Psychometric Evaluation of a Coping Strategies Inventory Short-Form (*CSI-SF*) in the Jackson Heart Study Cohort

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Abstract: This study sought to establish the psychometric properties of a Coping Strategies Inventory Short Form (*CSI-SF)* by examining coping skills in the Jackson Heart Study cohort. We used exploratory and confirmatory factor analysis, Pearson's correlation, and Cronbach Alpha to examine reliability and validity in the *CSI-SF* that solicited responses from 5302 African American men and women between the ages of 35 and 84. One item was dropped from the 16-item *CSI-SF,* making it a 15-item survey. No significant effects were found for age and gender, strengthening the generalizability of the *CSI-SF*. The internal consistency reliability analysis revealed reliability between alpha = 0.58-0.72 for all of the scales, and all of the fit indices used to examine the *CSI-SF* provided support for its use as an adequate measure of coping. This study provides empirical support for utilizing this instrument in future efforts to understand the role of coping in moderating health outcomes.

Keywords: Measurement; psychometric analysis; coping; African Americans

Introduction

Cardiovascular disease (CVD) remains the number one cause of death in the United States. A number of risk factors for coronary heart disease (CHD) and stroke have been identified, and population-based studies have begun to examine CVD risk prospectively in African Americans. Recent literature has established that death rates for CVD in the U.S. are disproportionately higher for African Americans [1-4]. The assessment of psychosocial factors, such as coping, is critical for a comprehensive understanding of cardiovascular risk and health [5]. Coping is believed to moderate the relationship between environmental stressors and physiological responses that ultimately influence health outcomes [6], signifying that defensive coping can modify the impact of hostile encounters on physiological functioning [7;8], and problem-focused coping can enable individuals with

higher coping skills to have fewer depressive symptoms [9-13].

Racial differences in chronic disease survival have been attributed in the past to lack of education, lower socioeconomic status, inadequate medical insurance, and limited access to healthcare. The difference in chronic disease survival between African American women and white women has been linked to differences in coping strategies employed by these two groups. [14-16]. It is believed that coping strategies by individuals with chronic diseases could help to explain the differences in their disease survival rates, as well as their ability to adjust to chronic diseases [17]. Even though some authors have described coping mechanisms as innate or acquired methods that individuals use to respond to internal or external stimuli, exploration of coping strategies used by African Americans has not been very well defined in the literature [18]. Coping strategies are essential for

adaptation and survival, but the experiences of African Americans with traditional health care services do not provide them with adequate adjustment to chronic diseases. It has been reported that African Americans, however, generally assimilate information through a cultural context, using positive reappraisal, social support, and problem-solving that may have an impact on their survival rates when confronted with chronic diseases [19].

The original Coping Strategies Inventory (CSI) was developed to categorize coping responses based on coping target and directionality of response [20]. With this system, individuals are classified using a 2x2 matrix that quantifies the degree to which each strategy is generally employed. Coping efforts are first categorized as to whether they represent an engagement strategy, involving approach-related actions that result in confronting stressors, often viewed as a crucial factor in limiting the long-term psychological and physiological sequelae of environmental stressors, or disengagement strategy (avoidance) seeking to limit exposure to noxious stimuli, often producing desirable short-term effects, but leading to longer-term problems, including depressive symptoms [6;21]. Within these categories, the target of the coping effort is either Problem-focused or Emotion-focused [21-23]. Emotion-focused coping emphasizes the regulation of one's affective response, whereas Problem-focused coping emphasizes management of the stress-producing situation.

Despite the myriad of stressors to which most African Americans are exposed, relatively little is known about patterns of coping in this population. When faced with stressful life circumstances, the general tendency is to react cognitively and/or behaviorally to reduce the effects of those experiences [7, 18, 24-26]. The science of psychometrics includes a set of standards and procedures by which to judge the characteristics and quality of a survey. A major goal of establishing psychometric properties is an evaluation of the consistency of psychometric results [27]. The purpose of this study was to expand previous studies of coping through an examination of the psychometric properties and the factor structure of the Coping Strategies Inventory Short Form (*CSI-SF)* that was administered to the Jackson Heart Study African American cohort.

