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# Health Status and Self-care Outcomes After an Education-Support Intervention for People with Chronic Heart Failure

## **Abstract**

**BACKGROUND:** The rising cost of hospitalizations for heart failure (HF) care mandates intervention models to address education for self-care success. The effectiveness of memory enhancement strategies to improve self-care and learning needs further examination.

**OBJECTIVE:** The objective of this study was to examine the effects of an education-support intervention delivered in the home setting, using strategies to improve health status and self-care in adults/older adults with class I to III HF. Our secondary purpose was to explore participants' subjective perceptions of the intervention.

**METHODS:** This study used a randomized, 2-group design. Fifty people were enrolled for 9 months and tested at 4 time points-baseline; after a 3-month education-support intervention; at 6 months, after 3 months of telephone/e-mail support; and 9 months, after a 3-month period of no contact. Advanced practice registered nurses delivered the intervention. Memory enhancement methods were built into the teaching materials and delivery of the intervention. We measured the intervention's effectiveness on health status outcomes (functional status, self-efficacy, quality of life, emotional state/depressive symptoms, and metamemory) and self-care outcomes (knowledge/knowledge retention, self-care ability). Subjects evaluated the usefulness of the intervention at the end of the study.

**RESULTS:** The mean age of the sample was 62.4 years, with a slight majority of female participants. Participants were well educated and had other concomitant diseases, including diabetes (48%) and an unexpected degree of obesity. The intervention group showed significant improvements in functional status, self-efficacy, and quality of life (Kansas City Cardiomyopathy Questionnaire); metamemory Change and Capacity subscales (Metamemory in Adulthood Questionnaire); self-care knowledge (HF Knowledge Test); and self-care (Self-care in Heart Failure Index). Participants in both groups improved in depressive scores (Geriatric Depression Scale).

**CONCLUSIONS:** An in-home intervention delivered by advanced practice registered nurses was successful in several health status and self-care outcomes, including functional status, self-efficacy, quality of life, metamemory, self-care status, and HF knowledge.

## **Keywords**

Chronic Disease, Female, Health Status, Heart Failure, Humans, Male, Middle Aged, Patient Education as Topic, Prospective Studies, Quality of Life, Self Care, Self Efficacy, Treatment Outcome

## **Disciplines**

Cardiology | Cardiovascular Diseases | Circulatory and Respiratory Physiology | Health Services Research | Medical Education | Medical Humanities | Medicine and Health Sciences | Nursing | Preventive Medicine

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## Health Status and Self-care Outcomes Following an Education-Support Intervention for People with Chronic Heart Failure

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### Abstract

**Background**—The rising cost of hospitalizations for heart failure (HF) care mandates intervention models to address education for self-care success. The effectiveness of memory enhancement strategies to improve self-care and learning needs further examination.

**Objective**—The objective of this study was to examine the effects of an education-support intervention delivered in the home setting, using strategies to improve health status and self-care in adults/older adults with class I-III HF. Our secondary purpose was to explore participants' subjective perceptions of the intervention.

**Methods**—This study used a randomized, 2 group design. Fifty people were enrolled for 9 months and tested at 4 time points—baseline; following a 3-month education-support intervention; at 6 months, following 3-months of telephone/email support; and 9 months, following a 3-month period of no contact. Advanced practice registered nurses (APRNs) delivered the intervention. Memory enhancement methods were built into the teaching materials and delivery of the intervention. We measured the intervention’s effectiveness on health status outcomes (functional status, self-efficacy, quality of life, emotional state/depressive symptoms, and metamemory) and self-care outcomes (knowledge/knowledge retention, self-care ability). Subjects evaluated the usefulness of the intervention at the end of the study.

**Results**—The mean age of the sample was 62.4 years, with a slight majority of female participants. Participants were well educated and had other concomitant diseases, including diabetes (48%), and an unexpected degree of obesity. The intervention group showed significant improvements in functional status, self-efficacy and quality of life (Kansas City Cardiomyopathy Questionnaire-KCCQ); metamemory Change and Capacity subscales (Metamemory in Adulthood Questionnaire-MIA); self-care knowledge (HF Knowledge Test-HFKT); and self-care (Self-Care in Heart Failure Index—SCHFI). Participants in both groups improved in depressive scores (Geriatric Depression Scale-GDS).

**Conclusions**—An in-home intervention delivered by APRNs was successful in several health status and self-care outcomes, including self-efficacy, quality of life, metamemory, self-care status, and HF knowledge.

