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Predictors of Depression in Older Adults with Heart Failure: An Acceptance and Commitment Therapy-derived Linear Regression Model

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ABSTRACT

Background: Depression is a frequently reported phenomenon that negatively affects self-care and healthcare provided to older adults with heart failure. However, the literature is contradicting about predictors of depression in older adults with heart failure. ***Purpose:*** To examine newly introduced variables derived from the acceptance and commitment therapy model (psychological flexibility, impulsivity, perceived stress and perceived control) and selected demographics as predictors of depression in older adults with heart failure. ***Methods:*** This study was conducted using a cross-sectional design. Participants with heart-failure ($N = 272$) were recruited from major regional hospitals during their regular visits to the heart-failure clinics. The following tools were used to collect the data: The Patient Health Questionnaire–9, the Acceptance and Action Questionnaire, the Perceived Stress Scale-10, the Barratt Impulsiveness Scale, the Atlanta Heart Failure Knowledge Test, the New York Heart Association and the Control Attitudes Scale-Revised. ***Results:*** Bivariate analysis shows that all bivariate correlations were significant ($r = 0.16$ to 0.63, $p < 0.05$), except for the correlation between "age with time since diagnosis" and "time since diagnosis with psychological flexibility". The results showed that time since diagnosis, impulsivity, stress, psychological flexibility and heart-failure knowledge significantly predicted depression in elder adults with heart failure. The model explained 49.5% of the variance in depression. ***Conclusion:*** An array of psychological and socio-demographic variables explained approximately a half of the variation in depression in elder adults with heart failure. The acceptance and commitment therapy model has been shown to be beneficial in incorporating new variables contributing to depression in older adults with heart failure. ***Implications for Nursing:*** The current study offers preliminary evidence of the potential benefit of the acceptance and commitment therapy model-based interventions. Further research should be conducted to minimize the impact of depression in older adults with heart failure.

Keywords: Depression, Stress, Perceived control, Impulsivity, Heart failure, Psychological flexibility.

What does this paper add?

1. Time since diagnosis, impulsivity, stress, psychological flexibility and heart-failure knowledge significantly predicted depression in older adults with heart failure.

2. The best fit model explained a half of the variance in depression in older adults with heart failure.

3. The current study taps on the importance of

borrowing new variables from well-established and validated models in other fields.

Introduction

Heart failure (HF) is a chronic condition affecting older adults and the heart's ability to pump out blood through the remodeling of the heart muscle. Remodeling is followed by structural and functional changes that further change and damage the heart cells (Aimo et al., 2019). Thus, the disease progression and exacerbations can go from bad to worse if preventive measures are not adopted. Approximately 64 million people live with heart failure globally (Groenewegen et al., 2020). In Jordan, it is estimated that more than 8,000 new cases are diagnosed annually with heart failure (Hayeah et al., 2017). In addition, heart failure is reportedly responsible for 8.7% of cardiovascular disease-related deaths (Jordanian Ministry of Health, 2017). Proper management of heart failure requires collaborative efforts of healthcare providers, older adults affected by heart failure and family caregivers (Jaarsma et al., 2021; Liu & Gellatly, 2021).

However, depression is a frequently reported phenomenon that negatively affects self-care and healthcare provided to older persons with heart failure (Lynos et al., 2018). It has been reported that more than 50% of older adults with heart failure and 15%-20% of those with cardiac illnesses suffer from severe depression (Tsabedze et al., 2021). Depression has been reported as a major predictor of pain, fatigue, hospitalization, re-hospitalizations, all-cause mortality, recurrent falls and weight loss (Cho et al., 2022). One explanation for such consequences of depression is the elevated inflammatory markers associated with stress and depression (Huffman et al., 2013). Another reason is that older adults with higher depression and stress are less likely to adhere to treatment plans (Kop et al., 2011). The literature suggests that older adults with depression have a two-fold increase in mortality rates than those without depression (Mbakwem et al., 2016). Thus, regardless of which explanation is more plausible than the other and considering the negative consequences of depression on disease progression, it looks necessary to determine factors that may enable us to predict and control depression in older adults with heart failure.

