ORIGINAL RESEARCH

A study of physically active versus inactive persons living with congestive heart failure during the covid-19 pandemic

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ABSTRACT

Covid-19 presented tremendous challenges to healthcare systems throughout the world. In particular, the presence of comorbid conditions became a significant factor due to the greatly increased risk of hospitalization and death in people living with diseases such as Congestive Heart Failure. While the literature has long indicated relationships between psychological challenges (depression and anxiety), the pandemic represented a particular challenge due to the way that it limited individual's ability to engage in activities outside of the home. While all activities were limited, exercise presented a particular challenge as it is so essential to Congestive Heart Failure self-management. The current study used a quantitative descriptive design to examine the relationship between psychological variables and heart failure self-management. The study indicated relatively mild alterations in depression and anxiety. However, the results indicated a significant relationship between physical activity during the pandemic and having engaged in Cardiac Rehabilitation prior to the lockdowns ($p < .05$). Further, the results indicated that self-efficacy related to self-management was higher in patients who engaged in higher activity levels ($p < .001$). The study supported the importance of cardiac rehabilitation and subsequent exercise in establishing self-efficacy and beneficial outcomes in patients living with Congestive Heart Failure.

Key Words: Congestive heart failure, Cardiac rehabilitation, COVID-19

1. INTRODUCTION

Since the first reported cases in December of 2019, the number of confirmed cases of the coronavirus Covid-19 in the United States has exceeded 94 million, with over 1 million deaths attributed to the virus.[1] Since being declared a global pandemic in March of 2020, Covid-19 presented tremendous challenges to healthcare systems throughout the world. Healthcare entities rapidly reorganized services to cope with the pandemic, and to reduce the risk of exposure amongst healthcare providers, patients, and staff. Many elective procedures, face-to-face appointments and outpatient services, such as cardiac rehabilitation, were cancelled or postponed.[2] Patients with comorbid cardiovascular conditions such as heart failure (HF) are at higher risk of severe infection and complications associated with Covid-19.[3–6] Studies have demonstrated the role of HF as a risk factor for a more severe clinical course as well as its' role as an independent risk factor for in hospital mortality resulting from Covid-19.[3,7]

Heart failure is a chronic, progressive condition that requires

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daily self-care by the patient, such as the management of complex medication regimens and the monitoring of new or worsening symptoms such as weight gain or dyspnea. Heart failure patients must also engage in lifestyle behaviors such as regular physical activity and a modified, low sodium diet to optimally manage their condition.[8,9] When the Covid-19 pandemic was at its' height, many aspects of HF management relating to daily self-care behaviors were affected. In addition to changes to the provision of healthcare, restrictions on social gatherings and temporary closures of many businesses affected day to day activity. Gyms, sports centers, and public recreation centers were closed, and activities such as jogging, walking, or cycling in public parks were prohibited. Along with these restrictions, the transition to working from home meant individuals were spending more time at home, and more time in front of a computer screen. The types and amounts of physical activity that individuals engaged in were greatly impacted by many of the precautionary measures instituted to curb the spread of the virus. Several studies have demonstrated that physical activity, as measured by remote monitoring or self-report, diminished in healthy individuals and in individuals with chronic disease due to Covid related restrictions.[10–13] Decreased physical activity results in negative health effects for all individuals; however, it could be very dangerous for individuals with HF. Intolerance of physical activity is a hallmark symptom experienced by HF patients, and as such engaging in physical activity is one of the primary self-care strategies recommended for the management of this condition.[14–16] Increased physical activity has been shown to improve exercise intolerance, improve overall well-being and reduce hospitalization and all-cause mortality in HF patients.[14,15] A decrease in physical activity in individuals with HF would most certainly heighten intolerance to exercise and further limit the ability to engage in this form of HF self-care.[10,16]

2. Background and Significance

2.1 Heart failure

Heart Failure (HF) is a clinical condition that results from any structural or functional impairments of either the filling of blood or the ejection of blood from the ventricles of the heart. These impairments cause inadequate perfusion of the body, resulting in the clinical symptoms commonly seen in HF (shortness of breath, fatigue, exercise intolerance, peripheral edema).[17] An estimated 6.2 million American adults have been diagnosed with HF and the prevalence of HF is projected to increase by 46% by the year 2030.[16] This equates to healthcare costs associated with this condition that exceed $30 billion per year. The lifetime risk of HF from 45-90 years of age ranges from 20%-45%, with higher risks associated with individuals with elevated blood pressure or higher BMI.[16] From 2013 to 2017 a 26% increase in HF hospitalizations was observed in the United States.[17]