### Keywords

heart failure; self-care; memory

## Background

The incidence of heart failure (HF) is reaching epidemic proportions in the U.S. resulting in an enormous medical and societal burden.<sup>1–4</sup> With over five million Americans living with the disease,<sup>3</sup> the financial output for HF care will increase over the next few decades due in part to the aging population and treatment progress in pharmacotherapeutics and devices.<sup>4</sup>

The recent \$34 billion dollar total annual cost of HF treatment<sup>5</sup> has garnered attention from providers, policy makers, and insurers, yet AHA estimates costs to rise to \$70 billion by 2030.<sup>3</sup> Thirty-day readmission rates for decompensated HF approach 25% in Medicare beneficiaries after hospitalization with HF<sup>6–8</sup> and by six months, the rate is almost 50%.<sup>1,6,8</sup>

Novel interventions are needed to impact escalating costs of hospitalizations for decompensated acute HF, as well as the overall expenses of managing chronic HF patients.<sup>9</sup> The complexity of effective self-care at home has been recognized in multiple studies that have failed to clearly demonstrate a successful intervention model.<sup>10–13</sup> Numerous barriers exist that hinder patients’ ability to engage in self-care.<sup>14–15</sup> Non-adherence to treatment plans for diet, medication regimens, and symptom monitoring contribute to increased resource utilization.<sup>16–17</sup> An estimated 60% of adults with HF are non-adherent with medications.<sup>17–18</sup> The research to date suggests that people with HF lack knowledge for competent self-care.<sup>15,19</sup> Further, cognitive deficits due to decreased cerebral oxygenation,

depression, and other etiologies<sup>20–23</sup> make it difficult for many patients to learn about their disease and self-care strategies.

The purpose of this randomized-control study was to examine the effects of an education-support intervention delivered in the home setting, using strategies to improve health status and self-care in adults/older adults with class I-III HF. At 4 time points over 9 months, we measured the intervention's effectiveness on health status outcomes (functional status, emotional state/depressive symptoms, and metamemory) and self-care outcomes (knowledge/knowledge retention, self-care ability). Our secondary purpose was to explore participants' subjective perceptions of the intervention.

### Theoretical Framework

This study was based on the health promotion model (HPM)<sup>24</sup> and self-efficacy theory.<sup>25–26</sup> According to the HPM, levels of health exist along a continuum in interaction with the experience of illness. Health promoting behaviors contribute to the actualization of potential and typically emphasize self-care rather than expert care. Self-efficacy is a predictor of behavioral change<sup>26–27</sup> that provides a basis for health-promoting behaviors, even in the face of disease or treatment-related symptoms.

## Methods

### Design

This was a prospective, randomized control study of adults/older adults living with chronic HF. The design comprised an education-support intervention for 3 months followed by 3 months with phone and/or email support but no visits, and then 3 months without contact with the research team. Data were collected at baseline, 3 months, 6 months, and 9 months.

### Sample and Setting

Non-hospitalized participants were recruited from physician/advanced practice registered nurse (APRN) referrals, HF Clinics, and media. Inclusion criteria were: diagnosed with New York Heart Association (NYHA) class I-III<sup>28</sup> systolic or diastolic HF; age 45 or above; willing to participate in a randomized 9-month study; living at home independently; able to speak, read, and write in English; and a score of at least 23 on the Mini-Mental State Examination (MMSE).<sup>29</sup> Individuals diagnosed with major cerebrovascular disease (as stroke) or NYHA class IV HF were excluded. Because women have traditionally been under-enrolled in studies about HF,<sup>30</sup> efforts were made to recruit women as well as ethnically diverse participants.

Fifty participants (25 control and 25 intervention) were randomized, enrolled and followed for the 9-month intervention. Two participants lost to follow-up were replaced (one moved out of state; the other moved and could not be located) and their data were eliminated from the analysis. Participants in the control group were wait-listed to receive the intervention at the end of the study. The study was conducted in a southwestern urban area and the University of Texas at Austin Institutional Review Board approved the study. All

participants gave written informed consent for eligibility screening, the study itself, and permission to have their HF medical records reviewed.

### Intervention

The intervention was adapted from Stuijbergen's health promotion in chronic illness intervention<sup>27,31</sup> which focuses on enhancing self-efficacy and has successfully utilized an educational and skill-building program with supportive phone follow-up. The content was delivered individually by APRNs who were adult clinical nurse specialists with master's or PhD education, and expertise in HF and advanced cardiovascular nursing. The educational content (Box 1) was developed and peer-reviewed to provide instruction and reinforcement targeting specific areas deemed essential to self-care for people living with chronic HF.<sup>32–34</sup> Participants received a loose-leaf notebook with content inserts of approximately 100 pages, divided into eight modules in large font, with room for note taking. All data were collected during home visits. Support by the APRN to build the participant's self-efficacy was a significant part of the intervention effect. Specific strategies to build self-efficacy included social persuasion and encouragement, focused feedback, and breaking information down into realistic segments, and skills mastery (example: reading food labels). Spouses (or significant others) were encouraged to attend.

