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Perceived Facilitators and Barriers to Treatment Fidelity in Computerized Cognitive Training Interventions

Elham Y Algashgari^{1,2}, Miyeon Jung², Diane Von Ah³, Jesse Stewart⁴, Susan J Pressler²

¹Nursing Department, College of Nursing, Jazan University, Jazan, Saudi Arabia

²Indiana University School of Nursing

³The Ohio State University College of Nursing

⁴Indiana University Department of Psychology

Abstract

Background: Computerized cognitive training (CCT) interventions may have an important role in improving cognition among patients with heart failure (HF). Ensuring treatment fidelity of CCT interventions is an essential part of testing their efficacy.

Objective: To describe facilitators of and barriers to treatment fidelity perceived by CCT intervenors while delivering the interventions to patients with HF.

Methods and Results: A qualitative descriptive study was completed with seven intervenors who delivered CCT interventions in three studies. Directed content analysis revealed four main themes of perceived facilitators: 1) training for intervention delivery, 2) supportive work environment, 3) pre-specified implementation guide, and 4) confidence and awareness. Three main themes were identified as perceived barriers: 1) technical issues, 2) logistic barriers, and 3) sample characteristics.

Conclusion: This study is novel because it was one of the few studies focused on the intervenors' perceptions rather than the patients' perception of using CCT interventions. Beyond the treatment fidelity recommendations, this study found new components that might help the future investigators in designing and implementing CCT interventions with high treatment fidelity.

Keywords

Heart failure; computerized cognitive training intervention; intervenors; treatment fidelity; qualitative descriptive

Heart failure (HF) affects approximately 6.2 million people in the U.S. and 26 million people worldwide.¹ HF is associated with cognitive dysfunction in 23–50% of patients.^{2,3,4} Cognitive dysfunction, including memory loss, is associated with poor self-management, increased hospitalization, and mortality.^{5,6,7}

Corresponding author: Elham Y Algashgari elhaalga@iu.edu.

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One promising intervention is computerized cognitive training (CCT) to improve cognitive function among patients with HF.⁸ In a recent pilot study with 69 patients with HF, patients randomized to the combined CCT intervention with aerobic exercise showed significant improvement in working memory over 3-months follow-ups and processing speed over 6-months follow-ups.⁹ In a recent review of 4 randomized controlled trials (RCTs) with a total of 138 patients with HF, Kua and colleagues found that CCT interventions improved processing speed, memory, working memory, and instrumental activities of daily living.⁸ However, none of these studies addressed treatment fidelity of the CCT interventions.

Assessing treatment fidelity is critical in efficacy studies, such as CCT interventions, to ensure internal validity of findings.¹⁰ In preparation for this study, a literature search was conducted to examine the current state of knowledge about facilitators and barriers to treatment fidelity of implementing CCT interventions. The search was performed using CINAHL, PsycINFO, and MEDLINE. The time frame for the search was between January 2009 to July 2021 because the first CCT intervention study in HF was published in 2010.^{11,8} keywords were (computer* cognitive training intervention OR CCT) AND (fidelity OR treatment fidelity). The search yielded 241 references. Titles and abstracts were reviewed by the first author. No abstract was focused on treatment fidelity or mentioned facilitators and barriers to CCT interventions based on intervenors' perceptions.

There are 5 components of treatment fidelity: study design, training providers, delivery of treatment, receipt of treatment, and enactment of treatment skills.¹⁰ The first 3 components are assessed by factors related to the study design and study team members. The fourth and fifth components are assessed by factors related to the sample. In the current study, the focus was on the 2 factors of training providers and delivery of treatment. Examining the intervenors' perceptions regarding the facilitators of and barriers to CCT treatment fidelity among patients with HF will provide knowledge that can be used to strengthen validity of findings for future studies.

Purpose

The purpose of this study was to describe the perceived facilitators of and barriers to the 2 components of treatment fidelity, training providers and intervention delivery, among intervenors who delivered CCT interventions to patients with HF in RCTs.

Methods

Study Design

A qualitative descriptive study was conducted¹² using a directed content analysis approach.^{13,12} The study was approved by the university institutional review board (IRB). Approval was obtained from participants by e-mail prior to data collection.

