 0.8lbs. of weight loss.

VA VIDEO CONNECT (VVC)

If the patient is unable to or advised not to come into the clinic or offsite location, VA Video Connect (VVC) is used. This is a synchronous format that utilizes AV to communicate with the patient at home. The patient is contacted via telephone by clinic staff to ensure they have a device capable of supporting the AV visit. If not, patients may be mailed an iPad® and in select cases, an Eko Duo® device to conduct the visit. The patient is sent an appointment email with a link that connects to the secure call via VA VVC platform (VA Video Connect). If the patient has a smart phone or computer access, non-VA platforms can also be used such as Cisco Webex™ or Doximity Inc.

There were no VVC visits prior to March 2020. Since then, the numbers have almost tripled every month with a total of 65 VVC visits in July 2020 (**Figures 1 and 2**).

Sample VVC visit:

Mr. C's CVT follow-up appointment with cardiology at the satellite VA site was changed to a VVC appointment due to SARS-CoV-2 restrictions. Given his lack of smart phone or computer access, an iPad® with built-in Internet access was mailed to him along with an eko® device to ensure an adequate cardiology auscultation and rhythm assessment. Training for the use of the iPad® and Eko® device was provided by VA staff at the patient's home.

REMOTE MONITORING

At the VA, patients who may need closer follow-up are referred to telehealth. This is an asynchronous telecardiology modality that is used to monitor heart rate, blood pressure, pulse oximetry, weight and pedometer steps. A large proportion of this population are patients with heart failure that have had a recent hospitalization for an exacerbation of the same. They are issued home monitoring technology called the In-Home Monitoring Device by Medtronic© with Internet-based transmission capability to record these measurements which are then transmitted to the VA. The device also administers a symptom-based survey of the respective disease process, in this case, symptoms of heart failure. An assigned telehealth case manager downloads the patient's clinical data on a periodical basis (daily, weekly, PRN) into the electronic medical records on demand. If critical values were noted, the relevant provider is alerted. This format has seen the most robust increase in numbers since March 2020. From a monthly average of 255 encounters a day from August 2019-February 2020, we are now conducting an average of 458 encounters a day since March 2020 (**Figures 1 and 2**).

Sample remote monitoring visit:

After the VVC visit, Mr. C was identified as being high risk of readmission for a heart failure exacerbation. He was issued a remote monitoring device and asked to monitor daily weights, blood pressures and heart rates. On 7/15/2020 it was noted that his blood pressures were trending lower than usual along a decreasing weight, without shortness of breath. His leg swelling was reported to be down as well. The cardiology provider was alerted of this change and dose reduction in the patient's diuretics was recommended and relayed to him by the telehealth RN. Mr. C has not visited an acute care facility during the COVID pandemic until present.

CONCLUSION

The VA hospital employs a multidisciplinary chronic care model for Outpatient Heart Failure management. The pandemic has made telecardiology an indispensable component of cardiology practice, outnumbering face-to-face visits. Some components of heart failure care such as IV Diuretic Outpatient Clinic are indispensable to provide volume assessment and aggressive diuresis to patients in need. Other aspects can be transitioned to a telecardiology format. Heart failure clinics are being conducted via VVC, patients requiring closer follow-up are being scheduled for remote monitoring in place of nursing visits. With the technology available it is straightforward to obtain a relevant history and physical exam.

With the current uncertain climate, we expect that telecardiology will continue to feature prominently in the delivery of cardiovascular care.

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Important Personal Values of Veterans Enrolled in Home-Based Cardiac Rehabilitation

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ABSTRACT

BACKGROUND: Home-based cardiac rehabilitation (CR) heavily relies on patients' personal motivation to engage in behavior change. Patients' core values (e.g., health, family) may serve as motivational factors to strengthen program engagement. This study sought to identify personal values of veterans participating in home-based CR.

METHOD: Veterans enrolled in a home-based CR program at the Providence VA Medical Center completed a self-report questionnaire assessing core values at intake and completion. Descriptive statistics and non-parametric tests (e.g., Friedman, Wilcoxon sign rank comparisons) were used to assess differences in core value ratings between intake and completion.

RESULTS: Sixty-six patients (72±7 years, 86% white, 97% male) completed the questionnaire. Patients most often rated independence (86%), family (70%), and health (67%) as important values. Value ratings did not change from intake to discharge (*p*s >.20).

CONCLUSIONS: Future research should evaluate whether incorporating values-based activities in home-based CR can improve patient adherence to treatment and outcomes.