Various variables had been associated with depression in older adults with heart failure. These variables include functional status, age, prior hospitalizations, sedentary lifestyle, lack of social support, quality of life and poor self-efficacy (Sbolli et al., 2020). However, the literature is mixed about predictors of depression in older adults with heart failure. For example, Sbolli et al. (2020) reported that female gender is considered a predictor of depression. However, Smaardijk et al. (2020) found that male gender is a significant predictor of depression in persons with heart failure. Thus, further research is needed to replicate previous research findings and examine new potential predictors of depression in older adults with heart failure. Thus, the aim of this study was to examine newly introduced potential predictors of depression in older adults with heart failure borrowed from the Acceptance and Commitment Therapy (ACT) model.

Background

The ACT model is a psychological model that proposes systematic processes and variables to predict and control human-related phenomena (Hayes et al., 2009). ACT model-based interventions and studies were successful in predicting and controlling various general and health-related human behaviors, like smoking cessation, diabetes self-care and distress, addiction, stress, job satisfaction and motivation, anxiety and burnout and domestic violence (Gloster et al., 2020; Montaner et al., 2022). Given the power of the ACT model in predicting and controlling various human behaviors, the current study borrowed two central concepts from the ACT model to examine their potential of predicting depression in older adults with heart failure; namely, psychological flexibility and impulsivity.

Psychological flexibility is the central concept of the ACT model (Hayes et al., 2009). According to Hayes et al. (2009), our engagement in adaptive or maladaptive behaviors is determined by a person's psychological flexibility. A study by McCracken et al. (2021) found that psychological flexibility accounted for most of the variance predicting mental health. In addition, the literature showed that psychological flexibility significantly affected depression in a sample of university workers (Lee et al., 2021).

Impulsivity is "an individualized, normative and multi-dimensional pattern of human decision-making behavior characterized by free will and insufficient reasoning due to the diminished reasoning process"

(Al-Hammouri et al., 2021, p.7). A systematic review found that individuals with major depression symptoms had higher levels of impulsivity (Fields et al., 2021). In addition, impulsivity is associated with depression in retired older adults (Monopoli et al., 2000). Another study concluded that impulsivity should be accounted for when assessing and treating depression (Moustafa et al., 2021). However, to the authors' best knowledge, the role of impulsivity and psychological flexibility on depression in older adults with heart failure was not examined yet.

Along with psychological flexibility and impulsivity, this study re-examines the role of previously studied variables concerning depression in older adults with heart failure. These variables are stress, time since diagnosis, heart-failure knowledge, functional status, gender, age and perceived control (Cirelli et al., 2018; Hwang et al., 2020). These are among the first variables examined to predict depression in older adults with heart failure. This study aimed to investigate potential socio-demographic and psychological predictors of depression in older adults with heart failure. The introduced socio-demographic predictors were time since diagnosis, knowledge of heart failure, functional status, gender and age. The psychological predictors were psychological flexibility, impulsivity, perceived stress, and perceived control.

Methods
Design
This study used a cross-sectional research design.

Setting
The data was collected from two major referral hospitals. The total bed capacity for both hospitals is approximately 900 beds. Both hospitals are located in north Jordan.

Participants
The sample was composed of 272 older adults with heart failure. The inclusion criteria in this study are 1) diagnosed with heart failure, 2) 18 years old or older and 3) ability to write and read Arabic. The data was collected from potential participants during their regular visits to the heart-failure clinic. The sample size was determined using G*Power with the following parameters: $\alpha = 0.05$, $\beta = 0.80$, effect size = 0.07 and number of predictors = 9. The resulting minimum estimated number of participants was 233 persons with heart failure. The participants were recruited using convenience sampling.

Data Collection
A trained research assistant approached potential participants during their visits to the heart-failure clinic. The research assistant explained to the participants that they could withdraw from the study at any time. Those who agreed to participate signed the study informed consent and completed the study questionnaires. The research assistant was available all the time for any questions from the participants and to provide guidance when needed. Each participant needed around 30 minutes to fill out the questionnaire.