Setting and Sample

The sample was intervenors from research teams led by the same PI (SJ Pressler) who had delivered nurse-enhanced CCT interventions to patients with HF.^{11,14,15} In these RCTs were, the initial intervention delivery visits were performed in patients' homes for the

majority of patients (over 90% of patients. If patients preferred, the initial visit was completed at the clinic or school of nursing. All patients performed the CCT interventions in their homes using BrainHQ from PositScience for 8 weeks. The CCT interventions were unsupervised and asynchronous. The BrainHQ CCT was designed based on the knowledge of neurogenesis and neuroplasticity principles.¹⁵ Patients with HF randomized to the CCT intervention had significant improvement in memory¹¹ and working memory¹⁴ compared to patients randomized to the active control group. In all 3 studies, the CCT was delivered in combination with the nurse-enhancement interventions that included education and support, assessment of clinical condition changes, and monitoring the treatment fidelity.¹⁵

Inclusion criteria for intervenors were: 1) had to have delivered the CCT intervention to at least 1 patient who in enrolled in MEMOIR studies; and 2) able to understand and speak English. The names of intervenors who met these criteria were provided by the PI of the 3 RCTs to be invited through e-mails. The invitation e-mails included a study information sheet that contained information about the purpose of the current study. Intervenors who agreed to participate received e-mails from the first author with a full explanation of the study purpose and methods to help them consider the questions prior to the interview.

Data Collection/ Procedures

The first author conducted all the individual interviews using 2 open-ended statements and 2 questions (Figure 1). These questions were developed by the research team to identify the intervenors' perceived facilitators, defined in this study as "an intervenor's perception of factors that help/promote the implementation of CCT interventions among patients with HF" and perceived barriers, defined as "an intervenor's perception of the challenging factors encountered when implementing the CCT interventions among patients with HF". Interviews were audio- or video-recorded and lasted 20–35 minutes (average 27.5 minutes). Demographic characteristics were collected at the end of the interviews.

Data Analysis

Directed content analysis^{12,13,16} was used to analyze the intervenors' data to identify perceived facilitators and barriers. During the interviews, the intervenors had the opportunity to clarify their responses as they were asked after each answer to give more information or examples. The interviewer asked follow-up questions and restated the intervenors' answers and then asked them if they agreed. All participants agreed with the restatement that was provided by the interviewer during the interview after each answer. Participants were not provided a written summation of their responses at the completion of the data collection process. First, the recorded interviews were transcribed verbatim. Second, transcriptions were independently reviewed and compared with the recordings by the first author and a second reviewer, who was a PhD nursing student, to ensure consistency and accuracy. Third, the data were read several times line-by-line by the first author to get a general understanding of the 1participants' statements. Then, data were highlighted and coded as perceived facilitators and barriers by identified meaning unit. The unit of analysis was the narrative description of the 7 intervenors and composed of keywords, phrases, or complete sentences. NVivo 11 qualitative data analysis software was used for organizing the coded data. The identified themes were revised and discussed by the research team until consensus

and agreement was reached on the final derived themes with no discrepancies. Finally, clusters were generated from the identified codes, aggregated into categories with brief headings, and then combined into broader, meaningful categories to formulate the final themes.¹⁷

Trustworthiness of findings was assessed by addressing credibility and dependability. The collected data and interpretation were checked by the first author and another reviewer to ensure that the interpreted data were matched with the emergent codes, categories, and themes.¹⁸

Descriptive statistical analyses were conducted to describe specific characteristics of the sample using SPSS. The demographic questionnaire included age, gender, race, professional type, level of education, and length of duration time delivering the interventions.

Results

Eleven intervenors who participated in at least one CCT among patients with HF were invited to participate. Seven (63%) intervenors agreed to participate (all women; median age 39 years, range 27 to 58; self-identified race white = 5 and Asian = 2). Two intervenors contacted did not respond to the email invitations and 2 intervenors declined to participate because of lack of interest and time. At the time of the parent studies, 2 intervenors had bachelor's in nursing degrees, 1 had a master's in nursing degree, 3 had bachelor's and master's in nursing and were Ph.D. nursing students, and 1 had a Ph.D. degree in nursing. Duration in the intervenor role ranged from 8 weeks to 3 years.

