A qualitative analysis of coronary heart disease patient views of dietary adherence and web-based and mobile-based nutrition tools

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Abstract

PURPOSE—Dietary adherence can be challenging for patients with coronary heart disease (CHD), as they may require multiple dietary changes. Choosing appropriate food items may be difficult or take extensive amounts of time without the aid of technology. The objective of this project was to (1) examine the dietary challenges faced by patients with CHD, (2) examine methods of coping with dietary challenges, (3) explore the feasibility of a web-based food decision support system, and (4) explore the feasibility of a mobile-based food decision support system.

METHODS—Food for the Heart (FFH), a website-based food decision support system, and Mobile Magic Lens (MML), a mobile-based system, were developed to aid in daily dietary choices. Three CHD patient focus groups were conducted and focused on CHD-associated dietary changes as well as the FFH and MML prototypes. A total of 20 CHD patients and 7 informal caregivers participated. Qualitative, content analysis was performed to find themes grounded in the responses.

RESULTS—Five predominant themes emerged: 1) decreasing carbohydrate intake and portion control are common dietary challenges, 2) clinician and social support makes dietary adherence easier, 3) FFH could make meal-planning and dietary adherence less complicated, 4) MML could save time and assist with healthy choices, and 5) additional features need to be added to make both tools more comprehensive.

CONCLUSIONS—FFH and MML may be tools that CHD patients would value in making food choices and adhering to dietary recommendations, especially if additional features are added to assist patients with changes.

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Keywords

dietary adherence; web and mobile based nutrition tools; coronary heart disease

Coronary heart disease (CHD) often results in angina, shortness of breath, myocardial infarction, and heart failure. Currently, it is the leading cause of death among Americans, and is a common diagnosis of individuals participating in cardiac rehabilitation. CHDis becoming increasingly prevalent, with 17.6 million individuals diagnosed, costing an estimated $177.1 billion in 2010.[1]

Many of the hospitalizations, morbidity, and mortality associated with CHD are preventable through lifestyle changes, such as quitting smoking, making dietary changes, losing weight, and engaging in physical activity.[2] Adherence to the dietary changes can be difficult for patients with CHD, since recommended changes include reducing sodium intake to less than 2.4 grams per day (approximately 1 teaspoon of table salt)[4] or less than 1.5 grams per day,[3] reducing saturated fat intake to less than seven percent of total calories,[2] and increasing consumption of fresh fruits, vegetables, and low-fat dairy products.[2,4]

Heart healthy dietary changes have been found to lower blood pressure and reduce the risk of CHD, myocardial infarction, and stroke.[5–7] However, adherence to dietary recommendations is poor among patients with CHD[8,9] and other diseases.[7,10,11] Without adherence to lifestyle and dietary recommendations, CHD progresses, requiring the use of additional medication therapy[2,4] and increasing the risk for adverse drug events, undesirable side effects, and increased healthcare costs.[12]

Patients with CHD are likely to have additional comorbidities (eg, diabetes, hypertension)[1,2] further complicating dietary adherence. Dietary choices associated with these comorbidities require accounting for multiple dietary variables, such as sodium, saturated fat, and carbohydrate content, while shopping for groceries or choosing entrees at a restaurant, which may be difficult or time-consuming without additional assistance, such as technology.[13] Incorporating the use of technology into diet and exercise interventions has been found to increase adherence.[14–16] Using technology to record dietary intake takes less time than traditional food diaries and is less burdensome.[17,18] Technology also has the potential to be as accurate as daily food diaries, traditionally used in diet studies.[19–21] However, there continues to be a need to create and assess technology to improve dietary adherence.[20,22]

In order to improve patient adherence to dietary recommendations in CHD and prevent complications associated with symptom exacerbation, tools are needed to assist patients in making appropriate dietary choices without reliance on memory. Furthermore, tools that include a comprehensive list of foods are needed to help patients determine if their selections meet individual dietary criteria. While publicly available, such tools have not been tested to determine their efficacy in assisting patients with CHD in dietary adherence.[13–20]

The purpose of this study was to examine the dietary challenges and strategies for adherence in patients with CHD, as well as the feasibility of utilizing technology to assist patients with CHD in making appropriate dietary choices.