Methods

The participants of this study comprised the Jackson Heart Study (JHS) cohort with a representative, population-based sample that includes 5302 African American men and women between the ages of 35 and 84. Power analyses confirmed that all scientific questions could be addressed with this sample. The sample is made up of four components of participants who are residents of Hinds, Madison and Rankin counties surrounding Jackson, Mississippi; Atherosclerosis Risk in Communities (ARIC) participants; random selection participants; volunteers; and family participants-- first degree relatives of index participants. There were 931

participants in the random group, 1570 in the volunteer group, 1185 in the ARIC group and 1626 in the family group, making a total of 5302 in the sample. Further details of the Jackson Heart Study sample are chronicled elsewhere [28].

The CSI was selected because it was believed to adequately address the question of coping, it addressed factors that were crucial to the study model, it was pertinent to theory, and it classified coping in a way that was believed to have established empirical support extending across age groups [29]. The CSI was originally constructed as a 78-item questionnaire [20]. A four point Likert scale was used to record the participants' responses. Respondents were asked to rate the general frequency with which they utilize each listed coping strategy on the survey and to indicate their choices in the following manner: 1 = "Never", 2 = "Seldom", 3 = "Sometimes", 4 = "Often" and 5 = "Almost Always".

The original CSI was shortened to a 16-item version for use in the JHS, after a validation study was conducted in Jackson, Mississippi, using research samples including headache sufferers, patients with coronary heart disease, and caregivers of Alzheimer's patients [30]. The *CSI-SF* was structured to reflect the original scale, with four 4-item subscales: (a) Problem–Focused Engagement, (b) Problem-Focused Disengagement, (c) Emotion-Focused Engagement, and (d) Emotion-Focused Disengagement [20]. Individuals receive scores for each first tier subscale (Engagement and Disengagement: range = 8 – 40), as well as for each of the four second tier subscales (Problem-Focused Engagement, Problem-Focused Disengagement, Emotion-Focused Engagement, and Emotion-Focused Disengagement: range = 4 – 20). Each of the four 2nd tier subscales created contained four items each [31].

Use of the 16 item *CSI-SF* in the JHS was believed to meet minimum psychometric requirements for measuring coping in this African-American population. It was believed that the methods used to construct and score the scales, as well as the summary measures, were appropriate for the group under investigation [29]. Participants of the JHS were instructed by Jackson Heart Study Home Induction Interviewers to complete the *CSI-SF* at home, prior to their clinic exams, and deliver it at their clinic exam visit. At that visit, an interviewer reviewed the form for completeness and for assurance that the participant had a clear understanding of instructions and content Interviewers would read instructions and questions aloud if the participant had a reading disability or other impediment that pre-empted their ability to fully comprehend the instructions and procedures [30].

Statistical Analysis

Our analyses evaluated whether the original CSI subscale configuration and its psychometric features had been maintained in this new 16-item CSI-SF instrument. Data collected were first examined by applying descriptive statistics procedures, using frequencies, mean

and standard deviations. A comparison of JHS participants who completed the CSI-SF and those who did not complete the CSI-SF was made to examine differences relevant to the study, and to ensure that non-response bias was not a problem [32].

The decision as to which approach to use depends largely on the current understanding of the factors under investigation. Two of the most widely used methods of factor analysis were considered for this study. Floyd and Widaman [31] suggested that exploratory factor analysis (EFA) is most appropriate in the initial stages of model development. An exploratory factor analysis can first be applied if it is unclear that a theory is sufficiently developed to justify a confirmatory analysis [33]. Confirmatory factor analysis (CFA) provides a more powerful tool in the second stage of research when a model has already been established. In the case of the *CSI-SF*, a highly promoted model was already available in the literature, and exploratory factor analysis (EFA) was not necessary to examine and verify the factor structure [31]. We decided to examine the validity of the revised 16-item CSI-SF through a preliminary exploratory factor analysis, and then tested these factors using CFA. The objective of conducting the EFA was to detect any low, inadequate factor loadings and delete such low loadings of response items from the model that would ultimately represent the coping characteristics of the JHS cohort. To be considered meaningful, the standardized path coefficients of the items should be above .30 [34;35].