The intervenors described their experience regarding the CCT intervention as a "process", starting from receiving the training for intervention delivery to implementing the intervention. Findings from directed content analysis revealed 10 categories identified as perceived facilitators combined into 4 main themes of: 1) training for intervention delivery; 2) supportive work environment; 3) pre-specified implementation guide; and 4) confidence and awareness. Five categories were identified as perceived barriers combined into 3 main themes of: 1) technical issues, 2) logistic issues, and 3) sample characteristics.

Perceived Facilitators

Four main themes emerged from combining 10 categories of perceived facilitators of treatment fidelity in implementing the CCT intervention. Illustrative quotations and summary are presented in Table 1. In the first theme of training for intervention delivery, intervenors described the training as formal education that they received at the beginning of the study before they delivered the intervention. In this theme, intervenors described their perceptions of the training as "standardized training", "written manual for intervenors", and "different training techniques".

"Standardized training" was the most frequently reported category perceived by the intervenors. Assessing and improving the training of nurse intervenors is an important area of treatment fidelity. Standardized training may serve to enhance intervenors' confidence and capability in delivering the intervention. All intervenors indicated that they satisfactorily

“received the same type of training” on how to deliver the intervention during the orientation before they started working with the patients. They described how they received a “one-to-one” “massive training” from the research team. The intervenors mentioned that receiving the study protocol with standard procedures as a part of training was helpful to familiarize themselves with all procedures and measurements used in the study. They reported that being familiar with the study protocol during the training helped them to deliver the intervention and maintain consistency.

“Written manual for intervenors” was the second frequent category that was identified as a perceived facilitator for implementing the CCT. All intervenors expressed appreciation of having the written step-by-step manual specifically for intervention process (e.g., delivery, weekly phone calls, progress check, pick up, troubleshooting). They said that the manual was the “most helpful resource” in delivering consistent instructions to the patients. The intervenors’ written manual “has all types of information”, as described by an intervenor.

The third category was the using of “different training techniques”. The intervenors expressed that they experienced different training techniques through their training, such as starting with “a checklist for all the intervention procedures”, “structured practice”, and “role-playing intervention delivery”. Some intervenors mentioned that they received annual intervention training, practiced the intervention delivery, and were evaluated by the research team on-site during the actual intervention delivery to ensure consistency and minimize drift in delivering the same high quality of interventions to the patients with HF over time.

The second theme of supportive work environment emerged as one of the perceived facilitators that helped the intervenors by encouraging them during the training and while implementing the interventions in real-world settings. Working in supportive work environment helped the intervenors to overtake any encountered struggle. This theme included 2 categories of “teamwork” and “intervention meetings” on a regular basis.

“Teamwork” was the first category that encompassed the positive attributes of the work environment that the intervenors perceived. They described teamwork as communicating with the team and getting help and support regarding questions encountered when implementing the interventions. Most intervenors stated that contacting a team member who “was more experienced” in troubleshooting was very helpful. Team members were readily available to answer questions and share solutions to issues. They described being a part of a team as encouraging and motivating work to satisfactorily deliver the intervention.

The second category was the occurrence of regular, weekly “intervention meetings”, where all study team members gathered to review weekly intervention activities and discuss any issues encountered. All intervenors appreciated these meetings because they could address potential issues in advance. They were comfortable sharing any struggle or issue and getting helpful answers during the meetings. An intervenor described these regular intervention meetings as “the best facilitators” to learn, teach, and deliver the interventions.

The third theme that emerged as a perceived facilitator was the pre-specified implementation guide for patient interaction. Having a well-designed plan to implement the intervention improved and eased the process of delivering and implementing the intervention with fewer

struggles and difficulties. “Providing written manual for patients”, “using the teach-back method” during the intervention delivery, and “referencing the study protocol” while trouble shooting were the most useful facilitators as perceived by the majority of the intervenors.