Adherence to lifestyle recommendations regarding nutrition, physical activity (PA), smoking cessation, weight, and alcohol intake have been shown to affect the risk of developing HF.[16] Utilizing data from the Physicians' Health Study I, Djousse' et al. (2009) examined the relationship between the development of HF and adherence to modifiable healthy lifestyle factors in a sample of 20,900 men.[18] Six different factors were assessed, including: body weight, smoking, exercise, alcohol intake, consumption of breakfast cereals, and consumption of fruits and vegetables. During a mean follow-up of 22.4 years, normal body weight (BMI < 25 kg/m^2), never smoking, regular exercise ($\geq$ 5 times per week), moderate alcohol intake (< 5 drinks per week), consumption of breakfast cereal ($\geq$ 1 serving per week) and consumption of fruits and vegetables ($\geq$ 4 servings per day) were individually associated with a lower lifetime risk of HR compared to the corresponding undesirable behavior.[18] Additionally, there was an inverse and graded association between the number of healthy lifestyle factors and lifetime risk of HF. When risk factors were limited to adiposity, smoking and exercise, the association between lifestyle factors and lifetime risk of HF was maintained, even among individuals with myocardial infarction (MI), type 2 diabetes mellitus (T2DM) or hypertension (HTN).[18]

In a more recent study, Larsson et al (2016) investigated the separate and collective associations of healthy lifestyle behaviors with the incidence of HF in 2 cohort studies consisting of 33,966 Swedish men and 30,713 Swedish women.[19] The lifestyle factors examined in this study were similar to the Djousse study and included smoking (smoker vs. non-smoker) physical activity ($\geq$ 150 min/week of physical activity vs. <150 min/week of physical activity), overweight/obesity (BMI $\geq$ 25kg/m^2 vs. BMI 18-25 kg/m^2), and a healthy diet (defined as moderate/high adherence to a modified Mediterranean diet).[18] Each healthy lifestyle factor was associated with a statistically significant lower risk of HF in both men and women, and the HF risk decreased with an increasing number of any healthy lifestyle factors. The relative risk of HF for those with 4 factors was 0.38 (0.28-0.53) and 0.28 (0.19-0.41) in men and women, respectively, compared to those with no healthy lifestyle factors. The lifestyle factor most strongly related to lower HF risk was smoking, and greater reductions in HF risk were observed for combinations of healthy lifestyle behaviors that included non-smoking. The reduction in HF risk persisted even after omitting potential influencing variables such as history of atrial fibrillation, T2DM, HTN and hypercholesterolemia.[19]

These studies illustrate the importance of healthy lifestyle behaviors in reducing the risk of HF.

2.2 Physical activity and cardiac rehabilitation

Reduced exercise tolerance is a hallmark symptom of HF, with both central and peripheral mechanisms contributing to this impairment.[20,21] Reductions in both cardiac and pulmonary reserve due to dysfunction induced by HF as well as peripheral factors such as peripheral vascular dysfunction, skeletal muscle dysfunction and impaired autonomic regulation are factors resulting in exercise intolerance.[21] Exercise intolerance manifests itself as dyspnea and fatigue on exertion, and ultimately impacts the quality of life (QOL) in individuals with HF and contributes to poor health outcomes. Many of the mechanisms contributing to this reduced exercise capacity could potentially be influenced by exercise training.