KEYWORDS: cardiac rehabilitation, motivation, veterans

INTRODUCTION

Home-based cardiac rehabilitation (CR) is a supervised exercise and cardiac risk factor modification educational approach offered in the home or other nonclinical settings to eligible patients who have limited or no access to center-based CR. Home-based CR in the Veterans Health Administration represents an important accomplishment to increase service delivery capacity and offer greater logistical flexibility for veterans who otherwise would not attend center-based sessions due to transportation or employment-related timing constraints.[1] In the VA system, patients receive the major components of center-based CR, including an exercise prescription and education on nutrition, stress management, and risk factor modification through weekly telephone or video contact with a CR provider over 12 weeks.[2] Home-based CR most notably differs from center-based CR in that exercise supervision and behavior change coaching is provided partially or entirely remotely and therefore more heavily relies on patients' personal motivation to engage in behavior change in light of less face-to-face provider and peer support. Patients' core values (e.g., health, family), or guiding principles that individuals identify as personally important, may serve as motivational factors that shape adherence to cardiac risk factor modification recommendations as affirming one's values can increase individual health behavior change.[3]

Prior research in a center-based cardiac and pulmonary rehabilitation (CPR) program revealed a wide variety of values that motivated program participation with only 50% of CPR attendees citing "health" as an important value driving their program engagement.[4] As home-based CR represents a behavior change opportunity largely focused on improving CVD-relevant health, it may be beneficial to understand whether improving one's health is typically identified as a personally important to the attendees. However, to our knowledge, no prior research has examined the personal core values endorsed by patients in home-based CR, which may differ from CPR participants. In addition, it is unknown whether patient-reported core values change over the course of home-based CR. For example, Ellis and colleagues reported that nearly half of their sample of CPR patients described evolving values over the course of program participation. Some patients initially prioritized health improvement or prevention of health decline; however, values were interpreted to become more variable and personalized over time.[4] Others have also described values change in response to aging[5,6] and life transitions.[7] Greater understanding of whether patient-reported values may change following completion of home-based CR may provide additional insight into patient motivational factors that might enhance patient engagement. Therefore, we sought to (1) identify personal core values in veterans participating in home-based CR and (2) examine whether personal core values change over participation in home-based CR.

METHOD

Sample

Participants were veterans enrolled in a home-based CR program between January 2019 and June 2020 at the Providence Veteran's Affairs Medical Center (VAMC; Providence, RI).

Measures

Demographic and clinical characteristics of the patients were collected by home-based CR staff as part of routine clinical care. Participants also completed a self-report questionnaire of their personal core values as part of clinical intake and discharge assessments. The adapted Chronic Pain Values Inventory (CPVI)[8] measured values across eight value domains including family, friends, health, independence, hobbies/activities/work, spirituality, growth/learning, and intimate relations (e.g., "Being the kind of partner you want to be…") on a 5-point scale ranging from "not at all important" (0) to "extremely important" (5).

Procedure

Patients were referred to home-based CR following hospitalizations with relevant diagnoses, procedures, and/or events (e.g., heart failure, myocardial infarction, coronary artery bypass grafting [CABG]) or through their outpatient cardiology provider. Upon enrollment, patients attended an in-person intake assessment with a nurse practitioner or registered nurse. At the in-person intake visit, the home-based CR staff member also provided the patient with a patient education workbook, hand peddler, pedometer, and resistance band, and provided instructions for a home-based exercise prescription. Following the initial meeting, patients received 12 weekly telephone calls from the home-based CR staff to assess their weekly behaviors related to home exercise, diet, smoking when applicable, weight, and medications. Patients are also provided with education on these topics as indicated. Phone calls lasted approximately 20–30 minutes. Patients returned to the clinic for the discharge assessment at 12 weeks. The study was approved by the Providence VAMC Institutional Review Board.

Analytic Plan

Summary statistics (e.g., means, medians, percentages) were used to describe the sample. The Friedman test was used to test differences in importance ratings across value domains. Pairwise comparisons via Wilcoxon signed rank tests with a Bonferroni correction were used to further evaluate significant Friedman tests. Analyses were conducted in Stata/SE version 14.2.[9]

RESULTS

The demographic and clinical characteristics of the sample are provided in **Table 1**. Sixty-six patients (mean age 72±7 years, 86% white, 97% male) completed the adapted CPVI at intake and program discharge. Most participants were admitted to the program due to heart failure (63%). All participants completed the 12 weekly telephone calls during the home-based CR program.

Table 1. Sample characteristics at home-based CR intake (n = 66).