The first category, “written manual for patients,” supported the process of implementing the intervention that was delivered to the “very ill patients, the patients with HF”, as described by the intervenors. Most of the intervenors mentioned that these written instructions played a critical role in clarifying the steps of completing the intervention to ensure that proper steps were taken to complete the intervention. An intervenor reported that the written intervention instructions had a clear, detailed description and explanation about how to demonstrate the intervention “step-by-step”. The intervenors recognized that all patients appreciated having this kind of detailed instructions that helped them with much less need to memorize the instructions or need to ask for further help from the intervenors. An intervenor said, “the patients don’t need to actually memorize, they can follow without any trouble.”

“Using the teach-back method” facilitated the process of delivering the intervention as perceived by most of the intervenors. Intervenors assessed patients’ understanding of the intervention by asking them to explain what they have to do. This method has been emphasized by most intervenors that helped them in ensuring effective patient training and comprehension. An intervenor said, “the teach-back was very helpful because then we could identify exactly where the disconnect was and which areas we needed to work on more.”

The third category was “referencing the study protocol” that facilitated the intervention implementation as perceived by the intervenors. All intervenors recognized that having access to the study protocol was helpful so that they could explain to patients why and how this intervention needed to be implemented. “A standardized intervention was delivered to the patients by following the study protocol”, as described by an intervenor.

The fourth main theme that emerged as a perceived facilitator was confidence and awareness. The intervenors believed that their previous experience in working with chronically ill people and patients’ cooperation, through their awareness of their cognitive dysfunction, played an important role in implementing the CCT intervention effectively.

Intervenors who had “previous experience” in delivering interventions like the cognitive intervention, or nurse intervenors who had a previous experience working with chronically ill patients, believed that their experience made them feel confident to deliver the intervention effectively. Some intervenors stated that the person responsible for delivering the intervention to patients with chronic conditions, such as HF, needs to be aware of how to deal specifically with “these very ill patients, how to communicate well with them, and how to teach them”. Thus, some intervenors described the confidence of the intervenors as “a critical characteristic” that should be considered in organizing the intervention team to enhance the delivery process and encourage the patients to engage well in the intervention.

“Patients’ awareness” of their cognitive dysfunction was one of the perceived facilitators that helped the intervenors to implement the intervention regardless of the patients’ serious condition. The intervenors emphasized that the more aware the patients were of their cognitive dysfunction, the more motivated they were to participate, learn, and interact well

with the intervenors, which will facilitate the process of implementing the CCT intervention. Some intervenors perceived that the patients' awareness of their needs and their interest in doing the intervention activities were expectancy signs of their "ability to make their minds stronger or keep them sharp." Thus, the patients' awareness played as a motivation to the patients themselves to learn and interact well with the intervenors and facilitate the process of delivering the CCT intervention.

Perceived Barriers

Three main themes emerged from combining 5 categories of perceived barriers to treatment fidelity in implementing the CCT intervention. Illustrative quotations and summary are presented in Table 2. In the first theme, most intervenors emphasized that technical issues related to using a computer for the cognitive training hindered the process of delivering the CCT intervention. The 2 categories of "computer" and "internet issues" comprised the theme of technical issues.

The intervenors perceived that most of the technical issues they encountered during implementing the CCT were caused by using rebuilt laptop computers that had some issues (e.g., unexpectedly stopped). Most intervenors mentioned that the computers sometimes ran slowly or were unreliable (e.g., freeze or unable to finish the assigned training) as they were relatively old computers and the issues made it difficult to complete the tasks in a timely manner. An intervenor said, "the laptops are a little old and sometimes they will just shut down." However, the intervenors believed that having a strong technical support staff and having a research team member who was knowledgeable in computer skills and delivery were helpful in solving the encountered technological issues.

No internet access or slow internet speed at patients' home was the other technical issue the intervenors perceived. Some intervenors reported that the internet sometimes was not available in some patients' homes, so they "needed to carry a portable Wi-Fi" to use as a remote internet access for the patients to complete the intervention. The patients' house locations in rural areas that have a poor internet access was another technical issue the intervenors encountered. As they said, "but that [internet access] is not always dependable." This issue may have influenced the patient's ability to complete the cognitive training activities as one intervenor indicated that "if the internet access isn't very good, the training stuff can be a kind of slow to load up the training."