CFA was subsequently applied to this factor solution since this is the appropriate measure when a model has already been established [31]. The output of CFA allows the researcher to evaluate the factor model overall, and, at the same time, evaluate the level of individual variable-factor relationships [36], in order to develop an adequate instrument for measurement [37].

Since the *CSI-SF* was developed by first identifying coping dimensions and then selecting items to measure those dimensions from the original CSI, an *a priori* structure was established, and the CFA conducted in this study sought to determine how well the previously created structure conformed to the data. Next, a structural equation modeling (SEM) procedure was conducted to examine the relationship among the many variables simultaneously. The PROC CALIS procedure in SAS was used to conduct the CFA. Internal consistency reliability coefficients were calculated based on Cronbach's alpha coefficient [35, 38]. With this procedure, the chi-square was first conducted to test the fit between the sample co-variance matrix and the matrix implied by the models. This chi-square statistic was utilized to test the difference between the predicted and the observed relationships (correlations/co-variances). Calculations were computed for *Root Mean Square Error of Approximation* (RMSEA), *Goodness of Fit Index* (GFI), *Root Mean Square Residual* (RMSR), *Adjusted Goodness of Fit Index* (AGFI), *Parsimonious GFI* (PGFI) and *Parsimonious NFI* (PNFI) (35, 39-41). Validity analysis focused on construct validity. The Pearson correlation coefficient was

computed for this purpose to assess the associations among the scales.

Results

The *CSI-SF* was given to all 5302 enrolled participants in the JHS. Of these participants, 81.4% provided a completed measure, while 18.6% did not. To investigate selection bias issues and to evaluate any potential variation between participants who completed the *CSI-SF* and those who did not complete the instrument, Chi-square analyses were computed on some demographic data that could relate to the response to the instrument. Table 1 displays analyses that were computed on gender, educational level, and income level of the participants to examine non-response bias between those who responded to the *CSI-SF* and those who did not.

Table 1: Demographic Characteristics of Respondents (Completing the CSI-SF) and Non-Respondents (Not Completing CSI-SF)

Category	Respondents		Non Respondents		p-value
	n	*%*	*n*	*%*	
Gender					
Female	2807	65.1	586	59.4	.0008
Male	1508	34.9	401	40.6	
Education					
Less than High School	709	16.4	264	26.7	
High School /GED/ Some College	1804	41.8	424	43.0	.0001
College /Associate Degree or Higher	1788	41.4	293	29.7	
No Response	14	0.4	6	0.6	
Income					
Low	533	12.4	169	17.1	
Medium	906	21.0	225	22.8	.0001
High	1112	25.8	206	20.9	
Affluent	1120	25.9	201	20.4	
No Response	644	14.9	186	18.8	

A comparison of those participants' responses revealed that there was some difference in gender (p = 0.0008), education (*p* = 0.0001), and income (*p* = 0.0001), but not enough to impact the validity of the survey, especially because of the large number of participants who completed the survey (81.4%) compared to the small numbers (18.6%) who did not respond. Age of the participants at Home Induction did not reveal any significant differences relevant to the study and is not

included in the table. Because the response rate was 81.4%, assessing whether there were differences between the types of individuals who participated in the CSI-SF (n = 4315) and those who did not (n = 987) was not critical to the results of this study.

The mean, standard deviation, and median from total scores obtained on the scales and sub-scales of the CSI-SF are summarized in Table 2. Cronbach's Alpha coefficients were computed for each of the four sub-scales of the *CSI-SF* to estimate internal consistency reliability (Table 2). All dimensions were shown to have marginal to acceptable levels of reliability (alpha = 0.58-0.72). Coefficients ranged from 0.58 to 0.72 for second tier subscales, which are Problem-Focused engagement, Problem-Focused Disengagement, Emotion-Focused Engagement, and Emotion-Focused Disengagement, and 0.59 and 0.70 for the first tier scales, Disengagement and Engagement respectively.