	Mean (SD) or n (%)
Age	72.06 (7.03)
Male	64 (96.70)
Race/ethnicity (n = 64)	
Non-Hispanic White	55 (85.94)
Non-Hispanic Black	1 (1.56)
Asian	0 (0)
Non-Hispanic Other/Unknown	7 (10.94)
Hispanic	1 (1.56)
Diabetes (n = 64)	27 (42.19)
Hypertension (n = 64)	57 (89.06)
Admission Diagnosis (n = 64)	
Heart failure	40 (62.50)
Coronary artery bypass grafting	7 (10.94)
Percutaneous coronary intervention	7 (10.94)
Stable angina	4 (6.25)
Valve replacement/repair	3 (4.69)
Myocardial infarction	2 (3.13)
Peripheral vascular disease	1 (1.56)

Abbreviations. *SD*, standard deviation; *n*, number of participants

Importance of Core Values at Home-Based CR Intake

At program intake, patients reported independence (n = 57; 86%), family (n = 46; 70%), and health (n = 44; 67%) as their most important values (i.e., rated as "very" or "extremely" important) (**Figure 1**). Spirituality was rated as least important, with 35% rating spirituality as "very" or "extremely" important (n = 23). Friedman tests examining the importance ratings indicated that the ratings were significantly different across the value domains, $\chi^2(7) = 219.12$, $p < .001$. Post-hoc comparisons with a Bonferroni correction indicated that

Figure 1. The proportion of participants who rated each value domain as "very" or "extremely" important at intake and discharge (n = 66).

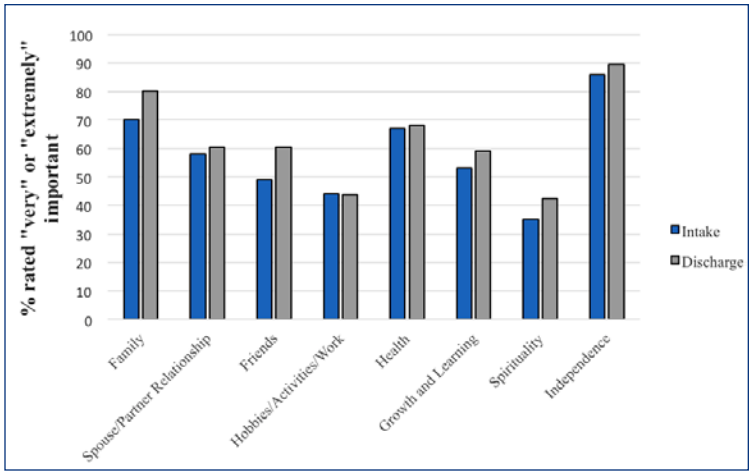

Table 2. Means and Median Ratings on the adapted CPVI (n = 66) at CR intake and discharge.

	INTAKE		DISCHARGE	
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)
Independence	4.18 (0.98)	4 (4–5)	4.26 (0.90)	4 (4–5)
Family	3.89 (1.28)	4 (3–5)	3.97 (1.35)	4 (4–5)
Health	3.79 (1.17)	4 (3–5)	3.83 (1.14)	4 (3–5)
Intimate Relations (e.g., spouse, partner)	3.36 (1.72)	4 (2–5)	3.17 (1.84)	4 (2–5)
Friends	3.27 (1.27)	3 (2–4)	3.36 (1.55)	4 (2–5)
Growth and Learning	3.23 (1.31)	4 (2–4)	3.83 (1.14)	4 (3–5)
Hobbies/Activities/Work	3.02 (1.52)	3 (2–4)	3.36 (1.55)	4 (2–5)
Spirituality	2.36 (1.89)	2 (0–4)	2.48 (1.87)	3 (0–4)

Importance items were rated on a 0 – 5 scale with higher values indicating greater importance in that value domain.
Abbreviation. SD, standard deviation; IQR, interquartile range

independence was rated more highly than friends (z = 4.642, p <.001), intimate relationships (z = 3.33, p <.001), growth and learning (z = -5.09, p <.001), hobbies/activities/work (z = 5.49= , p <.001), and spirituality (z = 5.79, p <.001). Family was rated as more important than friends (z = 3.98, p <.001), growth and learning (z = 3.65, p <.001), hobbies/activities/work (z = 4.36, p <.001), and spirituality (z = 5.63, p < .001). Health was rated more highly than growth and learning (z = 4.04, p < .001), hobbies/activities/work (z = 3.79, p <.001), and spirituality (z = 3.61, p <.001). Friends (z = 3.36, p <.001) and intimate relationships (z =3.81, p <.001) were also rated more highly than spirituality. The importance ratings at intake are presented in **Table 2**.

Importance of Core Values at Home-Based CR Discharge

At program discharge, independence (n = 59, 89%), family (n = 53, 80%), and health (n = 45, 68%) remained the value domains most often rated as "very" or "extremely" important (see **Figure 1**). The pattern of ratings was similar to intake with four exceptions: (1) independence was rated more highly than health at post-test (z = 3.14, p =.002); (2) family was rated more highly than intimate relationships (z = 3.67, p <.001); (3) health was no longer rated more highly than growth and learning (p =.002); and (4) intimate relationships and growth and learning were no longer rated more highly than spirituality (p >.002); The importance ratings at discharge are presented in **Table 2**.