The second barrier perceived by the intervenors was the logistical issues presented mainly in managing the traveling to patients' homes to deliver the intervention. Most of the intervenors perceived that traveling to patients' homes and balancing intervenors' schedules were the biggest barriers while delivering the CCT within a specific window of time to follow the study protocol. An intervenor said "my number one [barrier] was travel" meant travel to patients' homes for intervention delivery. Implementing the intervention requires the intervenors to meet the patients mostly in their homes, but intervenors perceived that it might be challenging to drive to several homes on the same day, especially if the patients scheduled on the same day live far away from each other. Finding time to drive to different areas besides dealing with the changes in the scheduled appointments was indicated by most of the intervenors as challenging. They said, "the logistics were mainly the biggest issue,"

“the logistics and the number of participants that we’re getting into the study were probably the two biggest barriers.”

In the last main theme, some intervenors perceived that some of the sample characteristics, such as older age and low computer literacy, might have been associated with having more difficulties during the intervention delivery and weekly intervention calls. Patients’ older age was the most prevalent category that was perceived by the intervenors as a barrier that delayed the process of implementing the intervention. The intervenors emphasized that the older patients experienced or might experience more challenges during learning and completing the intervention, especially when they had a chronic condition like HF. As an intervenor described the older patients’ struggles as a barrier “it says a lot about aging population” Some intervenor reported that some of the older patients were frustrated with the length of time it took to learn how to do the intervention activities, after completing the data collection interviews with cognitive tests. An intervenor response to the question about barriers was “the age of a lot of the patients... some of the patients would get frustrated.”

The intervenors perceived that patient’s computer literacy was the most important characteristic that should be considered while delivering the interventions, as the CCT intervention depends mostly on participants using a computer to demonstrate some cognitive tasks. All the intervenors mentioned the diverse computer literacy level of patients who received the CCT intervention. An intervenor mentioned how it was difficult to use the computer by some patients “they just couldn’t seem to use a computer... they couldn’t figure out the computer.” Some intervenors mentioned that they sometimes had to teach the patients the basics skills to use the computer, such as simple terms regarding computer functions (e.g., “capital letter” instead of “caps lock,” and “press this left side button twice” rather than double click). An intervenor said, “I think a lot of the difficulty for the patients was learning computers in general.”

Discussion

To the authors’ best knowledge, this is the first study to evaluate the intervenors’ perceptions of implementing the CCT among patients with HF for the purpose of assessing perceived facilitators and barriers to treatment fidelity. A qualitative descriptive study, using semi-structured, open-ended interviews, was conducted for a total of 7 intervenors who were educated to and delivered the CCT intervention in 3 previous studies among patients with HF. This study has the strength of identifying facilitators and barriers among intervenors who had different levels of education, different professional roles, and different lengths of time working in the intervention role.

It is important to note that these CCT interventions were nurse-enhanced interventions that were developed and tested by nurses. The nurse-enhanced interventions were delivered by trained intervenors and under the guidance of nurses with graduate education in nursing. Intervenors played an important role in delivering the interventions of cognitive training, include providing health education, home visits, monitor patient’s adherence to the intervention, and evaluating patient’s progress, which all support treatment fidelity.

Although the CCT interventions were beneficial in improving cognition among patients with HF and other populations,¹⁹ treatment fidelity assessment through the intervenors' perceptions was lacking in most CCT studies. The Behavior Change Consortium (BCC) encouraged treatment consistency in behavioral intervention studies, such as the cognitive training interventions, through enhancing the components of treatment fidelity¹⁰.

The treatment fidelity process starts with a design of the intervention including its specific components, such as design manuals for intervenors and for patients, intervenors' training (content, time, practice), and regular meetings to evaluate progress and troubleshoot issues early.²⁰ Therefore, most results from this study were similar to which have been identified and recommended as critical components for assessing treatment fidelity.^{10,21,22} Beyond what is in the treatment fidelity recommendations, the current study found new components that will be helpful for investigators to implement in future studies.