Cardiac rehabilitation (CR) is a multidisciplinary program that consists of structured activity, educational interventions, and social support for patients with cardiovascular disorders. While the emergence of CR began in the 1970s,[22] it is only within the last 10 years that insurance reimbursement has been provided for CR for patients with HF.[23] This was largely attributed to the outcomes of the HF-ACTION (Heart Failure: A Controlled Trial Investigating Outcomes of Exercise Training) Trial which demonstrated that exercise training was well tolerated, safe and effective in improving QOL in individuals with HF.[14] A review by Sagar et al. (2015) demonstrated the exercise-based CR significantly reduced the risk of overall hospitalization (RR 0.75; 0.62-0.92, p = .005) and HF-specific hospitalization (RR0.61; 0.46 to 0.80, p = .0004).[24] They also showed a clinically important improvement in QOL as measured by the Minnesota Living with HF Questionnaire (MLWHFQ). In addition to structured exercise training, CR also includes patient assessment, education about medication adherence, lifestyle risk factor modification, guidance for stress management, smoking cessation and nutritional recommendations.[25] In the current American College of Cardiology/American Heart Association guidelines for the management of HF, CR is a Class 1 recommendation.[17] Despite the proven benefits of CR, it remains an underused resource, with participation rate ranging from 10%-30%.[14,26,27] Multiple factors influence referral and adherence to CR including competition for time from other obligations (care of family, work, etc), poor social support, poor access to CR programs, travel challenges and insurance coverage, along with other psychosocial, physical and economic factors.[25–28] That said, CR is the optimal approach to the care of persons with HF who desire to continue active and fulfilling lives.

2.3 Covid-19

The emergence and spread of Covid-19 caused a global crisis. To reduce the spread of Covid-19 travel bans, social distancing, quarantine, and isolation measures were implemented. These societal lockdowns resulted in restrictions on gatherings, temporary closures of many businesses, and the temporary cessation of many different types of activities, drastically altering how people lived their daily lives. Gyms, sports centers, and public recreation centers were closed, and activities such as jogging, walking, or cycling in public parks were prohibited. Restrictions on public gatherings resulted in a shift to distance learning for students and working via virtual platforms for all non-essential personnel. Group-based outpatient CR programs were suspended, as they are primarily hosted in hospitals, community centers and public gyms and were considered "non-essential" healthcare services.[29,30] While these restrictions were necessary to curb the spread of this virus, they greatly impacted the level of PA undertaken by healthy individuals as well as individuals with chronic disease.

Ammar et al. (2020) examined the impact of the covid-19 induced home confinement utilizing an online survey which included the International Physical Activity Questionnaire (IPAQ).[31] Preliminary results from the first 1000 respondents (over 90% of whom were deemed "healthy") demonstrated a negative effect of home confinement on all levels of PA represented in the IPAQ (vigorous, moderate, walking and sitting).[31] Significant reductions in the number of days per week, minutes per day and MET values were observed for all levels of PA (vigorous, moderate and walking) during the period of home confinement, as compared to before the pandemic. The authors observed a corresponding 28.6% increase in the number of hours spent sitting during this period. Similarly, a review by Kirsch et al (2022) demonstrated significant reductions in PA at all levels, as well as increased hours of "sitting" time in healthy individuals.[11] In individuals with chronic conditions such as HF and cardiovascular disease, similar decreases in overall PA were observed during the covid-19 lockdown period.[10–12,31,32] The pandemic proved a significant challenge to individuals living with HF, particularly as it relates to their ability to engage in exercise.

2.4 Aims

The purpose of our study was to examine patterns in PA in HF patients now that most Covid-19 related quarantine and social distancing measures have abated. The aims of the study are as follows:

1) To determine the general anxiety, depression and self-efficacy profiles of patients living with HF in our sample.
2) To determine the relationship between physical activity

levels, and psychosocial variables.

3. METHODS

3.1 Research design

The study used a quantitative descriptive design. A questionnaire was deployed via the Prolific Panel online™ from May to July 2020 amongst individuals who self-reported that they had been diagnosed with HF. The questionnaire consisted of multiple validated instruments including: the Generalized Anxiety Disorder – 7 (GAD-7) questionnaire ; the Center for Epidemiological Studies Depression (CESD) scale (CESD-R: Center for Epidemiologic Studies Depression Scale Revised Online Depression Assessment, n.d.) ; the Cardiac Self-Efficacy Scale (CSES);[33] and the International Physical Activity Questionnaire (IPAQ).[34] Additionally, questions specific to changes in HF related care resulting from the covid-19 pandemic were included. This portion of our questionnaire was based on a modified version of the HF care questionnaire developed by Sankaranarayanan et al. (2021)[35]

3.2 Measures

The following measures were used in the study:

1) Heart Failure Care Questionnaire: Sankaranarayanan et al. (2021) utilized a work group comprised of HF patients, cardiologists, HF Advanced practice nurses and HF nurse consultant to develop a survey questionnaire to ascertain the impact of the Covid-19 lockdown on HF patient care.[35] Questions included in this survey asked about disruption to HF appointments, medication prescription services, and willingness to attend in-person appointments. The survey also asked HF patients to rate their anxiety about HF and Covid-19 and asked about respondents' opinions and preferences regarding telehealth alternatives implemented during the lockdown period.