Changes in the Importance of Core Values Over Time

No significant change in the importance of each core value was found from intake to discharge (ps >.23; data not shown).

DISCUSSION

Home-based CR patients most often rated independence, family, and health as highly important values. These findings corroborate and extend prior research with center-based CPR patients showing multiform personal values identified by patients.[4] This research, however, also showed being active, defined by the authors as "regular active engagement in physical, social, and mental tasks, hobbies, etc." (pg. 311) was the most frequently identified value and was endorsed by approximately 70% of participants.[4] Similarly, a national study of veterans found that "activity" was frequently included in veterans' perceptions of successful physical, emotional, and cognitive aging.[10] However, unlike these prior two studies, our response options were not open-ended and perhaps did not fully capture how remaining active physically, cognitively, and emotionally may be important to veterans or may be infused throughout home-based CR attendees' other core values. Veterans in home-based CR may prioritize being active in self-defined ways that do not necessarily clearly map on to a specific hobby, occupation, or volunteer opportunity. Alternatively, uncaptured differences in health status may contribute to the lower importance placed on hobbies, work, and activities in our sample. In addition, our finding that spirituality was the value least often identified as important is inconsistent with prior research showing that religion is an important value for older adults.[11] This finding may have been influenced by sample, geographic, cultural, or site-specific factors.[12,13]

No changes in the value importance ratings were detected from home-based CR intake to discharge. It is possible that age-related value shifts identified in prior work were not observed due to the short duration of the home-based CR program. Additionally, although cardiac events and interventions preceding CR referral likely represent significant health events, and transitions for some, values shifts may have occurred prior to CR enrollment at another point during the illness course. Alternatively, veterans may enter CR with distinct prior life experiences that have cemented or stabilized their values, or uniquely alter the impact that CR may have on their life priorities. Additional research is needed to clarify how veteran status or cardiac history of the sampled patients may have contributed to the observed results.

Clinical Considerations

Values information may be useful to clinicians to engender patient-centered care. Patients may describe themselves as motivated to engage in health behavior change for the purposes of improving their health but improving health may not be the most important value for all patients. Affirming other important values, such as independence, may also promote openness to behavior change, buffer against stress, and increase personal relevance of cardiac risk factor

recommendations.[14,15] However, additional research is needed to clarify whether values identification may create distress when patients are confronted with values for which they are not currently engaging in values-consistent behavior.

Values-based approaches are increasingly incorporated into psychotherapeutic and behavioral health settings and may offer an opportunity to further motivate behavior change through supporting patients in the identification of individualized, values-based goals. For example, Acceptance and Commitment Therapy and Behavioral Activation emphasize the importance of values-guided behavior change. Future research exploring whether and how such principles may be incorporated into the home-based CR protocol is warranted.

Limitations

Our results should be interpreted within the context of the study's limitations. First, our sample size was small, and the results need replication in a larger sample with greater representation of persons of color and women. Second, our results may not generalize to non-veteran samples and center-based CR patients. Third, our self-report survey included limited response options of value domains. Other values not captured by this tool may also be relevant. Future research should examine whether different values or value patterns are associated with CR outcomes. If so, values assessment may assist clinicians in identifying patients at risk of submaximal benefit in the context of competing life priorities.

CONCLUSIONS

Independence, family, and health are important values for veterans enrolled in home-based CR. Future research is warranted to better clarify how identifying individualized core values can assist home-based CR clinicians in delivering patient-centered care and supporting values-driven goal setting as part of cardiac risk factor modification recommendations for veterans.

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Transition to Home-Based Treatment Plans for Center-Based Cardiac, Pulmonary, and Vascular Rehabilitation during COVID-19

HAYDEN RILEY, MS; LOREN STABILE, MS; WEN-CHIH WU, MD, MPH

ABSTRACT

BACKGROUND: Traditional rehabilitation services, whether they are cardiac, pulmonary, or vascular, consist of 6-36 center-based, supervised sessions; however, due to COVID-19, in-person visits were suspended. This study sought to implement a transitional home-based treatment plan (HBTP) to patients.

METHOD: Patients enrolled in a rehabilitation service at the Miriam Hospital during the time of temporary closure were provided with a HBTP that was individualized to their needs and multi-disciplinary in nature. Patients were called weekly for continual guidance and support.

RESULTS: Of the 129 patients that received a HBTP, 115 (89%) participated in follow-up correspondence (63±12 years, 83% white, 66% male, 81% enrolled in cardiac rehab). Nearly 70% of patients continued to participate in regular exercise and upon re-opening, 69 (60%) of patients returned to center-based care. Psychosocial factors appeared to inhibit treatment adherence.