Overall, the intervenors had positive perceptions about implementing the CCT among patients with HF based on the perceived facilitators. Although the study purpose was focused on 2 components of treatment fidelity, training providers and implementing the intervention, some of the comments were related to the study design, too. All intervenors emphasized the importance of receiving an intense, standardized training and having the written manual instructions available for all procedures before delivering the intervention to the patients. Standardized training is a substantial domain of treatment fidelity to guarantee satisfactorily trained intervenors for delivering the intervention per protocol.¹⁰ To standardize the intervention delivery and eliminate differences in delivery a detailed written manual is highly recommended.²³ The intervenors reported use of different techniques in training as a facilitator, including using a training checklist, having certified training, role-playing, and observing the actual intervention delivery. These methods were recommended by the BCC to ensure the intervenors' skill acquisition for valid intervention delivery.

Receiving training in specific interventions, especially CCT, needs to be designed and monitored using different training techniques. These techniques are important to ensure consistent, high-quality intervention delivery in order to enhance the intervenors' comprehension and capability in implementing the intervention among the patients. Monitoring the intervention implementation needs regular meetings and supervision¹⁰ as well as a supportive work environment. Supportive work environment showed a significant benefit in increasing the productivity and problem-solving among the intervenors while participating in delivering the CCT intervention. As shown in a recent systematic review, the productivity of academic research was influenced by the organizational and psychosocial characteristics, such as collaborative teamwork and workplace environment.²⁴ Collaborative teamwork and regular meetings help early identification of any issue or deviation that might affect the rhythm of implementing the intervention.

Intervention implementation was facilitated by having pre-specified implementation guide to standardize the intervention delivery process as perceived by intervenors. The recommendations of BCC emphasized the need of reducing differences within the patients who received the intervention.²⁵ Thus, providing scripted instructions for patients is important to ensure that the same intervention delivered in the same condition for all the

patients in the study. As well as, using the teach-back method with the patients was helpful to ensure that the patients received a comprehensive teaching to complete the intervention and enhance self-care.²⁶ Referencing and adhering to the study protocol also enhanced implementing the intervention equally between the patients and ensure that the intervenors have the same comprehension regarding delivering the intervention.¹⁰

Beyond what is in treatment fidelity checklist, intervenors' confidence to deliver the intervention and patients' awareness of their needs were perceived as essential facilitators for effective intervention implementation. One of the nurses' responsibilities is teaching the patients and providing them with instructions during the regular nurse-patient interacting. Thus, it should be considered when organizing an intervention team in behavioral interventions, such as CCT interventions. The patients' awareness of their cognitive dysfunction could play a critical role in implementing the intervention, as the patients would be more interested in completing the cognitive training to improve their cognition.

While the majority of the intervenors' perceptions were positive, some encountered factors were perceived as barriers to treatment fidelity. Although these barriers might hinder implementing the intervention, most of them were manageable without great complications. Elements of the study design were challenging for some intervenors, such as the home-based intervention delivery and sample characteristics of patients with HF.

Most intervenors mentioned concerns regarding the barriers that were either directly or indirectly related to the technical issues (e.g., using a computer and an internet for CCT) that might have affected the intervention implementation efficiency. These are perceptions and are not necessarily consistent with actual data. In MEMOIR-HF, specific computer problems and changes in computers were carefully monitored to ensure smooth intervention delivery. Nevertheless, investigators need to purchase high-quality equipment and closely monitor implementation for the duration of the study to ensure the efficacy of the intervention and minimize the confusion of the poor enactment whether because the patients' ability to practice or the computer ability to run the intervention. Also, the investigators need to consider using CCT interventions that is not requiring internet access to ease the training process.

Concerns related to logistic issues presented in managing their time while traveling to the patients' homes in different areas and dealing with the last-minute schedule change may cause some difficulties, as perceived by the intervenors. Although the intervenors identified travel to patients' homes as a barrier, this travel was a strength of the MEMOIR studies. The home-based CCT intervention was designed for the ease and convenience of the patients with HF and their family caregivers. Patients with HF have multiple physician visits and it was a burden to them and the caregivers. The recruited patients in these studies live within 60 miles of the school of nursing, and the intervenors were reimbursed for travel time and mileage. Thus, designing alternative strategies to home-visit may be useful in the future. For example, meeting patients when they have physician visits or after physician visits to limit travel time. However, it should be considered that the CCT intervention needs more preparation in a place that patients could feel more comfortable to use the computers.