Ethical Considerations
The study was approved by the IRB committees at the affiliated university and the targeted hospitals before starting the study. The participants were informed that they have the right to withdraw from the study without consequences. Each participant was assigned an ID number to ensure confidentiality instead of using identifiable information. The data was entered into a password-protected computer only accessible by the research team.

Measures
The Patient Health Questionnaire–9 (PHQ-9) was used to measure depression among the participants (Kroenke et al., 2001). It has nine items on how often certain depressive symptoms appeared in the past two weeks. The PHQ-9 follows Likert-scale response options ranging from 0 "not at all" to 3 "nearly every day." Total possible PHQ-9 scores range from 0 to 27, where higher scores indicate more severe levels of depression. Mild, moderate, moderate to severe and severe levels of depression are categorized based on scores of 5, 10, 15 and 20, respectively (Kroenke et al., 2001). The PHQ-9 had sufficient psychometric properties as evidenced by the support of its internal consistency with Cronbach's α of 0.83. The range of inter-item correlations was 0.22 to 0.66 (Hammash et al., 2013).

The Acceptance and Action Questionnaire (AAQ-II) was used to measure psychological flexibility (Bond et al., 2011). AAQ-II is a seven-item single-factor measure used to evaluate psychological inflexibility. Items of the

AAQ-II follow a 7-point Likert-like response scale ranging from 1 "never true" to 7 "always true". Possible scores on the AAQ-II range between 7 and 49, with higher scores meaning less psychological flexibility. The internal consistency of the AAQ-II was supported with Cronbach's α between 0.78 and 0.88 (Bond et al., 2011).

The Perceived Stress Scale-10 (PSS) was used to measure perceived stress (Cohen et al., 1983). The PSS-10 has 10 items asking about the frequency of experiencing stressful events in the last month. The responses follow a 5-point Likert-like scale: 0 "never" to 4 "very often". The total score is calculated as the sum of individual items with total scores ranging from 0 to 40. Higher PSS-10 scores reflect higher perceived stress. The Cronbach's α coefficient was 0.75 (Lee, 2012).

The Barratt Impulsiveness Scale (BIS-11) was used to measure the level of impulsivity. It is considered the most frequently used impulsivity measure (Patton et al., 1995). It has 30 items and each item has a 4-point Likert-like scale ranging from 1 "rarely/never" to 4 "almost always". Total scores on the BIS-11 range from 30 to 120. Higher scores indicate higher levels of impulsivity. According to Stanford et al. (2009), it has sufficient psychometric properties with Cronbach's α values of 0.71 to 0.83.

The Atlanta Heart Failure Knowledge Test (version 3) (AHFKT) was used to evaluate the participants' knowledge about their illness. The AHFKT (version 3) is a 30-question test to inquire about patients' practices concerning their HF illness and self-care practices. Total AHFKT (version 3) scores range between 0 and 30, with higher scores meaning better HF-related knowledge. Cronbach's α value was 0.84 for older adults with HF (Reilly et al., 2016).

The New York Heart Association (NYHA) was used to classify participants' functional status according to symptom severity (Levin et al., 1994). The NYHA functional status is determined by the occurrence of specific manifestations like fatigue, dyspnea and angina in relation with the level of activity. The NYHA has four classes from I "no symptoms with ordinary physical activity" to IV "symptoms occur at rest". The evidence supports the construct validity of the NYHA (Bennett et al., 2002). In addition, the inter-rater reliability of the NYHA was sufficient (Bennett et al., 2002).

The Control Attitudes Scale-Revised (CAS-R) was used to measure perceived control (Moser et al., 2009).

It is an 8-item scale with a Likert-like response style ranging from 1 "totally disagree" to 5 "totally agree". Total scores on the CAS-R range from 8 to 40 and higher scores indicate more perceived control (Moser et al., 2009). Cronbach's α for the CAS-R in persons with HF was 0.76 (Moser et al., 2009). The construct validity of the CAS-R was also supported (Moser et al., 2009).

Age, gender and time since diagnosis information was collected using a socio-demographic questionnaire developed for this study. Time since diagnosis was measured by asking the patient about the date of diagnosis with heart failure and cross-checked against the participants' health record. Then time since diagnosis was calculated in months.

