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Maria Liljeroos, Anna Strömberg, Kristofer Årestedt and Misook L. Chung

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Mediation effect of depressive symptoms in the relationship between perceived control and well-being in patients with heart failure and their partners

Maria Liljeroos, RN, PhD^{1,2} maria.liljeroos@dll.se

Anna Strömberg, RN, PhD, FAAN, Professor ^{1,3} anna.stromberg@liu.se

Kristofer Årestedt, RN, PhD, Professor ^{1,4,5} kristofer.arestedt@lnu.se

Misook L, Chung, RN, PhD, FAAN Professor ⁶ misook.chung@uky.edu

¹ Division of Nursing Sciences, Department of Medical and Health Sciences, Linköping University, Sweden

² Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden

³ Department of Cardiology, Linköping University, Sweden

⁴ Faculty of Health and Life Sciences, Linnaeus University, Kalmar, Sweden

⁵ Kalmar County Council, Kalmar, Sweden

⁶ College of Nursing, University of Kentucky, Lexington, United States

Corresponding author: Maria Liljeroos, maria.liljeroos@dll.se, phone number +46703728329, Mälarsjukhuset hospital, 63188 Eskilstuna, Sweden

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Abstract

Background: As treatment has improved, patients with heart failure (HF) live longer, and the care mostly takes place at home with partners providing the main assistance. Perceived control over HF is important in managing self-care activities to maintain health in patients and their family. Depressive symptoms are associated with impaired health status in patients with HF and their family. However, there is limited knowledge about how depressive symptoms affect the relationship between health status and perceived control over the HF in patients with HF and their cohabiting partners.

Aim: To examine whether the relationship between perceived control and health status (i.e., mental and physical) was mediated by depressive symptoms in patients with HF and their partners.

Methods: In this secondary data analysis, we included 132 HF patients and 132 partners who completed measures of depressive symptoms (the Beck Depression Inventory-II), perceived control (the Control Attitude Scale), and physical and mental health status (the Short-Form 36) instruments. The mediation effect of depression was examined using a series of multiple regression in patients and their family caregivers separately.

Results: We found a mediator effect of depressive symptoms in the relationship between perceived control and mental health status in both patients and partners. The relationship between perceived control and physical health status was mediated by depressive symptoms in the patients, not in the partners.

Conclusion: Efforts to improve self-care management and maintenance by targeting perceived control may be more effective if depressive symptoms are also effectively managed.

Keywords:

Heart failure, well-being, depressive symptoms, mediator, perceived control, family

Introduction

Heart failure (HF) is a serious and common condition. In developed countries 1-2% of the population is diagnosed with HF and the prevalence is higher than 10% among persons above 70 years of age.¹ As treatment has improved, patients with HF now live longer, and the care mostly takes place at home.² Between 45-70% of patients with HF live with a family member who is involved in the care as an informal caregiver. When the patient and the partner are living in a dyadic relation, the partner is usually the primary caregiver.³ Supportive relationships where self-care activities could be shared with a partner are known to improve outcomes, such as self-care, adherence, and health status in patients with HF.⁴

Partners form a significant resource in supporting patients' self-care, and patients and partners handle several health problems without consulting healthcare professionals.⁴ While partners often experience it as positive to be involved in care,⁵ there is also research showing that the involvement can be burdensome and that caregivers are at greater risk for impaired well-being due to the caregiving situation.⁶ Partners are known to experience similar mental distress as the patients,⁷ and have also reported deteriorating mental and physical health status related to the role as informal caregivers.⁸ Further, caregivers also seek healthcare to a greater extent than non-caregivers.⁸

Since living with HF is a stressful event for both the patient and the partner, the level of perceived control over the HF is an important coping response. Perceived control can be defined as a self-generated belief that a person has the internal resources to influence adverse events positively and bring about a desired change in his/her environment.⁹ High levels of perceived control are related to a better adaptation to HF, and associated with better physical health status and fewer symptoms of depression in the patients.¹⁰ Low perceived control is associated with poorer self-care activities and is independently associated with physical and

mental health status.¹¹ Several studies found that partners experience lower perceived control than the HF patients themselves.^{12, 13} If a person can regain control, then they are more likely to manage self-care, which can improve both physical and mental health status.¹¹