CONCLUSIONS: Patients are receptive to an HBTP and subsequent follow-up throughout temporary closure of rehabilitation services.

KEYWORDS: home-based cardiac rehabilitation, pulmonary rehab, vascular rehab, COVID-19

INTRODUCTION

Cardiac (CR), pulmonary (PR), and vascular (VR) rehabilitation are evidence-based, secondary prevention programs comprised of behavior modification and health education. The following rehabilitation services provide patients with a continuum of care following the diagnosis of heart disease, lung disease, and peripheral vascular disease, in order to reduce rates of morbidity and mortality.[1]

Standard cardiac rehabilitation services in the US include 6 to 36 in-person sessions to be completed over the course of 18 to 36 weeks depending on program involvement and payer coverage. Programs are usually center-based and do not traditionally involve home-based delivery of care; however, due to COVID-19 and consequent stay-at-home orders, many rehabilitation programs were temporarily suspended. As a result, we described the implementation of a quality improvement (QI) initiative in the setting of COVID-19 based on the Plan-Do-Study-Act (PDSA) cycle.[2] The QI initiative was two-fold: (1) preparation and distribution of individualized, home-based treatment plans, and (2) weekly follow-up support and interventions provided by a clinical staff person. The primary purpose of the present QI intervention was to ensure the health and safety of the patient population during temporary closure, while continuing to provide secondary prevention guidance and support to maintain a healthy lifestyle.

METHODS

This is a retrospective report of a QI intervention based on the Deming's PDSA cycle to implement home-based treatment plans for patients enrolled in center-based rehabilitation services at a city site in Rhode Island during a temporary closure between April 6, 2020 and May 27, 2020.

An enrolled patient was defined as a patient that participated in 1 to 11 week(s) of cardiac, pulmonary, or vascular rehabilitation. As of March 31, 2020, center-based rehabilitation services were temporarily suspended due to COVID-19 guidelines and restrictions. At this time, enrolled patients met with their assigned case manager, in person or on the phone, to discuss a temporary home-based treatment plan. A personalized treatment plan was designed for each interested patient and then provided to the patient via mail or e-mail. Upon receiving the treatment plan, patients were called weekly by a staff exercise physiologist for follow-up care.

Home-Based Treatment Plan (HBTP)

A treatment plan was developed for all patients enrolled in a rehabilitation service and was tailored specifically to their needs based upon their referring diagnosis, whether it be cardiac, pulmonary, or vascular, as well as their comorbidities, fitness level, access to home exercise equipment or community resources and their goals. Regardless of diagnosis, each treatment plan consisted of three main domains: exercise, nutrition and psychosocial recommendations.

Within the exercise domain, patients were provided with specific exercise recommendations based upon their entry graded exercise test if applicable, the Frequency, Intensity, Time and Type (FITT) principle, instructions on how to gauge exercise intensity using rating of perceived exertion

(RPE) and heart rate, online exercise resources, and printed resources, including an exercise tracker. Online exercise resources included: "Staying Active during the Coronavirus Pandemic" from the American College of Sports Medicine (ACSM) and videos pre-recorded by the center that were published to the rehabilitation center's private YouTube® channel (www.youtube.com/channel/UCGsVnz92NIzpwkrtMTL-gww). Printed resources included staff-created handouts regarding safe home exercise. The exercise tracker, on paper, provided patients with an opportunity to record their exercise activity, workload, duration, RPE, heart rate, pain level, and additional notes regarding specific dates. Mobile phone applications used to track exercise were encouraged on an individual basis during follow-up phone calls if a patient was interested and capable.

Within the nutrition domain, the staff dietician provided "quick quarantine nutrition tips," various pre-recorded nutrition lectures posted to the centers private YouTube® channel, an abundance of online nutrition resources, a weight tracker, and a food log. Online nutrition resources included: My Fitness Pal®, Calorie King®, Healthy Dining Finder®, Diabetes Food Hub®, nutrition information from the American Diabetes Association, recipes from the American Heart Association, The Garden Grazer® recipes, Minimalist Baker® recipes, Nutrition News® and 2020 Dietary Guidelines.[3] The weight tracker provided was a paper log used to describe the patient's weight on a day-to-day basis and track weight fluctuations. The food log provided patients with a way to record on paper the foods they consumed on each day of the week. Patients were asked to provide specific brand names, sizes, amounts, among other details. Patients were encouraged to follow the template during closure for review by the staff registered dietitian upon rehabilitation re-opening for in-person participation.

Lastly, within the psychosocial category, patients were provided with "Stress Coping Plan for the COVID-19 Pandemic" written by Joel Hughes, PhD, FAACVP, as well as "Keys to Embarking on a Path Toward Reduced Stress and Improved Well-Being" by Mindy, Caplan, ACSM-EP.[4-5] Online resources, such as Gentle Chair Yoga for Beginners & Seniors® were included, along with phone applications and online resources for guided relaxation (Headpsace®, Calm, Mindful.org, Mindbodygreen.com). Instructions on how to start meditation were provided, as well as a paper log that could be used to record the type of relaxation/meditation practiced, and the time spent practicing.