Results

The mean age of our sample was 61.2 ($SD = 12.92$), ranging between 30 and 96 years. The majority of our sample was males (71%). Only 49 participants (18%) were in class I of the NYHA (i.e., had no symptoms with ordinary physical activity. Regarding the severity of depression, the average scores on the PHQ-9 was 11.25, indicating a moderate level of depression. Table 1 summarizes sample demographics and clinical characteristics. Table 2 shows a bivariate analysis among study variables. The bivariate analysis shows that all variables' bivariate correlations were significant, except for the correlation between "age with time since diagnosis" and "time since diagnosis with psychological flexibility". Depression had a negative, significant correlation with participants' age, perceived control and HF knowledge ($r = -0.16$, -0.30, and -0.32, respectively). On the other hand, depression had a positive, significant correlation with time since diagnosis, impulsivity, stress and psychological flexibility ($r = 0.26$, 0.39, 0.63 and 0.55, respectively).

Multiple regression was used to examine whether the proposed study variables will predict depression in older adults with heart failure. Initially, we entered all of the study variables into a model predicting depression in older adults with heart failure. Then, we used multiple regression to find the best fit model. Table 3 shows the results of the multiple linear regression of the initial and best-fit models. In these models, impulsivity, perceived control, time since diagnosis, age, gender, heart-failure knowledge, psychological flexibility, stress and functional status were regressed onto depression. The initial regression model explained about 51% of the

variance in depression in older adults with heart failure (F (9, 262) = 27.81, $p < 0.001$). The best fit model, on the other hand, explained about 49.5% of the variance in depression (F(5, 266) = 48.17, $p < 0.001$). The R-square change between the initial and best fit model was -0.013, which means a reduction of about 1.4% from the 51% of

variance explained in depression by the initial regression model. In other words, the following non-significant predictors: functional status, gender, age and perceived control accounted only for 1.4% in the initial model (Table 3).

Table 1. Participants' characteristics (N = 272)

Variable	n	~Percentage
Gender:		
Female	79	29
Male	193	71
Functional status:		
I	49	18.0
II	90	33.1
III	89	32.7
IV	44	16.2
	Mean	**SD**
Age (years)	61.2	12.92
Time since diagnosis (months)	22.84	38.64
Depression	11.25	7.12
Impulsivity	62.56	9.85
Stress	18.83	6.70
Perceived control	28.28	5.19
Psychological flexibility	18.50	9.72
HF knowledge	17.98	6.20

Table 2. Bivariate correlations

	[8]	[7]	[6]	[5]	[4]	[3]	[2]	[1]
Depression [1]	-0.32**	0.55**	-0.30**	0.63**	0.39**	0.26**	-0.16**	1
Age [2]	0.21**	-0.21**	0.09	-0.22**	-0.14*	0.04	1	
Time since diagnosis [3]	-0.17**	0.05	0.26**	0.15*	0.12*	1		
Impulsivity [4]	-0.32**	0.35**	-0.33**	0.38**	1			
Stress [5]	-0.17**	0.59**	-0.31**	1				
Perceived control [6]	0.24**	-0.25**	1					
Psychological flexibility [7]	-0.19**	1						
HF knowledge [8]	1							

* p value <0.05 (two-tailed).
** p value <0.01 (two-tailed).

Table 3. Multiple linear-regression results

	Initial Model					Best fit model				
Model Summary	**R^2**	**F**	**df1, df2**		**p**	**R^2**	**F**	**df1, df2**		**p**
	0.508	27.81	9, 262		0.000	0.495	48.17	5, 266		0.000
Predictor	**B**	**SE**	**β**	**T**	**p**	**B**	**SE**	**β**	**t**	**p**
Constant	-3.69	4.33		-0.85	0.39	-2.09	2.66		-0.78	0.43