Perceived control is also of importance for caregivers when they support their ill family members' managing heart problems. Caregivers' perceptions of control have been related to their mental health status, where low control leads to mental distress.¹⁴ Bakas et al found that low caregiver perceived control over their family member's heart problems was reported by 42.9% of the caregivers.⁷ The burden of caregiving has been found to be lower when the patient experiences better mental and physical health and when the partner experiences higher control over the heart disease.¹⁴

Depressive symptoms are common among patients with HF, the prevalence ranges from 9% to 60%.¹⁵ Depressive symptoms are associated with impaired health status and predict medical adherence and self-care management.¹⁶ Depressive symptoms have also been found to be associated with reduced physical activity in patients with HF because of the lack of motivation.^{16, 17} Caregivers experience depression commonly and the levels of depressive symptoms and prevalence of depressive symptoms are very similar to those of patients with HF.^{8, 14}

Thus, there is limited knowledge about how depressive symptoms affect the relationship between perceived control over HF and physical and mental health in both patients and partners.

Chung et al¹⁸ found that perceived social support and depressive symptoms were independent predictors of physical and mental health in patients with HF, and neither social support nor

depressive symptoms moderated quality of life. Doering et al¹⁹ found that depressive symptoms was a mediator between perceived control and both general and cardiac specific mental and physical health and concluded that high control was associated with improved depressive symptoms in heart transplant recipients. In this study, we assumed that depressive symptoms play a role of mediation in the relationship between perceived control and health status and this phenomenon may be same for both patients and partners.

Thus, the aim of this study was to examine whether the relationship between perceived control and health status (i.e., mental and physical) was mediated by depressive symptoms in patients with HF and their partners.

Methods

Design and settings

This study is a secondary data analysis using the baseline assessment data from a randomized controlled intervention study (ClinicalTrials.gov, identifier: NCT02398799).²⁰ Patients with HF and their partners were recruited at a university hospital and a county hospital in the southeast of Sweden between 2005 and 2008. In the present study, only patients and partners who had completed data of key variables (i.e., depressive symptoms, perceived control, and health status) in the baseline assessment were selected. The study conforms with the principles outlined in the Declaration of Helsinki and was approved by the Regional Ethical Review Board in Linköping, Sweden (No. 03-568, No.M178-04).

Sample and procedures

Eligible participants were individuals diagnosed with HF (NYHA class II-IV) according to guidelines¹ with a partner cohabiting in the same household. Exclusion criteria were diagnosed dementia in one of the dyad members or other severe psychiatric illness, drug

abuse, difficulties to understand or read the Swedish language, planned cardiac surgery or participation in other studies.

Patients and their partners were informed verbally about the study at a visit at the HF clinic or by phone. Those interested in taking part in the study were given additional written information. Both patients and partners signed informed consent and separate questionnaire packets were sent by post to the patient and partner to complete at home.

Measures and data collection

The following instruments were used; Control Attitude Scale,²¹ Beck Depression Inventory²² and 36- item Short-Form Health Survey.²³ In addition, demographic data and health history were collected, using a structured questionnaire, to describe sample characteristics.

Perceived control

Control Attitude Scale (CAS) consists of 4 items, two of which reflect the patient's perceptions and two reflect the patient's perception about family members' perceived control and vice versa for the partners. Response statements were scored on a scale from 1 (none) to 7 (very much). The total score ranges from 4 to 28, with higher scores reflecting higher levels of perceived control. The CAS-English version has been reported as a reliable instrument as Cronbach's alpha values ranging from 0.77 to 0.89.²¹ The psychometric testing for the Swedish translation has shown reliability coefficient $\alpha > 0.80$ for the patient version and 0.60 to 0.70 for the partner version.²⁴ In the present study Cronbach's alpha was 0.80 for both the patient and the partner version.

Depressive symptoms

Beck Depression Inventory II (BDI-II) was used to assess depressive symptoms.²² Each answer is scored on a scale from 0 to 3, indicating feelings over the last two weeks. Higher scores indicated more severe depressive symptoms. The cut off scores recommended by the developer are: 0–13: no depression; 14–19: mild depression; 20–28: moderate depression; and 29–63: severe depression. A Swedish version of the BDI-II has been validated.²⁵ In this study, Cronbach's alpha was 0.92 in patients and 0.90 in the partners.