2) Generalized Anxiety Disorder – 7 (GAD-7) Scale: The 7-item Generalized Anxiety and Depression Scale has been shown to be a valid and efficient instrument for screening for generalized anxiety, with good reliability and validity[36,37] The scale has also been validated as a reflection of severity with increasing scores on the GAD-7 being associated with many domains of functional impairment. A cut point of 10 was used to identify cases of generalized anxiety with scores of 5, 10 and 15 representing mild, moderate and severe levels of generalized anxiety with a sensitivity of 89% and a specificity of 82%.[37]

3) Center for Epidemiological Studies Depression (CESD) Scale: The Center for Epidemiological Studies Depression Scale (CESD) is a 20-item measure that asks respondents to rate how frequently they have experienced different symptoms associated with depression, over the past week.[38] Scores range from 0-60 with higher scores indicating greater depressive symptoms, and a cutoff score of 16 is utilized to identify individuals at risk for clinical depression.[38,39] Internal consistency, test-retest reliability and validity are high for this scale for a variety of age groups and populations.[39,40]

4) Cardiac Self-Efficacy Scale (CSES): The Cardiac Self-Efficacy Scale (CSES) was used to assess respondents' confidence in their ability to manage their cardiac disorder.[33] The scale consists of two dimensions which include confidence in the ability to control symptoms of the cardiac disorder and confidence in the ability to maintain functioning.[33,41] The scale has shown high internal consistency and good convergent and discriminant validities. The Cronbac's α of ability to control symptoms and ability to maintain functioning were 0.90 and 0.87, respectively.[33]

5) International Physical Activity Questionnaire (IPAQ): The International Physical Activity Questionnaire – short form (IPAQ) consists of questions that assess the amount of time respondents spend participating in vigorous- and moderate-intensity PA, as well as walking and sitting.[42] Activity in each category is calculated as minutes per week which is then converted to a metabolic equivalent (MET) minutes per week based on standardized MET values for each intensity. Sitting is reported as minutes per week. Scores can be calculated as a continuous MET minutes per week value, or categorized as "low", "moderate" or "high" levels of PA. The IPAQ short form has demonstrated moderate levels of validity when compared to other objective measures of PA however it tends to overestimate total PA.[42,43]

3.3 Recruitment and participants

The questionnaire was implemented through a Qualtrics electronic survey and distributed via the Prolific Panel online ™ recruitment platform. Prolific ™ allows current users to receive information about studies they may qualify for and receive compensation per hour to complete research surveys. For the current study, individuals who answered "yes" to the question "Have you ever been diagnosed with HF by a medical doctor" (i.e. self-reported HF diagnosis) were provided information and a link to the questionnaire. The link took participants to the Qualtrics survey allowing respondents to remain anonymous. Respondents were divided into two groups based on the score calculated from the responses to the IPAQ questionnaire. Calculations based on IPAQ categorize respondents into three categories: inactive, minimally active, and high active (International Physical Activity Questionnaire, n.d.). The "high active" categorical score indicates an activity level that exceeds the minimum public health PA recommendations, and subsequently could potentially provide greater health benefits ("active" group). Given that the "minimally active" and "inactive" categories

do not represent a level of PA that would potentially provide an adequate stimulus for health-related benefits, these two categories were combined ("inactive" group) when analyzing this sample.

3.4 Protection of human subjects

The study received ethical approval from the Florida State University Institutional Review Board (IRB). Online informed consent was obtained from all participants prior to any study-related procedures were performed.

3.5 Data analysis

Descriptive statistics were used to describe all demographic variables and the domains of basic measures. Independent samples *t*-tests were used to determine whether significant differences existed between the "active" and "non-active" groups. The correlations between the IPAQ activity category, the psychosocial variables, and the individual items of the CSES were examined and reported as Pearson correlation coefficients.