Time Since Diagnosis	0.03	0.01	0.15	3.10	0.002	0.03	0.01	0.15	3.27	0.001
Impulsivity	0.07	0.04	0.09	1.87	0.06	0.07	0.04	0.10	1.97	0.04
Stress	0.43	0.06	0.40	6.77	0.000	0.42	0.06	0.39	6.81	0.000
Psychological inflexibility	0.17	0.04	0.23	4.02	0.000	0.17	0.04	0.24	4.18	0.000
HF knowledge	-0.14	0.06	-0.13	-2.51	0.013	-0.17	0.05	-0.14	-2.98	0.003
Functional status	0.20	0.31	0.03	0.65	0.51	-	-	-	-	-
Gender	1.56	0.74	0.09	2.09	0.04	-	-	-	-	-
Age	0.03	0.03	0.05	1.14	0.25	-	-	-	-	-
Perceived control	-0.07	0.07	-0.05	-1.07	0.28	-	-	-	-	-

Discussion

The goal of the current study was to examine whether psychological flexibility, impulsivity, stress, time since diagnosis, heart-failure knowledge, functional status, gender, age and perceived control will predict depression in older adults with heart failure. Psychological flexibility and impulsivity were borrowed from the acceptance and commitment therapy model as potential predictors for depression in older adults with heart failure. The best fit model showed that time since diagnosis, impulsivity, stress, psychological flexibility and heart-failure knowledge explained about a half of the variance in depression in our sample. These results were consistent with previous literature regarding time since diagnosis, stress and heart-failure knowledge (Cirelli et al., 2018; Hwang et al., 2020).

Although there were no previous studies that linked psychological flexibility and impulsivity to depression in older adults with heart failure, the current-study results were consistent with the previous studies' findings in other populations. For example, psychological flexibility has been reported to be associated with depression in older adults with chronic kidney disease, general population and women with breast cancer (Ghorbani et al., 2021; Iida et al., 2020). In addition, psychological flexibility is a main predicting variable of mental health (McCracken et al., 2021). Similarly, impulsivity has been found to be associated with depression in older adults with unipolar and bipolar diseases and suicide attempters (Ozten et al., 2019). Impulsivity is also a key predictor of depression in older adults (Monopoli et al., 2000). Lack of previous studies regarding the role of these factors in predicting depression in persons with heart failure limited the authors' ability to further discuss the results of this study within the context of the literature. Nevertheless, the results of this study indicate that depression in persons with heart failure is a complex phenomenon that is influenced by many demographic and psychological factors.

Against the available evidence in the literature, functional status, gender, age and perceived control did not predict depression in the best fit model (Cirelli et al., 2018; Hwang et al., 2020). These results are inconsistent with previous studies where certain demographic variables, for example age and gender, were significant predictors of depression (e.g. Sbolli et al., 2020; Smaardijk et al., 2020). One explanation could be that entering the unique variables' combination along with newly proposed predictors masked out the role of these variables in the model. This was evident by the negligible change in the variance explained between the initial and best fit models. Another explanation is that the association between these variables and depression was based on bivariate association without accounting for other variables' roles.

Implications for Nursing

The current study offers a preliminary evidence of the potential benefit of the acceptance and commitment therapy model-based interventions. Thus, it lays the ground for applying such interventions. In addition, the current study showed the potential of the acceptance and commitment therapy model in predicting mental health issues in older adults with heart failure. In addition, we believe that the variables borrowed from the ACT model may also be beneficial in exploring mental issues and problems in older adults with other chronic illnesses.

However, this only can be supported by future research on populations with other chronic illnesses.

Limitations

The generalizability of the study findings is limited by convenience sampling. In addition, participants were recruited from two hospitals in northern Jordan. Regarding the gender of participants, more than two thirds of the participants were male persons with heart failure. Conducting further research that addresses these limitations is warranted to expand the scientific knowledge regarding the predictors of depression among older adults with heart failure.

Conclusion

The current study investigated the role of potential predictors borrowed from the acceptance and commitment therapy model in predicting depression in older adults with heart failure. The results showed that the ACT model could be important if adopted to investigate mental-health issues; namely, depression, in older adults with heart failure.

Ethical Approval

All research activities were in accordance with ethical guidelines.

Conflict of Interest

The authors declare no conflict of interest

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