Because several memory enhancement interventions for healthy elderly have been successfully conducted,<sup>35–38</sup> we incorporated innovative strategies for enhancing memory performance into the intervention delivery. Each participant received a copy of *Improving Your Memory*,<sup>39</sup> a book used effectively in previous research<sup>36–37</sup> to read prior to beginning the in0home classes. Review and repetition were built into content in each module. Advance organizers were integrated to provide overview material and concrete examples to enable learners to activate relevant schemas for content association. Teaching targeted internal memory strategies (chunking, categorization, active observation, association, attention, concentration, elaboration, rehearsal, review and visualization), and external strategies (calendars, lists, notes, person, place).<sup>32, 36–37</sup>

### Procedures

An initial telephone screening provided assessment of cognitive status and potential language barriers. At the first meeting in person, the MMSE was administered.<sup>29</sup> Demographic, health, and medical data were obtained, and the battery of instruments was completed. The first phase of the 9-month intervention was delivered over the first 3-month period, meeting every 10–14 days for 1–1.5 hours to present the educational content. At the end of this phase, participants again completed the instruments and were then given the choice of either a weight scale or blood pressure device as an appreciation gift. During the last home visit, the APRN described the second phase of the study and determined how the participant wanted to be contacted. The second 3-month phase of the intervention was delivered by phone and/or email with the APRN, with no home visits. The APRN contacted the participant at the beginning of this phase in the agreed upon method. The number of contacts and length of calls varied depending on the interest of the participant—the average being every 3–4 weeks from 5–15 minutes. There was no prescribed number of contacts and participants were encouraged to call/email at any time. The research team fostered effective

decision-making about symptom management decisions and health-promoting activities, and reinforced content from the modules. At the end of this phase, participants completed instruments and received a \$25 cash retention gift. In the final 3-month phase, participants received no home visits, emails, or phone calls, and were instructed to communicate with their physician if questions arose. Patients thus returned to status quo medical care so that we could determine if the intervention had a sustained effect in improved outcomes. A final home visit solely for the purpose of data collection was made at 9 months. In addition to completing the instruments, participants evaluated the usefulness of the intervention and their responses were audiotaped. They also rated the value numerically from 1–10 and then received a \$25 cash appreciation gift.

The control group received a loose-leaf notebook of selected pages containing information on health promotion for adults/older adults information obtained from the National Institute of Aging website; Centers for Disease Control and Prevention, American Cancer Society, and the American Geriatric Society. Sample topics were: fall prevention; crime and older adults; arthritis; and bladder control. No content about HF was included. Meetings were scheduled during the first 3 months depending on the needs and interest of the participant. No phone or email teaching was done. Instruments were completed at the same 4 time periods (baseline, 3 months, 6 months, and 9 months) and retention gifts were provided (\$25 each testing period). Usual medical care was received. All participants were offered the chance to receive the intervention at the end of the study; the majority received it.

Approximately 275 home visits were done to deliver the intervention and conduct testing for the 25 participants in the intervention group and approximately 225 visits were done to deliver the non-HF education and conduct testing in the 25 control group participants at the 4 time points.

### Instruments

Baseline demographic data included gender, race, ethnicity, marital status, age, socioeconomic status, and educational level. Baseline health and medical data obtained included time since diagnosis; current prescription medications; over-the-counter and alternative medications currently or commonly taken (including memory improvement pills, sleep aids, antihistamines); concurrent medical diagnoses and reported health problems, consistent with the ACC/AHA recommendations for studies of HF patients;<sup>40</sup> explanatory model for the cause of the HF;<sup>41</sup> estimated past education about HF and source; and usual dietary modifications. Data from the following instruments were collected at baseline, 3 months, 6 months, and 9 months.

**Health Status Outcome: Functional Status**—The Kansas City Cardiomyopathy Questionnaire (KCCQ) is a widely used 23-item questionnaire that quantifies several health status domains including physical limitations, symptoms, self-efficacy, social interference, and quality of life.<sup>42–43</sup> It is a valid, sensitive, HF disease-specific health status measure with excellent metric properties.<sup>44</sup> Chronbach's alphas for the subscales have been reported for the subscales as follows: physical limitation 0.90; symptoms (frequency, severity, and recent changes over time) 0.88; quality of life 0.78; social limitation 0.86; self-efficacy 0.62;



and KCCQ clinical summary 0.95.<sup>42</sup> Each KCCQ scale is transformed to a score of 1–100 with higher scores reflecting better health status.<sup>43</sup> The total score and the overall summary score are the same—the author of the instrument recommends using the total score as an overall summary of the impact of an intervention.<sup>45</sup> The overall summary includes the scales for physical limitation, the symptom summary, social limitation, and quality of life.<sup>43,45</sup> A 5-point change in the KCCQ total score is a clinically important difference.<sup>43</sup>

**Health Status Outcome: Emotional State: Depressive symptoms**—Depressive symptoms, as a major component of a person’s emotional state, were measured with the Geriatric Depression Scale (GDS) Short Form which contains 15 true/false items.<sup>46</sup> The GDS was found to have 92% sensitivity and an 89% specificity when evaluated against diagnostic criteria.<sup>46</sup> It correlates highly with other depression measures, with an alpha reliability coefficient of .94.<sup>35</sup> Scores over 5 are suggestive of depression and scores above 10 almost always indicate clinical depression.<sup>47</sup>

