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Development and Preliminary Testing of the Graven and Grant Social Network Survey in Patients with Heart Failure

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Introduction and Background

Heart failure (HF) is common form of cardiac dysfunction that affects over five million Americans and is responsible for upwards of 32% of preventable hospital re-admissions each year in adults over the age of 65 [1,2]. Cardiac function progressively worsens, resulting in advanced symptoms (i.e., dyspnea, fluid retention, and activity intolerance) and an increased need for assistance with activities of daily living [3,4]. The decline in physical function that accompanies HF necessitates a need for assistance and support by others to influence disease-related outcomes (i.e., quality of life, event-free survival, depressive symptoms) [5-8]. Consequently, social support plays a critical role in assisting individuals with HF to maintain their physiological and psychological well-being [9,10]. In fact, evidence suggests that social support is vital and aids in influencing self-care behaviours in those with HF, by indirectly affecting self-care management through self-care confidence and influencing treatment adherence [11,12]. Family support, particularly, aids in symptom assessment and management and in the problem-solving process regarding treatment-seeking decisions for symptoms of HF [13,14]. Family support is also instrumental in providing assistance with daily activities (e.g., cooking, cleaning, and home maintenance) as HF progresses and functional ability is impacted [15].

Evidence also suggests that the provision of support facilitates coping and psychological well-being in those with HF [9,16,17]. For example, studies report that upwards of 50% of individuals with HF suffer depressive symptoms; however, evidence from several studies indicate an increase in social support is associated with fewer depressive symptoms [16,18-22]. Thus, social support is an important variable which appears to influence positive outcomes in those with HF, as well as outcomes in other chronic illness populations (e.g., HIV, stroke) [23,24].

Social support is a potential coping resource which provides a buffer against stressful situations and involves the provision of functional and structural support [25-27]. Functional support is individuals' subjective perceptions about assistance from significant others or social relationships and includes belonging (i.e., feeling of acceptance), appraisal (i.e., assessment and validation of a threat), tangible support (i.e., provision of goods and services), and informational support (i.e., provision of information during a time of stress and assistance with problem-solving) [25,28,29]. In contrast, structural support is defined as the accessibility of support through social ties to other individuals, groups, and one's larger community and involves the concrete provision of support through one's social network [29-31].

Social network is a measure of structural support and assists in buffering the effects of stressful situations [9,25,27,29]. Social network is a channel through which social support is provided and involves a field of persons (e.g., friends, family) who provide helpfulness and protection through a reciprocal process [29,32]. It is a multi-faceted concept which historically has been difficult to measure due to the multiple components identified with the concept. Components of social network identified in the literature, include: numbers of people involved, strength of relationships, associated relational content [family versus friends]; marital and living status, amount of telephone contact with others, frequency of contacts, durability of relationships, presence of reciprocity, and length of time home alone per day [11,27,33-35].

The majority of research examining social support in patients with HF has historically investigated functional support rather than social network [5-7,36]. Available social support instruments also primarily measure functional support (e.g., Interpersonal Support Evaluation List, Medical Outcomes Study Social Support Survey, and the Duke University Functional Social Support Questionnaire) [25,37,38]. However, one's social network is a major provider of support for patients with HF [39]. Yet, there are few instruments available to measure social network for use in survey research (e.g., Social Relationship Scale, Social Support Questionnaire, and the RAND Social Health Battery) [35,40,41]. Additionally, instruments to assess social network could be valuable in clinical settings and used to evaluate the quantity and quality of patients' support system in a quick and reliable manner. Thus, development of a valid and reliable instrument to measure social network can be beneficial to both research and practice. Therefore, the purposes of this article are to (1) describe the development and preliminary testing of the Graven and Grant Social Network Survey (GGSNS) and to (2) present preliminary psychometrics of this instrument in a sample of outpatients with HF.

Procedures for Instrument Development

Theoretical framework and conceptual definition

The development of the GGSNS was based upon the theory of stress, appraisal, and coping and selected components from available literature [11,27,33-35,40,41]. Coping is a process that involves the manner in which individuals appraise stressful situations and their perception of available resources to effectively manage these threatening situations [27]. Social network is a coping resource through which support is provided in assisting individuals to effectively adapt to stressful situations [25,27]. It involves a dyadic and interactive process in which spouses/significant others, family, and

friends create an interconnected system and alliance as a means of helping individuals to manage stressful situations. Specific components of social network include: the number of social network members, number of close friends/relatives, strength of relationships, presence of reciprocity, frequency of contacts, and amount of telephone interaction with others [11,27,33-35,40,41].