4. RESULTS

A sample of 131 U.S. respondents were included in this analysis. Subject characteristics are reported in Table 1. A larger proportion of the participants were male however the age ranges were evenly represented within the sample. The racial and ethnic characteristics of the sample included a significant representation of African Americans and ethnically Hispanic persons, both at rates greater than their representation in the general population. While small, the sample is reasonably diverse in terms of gender, age, race and ethnic composition.

Table-2 Reflects the communities from which participants were recruited. The sample included a wide distribution of people according to the various reported classifications. The majority of participants were from metropolitan areas, with lesser percentages from small towns and rural areas. All told, the sample reflects a broad geographic representation of persons living with HF.

Table 1. Basic demographics

Total number of respondents: 131		
Variable	**n**	**Percent (%)**
Gender:		
Male	77	58.8
Female	53	40.5
Unspecified	1	0.8
Age Range (years):		
18-40	47	35.9
41-60	48	36.6
61-80	36	27.5
Race		
White	55	42
Black or African American	39	29.8
American Indian/Alaskan Native	11	8.4
Asian	22	16.8
Native Hawaiian or other Pacific Islander	4	3.1
Ethnicity		
Hispanic	29	22.1
Not Hispanic	102	77.9
Attending CR Pre-Covid:		
Yes	43	32.8
No	88	67.2
IPAQ Activity level:		
Highly Active	28	21.4
Not Highly Active	103	78.6

Table 3 reports the mean (SD) cumulative scores for the psychosocial measures included in the survey. On average this sample of participants reported mild anxiety as indicated by the GAD-7 score. A score of greater than 16 on the CESD is generally accepted as indicating a risk for clinical depression (CESD-R: Center for Epidemiologic Studies Depression Scale Revised Online Depression Assessment, n.d.).

Table 2. Regional classification of participants (N = 131)

Classification	**Number**	**Percentage (%)**
Large Metropolitan Areas (> 1.5 million persons)	29	22.1
Metropolitan Areas (500,000 to 15. Million persons)	26	19.8
Medium Urban Areas (200,000 to 500,000 persons)	20	15.3
Small Urban Areas (50,000 to 200,000 persons)	26	19.8
Towns (< 50,000 persons)	9	6.9
Rural Areas (no stated town, low population density region)	21	16

Table 3. Cumulative scores for full sample for psychosocial measures

Variable	**Mean (SD)**
GAD7 Cumulative Score	7.8 (5.7)
CESD Cumulative Score	22.7 (13.5)
MET minutes per week	2,377(4,596)

Calculations based on the IPAQ responses group respondents into three categories: inactive, minimally active, and high active (International Physical Activity Questionnaire, n.d.). The "high active" categorical score indicates an activity level that exceeds the minimum public health PA recommendations, and subsequently could potentially provide greater health benefits ("active" group). Given that the "minimally active" and "inactive" categories do not represent a level of physical activity that would potentially provide an adequate stimulus for health-related benefits, these two categories were combined ("inactive" group). Twenty-eight of the respondents were considered "active" while 103 of the respondents

were considered "inactive". Table 4 provides a comparison of the "active" and "inactive" groups. There was a significant difference between the two groups' CR attendance with more of the active group attending CR prior to the COVID-19 lockdown period (p = .029). Among the respondents that attended CR, there was a significant difference in the return to in-person CR post Covid-19 lockdown with the active individuals being more likely to return to in-person cardiac rehab (p = .020).

When examining cardiac self-efficacy, Individuals in the active group reported higher cumulative scores on the Cardiac Self Efficacy Scale compared to those in the inactive group (55.6 (10.3) vs. 50.6 (9.9), p = .020). When specific CSES items were analyzed, significant differences were observed between the groups in two of the items, including: CSES item 11 ("How confident are you that you could lose weight (if you are overweight)?") (p = .001) and CSES item 13 ("How confident are you that you could maintain your usual activities at work?") (p = .012).