Additional information regarding COVID19 guidelines as it applies to execution of the rehabilitation recommendations, medication compliance, symptom management, self-management tips of diabetes, heart failure and hypertension; energy conservation strategies on activities of daily living, oxygen use and tobacco use, were provided on an individualized basis where applicable. Lastly, the HBTP was provided in conjunction with an education book titled, *Living Well with Heart Disease* or *Living Well with Chronic Lung Disease*, depending on the patient's diagnosis.[6-7]

Follow-up Care

Follow-up contact was provided primarily via telephone; however, email was also used if preferred. Patients were contacted at least one time per week. If contact could not be established within the first three attempts, no further attempt to reach the patient was made.

When a patient was contacted, they were first asked, "What are some of the challenges that you are facing being home every day?" In addition, patients were asked to report their exercise participation, nutrition choices, weight, mental health, and patient-specific goals, such as the management of symptoms, diabetes, heart failure, blood pressure, tobacco use, where applicable, similar to the themes covered during exercise and education sessions by the patient's case manager during the in-person rehabilitation sessions.[8] Additional support and resources were provided to the patient, as needed, and a summary of each call was transcribed into the patient's medical record. Clinical changes were tracked and documented per patient self-report.

Management supervision

Each week, the management of the rehabilitation services facilitated a conference call with the clinical staff to discuss how to improve follow-up care based upon patient progress and barriers. As a result, a list of resources was compiled and distributed to the staff to aid in patient phone calls for subsequent weeks.

RESULTS

Of the 129 patients that were mailed a HBTP package, 120 (93%) responded to follow-up care on at least 1 occasion. Of those 120 patients, 5 (3%) deferred weekly follow-up care, resulting in 115 patients (89%) that were called or contacted by email weekly throughout the closure period. Reasons for deferring follow-up included: lack of interest (2), confidence in ability to progress independently (2), and disinterest in CR services due to copay for center-based program (1) despite these sessions being free to the patient. As a group, the 115 patients were 63 years old (± 11.8), 66% male (n = 76), and 83% white (n = 96), with 93 (81%) enrolled in CR. On average, each patient communicated with a clinical staff person 4 to 5 times (4.56) over the 7-week closure.

Assessment of treatment plan adherence

Of the 115 patients, 80 (70%) reported participating in regular, weekly, home-based exercise. Home-based exercise varied from patient to patient depending upon individual exercise capacity and access to exercise equipment; however, exercise ranged from 2–7 days of participation per week. In addition, 78 patients (68%) tracked one or more

of the following metrics: weight, diet, blood pressure, blood glucose, heart rate, and/or oxygen saturation, with weight being the most commonly tracked variable (69 patients, 60%). Additional resources were provided to patients based upon their personal interests, goals, and reported barriers. Most commonly, patients were provided with additional exercise resources, such as home-exercise handouts, online videos, mobile phone applications, among the most common ones (34 patients, 30%) to overcome the barrier of limited exercise capabilities at home. Furthermore, 25 patients (22%) received additional educational materials, via email or the center's YouTube® channel, beyond what was provided in their HBTP to provide additional support related to patient-specific goals and/or barriers.

For individuals who expressed concern with their weight (8 patients, 9% of CR patients), an online weight loss research study particular to CR patients was offered. Of those 8 patients, 6 gained weight and 2 lost weight, which resulted in an average weight gain of 1.3lbs. For patients that were recent or current tobacco users (18, 16%), tobacco treatment or relapse prevention counseling was provided by a tobacco treatment counselor. As a result, 3/18 patients received smoking cessation pharmacotherapy (1: varenicline, 1: bupropion, 1: nicotine replacement).

Barriers to treatment adherence

Psychosocial: after three weeks, in response to a common theme of patients having difficulty coping with stress, anxiety, depression and isolation surrounding COVID-19, a fee-for-service virtual group therapy intervention was established. As a result, 13 patients (11%) were referred to participate. There were 6 patients interested in participating; however, only 2 patients completed the 6-week program. Reasons for not participating included: insurance co-payment and lack of interest in group therapy. Patients (11, 9%) were also referred to a hospital-based therapy access line which provided patients access to an on-call fee-for-service 1:1 therapy session.

Physical: 11 patients reported various limitations/injuries (i.e. back pain, shoulder pain, leg pain/claudication, tendon tear) that limited their participation in exercise.