Design and content validity

Following a review of social support theoretical frameworks, empirical evidence, and conceptual analysis of social network, items were generated based upon identified components of social network. The initial item pool consisted of 15 items, since a small number of social network components were identified in the literature. Content validity was established using a modified Delphi Technique that required five rounds of independent review by four researchers with expertise in heart failure, social support, and instrument development before consensus was reached. Reviewers were provided with the conceptual definition, purpose, and instructions to participants. During the first round of review, the item pool was reduced to 12 items and it was determined that items related to the quality or strength of relationships be measured using a rating scale, while items pertaining to quantity of social network be scaled numerically. The percent agreement (and kappa coefficient) for the format and appropriateness of items ranged from 36% (k = 0.583) to 63% (k = 0.749), respectively, in Round One and reached 100% (k = 1.0) for both the format and appropriateness of items in Round Five. Similarly, the percent agreement (and kappa coefficient) for clarity of items ranged from 36% (k = 0.583) in Round One to 100% (k = 1.0) for Round 5.

Description and scoring

The GGSNS is a short 12-item survey which asks participants to rate their views about people that they are connected to and involved with who provide them with help, assistance, and support. These people may include spouses/significant others, family, friends, and other individuals who provide support on a regular basis (i.e., co-workers, church and organizational members, etc.). Types of help, assistance, and support often provided by others may include emotional, social financial, tangible/physical, and spiritual support. Items include questions pertaining to the six components of social network, including number of social network members, number of close friends and relatives, strength of relationships, presence of reciprocity, frequency of contacts, and amount of telephone contact with others. For each item, the participant is asked to indicate how strongly they either agree or disagree with the statement on a seven-point scale, with one being strongly disagree and seven being strongly agree. Some items also ask participants to identify a number between zero and 13 or more. Scores for the GGSNS are obtained by summing scores for all items and range from 12-84. Higher scores indicate availability of a larger social network; whereas, lower scores suggest presence of a smaller social network. Completion time is approximately 10 minutes.

Methods for Psychometric Testing

Design, setting and participants

This study was a subset of a larger study which used a cross-sectional, descriptive, correlational design to investigate variables and

their relationship with depressive symptoms and self-care behaviours. Following institutional review board approval, outpatients with HF (n = 201) were recruited from three hospital-affiliated clinics in Northwest Florida. Eligible patients were given a flyer or mailed a letter with information regarding the study. Interested patients then contacted the primary investigator to learn more about the study and complete inclusion criteria screening. To be included in the parent study participants must (1) have had a diagnosis of HF confirmed by primary health care provider; (2) be 55 years of age and older; (3) reside in an outpatient setting; and (4) be able to speak, read, and understand English. Patients with cognitive impairment were excluded, as evidence by a score of ≤ 30 on the Telephone Interview for Cognitive Status (TICS) [42].

Procedure

Following recruitment, interested participants contacted the primary investigator and underwent telephone screening to determine study eligibility. Individuals who met the inclusion criteria were then scheduled for an individual interview. After obtaining informed consent, a set of randomized self-reported surveys that measured variables examined in the parent study, including the GGSNS and the Interpersonal Support Evaluation List -12 (ISEL-12), were used to guide the participant interview [25]. For the purpose of examining the psychometrics of the GGSNS, a smaller subset of participants (n = 50) underwent a second round of data collection two to three weeks following initial data collection to evaluate test-retest reliability. In addition, in order to examine the telephone reliability of the GGSNS, as compared to face to face reliability, the second data collection contact was conducted via telephone. No incentives were offered.

Measures

Social support: In addition to the GGSNS, the ISEL-12 was also administered to assess convergent validity. The ISEL-12 is a measure of functional social support and measures belonging, appraisal, and tangible support. Scores range from zero-36, with higher scores representing higher levels of perceived functional support. Adequate construct validity and internal consistency has been reported in prior research [21,25,43]. In this study, the three ISEL subscales were combined to obtain a single index of functional support. Cronbach's alpha was 0.90.