**Health Status Outcome: Metamemory**—Metamemory is an individual’s knowledge, perceptions, and beliefs about the functioning, development, and capacities of his or her own memory and the human memory system.<sup>48</sup> Three subscales of the Metamemory in Adulthood Questionnaire (MIA) were used: Capacity (17 items), Change (18 items), and External Strategy (9 items). The MIA measures memory components of knowledge, beliefs, and affect,<sup>48–49</sup> with responses rated on a 5-point Likert scale from strongly agree to strongly disagree. Psychometric characteristics have been examined with community-dwelling, middle-age, and older adults. Chronbach’s alphas for these subscales ranged from .73 to .95.<sup>36</sup>

**Self-Care Outcome: Knowledge**—Knowledge was measured by a new 20-item multiple-choice tool, the HF Knowledge Test (HFKT). Content validity was established by an extensive literature review and critique by 9 experts in HF and adult/older adult health. The HFKT’s five subscales measure pathophysiology (3 items); symptom management (5 items); nutrition (4 items); medications (4 items); and health promotion (4 items). Chronbach’s alpha for the HFKT in the present study was 0.765.

**Self-Care Outcome: Self-management/self-care ability**—Self-care was measured with the 15-item Revised Self-Care of Heart Failure Index (SCHFI), version R4.<sup>50</sup> This instrument measures three main concepts: (1) self-care maintenance, which encompasses monitoring and treatment adherence<sup>51</sup> performed to maintain one’s health with positive health practices;<sup>14</sup> (2) self-care management, a decision-making process of recognizing and evaluating HF symptoms, along with treating and evaluating treatment choices;<sup>51</sup> and (3) self-care confidence or self-efficacy, which is thought to moderate the relationship between self-care and outcomes.<sup>14</sup> Alpha coefficients calculated for the present sample were .62 for self-care maintenance, and .88 for self-care confidence. The management score reliability could not be calculated because an insufficient number of subjects reported symptoms. Scores on each scale range from 0 to 100, with higher scores reflecting better self-care.<sup>51</sup> Scores of 70 or greater on each SCHFI scale are thought to indicate individuals with adequate self care (self-care adequacy).<sup>51</sup>

## Statistical Analysis

Descriptive statistics were computed for study variables. Repeated measures analysis of variance (ANOVA) was used to examine the effects of the intervention on health status and self-care outcomes. In addition, a series of analyses was conducted to examine the impact of HF class on the proposed outcomes over time. Repeated measures ANOVA was used to determine the main effect of time while controlling for the effect of HF class and gender. Simple contrasts were used to look for differences between two populations—intervention and control. For the HFKT, statistical analysis included Mann-Whitney U and Wilcoxon Rank tests to test the differences between the two groups. The alpha level was set at .05.

## Findings

Characteristics of the 50 participants are shown in Table 1. Gender was split almost evenly in the sample, with slightly more females. Only 5 participants were below age 50. All three inclusion criteria NYHA classes were represented. Half of the participants were married and the majority were White and well educated, with only one subject lacking a high school degree. There were no group differences except for somewhat higher reported socioeconomic status in the intervention group.

The majority of the participants had other concomitant diseases, including diabetes mellitus (48%) and obesity (mean body mass index (BMI) of 34.1% mg/m<sup>2</sup>). Most participants were prescribed evidence-based HF medications.<sup>33, 52</sup> At baseline, seventy-three percent of participants reported eating foods with salt restrictions, and 33% indicated they ate a low fat diet. At baseline, participants reported a large number of troublesome symptoms including fatigue (88%), shortness of breath (76%), edema (78%), dizziness (60%), anxiety, nausea (28%), thirst (66%), thinking clearly (54%). Sleep and memory problems were also described.

The effects of the education-support intervention are reported by health status outcomes and self-care outcomes.

**Health Status Outcome: Functional Status-KCCQ Total Score (Table 2)**—No significant main effect for time was found [ $F(2.55, 117.109)=.083, p=.953$ ]. However, there was a significant interaction effect between time and group [ $F(2.55, 117.109)=3.142, p=.035$ ]. The control group showed no change in their KCCQ scores over time, but the intervention group increased their KCCQ scores over time. Simple contrast results showed that participants in the intervention group showed significantly higher scores in their KCCQ scores at time point 2 [ $F(1,46)=6.618, p=.013$ ] and 3 [ $F(1, 46)=4.773, p=.034$ ] than KCCQ scores at time point 1. No significant effect for gender or HF class was found.

**KCCQ Self Efficacy and Quality of Life subscales (Table 2)**—The intervention group had a significant time by group interaction for self-efficacy [ $F(1.952, 89.807)=3.774, p=.028$ ] and quality of life [ $F(2.490, 112.028)=3.790, p=.018$ ]. Simple contrast showed that self-efficacy in intervention group participants at time point 2, 3, and 4 were significantly higher than the scores at time 1. Also, quality of life in the intervention group at time point 2 and 4 were significantly higher than scores at time 1.