METHODS

Institutional review board approval was obtained prior to participant recruitment. Patients with CHD and their informal caregivers were recruited from a cardiopulmonary

rehabilitation clinic in Indiana, serving a predominately rural-based population. Any participant who had a diagnosis of coronary heart disease was invited to participate. Caregivers provide essential input related to dietary issues because often caregivers are overseeing and implementing these dietary changes, so they also were included in the focus groups. Flyers were distributed by the clinic staff, and interested participants completed an authorization form allowing contact by the researchers. Participants then were asked to take part in a focus group session.

Technology - Food for the Heart and Mobile Magic Lens

Two food decision support systems, Food for the Heart (FFH) and Mobile Magic Lens (MML) were created and examined in this project. These support systems are based on the "Dust and Magnet" (DnM) technology, as described previously.[13] DnM technology performs multivariate analysis to determine which items best fit the criteria from a database of items. For example, if an individual would like to select a cereal low in fat and sugar but high in protein and vitamin content, it can be difficult to choose from the extensive varieties of cereals available in the grocery store. However, with the DnM software, nutritional data are loaded into the database which allows the individual to select specific nutritional criteria (eg, fat, sugar, protein, and vitamins). The software then utilizes the available database and analyzes which cereals best fit the specified criteria. DnM provides a graphic displaying all 4 criteria and ranks cereal(s) based on all 4 criteria. As a result of this technology, the individual is assisted in choosing an appropriate cereal to purchase and consume.

Food for the Heart (FFH) is a web-based food decision support system based on the DnM technology and designed to select food items based on multiple nutrition criteria allowing the generation of a list of items to buy, ie, a "shopping list", or assist in creating meals and recipes. Individuals select the dietary component(s) they monitor, such as fat or sodium, and then they can use the features of the website. FFH also has the capability to track food eaten and determine adherence to the dietary guidelines on a daily and/or weekly basis. Another feature of FFH is an online community support group where users can share information and recipes.

MML is another mobile-based food decision support system designed to inform individuals whether a food item is nutritionally appropriate by reading barcodes using a mobile device camera. The barcode is transmitted to a database for analysis based on the individual user predefined dietary needs. The system categorizes the scanned food item into 1 of 3 groups by using a "stoplight" visualization (eg, green, yellow, and red) from the National Heart, Lung, and Blood Institute/National Institute of Health (NHLBI/NIH) healthy eating campaign.[23] A green color indicates that the item is a good dietary choice. A yellow color indicates that the food item is not the optimal choice for dietary adherence, yet acceptable. A red color indicates that the food item does not meet individual dietary guidelines. Users are provided with alternate choices if an item falls into the red zone.

Focus Group Sessions

Before each focus group session, participants (patients with CHD and their informal caregivers) were asked to complete a brief survey regarding responsibility for preparing meals and grocery shopping, gender, and age. Each focus group session was approximately 1 hour in length and was audio-taped. There were a total of three focus group sessions, held in a private conference room area of the cardiopulmonary rehabilitation clinic. They were held over the span of a month on different days and times to accommodate participant schedules. Moderators also took notes during the sessions.

A total of 14 questions were created prior to the focus group sessions after an extensive review of the literature related to dietary adherence and discussion amongst researchers with clinical research experience (Table 1). These questions were asked during the focus group session, along with followup questions based on participant responses. Each of the questions was addressed, either extensively or briefly, depending on the focus group session. During the focus group session, participants were asked about their favorite foods, dietary changes made since CHD diagnosis, challenges in making dietary changes, and ways of overcoming these challenges. Participants then were shown the FFH and MML prototype and asked which components they liked or disliked, how FFH and MML could assist them in making dietary changes, as well as the potential problems with the use of FFH and MML. A pharmacist and a nurse moderated each session, allowing for followup on dietary, lifestyle, and medication-related discussions.

Analysis

Statistical analyses for quantitative data were conducted using PASW software for Windows (version 18.0; SPSS Inc, Chicago, IL) to determine frequencies, means, and SD as appropriate. Tapes from the focus groups were transcribed verbatim, and content analysis of the qualitative taped data and researcher notes were performed to identify themes grounded in the responses.[24] The transcripts were examined by the 3 of the researchers independently to identify themes, drawing upon a grounded theory approach.[24] The three researchers then held a discussion to reach consensus on the predominant themes from the focus groups.