Data Analysis

Established guidelines for psychometric analysis of questionnaires guided the statistical analyses [44,45]. Several psychometric areas were evaluated, including internal consistency, criterion validity, construct validity, agreement, reliability, and floor/ceiling effects. Statistical analyses of these items included computation of Cronbach's alpha, examination of inter-item and item-total correlations and calculation of the intra-class correlation coefficient (ICC) and exploratory factor analysis with oblimin rotation. Oblimin rotation was chosen due to the possibility that factors may be correlated. Factors with an eigenvalue greater than one were retained. Scree plots were evaluated to support the number of factors. Items were retained based upon factor loading, with a factor loading of 0.40 considered desirable for each item. Distinct factor loading was required, with no items loading highly on more than one factor. Results were then compared for consistency with theoretical/conceptual considerations. In addition, a subset of the larger sample was tested twice two to three weeks following the initial

data collection to examine reliability of different data collection methods (face to face versus telephone).

Results

Sample characteristics

The mean age of participants was 72.57 years (SD, 8.94), with a range of 55 – 99 years. The majority of participants were Caucasian males (Table 1). All classes of New York Heart Association (NYHA) HF were represented in the sample; however, most participants (66.6%) had NYHA Class I or II HF. Scores on the GGSNS ranged from 12 to 84, with a mean of 56.46 (SD, 18.74). This suggests that most participants had a larger than average social network. Considering the majority of participants were NYHA Class I and II HF, it is not surprising that the majority of the sample reported a large social network. These individuals are unlikely to need as much social support as those with NYHA Class III and IV HF.

	NYHA Heart Failure Classification				
	Class I	Class II	Class III	Class IV	Total n (%)
	n (%)	n (%)	n (%)	n (%)	
Gender					
Male	26 (12.9%)	59 -29.4%	16	24	125
Female	13 -6.5%	36 -17.9%	6 -3%	20 -10%	75 -37.3%
Transgendered	0 0%	0 0%	1 -0.5%	0 0%	1 -0.5%
Race					
Caucasian	35 -17.4%	82 -40.8%	19 -9.5%	37 -18.4%	173 -86.1%
African-American	3 -1.5%	13 -6.5%	4 -2%	7 -3.5%	27 -13.4%
Hispanic/Latino	1 -0.5%	0 0%	0 0%	0 0%	1 -0.5%
Total	39 -19.4%	95 -47.3%	23 -11.4%	44 -21.9%	201 -100%

Table 1: Sample characteristics by NYHA class (n = 201).

Psychometric analysis

Reliability and item homogeneity: Internal consistency was evaluated using Cronbach's alpha [44]. Cronbach's alpha was initially calculated for the total instrument, with adequate internal consistency (α = 0.89). However, following factor analysis, internal consistency was assessed for the three factors identified and supports the reliability of a three scale instrument (Table 2). A subsample of 50 participants answered the questionnaire twice to assess the reliability among face-to-face and telephone administration (α = 0.792). Additionally, the ICC was 0.891. These analyses indicate adequate reliability of the instrument since all are above the suggested 0.70 [44].

Item	Factor 1 "Strength of Family/Significant Other Support"	Factor 2 "Social Network Size"	Factor 3 "Frequency of Support"
1. committed relationship support	0.814	0.185	0.078
2. committed relationship opportunity to talk	0.828	0.202	0.075
3. telephone contact support	0.855	0.254	0.067
4. telephone contact opportunity to talk	0.841	0.277	0.098
5. number of times/week receive support	0.113	0.369	0.982
6. number of times/week opportunity to talk	0.112	0.391	0.981
7. numbers of family or friends…support	0.274	0.925	0.358
8. numbers of family or friends… opportunity to talk	0.262	0.942	0.369
9. comfortable asking for support	0.92	0.235	0.136
10. comfortable talking	0.909	0.251	0.142
11. numbers of family or friends … comfortable asking for support	0.247	0.945	0.366
12. numbers of family or friends… comfortable talking	0.232	0.938	0.353
Internal Consistency using Cronbach's Alpha			
Total Scale 0.89	0.944	0.967	0.981

Table 2: Factor loadings and internal consistency reliability.

Inter-item correlations were evaluated to assess the presence of repetitious items. Correlations (> 0.8) between items suggest that items overlap [46]. Several items were highly correlated (> 0.94), indicating redundancy (See Table 3). Item–total correlations were used to evaluate whether all items were measuring the same concept, as these items should correlate with the total score of the instrument [46]. To reduce bias, since the item itself is included in the total score, Bowling recommends calculating a corrected item-total correlation [47]. It is suggested that items with low item-total correlations (< 0.3) do not adequately measure the construct well and should be deleted from the questionnaire [48]. Although items in Factor 3 had low item-total correlations (See Table 3), the correlations were not low enough to warrant dropping the items. All other item-total correlations were adequate (Table 3).