Other barriers reported by the intervenors were the patients' education level and computer literacy that might be a challenging to implement the intervention. Even though the intervenors perceived the older age, education level, and computer literacy as barriers, the literature shows that older patients with cognitive dysfunction satisfactorily completed the CCT intervention.^{27,28} Thus, well-prepared study protocols to overcome the barriers (e.g., instructions with graphics or pictures, supplemental information sheets for computer function) would facilitate treatment fidelity in delivering CCT.

Although there are some barriers due to the intervention delivery setting being a home-based such as internet access and scheduling issues due to intervenor's traveling, home-based interventions are beneficial for patients with HF who are more likely to have physical limitations due to HF symptoms (e.g., swelling on lower extremities, fatigue, or shortness of breath). Thus, we discussed the need for strategies to overcome the barriers while not requiring traveling for the patients with heart failure.

Limitations

This study has limitations worthy of comment. The sample of intervenors was small, and all were women. Intervenors were recruited from the research teams led by the same PI who had delivered CCT interventions using BrainHQ, which may limit generalizability of the results. It would be valuable in future work to increase the sample size and include intervenors from other studies that used CCT interventions to other population other than HF to include other investigative team and patient populations. It is important to consider different studies that used computerized intervention to confirm facilitators and barriers that might be encountered while delivering this kind of intervention with different populations. Another limitation was that the number of interventions delivered by each intervenor was not available. This lack limited generalizability of the findings and therefore, finding should be interpreted cautiously. The data were perceptions of the intervenors. The responses were based on questions that asking about the training and the intervention delivery. However, a different set of questions centered around each component of treatment fidelity may have yielded different results. Participants were not provided a written summation of their responses at the completion of the data collection process, that may have led to other findings.

Conclusions

This study is novel because it is focused on research intervenors' perceptions of delivering CCT interventions. During the delivery of CCT intervention, the intervenors experienced both facilitators and barriers to treatment fidelity. The perceptions of intervenors described the CCT as a promising intervention for improving cognition among HF patients with cognitive dysfunction. The results will assist future investigators using CCT to strengthen treatment fidelity.

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What's New?

- Exploring the intervenors' experiences and perceptions is critical to identify facilitators and barriers to treatment fidelity to improve the process of interventions delivery in future studies.
- Beyond what is in the treatment fidelity recommendations, the current study found new components that might help the future investigators in designing and implementing CCT interventions with high treatment fidelity.
- The perceptions of intervenors described the CCT as a promising intervention for improving cognition in HF patients with cognitive dysfunction.