Clinical Changes during closure period

By self-report, 6 patients (5%) were tested for COVID-19; however, no patients tested positive. Despite no hospitalizations due to COVID19, 5 (4%) patients were hospitalized for the following reasons: a mechanical fall (2), stomach pain, kidney stones, and chest pain, respectively. The patient who was hospitalized with chest pain underwent successful percutaneous coronary intervention with three drug-eluting stents, and one patient that fell had to undergo a hip replacement. Of note, 2 additional patients reported chest pain, both were in contact with their physicians; however, one passed away at home due to cardiac arrest, and the other was medically managed.

Return to cardiac, pulmonary or vascular rehabilitation after re-opening

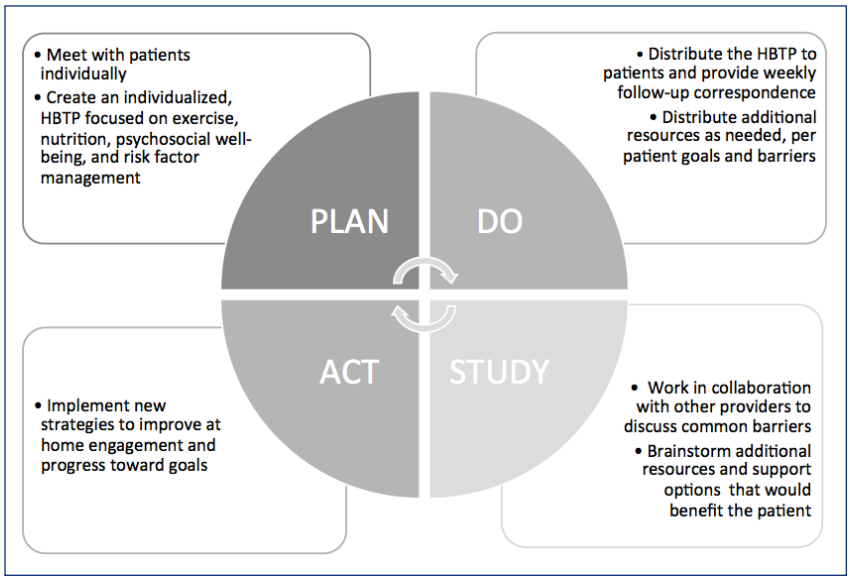
Overall, 60% (69) of patients returned to rehabilitation services: 56 (81%) CR, 16 (11%) PR and 2 (3%) VR when in-person care was reestablished. Comparison of patients who returned versus those who did not showed that there were no significant associations between gender ($p = 0.17$), race ($p = .41$), or specialty (CR, PR or VR) of rehabilitation service provided ($p = .92$) and return to center-based care upon reopening. However, the number of times in which a patient was contacted was significantly associated with a higher likelihood of a patient's return to rehabilitation services upon reopening ($p = < 0.001$).

DISCUSSION

The following QI initiative was based upon Deming's Plan, Do, Study, Act Cycle as shown in **Figure 1**. From this project, we learned that close to 90% of patients participating in cardiac, pulmonary, or vascular rehabilitation, are receptive to participating in home-based rehabilitation services in the setting of a temporary closure, such as COVID-19 stay-at-home orders. Approximately 70% of the patients were responsive to follow-up phone calls and were willing to track their individual progress in one or more areas. As a result, upon the re-opening of rehabilitation services, more than half of the patients returned to the center-based program.

In the setting of a pandemic recurrence, it appears that a home-based treatment plan is a feasible option to bridge

Figure 1.



the gap of a temporary suspension of center-based care. Follow-up contact should be consistent and frequent to ensure adherence and re-enrollment upon the reopening of in-person services. Similar to in-person visits, treatment plans should be individualized and include psychosocial interventions, such as individual or group support sessions.

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Promoting Social Connectedness among Cardiac Rehabilitation Patients During the COVID-19 Pandemic and Beyond

LORI A. J. SCOTT-SHELDON, PhD; EMILY C. GATHRIGHT, PhD; WEN-CHIH WU, MD, MPH

Cardiac rehabilitation (CR) is a critical component of the continuum of care for cardiovascular patients and includes physician-supervised exercise, patient counseling and education to address risk factors for cardiovascular disease, and social support. The effectiveness of center-based CR is well established, and the benefits include reduced mortality and rehospitalizations, improved physical functioning, fewer depressive symptoms, and increased quality of life.[1] The social distancing recommendations to reduce the spread of COVID-19, however, has made it necessary to close, alter, or limit the availability of center-based CR services. Avoiding close-contact settings, confined and enclosed spaces, and limiting contact with other people are essential to preventing COVID-19 transmission, especially among people with underlying medical conditions such as heart failure or coronary artery disease. Nonetheless, measures used to mitigate the spread of COVID-19 concomitantly increase cardiac patients' risk for poor physical and mental health. Furthermore, social isolation during the COVID-19 pandemic is a serious public health concern given the association between loneliness and poor cardiovascular and mental health outcomes.[2] Home-based programs can mitigate these health risks by offering remote coaching, supervised exercise training, and support to cardiac patients during the COVID-19 crisis.