Items	Corrected Item-Total Correlation	Inter-Item Correlations											
		SN1	SN2	SN3	SN4	SN5	SN6	SN7	SN8	SN9	SN10	SN11	SN12
SN1	0.642	1											
SN2	0.66	0.949	1										
SN3	0.689	0.608	0.626	1									
SN4	0.698	0.586	0.608	0.944	1								
SN5	0.35	0.069	0.064	0.079	0.1	1							
SN6	0.36	0.088	0.085	0.06	0.105	0.963	1						
SN7	0.588	0.195	0.223	0.256	0.27	0.354	0.357	1					
SN8	0.586	0.19	0.213	0.235	0.264	0.356	0.376	0.969	1				
SN9	0.735	0.718	0.714	0.757	0.751	0.135	0.126	0.231	0.224	1			
SN10	0.738	0.691	0.709	0.755	0.747	0.144	0.129	0.249	0.237	0.958	1		
SN11	0.575	0.165	0.174	0.237	0.257	0.351	0.377	0.829	0.84	0.223	0.236	1	
SN12	0.557	0.161	0.171	0.209	0.236	0.332	0.367	0.816	0.841	0.209	0.225	0.98	1

Table 3: Item-total and inter-item correlations.

Validity: A lack of available social network instruments that measured all components limited the ability to examine criterion validity. Thus, the ISEL-12 was administered to participants along with the GGSNS in order to assess convergent validity [25]. The correlation between the two sets of scores was 0.521 ($p < 0.001$), indicating a moderate association between the two instruments [46]. This finding was not surprising given that both instruments measure a similar, yet different construct of social support.

Factor analysis: Three factors were extracted using oblimin rotation. All items loaded distinctly onto 3 factors, with loadings well over the desired 0.40 (See Table 2). Thus, all items were retained. Items 1-4, 9, and 10 loaded onto factor 1 and included items pertaining to the strength of relationships with family or significant others. Therefore, Factor 1 was identified as "Strength of Family/Significant Support." Four items (i.e., 7, 8, 11, and 12) loaded onto factor 2 and examined the number of individuals within one's social network. Subsequently, Factor 2 was identified as, "Social Network Size." Factor 3 included two items (i.e., 5 and 6) that investigated the frequency of contacts with network members and was aptly termed, "Frequency of Support." Scree plots supported the number of factors extracted. All three factors accounted for 86% of variance observed. Higher scores on each factor will suggest higher levels of the respective social network construct. Figure 1 represents social network components in patients with HF identified in the factor analysis (Figure 1).
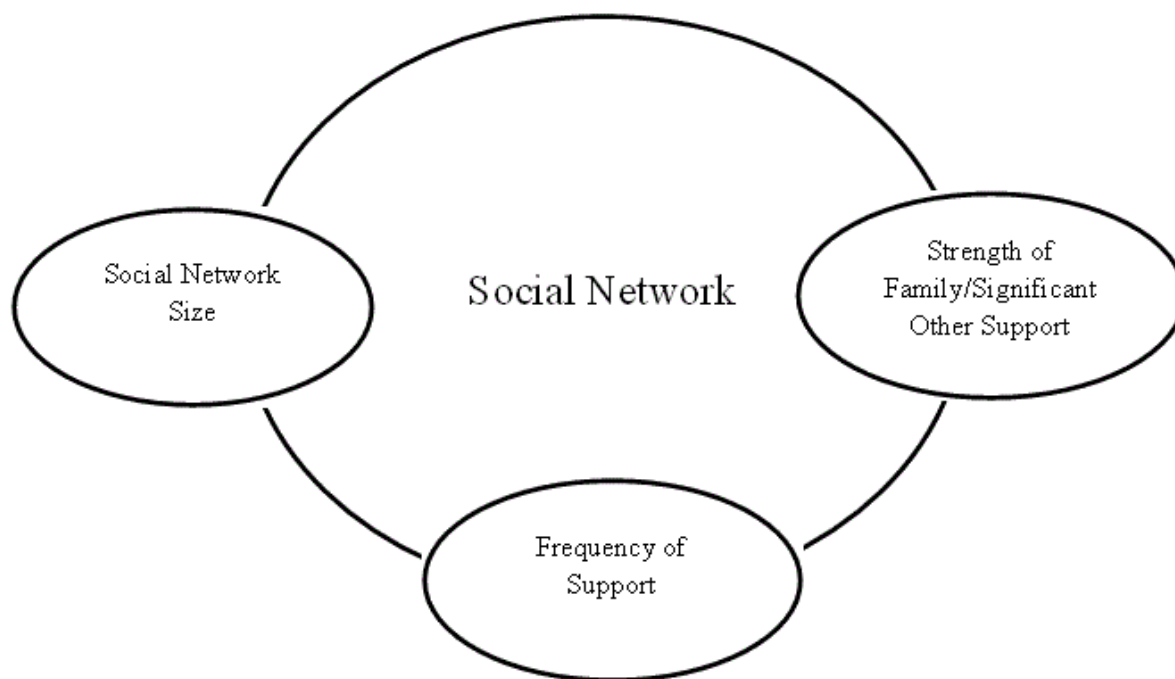
Figure 1: Social network components in individuals with heart failure.