**Emotional State-Geriatric Depression Scale**—No significant main effect was found [F(2.882, 132.584)=.401,  $p=.744$ ] for time by group interaction effect [F(2.882, 132.584)=1.887,  $p=.137$ ] was found for depressive symptoms. Trend data showed both groups improved in scores. No significant effect for gender or HF class was found.

### **Memory Subscales of the MIA (Table 3)**

**Metamemory-Capacity Subscale:** Results indicate that while overall scores did not differ significantly over time, there was a significant difference across time by group status (F(3,138)=3.853,  $p=.011$ ). While the control group showed a decrease in their scores, the intervention group showed a significant increase in their scores after the intervention. Results of simple contrast indicated that the scores on participants in the intervention group at time point 2 [F(1,46)=6.834,  $p=.012$ ], time point 3 [F(1,46)=6.325,  $p=.015$ ], and time point 4 [F(1,46)=5.996,  $p=.018$ ] were significantly higher than the scores at time point 1. No significant effect for gender or HF class was found.

**Metamemory-Change Subscale:** Results showed that the main effect of time was not significant. However, a significant interaction of time and group was evident, suggesting that metamemory scores changed in different ways for the two groups [F(3,138)=7.671,  $p=.000$ ]. The control group showed a decrease in their scores over time, the intervention group showed an increase in their scores. Simple contrast showed the scores of participants in the intervention group differed significantly from control group participants at time point 2 [F(1,46)=14.624,  $p=.000$ ], time 3 [F(1,46)=10.454,  $p=.002$ ], and time 4 [F(1,46)=13.555,  $p=.001$ ]. No significant effect for gender or HF class was found.

**Metamemory-External Strategies Subscale:** No significant main effect for time [F(2.848,131.014)=1.823,  $p=.149$ ] nor for time x group interaction effect [F(2.848,131.014)=1.004,  $p=.390$ ] was found. Also, HF class and gender did not have a significant effect on the scores.

### **Self-Care Outcomes**

**Knowledge/Knowledge Retention HFKQ Scale (Knowledge):** After controlling for class and gender effects, there was a significant change over time in the HFKQ scale [F(3,138)=5.321,  $p=.005$ ] and there was also a significant difference in the change by group [F(3,138)=11.885,  $p=.000$ ]. These results suggest that HFKQ scores changed significantly across time and there were differences in the patterns of HFKQ by group status. While the control group showed little change in scores, the intervention group showed significant increases in their HFKQ scores after the intervention. The results of simple contrast indicated that HFKQ scores on participants in the intervention group at time point 2 [F(1,46)=20.682,  $p=.000$ ], time point 3 [F(1,46)=12.651,  $p=.001$ ], and time point 4 [F(1,46)=15.191,  $p=.000$ ] were significantly higher than the scores at time point 1.

**Self-Care Ability-SCHFI (Self-Care of Heart Failure Index):** Self-care maintenance scores improved significantly over time in both groups (F=7.24,  $df=3,46$ ,  $p<.001$ ). In addition, even with this small sample, there was a strong trend toward statistical significance in differential group change in maintenance scores (F=2.59,  $df=3,46$ ,  $p=.06$ ) with the

intervention group improving more than in the control group over time. When this analysis was replicated with self-care confidence, both groups improved over time ( $F=7.04$ ,  $df=3=43$ ,  $p=.001$ ) but the intervention group improved significantly more than the control group ( $F=6.70$ ,  $df=3,43$ ,  $p=.001$ ). Alpha coefficients could be calculated for self-care maintenance (.62) and confidence (.88). The SCHFI instrument asks patients about two symptoms—trouble breathing and ankle swelling. The management score reliability could not be calculated because so few subjects said they had these symptoms (8 at time 1; 14 at time 2; 18 at time 3; 12 at time 4).

Group differences in self-care management were analyzed at time 3 (when the most participants provided data on this scale) using nonparametric statistics. The mean rank was almost double in the intervention group compared to the control group (12.22 vs. 6.78) and the difference in rank was statistically significant (Mann Whitney  $U = 16.00$ , 2-tailed  $p = .03$ ).

When group differences in self-care adequacy were compared with chi square analysis, the intervention group was significantly more likely than the control group to be adequate in self-care confidence at time 3 ( $X^2=7.71$ ,  $df=1$ ,  $p=.006$ ). Group differences in self-care maintenance adequacy were not significantly different at the various time periods. When chi square was used to assess group differences in those who were adequate in management the last time they were symptomatic, significantly more of those in the intervention than control group were adequate in self-care management (100% vs. 58.3%,  $p=.04$ ).

**Participants' Perceptions of the Intervention:** Content analysis of the audiotaped interviews was done to evaluate the participants' perception of the usefulness of the intervention. All 25-intervention participants completed interviews and reported the intervention to be extremely valuable. On the 1–10 numerical scale, 24/25 rated the usefulness as a 10 (very helpful); one rated it at 8/10. It was also evident based on verbal comments from the control group that they also felt supported with the ongoing relationship with someone interested in their well-being.