Health status

The Short-Form-36 (SF-36) was used to assess physical and mental health status.²³ SF-36 consists of 36 items which measure eight health concepts: physical function, role limitation caused by physical problems, bodily pain, general health, social function, mental health, role limitation caused by emotional problems, and vitality. A standard scoring algorithm can be used to aggregate scores from the eight health components into two higher order summary scores, the physical component summary (PCS) and the mental component summary (MCS). The MCS comprise a summary of four subscales based on a wide variety of different item in SF-36 namely social function, mental health, role limitation caused by emotional problems, and vitality. The PCS compromise a summary of physical function, role limitation caused by physical problems, bodily pain, general health. The PCS and MCS have 0 as the lowest possible score, but in contrast to the eight health components, they cannot reach 100. In the present study, PCS and MCS were used to assess physical and mental health status. The SF-36 has been frequently used and has been found to have good reliability and validity.²³

Data analysis

Descriptive statistics (frequency, mean, standard deviation, median, range) were used to describe demographic and clinical characteristics of participants. Associations between

depressive symptoms, perceived control, and physical and mental health status were assessed using Pearson's correlation.

To examine the mediator effect of depressive symptoms we used a linear regression approach guided by Baron and Kenny.²⁶ Analyses were conducted separately for patients and partners.^{26, 27} In the first step, the outcome variable (i.e. mental or physical health status) was regressed on the independent variable (perceived control). This indicates the total effect of the predictor on the outcome variable. In the second step, the mediator variable (depressive symptoms) was regressed on the independent variable (perceived control), and then in the third step, the outcome variable was regressed on the mediator variable. In the final step, the outcome variable (i.e. mental or physical health status) was regressed on the mediator (depression) and the independent variable (perceived control). A mediator effect is supported when the significant association between the independent variable (perceived control) and outcome variable (i.e. mental or physical health status) becomes less significant or non-significant when both independent variable and mediator are entered in the regression model (step four). We used the Sobel test to confirm significance of mediator effect using the web page MedGraph.²⁸ The MedGraph also provides information for total effect of predictor on outcomes, direct (i.e., predictor) and indirect (i.e., mediator) effects on the outcomes. The level of statistical significance was set to $p < 0.05$. Statistical analyses were conducted using SPSS 18 for Windows (SPSS Inc, Chicago, IL, USA).

Results

Characteristics of the participants

The final sample consisted of 132 patients and their cohabiting partners. The majority of the patients were men (75%) while the majority of partners were women (75%). Patients were two years older than their partners (69.4 (± 13.6) vs. 67.1 (± 12.1) years. Half of the patients were classified in NYHA III (59.1%) (Table 1).

Insert Table 1. Clinical and demographic characteristics of the patients and the partners.

Mediation effect of depressive symptoms on the relationship between perceived control and mental health status

Patients

In a series of four linear multiple regressions, we found a significant mediator effect of depressive symptoms in the relationship between perceived control and mental health in patients (Table 2). Perceived control predicted mental health status ($\beta = .357, p = .001$) in step one and perceived control also predicted depressive symptoms ($\beta = .336, p = .001$) in step two. In step three, depressive symptoms predicted mental health ($\beta = -.651, p = .001$). When we entered both perceived control and depressive symptoms in prediction of mental health status, the standardized regression coefficient for the association decreased from $\beta = .357$ to $\beta = .155$ but remained significant in step four ($p = .028$). The Sobel test also confirmed the significant mediator effect of depressive symptoms (sobel z score = 3.67, $p = .001$). The indirect to total effect ratio indicated that 63% of the total effect were explained by depressive symptoms (i.e. the mediator variable, Figure 1).

Insert Table 2. Mediator effect of depressive symptoms on the relationship between perceived control and mental health status in patients (n=132) **and**

Insert Figure 1. Mediator effect of depressive symptoms on mental and physical well-being on patients and partners.