Floor/ceiling effects: Floor/ceiling effects ultimately affect content validity and reliability and are considered present when more than 15% of participants obtain the lowest or highest possible score [44]. In this study, no floor/ceiling effects were present given that only 1% scored the lowest possible score and 6.5% scored the highest possible score.

Discussion

The GGSNS was developed to measure social network, addressing a need for instrumentation for use in survey research and clinical practice. Factor analysis revealed a three factor instrument. While research is scarce, components of social network represented by two of the three factors found in this study have been evaluated in prior research [11,33]. Social network size and frequency of support (i.e., amount of telephone contact with others) was found to be related to hospital readmissions, with those having moderate to low social networks having more frequent readmissions [33]. Social network size also appears to have a negative effect on self-care confidence, as well as self-care management, suggesting that individuals with large social networks are less confident in their ability to manage their HF [11]. While, previous research has primarily investigated one rather than multiple components of social network, use of an instrument which represents all components increases the ability to fully evaluate social network [11,34]. For example, future researchers will be able to assess the quantity of support, as well as the quality of support through examination of relationship strength, reciprocity, and durability. Additionally, following further analysis of this instrument, partnership (i.e., between clinicians and patients) interventions, such as the use of

care managers, can be evaluated to determine their influence on social network [49].

Ability to measure social network fully, in clinical settings, is also valuable given social network has been identified as an important resource for patients with HF and other chronic illnesses [14,23,24,39]. The small number of items on this instrument lends itself to use in a busy clinical environment and may aid clinicians in assessing patients' social network quickly. Furthermore, the GGSNS not only assists clinicians with determining social network size, but also provides information regarding the quality of the relationships. Information regarding quality of relationships is important, as patients' may have a large social network, yet the relationships therein may be unsupportive or inadequate to meet the needs of the patient. In addition, telephone reliability of the GGSNS allows clinicians to assess patients' social network remotely and its use may be beneficial in HF clinics or other settings where telehealth is utilized.

Strengths and limitations

This study did have limitations. Considering the age range of participants (i.e., 55 – 99 years), the results of this study may not be generalizable to young adults [20]. The majority of participants were Caucasian men, further limiting generalizability. As expected in survey research, the factors identified in this study are subjective and highly variable; thus, impacting the total scores on the instrument, as well as scores on the individual factors. Future psychometric testing of this instrument, using a larger sample, may help to address this issue. Variables that may influence social network, such as medications and lifestyle were not evaluated in this study and should be considered in

future research. However, strong steps were used to enhance the content validity of the GGSNS and construct validity was supported via factor analysis. This study developed an instrument that more fully represents components of social network identified in the literature. Reliability of alternate methods supports adequate reliability with telephone data collection, which could be useful in studies involving this population and in telehealth.

Conclusion

These findings are preliminary and further revision and testing is needed on this instrument to refine items and more appropriately measure the components of social network. Yet, preliminary psychometrics indicate this instrument may be a valid and reliable three factor instrument to measure social network in patients 55 years and older, considering the limitations of the study. Revisions are recommended based upon inter-item correlational analyses and consideration for additional items will be explored. Although originally tested in a sample of HF patients, it is desired that this instrument be used in the general population. Therefore, following revision, future testing is planned to evaluate psychometrics in the general population.

Conflict of Interest Statement

No conflict of interest exists between the authors of this manuscript and any commercial entity or product related to this manuscript. No financial support for this manuscript was received from either a commercial or private entity.

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