## Discussion

Our study is one of the first randomized control trials to integrate a memory enhancing component into an education-support intervention. The results indicate that the intervention led to significant improvements in subjective memory evaluation of capacity and change, functional status, self-efficacy, quality of life, self-care knowledge, and self-care abilities. Telephone and email support follow-up appears to have helped participants maintain gains, which is consistent with the findings of McAlister<sup>53</sup> and Hansen.<sup>54</sup> Efforts to recruit more women and a diverse sample were successful, with over 50% of the sample female, 18% African American (AA), and 24% Hispanic or Latino ethnicity. Blacks have been found to have an excess risk of HF compared to whites.<sup>55</sup> Possible reasons for our lack of attrition may have been the ongoing support in the home setting and the retention gifts.

Though cognitive impairment has been reported in both HF and aging,<sup>41,56</sup> our sample had an average MMSE score of 29, indicating no cognitive impairment. However, the MMSE

can show a ceiling effect allowing individuals with cognitive impairment to have a perfect score, especially those with more education.<sup>57</sup> Intervention participants perceived increased memory capacity and change toward stability.<sup>48–49</sup> There was no change in the use of external strategies. No gender differences were found unlike Pressler and colleagues who reported finding poorer memory in men.<sup>58</sup>

Both men and women in the intervention group significantly increased their HF knowledge that persisted over the 3 time periods. Our sample was well educated which likely affected the baseline knowledge of both groups. However, even though both groups were equivalent in education, the intervention group still achieved higher success.

Functional and cognitive limitations can be affected by other co-morbidities in addition to HF.<sup>15</sup> Nearly half of the participants had concomitant diabetes mellitus (Type 1= 6%; Type 2= 42%). Diabetes and HF share several risk factors, including obesity.<sup>59</sup> A future study should target both diseases to synergistically aim to improve outcomes and reduce the adverse effects of diabetes in HF,<sup>59</sup> consistent with the recommendations by McCauley and colleagues.<sup>60</sup> The degree of obesity in participants was an unexpected finding. Obesity can affect a patient's interpretation of HF symptoms as dyspnea and fatigue.

A constellation of symptoms can accompany HF and its pharmacologic treatment. The symptom categories were high at baseline. Albert and colleagues found that dyspnea was reported by 100% of ambulatory patients (n=89) as their most common symptom,<sup>61</sup> similar to the 76% in our sample at baseline. In a recent narrative review about symptom onset and treatment, researchers found delays of 2 hours to 7 days from the symptom onset until hospital admission.<sup>62</sup> The intervention emphasized symptom recognition of worsening HF to build critically important self-care skills. Prior research<sup>63</sup> found that 42% of patients seeking emergency care were sent by relatives or healthcare providers and were uncertain about the seriousness of worsening HF.

Baselines self-care scores in the sample were high. Incorporating knowledge about symptom recognition and management, medications, nutrition, and healthy behaviors were effective in increasing self-care confidence and self-care maintenance measures on the SCHFI instrument. The decision-making needed for effective self-care management is complex and more difficult to achieve than maintenance.<sup>50</sup> Self-care confidence is important in generating and maintaining behavior change. The emphasis on teaching metacognition strategies to improve may have contributed to the improved self-care scores.<sup>50</sup>

Both HF and depression conditions share biological processes including increased neurohormone production and autonomic nervous system dysregulation.<sup>64</sup> In our study, participants in both groups improved in depressive symptoms. The intervention group began with higher depressive symptom scores on the GDS and trended down at all 3 time points after baseline, as did the control group. We attribute this to the effect of the APRN support felt by those in both groups. No differences in GDS scores were seen between the NYHA classes across both groups. Some studies have reported more depressive symptoms with higher NYHA functional classes, especially class III and IV.<sup>64–65</sup>

The percent of participants who self reported restricting sodium in their diet (73%) is consistent with Lennie and colleagues<sup>68</sup> who reported that 75% of participants (N=246) said they followed a low sodium diet all or most of the time, yet a 24-hour urine sodium excretion level reveal that only 25% of the participants were accurately self-reporting. Nutrition self-care behaviors are unique from most other activities in that they necessitate modifying existing behaviors and habits.<sup>67</sup> Teaching diet skills, as label reading for sodium content was incorporated, as was an interactive “pantry analysis” to specifically evaluate foods and sodium content actually present in the home. We recommended a 2000–2400 mg sodium diet, consistent with the teaching in HF Clinics in the city and the Nutrition Committee of the AHA.<sup>67–68</sup>

The improvement in functional status scores in the intervention group reflects a composite of items on the instrument. The results indicate that the intervention had a positive impact on participants’ health status including a major improvement in self-efficacy. Self-efficacy scores increased 20 points indicating a new level of confidence in the intervention group’s perception of their self-care ability. Some studies have noted worsening KCCQ responses over time with more severe cases of HF.<sup>43</sup>

Using APRNs who were HF experts to deliver the intervention was consistent with recommendations of utilizing specially trained HF nurses from a systematic review of 29 randomized trials of multidisciplinary programs to improve HF care.<sup>53</sup> Recent attention to transitional care for Medicare patients with high-risk conditions focuses on hospital to home transition. The seminal work of Naylor and colleagues with coordination of care by APRNs for HF patients provided much of the evidence to lay the groundwork.<sup>60,69–70</sup> Menefee<sup>71</sup> found that 50% of HF patients improved KCCQ scores after 3-months of care in an APRN-led HF clinic.