Partners

We also found a significant mediator effect of depressive symptoms in the relationship between perceived control and mental health for partners (Table 3). Partners' perceived control did not reach statistical significance in predicting mental health status ($\beta = .158, p = .064$) in step one. Though in step two, partners perceived control predicted depressive

symptoms ($\beta = .196, p = .021$), and in step three, depressive symptoms predicted mental health ($\beta = -.548, p = .001$). When we entered both perceived control and depressive symptoms in prediction of mental health, the standard coefficient value of perceived control was decreased ($\beta = .053, p = .072$), while depressive symptoms remained as a strong predictor of mental health ($\beta = -.538, p = .001$). The Sobel test indicated significant mediator effect of depressive symptoms ($p = .026$). The indirect to total effect ratio indicated that 66% of the total effect were explained by depressive symptoms (Figure 1).

Insert Table 3. Mediator effect of depressive symptoms on the relationship between perceived control and mental health status in partners (n=132).

Mediation effect of depressive symptoms on the relationship between perceived control and physical health status

Patients

In a series of four linear multiple regressions, we found a significant mediator effect of depressive symptoms in the relationship between perceived control and physical health in patients (Table 4). In step one of the mediation analysis, perceived control significantly predicted physical health status ($\beta = .187, p = .032$) and perceived control also predicted depressive symptoms ($\beta = -.341, p = .001$) in step two. In step three, depressive symptoms predicted physical health ($\beta = -.335, p = .001$). In the final step, when both perceived control and depressive symptoms were entered, only depressive symptoms remained as a significant predictor of physical health status, thus demonstrating that depressive symptoms were a mediator of the relationship between perceived control and physical health status ($\beta = -.306, p = .001$). The Sobel test was significant (sobel z score=2.69, $p = .007$). The indirect to total effect ratio indicated that 56% of the total effect were explained by depressive symptoms (Figure 1).

Insert Table 4. Mediator effect of depressive symptoms on the relationship between perceived control and physical health status in patients (n=132)

Partners

We found no significant mediator effect of depressive symptoms in the relationship between perceived control and physical health in partners. Perceived control did not reach statistical significance in predicting physical health ($\beta = .004, p = .959$), or depressive symptoms ($\beta = .033, p = .708$). Though, depressive symptoms predicted physical well-being ($\beta = .178, p = .037$). When entering both perceived control and the mediator depressive symptoms, both variables predicted physical well-being (perceived control $\beta = .041, p = .036$; depressive symptoms $\beta = .186, p = .033$). That indicates, depressive symptoms were not significant as a mediator but played a role as an enhancer in the relationship of perceived control with physical health status.

Insert table 5. Mediator effect of depressive symptoms on the relationship between perceived control and physical health status in partners (n=132)

Discussion

To the best of our knowledge, this is the first study to examine if the relationship between perceived control and health status are mediated by depressive symptoms in patients with HF and their partners. Overall, our findings showed that depressive symptoms mediated this association for both patients and partners.

We found a mediator effect of depressive symptoms in the relationship between perceived control and mental health status in both patients and partners. Psychological problems are common in patients with HF, for example one in every five HF patients experience depressive symptoms.¹⁵ Patients with higher levels of perceived control have been found to experience

fewer symptoms of depression compared to patients who experience lower levels of perceived control.²⁹ This result indicates that patients experiencing depressive symptoms and low control are at risk for impaired mental health status. This could also reflect on the fact that we also found that depressive symptoms were a mediator in the relationship between perceived control and physical health status for the patients. Goldstein et al. found that individuals with higher levels of depressive symptoms, more regimen complexity was associated with lower medical adherence, which affect the outcome.¹⁶

Depressive symptoms have previously been associated with poor engagement in self-care management and decreased quality of life in patients with HF. Self-care influences both medical and person-centred outcomes, such as well-being, quality of life, readmission rates and mortality.³⁰ Effective HF self-care is important for maintaining health and to prevent patients from HF exacerbation.³⁰ HF- specific self-care behaviors include taking prescribed medications, keeping physically active, eating healthy, avoiding excessive salt, fluid and alcohol intake, and maintaining a healthy body weight. Self-care management also includes daily monitoring and recognition of changes in signs and symptoms, knowing how and when to contact healthcare professionals and, in line with professional advice, know when to self-manage diuretic therapy.¹ Individuals with depression may have distinct problems in performing self-care due to impaired motivation. It is known that HF patients with depressive symptoms might not be optimal candidates for regular self-care interventions.¹⁶ To help patients with depressive symptoms and their partners to be able to manage the self-care they may need diverse types of support. To improve outcomes, individualized and more targeted interventions, which address both practical and mental components, are probably needed.