Home-based CR programs have been successfully used in other countries (e.g., Australia, Canada, United Kingdom) but have largely been limited (with some exceptions, e.g., Kaiser Permanente HMO) in the United States to patients in the Veterans Affairs (VA) Healthcare System. Unlike many center-based programs outside the VA, home-based CR programs within the VA continued and, in some cases, were extended to veterans receiving center-based CR during the COVID-19 pandemic.[3] While the Centers for Medicare and Medicaid Services (CMS) expanded reimbursement for telehealth coverage for patients during the COVID-19 pandemic, reimbursement for home-based CR was not included.[3] The ongoing social distancing efforts to mitigate the transmission of COVID-19, and the lack of CMS reimbursement for home-based CR, has resulted in delayed critical secondary prevention services as patients are waitlisted due to prolonged center closures or reduced access to in-person rehabilitation services. Concerns about the safety and efficacy of home-based CR may contribute to the reluctance to offer the program to all patients but meta-analyses of randomized controlled trials showed that home-based CR is as safe as center-based CR[4] and associated with reduced rehospitalizations or cardiac events relative to usual care (RR = 0.56, 95% CI = 0.39, 0.81, p <.001).[5] These benefits strongly suggest that home-based CR should be considered for all patients eligible for center-based CR to minimize the care gap during the COVID-19 pandemic. As others have asserted, "there is no better time than now" for providers to explore new approaches to deliver cardiac rehabilitation programs.[6]

The social distancing required to mitigate the transmission of COVID-19 conflicts with the innate human need for social connection, which may increase loneliness.[7] Innovative methods to enhance social connectedness during home-based CR will be critical for keeping patients motivated and healthy until a vaccine for SARS-CoV-2 becomes available. While technology is vastly underutilized in the management of cardiovascular diseases, the COVID-19 pandemic has renewed interest in the use of innovative strategies to provide ongoing care. The growing popularity of digital health technology such as smartphones, video-based platforms, and social media, and the social distancing required to avoid spreading COVID-19, presents a unique opportunity to engage and motivate home-based CR patients while promoting social connection.

Many technology tools are readily available to the healthcare community at low or no cost to the CR provider or patient. Facebook, for example, is the largest freely available social media platform with more than 2.5 billion monthly active users worldwide.[8] Seven out of ten U.S. adults are Facebook users with 74% visiting the site at least once per day.[8] Facebook is the most popular social media platform across all age groups. It has also become an important source of health information with 90% of users ≥50 years of age using Facebook to find and share health information.[9] Furthermore, Facebook has become an important tool to share information about COVID-19 with 74% of the public posts sharing news articles on COVID-19.[10] Users are not only sharing information about COVID-19 on their Facebook feeds but they are also using other features of the platform, such as Facebook Groups, a place to communicate with others about common interests, to connect with family, friends, and neighbors while socially distancing.[11] Identifying credible groups is critical to enhancing knowledge, increasing motivation, and forging social connections. Thus,

social media groups that are facilitated and moderated by the health care team may offer home-based CR patients the opportunity to share and receive accurate, real-time information to support disease management and social connections while reducing their risk for COVID-19.

Social media platforms offer the additional advantage of enhancing patient care by enabling providers to provide ongoing support to their patients. Healthcare providers can interact directly with patients by sharing critical information on cardiovascular risks via text or infographics, responding to posted messages, and engaging with patients using a live video streaming tool to support healthy behaviors. Recommendations[12] on the adaption of health-related interventions for social media delivery can guide the process: closed or private groups allow for the content and activities to only be shared among individuals invited to participate in the group; content must be adapted to align with how users interact with the platform, and participants must be trained to optimally use the platform; moderators can facilitate the flow of content to the group, and provide reminders regarding privacy and personal safety to participants; and peer "champions" can be trained to motivate and engage with other patients and to support healthy social behaviors. Implementation of a group to support home-based CR patients can not only support patients during the COVID-19 pandemic but may also bridge the gap between the adoption of new behaviors and implementation within patients' home, work, and community environments.

Clinical care is often slow to change, requiring extensive study often over a long duration. The COVID-19 pandemic changed healthcare delivery and afforded clinicians and researchers a rare opportunity to rapidly explore innovative tools, methods, and approaches to deliver cardiac rehabilitation to all cardiac patients. Now is the time to show how cardiac rehabilitation that uses modern methods to promote social connectedness can improve cardiac outcomes during the COVID-19 pandemic and beyond.

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Disclosures/Conflicts

None

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