## Limitations

Several limitations were present. Data were collected in one southwestern city. Though randomized, the sample size was only 50 patients. The education level of participants was high but could not have been prevented unless some educational limit had been set. Using a more comprehensive battery of neuropsychological tests, similar to the work of Pressler<sup>22,58</sup> would improve measurement of cognitive impairment. The sample may not be reflective of many HF patients who are older, with cognitive impairment, and do not receive support in the home setting. Intervention fidelity and consistency in delivery of the intervention may have been affected by having several different APRNs, though we tried to standardize it with the modules and training sessions. Bias may have been present for the data about subjective perceptions of the intervention since the same APRN who conducted the intervention also collected that data though we tried to mitigate that by having the audiotapes analyzed by a different person and by using a numerical scale rating. Duplicating the in-home intervention could be time consuming and costly. Only literate people were eligible for the study and the study design used multisession education.

## Conclusion

This randomized control study examined the outcomes from an education-support intervention infused with a dose of memory enhancement which we believe to be an innovative approach to this population. Positive outcomes were seen in several patient-reported health status variables, including metamemory, self-efficacy, quality of life, self-care status, and HF knowledge. The American Heart Association says multiple studies have shown that patient-reported health status measures are strong, independent predictors of subsequent mortality.<sup>72</sup> Thorne<sup>73</sup> suggests that providers need to support competency building for chronically ill patients and assume that most will be able to gain fairly high levels of expertise in self-care. A state of the science paper on self-care in HF contends it is impossible for community-dwelling patients with chronic HF to avoid self-care.<sup>74</sup> The challenge before us is to continue to test models and interventions to improve self-care competencies and prevent costly readmissions.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1**

## Demographic Characteristics of Participants (n = 50)

	Total	Intervention (n= 25)	Control (n= 25)	$\chi^2$
<b>Gender</b>				
Male	48% (n=24)	36% (n= 9)	60% (n= 15)	2.89
Female	52% (n=26)	64% (n= 16)	40% (n= 10)	
<b>Marital Status</b>				
Married	50% (n=24)	52% (n= 13)	44% (n= 11)	1.52
Divorced	23% (n=11)	20% (n= 5)	24% (n= 6)	
Widowed	15% (n=7)	16% (n= 4)	12% (n= 3)	
Single	10% (n=5)	8% (n= 2)	12% (n= 3)	
Separated	2% (n=1)	4% (n= 1)	0% (n= 0)	
<b>Race</b>				
White	80% (n=40)	80% (n= 20)	80% (n= 20)	2.14
Black/African American	18% (n=9)	20% (n= 5)	16% (n= 4)	
American Indian/Alaska Native	2% (n=1)	0% (n= 0)	4% (n= 1)	
<b>Ethnicity</b>				
Hispanic or Latino	24% (n=12)	16% (n= 4)	32% (n= 8)	3.01
Not Hispanic or Latino	74% (n=37)	84% (n= 21)	64% (n= 16)	
Unknown	2% (n=1)	0% (n= 0)	4% (n= 1)	
<b>Education</b>				
Primary school	2% (n=1)	0% (n= 0)	17.4% (n= 1)	3.44
High school	36% (n=17)	47.8% (n= 11)	26% (n= 6)	
Some college	23% (n=11)	25% (n= 6)	21.7% (n= 5)	
College	17% (n=8)	12.5% (n= 3)	21.7% (n= 5)	
Master	11% (n=5)	8.3% (n= 2)	13% (n= 3)	
PhD	11% (n=5)	8.3% (n= 2)	13% (n= 3)	
<b>Socioeconomic Status (SES)</b>				
Do not have enough	26% (n=12)	17.4% (n= 4)	34.8% (n= 8)	8.51*
Enough for medications	26% (n=12)	30.4 (n= 7)	21.7% (n= 5)	
Enough plus extra	33% (n=15)	47.8% (n= 11)	17.4% (n= 4)	
Plenty	15% (n=7)	4.3% (n= 1)	26% (n= 6)	
<b>NYHA I</b>	14% (n=7)	12% (n= 3)	16% (n= 4)	.37
<b>NYHA II</b>	42% (n=21)	40% (n= 10)	44% (n= 11)	
<b>NYHA III</b>	44% (n=22)	48% (n= 12)	40% (n= 10)	
<b>Had to stop work because of HF</b>				
Yes	24% (n=11)	30.4% (n= 7)	18.2% (n= 4)	.91
No	76% (n=34)	69.6% (n= 16)	81.8% (n= 18)	
<b>Have insurance</b>				
Yes	93% (n=41)	100% (n= 22)	86.3% (n= 19)	3.22
No	7% (n=3)	0% (n= 0)	13.6% (n= 3)	
<b>Mean and Standard Deviation</b>				<b>t</b>