Also in patients with other chronic disease affecting the heart and lungs, low levels of perceived control have been shown to negatively affect depressive symptoms and health

status. Higher levels of perceived control are related to less depressive symptoms in patients with coronary heart disease²⁹ and with less severe depressive symptoms in asthma patients.³¹ The result in the present study highlights the importance of increasing the patients and partners perceived control over their heart disease. Perceived control is a relevant target for nursing interventions since increased control may reduce complications, and has been found to be sensitive to psychosocial and educational interventions in both patients and partners. These findings also highlights the importance of including partners in the HF programs.^{9, 31} The level of perceived control could be easily measured by for example the CAS.²¹ The CAS instrument consists of four belief statements designed to measure perceptions of personal and family control (and conversely helplessness) in the context of cardiovascular disease, and could be used for both patients and partners.

Surprisingly, for partners, perceived control failed to predict their own mental health. One reason for that could be that the partners in this study scored relatively high levels of perceived control and low levels of depressive symptoms.

However, partners' perceived control predicted their depressive symptoms, meaning that partners with low control are at risk for depressive symptoms. Relatively high levels of depressive symptoms and deteriorating mental health have been identified among partners, sometimes even higher than in the HF patients.⁶ Depressive symptoms and partners mood states can have detrimental effect on HF patients self-care ability.³² Patients with moderate to severe HF are often reliant on their partners for assistance with self-care activities, meaning that also partners need knowledge about disease management. There is a relationship between the amount of care provision and partners health, and when the burden increases, so does the risk of illness among partners.⁷ This call for a family-oriented approach in which nurses also assess the way that family members are affected by the HF of the patient. Education and skills training for both patients and partners seem to be highly necessary to improve the level of

control of the HF. Also, screening and treatment of depressive symptoms is important in improving both patients and partners mental health status and self-care among HF patients. Screening depressive symptoms for both patients and partners living with HF are still rare in clinical practice.

This study has limitations that affect generalizability. Because this study is a secondary data analysis, data was collected some years ago. However, screening for depression is still rare in clinical practise for patients and partners living with HF. Further, since this was a cross-sectional study, no causal relationship could be established. Using both MCS and BDI in the same mediation analysis can be questioned. However, MCS and BDI measure different, but somewhat overlapping concepts, with the correlation 0.55 for patients and 0.66 for partners. Beck Depression Inventory is defined as a depression screening instrument with a strong correlation with the clinical assessment for depression, while the MCS comprise a summary of four subscales based on a wide variety of different item in SF-36 namely social function, mental health, role limitation caused by emotional problems, and vitality.

In the study sample there was an unequal gender distribution, where the majority of the patients were male with female spouses. Therefore, we cannot exclude the possibility that our findings to some extent may reflect gender differences. In previous research there has been inconclusive findings regarding the relationship between gender, perceived control and depressive symptoms. Chung et al³³ found that caregivers' perceived control predicted their depressive symptoms and this was not related to gender. While Rohrbaugh et al¹² found that both female patients and partners experienced more distress and depressive symptoms than their male counterparts. Further studies using longitudinal study designs are needed to determine whether there is a gender difference rather than a patient/partner difference regarding perceived control and depressive symptoms.

The data were collected in one academic hospital and one county hospital in Sweden so that it is limited to generalize in patients with HF in another context. Further, the current study only included spouses and no other family members. More research is needed including other informal caregivers, for example children or other persons supporting patients with HF.

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Table 1. Clinical and demographic characteristics of the dyads.