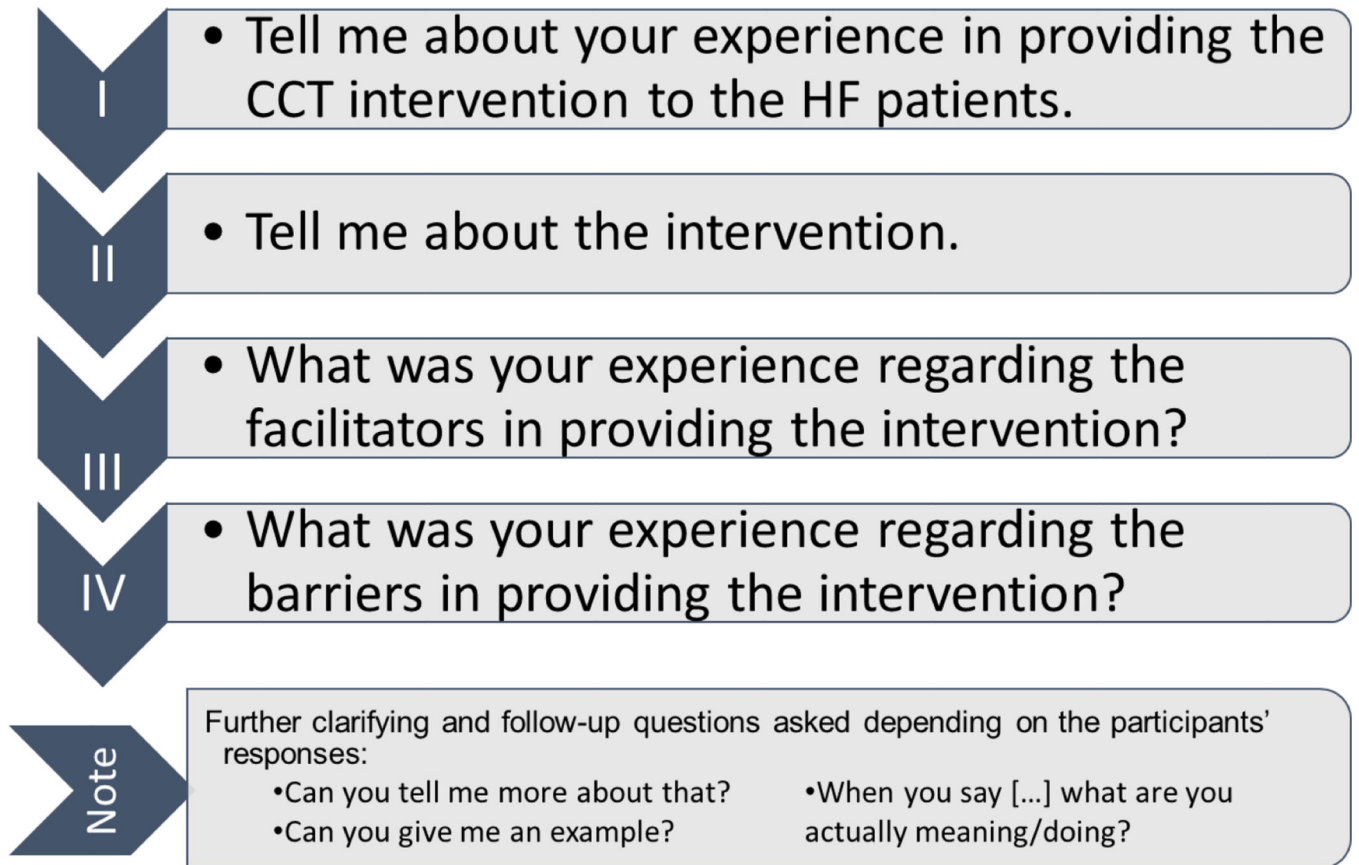


Figure 1.
The Interview Guides and Clarifying Questions for Qualitative Descriptive

Table 1.

Perceived Facilitators of Treatment Fidelity: Quotations, Categories, and Themes

Example Quotations	Categories	Themes
“We received the same type of training.”	1. Standardized training	1) Training for intervention delivery
“I use that all the time to go back and look at the instructions again to make sure I’m doing everything right.”	2. Written manual for intervenors	
“We have a checklist to start with,” “It’s kind of playing a role,” “massive training,” “annual recertification.”	3. Different training techniques	
“It’s good to be able to talk with the group to see did I do the right thing!”	1. Teamwork	2) Supportive work environment
“Team meetings were definitely the best.”	2. Intervention meetings	
“They (participants) don’t need to actually memorize,” “they can follow without any trouble.”	1. Written manual for patients	3) Pre-specified implementation guide
“I would have them teach back and demonstrate back how to do it.”	2. Teach-back method	
“A hardcopy of the protocol for consistency is pretty good.”	3. Referencing the study protocol	
“Feeling comfortable...some of it was already familiar I had used in a previous study.”	1. Intervenors’ experience	4) Confidence and awareness
“They’re aware of their cognitive health and their ability to influence their cognition based on the activities they’re doing.”	2. Patients’ awareness	

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Table 2.

Percived Barriers to Treatment Fidelity: Quotations, Categories, and Themes

Example Quotations	Categories	Themes
“Laptops are a little bit old, sometimes they just shut down.”	1. Computers issues	1) Technical issues
“If the internet access isn’t very good, the training stuff can be kind of slow to load up the training.”	2. Internet issues	
“My number one (issue) was travel.”	1. Travelling to patients’ homes	2) Logistic issues
“The age of a lot of the patients... some of them would get frustrated.”	1. Older age	3) Sample’s characteristics
“Not familiar with a computer or how to login or use a mouse,” “They don’t know what click means.”	2. Low computer literacy	

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