Table 4. Comparison between highly active and inactive groups

	Highly Active	Not Active	*t*-Score	Sig
Level of anxiety relating to HF Diagnosis	6.0 (2.7)	6.0 (2.5)	-.156	.877
Level of anxiety relating to COVID-19	6.0 (2.1)	5.4 (2.9)	-1.027	.224
Number of HF appointments scheduled in the last 6 months	2.8 (1.8)	2.4 (1.9)	-.978	.330
Has the prescription or monitoring of your HF medication been affected by the ongoing COVID-19 pandemic	1.8 (0.4)	1.8 (0.4)	1.043	.303
"Were you attending in-person cardiac rehabilitation prior to the onset of the Covid-19 pandemic	1.5 (0.51)	1.7 (0.45)	2.060	.029*
"Did you resume in-person cardiac rehab post Covid-19"	0.86 (1.08)	0.42 (0.80)	-1.991	.020*
CSES Cumulative Score	55.6 (10.3)	50.6 (9.9)	-2.361	.020*
GAD7 Cumulative Score	7.4 (5.1)	7.8 (5.8)	.349	.313
CESD Cumulative Score	20.1 (12.1)	23.4 (13.8)	1.125	.302
CSES item 11	3.5 (1.2)	2.6 (1.2)	-3.329	.001**
CSES item 13	4.0 (1.1)	3.4 (1.1)	-2.563	.012*

*$p \leq .05$, **$p \leq .01$

Correlation analysis (Pearson's R) revealed a small, positive correlation between the IPAQ activity category and the CSES cumulative score (r = .183, p = .036). IPAQ activity was not correlated with anxiety as reported by the GAD-7 score (r = .008. p = .931) or depression as reported by the CES-D (r = -.052, p = .555). Further analysis of the individual CSES items revealed small but significant positive correlations between the IPAQ activity category and four CSES items which included: "How confident are you that you can control your breathlessness by changing your activity level?" (r = .191, p = .029); "How confident are you that you can control your chest pain by changing your activity level?" (r = .215, p = .014); "How confident are you that you can lose weight (if you are overweight)?" (r = .261, p = .003); and "How confident are you that you can maintain your usual activities at work?" r = .206, p = .018).

5. Discussion

5.1 General Aim-1: To determine the general anxiety and depression profiles of patients living with HF in our sample

Depression and anxiety disorders are common amongst individuals with HF.[44–47] The current study utilized the CESD scale for which a score of greater than 16 is generally accepted as indicating a risk for clinical depression (CESD-R: Center for Epidemiologic Studies Depression Scale Revised Online Depression Assessment, n.d.). The mean CESD score of 22.7 $\pm$ 13.5 indicates that this sample is at risk for clinical depression, which is consistent with the literature. Incidences of these disorders have been associated with progression of HF, increased all-cause mortality and lower subjective ratings of quality of life.[45,46,48,49] Research has shown that depression is a frequent comorbidity in individuals with HF with an estimated prevalence of 20%-30% in this population.[49–51] A large population-based study found that HF was associated with a greater risk of depressive symptoms and syndromes (HR = 1.41, 95% CI = 1.03-1.94) demonstrating that HF is a risk factor for incident depression.[52] The relationship between HF and depression is complex and multi-faceted and each of these conditions have been shown to contribute to the development and/or the progression of the other.[44,49,53] The symptoms and frequent hospitalizations attributable to HF are frequently associated with reduced QOL, which can contribute to the development of depression. In a study of 839 individuals with symptomatic HF free of depression at baseline, repeat depression screening after 12-months revealed an overall depression incidence rate of 12.9%.[54] Interestingly, correlation analysis of their results revealed that the incidence of depression was more highly correlated with variables reflecting perceived burden of disease (NYHA class, lower SF-36 physical function score, PHQ-9 score) rather than objective measures of cardiac dysfunction (LVEF, HR, presence of edema, pharmacotherapy).[54]

Rates of anxiety appear to be higher in individuals with

HF compared to healthy older adults and adults with other medical conditions.[45,47] The current survey utilized the GAD-7 questionnaire to assess the level of generalized anxiety which designates cut points of 5, 10 and 15 to represent mild, moderate and severe levels of anxiety, respectively.[37] The mean GAD-7 score of 7.8 ($\pm$ 5.7) would suggest that this sample of individuals with HF experience mild anxiety. A meta-analysis of 73 studies identified a pooled prevalence of 55.5% (95% CI, 48.08%-62.83%) for elevated symptoms of anxiety in HF patients and a pooled prevalence of 28.79% (95% CI, 23.30%-34,29%) for probable clinically significant anxiety.[47]