	Total	Intervention (n= 25)	Control (n= 25)	$\chi^2$
<b>Age (years)</b>	62.4 (+/-10.9)	61.7 (+/-10.3)	63.0 (+/-11.7)	.44
<b>Weight (lb)</b>	208.6 (+/-77.4)	206.2 (+/-79.4)	211.0 (+/-77.0)	1.47
<b>Body Mass Index (BMI)</b>	34.1 (+/12.5)	34.2 (+/-11.4)	34.1 (+/-13.8)	-.02
<b>Mini-Mental Status Exam (MMSE)</b>	28.7 (+/-1.4)	28.8 (+/-1.6)	28.6 (+/-1.2)	-.59
<b>Time since diagnosis of HF (months)</b>	67.7 (+/-62.8)	58.7 (+/-52.2)	76.8 (+/-14.4)	1.02

\* Some variables do not sum to a total sample of 50 due to missing values.

\* p< .05

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**Table 2**

Kansas City Cardiomyopathy Questionnaire (KCCQ) Scores across 4 times

	Intervention (n=25)				Control (n=25)				F-test
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Physical Limitation Subscale									
Physical Limitation scores for Time 1	54.10	27.22	62.23	28.25					
Physical Limitation scores for Time 2	59.10	28.20	61.78	27.28					F = 1.063 (p = .367)
Physical Limitation scores for Time 3	61.28	26.93	60.00	27.18					
Physical Limitation scores for Time 4	58.60	27.40	64.58	25.27					
Total Symptom score									
Total Symptom scores for Time 1	60.92	27.52	64.42	24.37					
Total Symptom scores for Time 2	71.88	21.38	65.38	25.23					F = .932 (p = .427)
Total Symptom scores for Time 3	70.58	23.27	66.33	26.95					
Total Symptom scores for Time 4	64.08	24.31	63.96	26.98					
Self-Efficacy Subscale									
Self-Efficacy scores for Time 1	73.00	24.12	81.00	17.35					
Self-Efficacy scores for Time 2	94.50	8.90	88.50	13.46					F = 3.774* (p = .028)
Self-Efficacy scores for Time 3	92.00	12.44	87.50	13.50					
Self-Efficacy scores for Time 4	93.00	11.46	86.50	16.50					
Quality of Life Subscale									
Quality of Life scores for Time 1	53.82	28.34	63.67	26.99					
Quality of Life scores for Time 2	71.53	21.27	63.67	25.10					F = 3.790* (p = .018)
Quality of Life scores for Time 3	68.40	24.69	65.33	28.63					
Quality of Life scores for Time 4	69.79	23.67	55.67	31.71					
Social Limitation Subscale									
Social Limitation scores for Time 1	59.15	29.03	65.34	25.87					
Social Limitation scores for Time 2	69.93	27.29	60.89	24.83					F = 2.394 (p = .072)
Social Limitation scores for Time 3	66.67	28.50	56.16	26.84					
Social Limitation scores for Time 4	61.78	26.26	57.77	28.33					
Overall Summary scores									
Over Summary scores for Time 1	55.38	23.98	63.08	22.90					F = 3.142* (p = .035)

	Intervention (n=25)		Control (n=25)		<i>F-test</i> time * group
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	
Over Summary scores for Time 2	67.23	20.69	61.82	21.13	
Over Summary scores for Time 3	65.77	21.60	61.53	24.16	
Over Summary scores for Time 4	62.61	21.80	60.43	24.12	

\*  $P < .05$

**Table 3**

Metamemory in Adulthood (MIA) Scores across 4 times

	Intervention (n = 25)		Control (n = 25)		F-test
	Mean	SD	Mean	SD	
Capacity Subscale					
Capacity subscale total score time 1	2.99	.70	3.30	.72	
Capacity subscale total score time 2	3.27	.59	3.20	.60	F = 3.85* (p = .011)
Capacity subscale total score time 3	3.21	.64	3.24	.70	
Capacity subscale total score time 4	3.18	.62	3.18	.68	
Change Subscale					
Change subscale total score time 1	2.40	.77	2.89	.66	
Change subscale total score time 2	2.67	.70	2.71	.62	7.67** (p = .000)
Change subscale total score time 3	2.65	.87	2.66	.65	
Change subscale total score time 4	2.69	.81	2.70	.72	
External Strategies Subscale					
External Strategies total score time 1	3.52	1.00	3.52	.86	
External Strategies total score time 2	3.84	.79	3.78	.89	1.01 (p = .390)
External Strategies total score time 3	3.86	.74	3.66	.71	
External Strategies total score time 4	3.75	.73	3.70	.71	

\* p < .05,

\*\* p < .001