Table 2: Descriptive Statistics and Internal Consistency Reliability of Scales of CSI-SF

Scale	Mean	SD	Median	Range	Internal Consistency Reliability
PFE	15.09102	2.63961	15.0000	4-20	0.67
PFD	11.57924	2.98357	12.0000	4-20	0.60
EFE	13.06231	2.90092	13.0000	4-20	0.72
EFD	11.41843	2.64538	11.0000	4-20	0.58
E	28.16370	4.56045	28.0000	8-40	0.70
D	22.97040	4.43641	23.0000	9-40	0.59

PFE = Problem-Focused Engagement
PFD = Problem-Focused Disengagement
EFE = Emotion-Focused Engagement
EFD = Emotion-Focused Disengagement
E = Total Engagement; D = Total Disengagement

Table 3: Pearson Correlation of CSI-SF Scales and Subscales

Scales	Correlation coefficient					
	PFE	PFD	EFE	EFD	E	D
PFE	1.00	-0.09	0.36*	-0.14*	0.80*	-0.15*
PFD	-0.19*	1.00	0.05	0.19*	-0.02	0.85*
EFE	0.36*	0.05	1.00	-0.07	0.84*	0.00
EFD	-0.14*	0.19*	-0.07	1.00	-0.13*	0.69*
E	0.80*	-0.02	0.84*	-0.13	1.00	-0.09
D	-0.15	0.85*	0.00	0.69*	-0.19*	1.00

*p <.0001, n = 4315

Table 4: The Survey Item Factor Loadings for the CSI-SF

Survey Items	Mean	SD	Factor*	Loadings
1. I make a plan of action and follow it	3.65653	0.94486	2	0.92
2. I look for the silver lining or try to look on the bright side of things	4.09182	0.87564	2	1.00
3. I try to spend time alone	3.33692	0.91270	4	0.88
4. I hope the problem will take care of itself	2.55667	1.03334	3	0.93
5. I try to let my emotions out	3.24203	0.95468	1	1.00
6. I try to talk about it with a friend or family	3.55859	0.99147	1	0.91
7. I try to put the problem out of my mind	2.97849	1.04488	3	1.00
8. I tackle the problem head on	3.50519	0.96533	2	0.71
9. I step back from the situation and try to put things into perspective	3.67576	0.90556	2	0.92
10. I tend to blame myself	2.59278	1.00314	4	-0.99
11. I let my feelings out to reduce the stress	3.24357	0.97027	1	0.94
12. I hope for a miracle	3.38110	1.21038	3	0.90
13. I ask a close friend or relative that I respect for help or advice	3.34076	0.98582	1	0.92
14. I try not to think about the problem	2.91010	0.96179	3	0.98
15. I tend to criticize myself	2.59278	1.05723	4	1.00
16. I keep my thoughts and feelings to myself	3.02190	0.99340	4	0.13

*1=Problem-Focused Engagement, 2=Problem-Focused Disengagement, 3=Emotion-Focused Engagement, 4= Emotion-Focused Disengagement.
Responding Scores (1 = never, 2 = seldom, 3 = sometimes, 4 = often, 5 = almost always)

The analysis of the CFA produced a final confirmatory factor model with a good fit to the data. This was verified by the model fit indices. CFA was run based on a correlation matrix using maximum likelihood estimates, and the result indicated reasonable fit. The large chi-square value in Table 5 is due to the large sample size (n = 4315). Although the chi-square test was significant, χ^2 (78) = 1455.9406, $p < 0.0001$, the model yielded acceptably high goodness of fit indices (0.95 and 0.93) for both the GFI and AGFI respectively. Bentler [39] and Joreskog & Sorbom [40] warned against the sole use of the chi-square value in assessing the fit of the model because of the sensitivity of the chi-square to sample size.