5.2 General Aim-2: To determine the relationship between physical activity levels and psychosocial variables

The current Physical Activity Guidelines for Americans recommend that adults ages 18 and older should perform physical activity equating to 500-1,000 MET minutes per week for health benefits. The mean MET minutes per week calculated based on the responses to the IPAQ questionnaire were 2377 (4596) indicating that on average, the respondents of this survey were meeting the Physical Activity Guidelines for Americans. Using the IPAQ calculations and cut-off points, the respondents were divided into "active" (n = 28) an "inactive" (n = 103) groups.[55] Physical activity did not impact the psychological measures, as no significant differences in ratings of anxiety or depression were observed between the two groups. Our results differ from those of Chiala' et al. (2018) who found that distance walked on the six minute walk test (6MWT) was negatively correlated with anxiety and with depression in sample of 96 patients with HF.[46] Similarly Shen et al.(2011) examined changes in depression and anxiety (as measured by the Hospital Anxiety and Depression Scale) in a group of 238 HF patients and found that baseline levels as well as increases in each of these psychological measures independently predicted a greater decline in physical function at 6- month follow up (as assessed by the MLWHFQ).[56] The lack of statistically significant difference in anxiety or depression amongst the two groups in the current study is likely influenced by the measurement scales utilized, as well as the fact that the variables were assessed at only one point in time. The active and inactive groups in the current study were not significantly different with regard to the number of appointments postponed (p = .659) or cancelled (p = .065) during the lockdown period ("Has scheduling of any of your heart failure appointments or cardiac investigations/operations been affected by the Covid-19 pandemic (select all that apply)?"); nor did they differ in their perceived access to HF care ("Do you feel you can access your heart failure services promptly if your symptoms worsen?") (p = .80). Similarities in access to care may also partially explain the lack of significant difference in ratings of anxiety and depression between these two groups.

The current study demonstrated a significant difference between the active and inactive groups regarding utilization of in-person CR prior to the pandemic, with a larger proportion of the active group participating in CR. Interestingly of the individuals who were participating in CR, a higher proportion of the active respondents returned to in-person CR once it was resumed post-lockdown when compared to the inactive respondents. These results suggests that the individuals living with HF who were more active perceived a greater benefit from in-person CR as evidenced by the fact that more of these respondents resumed participation once restrictions were lifted. As was mentioned previously, the utilization of CR in the population of patients with HF remains poor. Baseline assessment of PA may assist with identification of patients who are less likely to attend CR, so that earlier or more in-depth education regarding the benefits of this resource can be provided. Similarly, more frequent assessment of PA performed outside of CR may be another strategy to reduce early attrition from CR.

The active and inactive groups were found to be significantly different in their perceived self-efficacy as it relates to the management of their cardiac condition, with the active individuals having higher cumulative CSES scores. The positive. correlation between the CSES score and the IPAQ activity category illustrates the relationship between these factors, though it is difficult to ascertain which is the dependent factor. Regardless, patients with higher activity levels were more confident in their ability to manage their condition. Thus, strategies to improve self-efficacy as well as PA are important in the treatment of HF patients. Further analysis of the CSES items showed significant differences between the active and inactive groups on two items: Item 11 – "How confident are you that you can lose weight (if you are overweight)?" and item 13 – "How confident are you that you can maintain your usual activities at work?". Respondents in the "active" group indicated that they felt confident in maintaining activities associated with work, which would suggest better overall maintenance of associated comorbidities. Maintenance of work activities could also imply the ability to perform activities of daily living and to maintain a level of independence associated with better self-care and management of this condition.

6. Conclusion

The pandemic proved instructive in many respects, as the abrupt changes to our systems of care challenged our normal means of providing care. Additionally, it changed the

self-care paradigm for patients suffering a variety of comorbid conditions. The current study demonstrates several important factors that influence self-care. In particular, the demonstration of linkages between cardiac rehabilitation prior to the pandemic and subsequent self-efficacy. This finding emphasizes that the patients who had engaged a cardiac rehabilitation program subsequently maintained higher levels of healthful activity and maintained higher levels of self-efficacy as a result. This illustrates the necessity of improving participation rates for cardiac rehabilitation. Despite the relatively low participation rates prior to the pandemic, CR remains a highly effective modality for ensuring a return to maximal cardiac function. While the study supports PA in general, the structured nature of CR is an optimal initial approach to PA for the HF patient.

Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

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