Characteristics	Patient (n=132)	Partner (n=132)
Female, n (%)	31 (23.5)	101 (76.5)
Age, mean (SD)	71.3 (11.5)	68.8 (12.5)
Medical history n (%)		
Myocardial infarction	57 (43.2)	13 (9.8)
Hypertension	61 (46.2)	54 (40.9)
Diabetes	37 (28.0)	17 (12.9)
Stroke	19 (14.4)	9 (6.8)
Lung disease	10 (7.6)	10 (7.6)
Pacemaker	20 (15.2)	2 (1.5)
Cardiac resynchronization therapy	23 (17.4)	1 (0.8)
Implantable cardioverter defibrillator	5 (3.8)	7 (5.3)
Percutaneous coronary intervention	25 (18.9)	7 (5.3)
Coronary artery bypass surgery	29 (21.0)	5 (3.8)
NYHA class. n (%)		
II	37 (28.1)	
III	77 (58.3)	
IV	18 (13.6)	
Medication. n (%)		
ACEI/ARB	130 (98.5)	
Beta-blockers	125 (94.7)	
Diuretics	122 (92.4)	
Employment. n (%)		

Full time	13 (9.8)	31 (23.4)
Disability pension/sick leave	13 (9.8)	5 (3.7)
Homemaker	3 (2.2)	2 (1.6)
Pension	103 (78.2)	94 (71.2)
Lifestyle. n (%)		
Smoking	6 (4.5)	15 (11.3)
Alcohol	Never drink alcohol	29 (22.0)
	≤7 glass/week	97 (73.5)
	> 7 glass/week	6 (4.5)
Exercise	< 30 min/week	7 (5.3)
	30 min-3 hours/week	51 (38.6)
	> 3 hours/week	74 (56.1)
Instruments		
PCS, mean (SD)	32.7 (9.4)	46.4 (11.3)
MCS, mean (SD)	41.1 (12.7)	46.2 (11.5)
BDI, mean (SD)	11.5 (8.8)	7.44 (6.7)
CAS, mean (SD)	15.9 (4.6)	16.1 (5.2)

Table 2. Mediator effect of depressive symptoms on the relationship between perceived control and mental health status in patients (n=132)

	Predictor	Outcome	Standardized β	Unstandardized β	Std. error	<i>p</i> - value	R ²
Step 1	Perceived control	Mental health	.357	.953	.219	.001	.127
Step 2	Perceived control	Depressive Symptoms	.336	-.615	.151	.001	.113
Step 3	Depressive Symptoms	Mental health	-.651	-.952	.097	.001	.424
Step 4	Perceived control	Mental health	.155	.415	.186	.028	.445
	Depressive Symptoms		-.599	-.875	.102	.000	

Table 3. Mediator effect of depressive symptoms on the relationship between perceived control and mental health status in partners (n=132).

	Predictor	Outcome	Standardized β	Unstandardized β	Std. error	<i>p</i> - value	R2
Step 1	Perceived control	Mental health	.158	.333	.178	.064	.025
Step 2	Perceived control	Depressive Symptoms	.196	-.252	.108	.021	.038
Step 3	Depressive Symptoms	Mental health	-.548	-.898	.117	.001	.301
Step 4	Perceived control	Mental health	.053	.111	.154	.072	.303
	Depressive Symptoms		-.538	-.881	.120	.001	

Table 4. Mediator effect of depressive symptoms on the relationship between perceived control and physical health status in patients (n=132)

	Predictor	Outcome	Standardized β	Unstandardized β	Std. error	<i>p</i> - value	R2
Step 1	Perceived control	Physical health	.187	.363	.167	.032	.035
Step 2	Perceived control	Depressive Symptoms	-.341	-.625	.149	.001	.116
Step 3	Depressive Symptoms	Physical health	-.335	-.356	.088	.001	.112
Step 4	Perceived control	Physical health	.084	.163	.171	.340	.118
	Depressive Symptoms		-.306	-.326	.093	.001	

Table 5. Mediator effect of depressive symptoms on the relationship between perceived control and physical health status in partners (n=132)

	Predictor	Outcome	Standardized β	Unstandardized β	Std. error	<i>p</i> - value	R ²
Step 1	Perceived control	Physical health	.004	.009	.171	.959	.007
Step 2	Perceived control	Depressive Symptoms	.033	.039	.105	.708	.113
Step 3	Depressive Symptoms	Physical health	.178	.276	.131	.037	.112
Step 4	Perceived control	Physical health	.041	.081	.172	.036	.182
	Depressive Symptoms		.186	.288	.134	.033	

Mediator effect of patients depressive symptoms on mental well-being.

Mediator effect of spouses depressive symptoms on mental well-being.

Mediator effect of patients depressive symptoms on physical well-being.