Table 5: Results of a Confirmatory Factor Analysis of the Four Factor *CSI-SF*

	Value	*Chi-Square*	*Prob.*
Goodness of Fit Index (GFI)	0.95		
GFI Adjusted for Degrees of Freedom (AGFI)	0.93		
Root Mean Square Residual (RMSR)	0.05		
RMSEA Estimate (RMSEA)	0.06	1455.9406	<.0001
Parsimonious GFI (Mulaik, 1989) (PGFI)	0.76		
James, Mulaik & Brett (1982) Parsimonious NFI (PNFI)	0.66		

The Goodness of Fit Index (GFI), an indication of how well the observed variables in combination serve as measuring instruments for all latent variables jointly, was remarkably high (0.95). Because the GFI is considered a generalized indicator of reliability [41], the high coefficient score indicates that the measurement model is excellent. Results of CFA for the short form of the CSI reveal a sound model fit with Root Mean Square Residual (RMSR) of 0.05 and Root Mean Square Error of Approach (RMSEA) of 0.06. (<0.08 signifies sound model fit). Finally, PGFI (0.76) and PNFI (0.66) indicate good model parsimony. Overall, these indices provide very strong support for the postulated measurement model for the CSI-SF.

Conclusion

Before deciding to use the *CSI-SF*, three main issues had to be addressed. The first was the reliability of the

instrument. Secondly, we had to establish the validity of the instrument. Validity was assessed by examining how each item grouped onto a particular theme. Thirdly, we had to ensure that the *CSI-SF* was used appropriately, and adequately measured the coping skills of the JHS African-American cohort.

Factor analysis highlighted the factors from each scale that could be useful in accurately identifying the coping behaviors of the JHS cohort. There is evidence that the items in each subscale of the *CSI-SF* are measuring the same underlying construct. They have good reliability in effectively measuring each individual subscale. This evidence was strengthened by the descriptive statistics that revealed sufficient variability in scores to warrant its use as an adequate measure. The major limitation of this study is the fact that some of the Cronbach alpha reliabilities for the subscales were not as strong as others in establishing sound reliability in all of the constructs.

This large number of participants and the large number of responses examined substantially improved the chance of achieving confidence in the analyses. All of the fit indices satisfied the range requirements that many researchers deem indicative of adequate fit. The four indicators of overall coping and the two sub-scales had reliabilities that were adequate for acceptance of the CSI-SF as a valid measure of the coping strategies used by the JHS cohort. This instrument seems to adequately identify the dimensions of coping that were earlier projected through the study done by Tobin, Holroyd, Reynolds & Wigul [20].

Support for the scales of Problem-Focused Coping and Emotion Focused Coping as proposed by Lazarus [7] and Tobin, Holroyd, Reynolds & Wigul [20] is evident. The fit indices and the reliabilities provide evidence that the factors presented in the *CSI-SF* adequately describe the structure of coping in the JHS cohort. Analysis of gender, age, educational level, and income of the participants who responded to the *CSI-SF* and those who did not, failed to provide any evidence of unusual bias or response variation that would affect validation of the *CSI-SF*.

The decision to include the *CSI-SF* in the Jackson Heart Study was based on the assumption that the survey and the data generated would meet minimum psychometric requirements for measuring this African-American population. In order to accurately assess coping strategies in this community, it is important that the methods used to construct and score the scales and the summary measures be appropriate for the group under investigation. A major goal of the establishment of the psychometric properties is an evaluation of the consistency of psychometric results [27]**.** During this process of psychometric analysis, poor performing items are discarded [43]. In this study, item # 16 was discarded making the CSI-SF a 15-item survey. This study has established the usefulness of the four- factor 15-item *CSI-SF* as a measure of coping in African Americans and provides empirical support for utilizing this instrument in future efforts to understand the role of coping in

moderating health outcomes. Future researchers can now build upon our work by further applying the *CSI-SF* to research with similar populations.

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