RESULTS

A total of 20 patients with CHD (see Table 2) and 7 informal caregivers of CHD patients participated in a focus group session. Response saturation, ie, no new information was presented, was met (as deemed by moderators) after 3 focus groups, so no more focus group sessions were held. Slightly more than half of CHD patients were male (n=11) and the average age was 68.35±10.34 years. One of the CHD patients also indicated that he is an informal caregiver for another CHD patient (He was included in the study as a patient rather than an informal caregiver). Nearly half of the CHD patients (n=11) prepared their own meals or assisted their spouse, with the remainder of CHD patients indicating that their spouse prepared their meals (n=7) or they dined out most meals (n=2). Many CHD patients (n=11) or their spouses (n=6) did the grocery shopping, or they did grocery shopping together (n=3). All but 1 CHD patient (n=19) indicated that they, or their spouse, used a list when grocery shopping.

Qualitative Results

Theme 1: Reducing carbohydrate intake and portion control were the most common dietary challenges—Two of the largest challenges with the dietary changes were reducing carbohydrate intake and portion control. CHD patients indicated that their favorite foods included breads, ice cream, pizza, pasta, and red meat (steak). Many of these favorite foods are high in carbohydrates. As one participant stated, "Not to eat the white stuff: pasta, potatoes, white bread. That is challenging." However, since their diagnosis, CHD patients have had to make changes such as avoiding fried foods, incorporating more whole grains, eating more fish, and eating less red meat and desserts to decrease sodium, fat, and carbohydrate intake. Participants mentioned that portion control was difficult, especially, "…during the holidays with other people and going out to eat. Limiting portions." and "Portion control. Not eating desserts. It is hard to find healthy foods at the restaurants."

Additional challenges mentioned included the lack of time to cook at home. As one participant stated, "*My biggest challenge is always time…*it is just having the time to fix something healthy. It seems like it requires more. I work 2 jobs and am a single parent…. When I do [eat] it is something quick and it is usually not the best thing to eat, so time is the biggest challenge for me." Other challenges mentioned were eating fewer desserts and making appropriate diet-specific choices at restaurants or family gatherings.

Theme 2: Clinician and social support makes dietary adherence easier—
Patients often received clinic staff support and spousal, family, or friend support (ie, social support) to deal with dietary challenges, which was very important. Clinic staff may play a large role, as participants mentioned, "There is a nurse over here and she kicked me in the bottom and told me this is the way it is going to be (buddy) and that is what you got to do." and "…Your class (cardiac rehabilitation) because they stressed what is really bad for you and what is good for your [sic] so that makes you stop and think when you are even buying your groceries to make sure you are getting the right stuff."

Social support may assist in managing dietary changes. One participant stated, "If I don't understand anything, if I think I am doing something wrong, I will call my sister and say `is this the way it should be.' She is diabetic, so that way we help each other." Several husbands indicated that their wives monitored their diet very carefully and reminded them to adhere to dietary recommendations. As one said, "Well she (spouse) has me tied down too tight on salt, I had no salt whatsoever. I had a lot of Mrs. Dash and pepper and stuff like that but no salt… She would sit there every morning and say `you gotta [sic] do this, and you gotta do this, you gotta eat this, did you take all your medicine, did you take your blood test.' It is like a recorder you know, it pushes you."

Other patients with CHD who had less support indicated difficulty adhering to diet changes due to time constraints, such as longer time needed to find and prepare healthy food items. Other methods of coping included using reference books, making seasoning substitutions, and logging dietary intake. One participant stated, "We got one thing that really works good [sic] and that is go to the diabetes center and get one of their exchange books and it shows you the exactly what you might eat…." Overall, participants indicated that in spite of using these resources, it is still difficult to adhere to their diets.

Theme 3 and 5: The Food for the Heart (FFH) website may make meal-planning easier but needs additional features—Focus group participants were shown a prototype of the FFH website and the different features available were mentioned, such as online community support, recipe builders, and diet monitoring. CHD patients liked the ability to self-monitor their diet as well as the online community support options. They also liked the capability to build meals and recipes based upon their own specific dietary recommendations. As one participant mentioned, "…we could use it for meal planning, so you could put your meal plan together ahead of time and adjust it if it looks like they are out of whack [sic]."

CHD patients recommended additional options such as a "ask a healthcare professional" page, the ability to track overall health (eg, weight, exercise, and blood pressure), the option for healthcare providers to log in and view the patient history, and the opportunity to individualize the website according to each chronic disease(s). Participants stated, "I think it is very important to do something like that because then you can watch your weight week to week or day to day you know [sic]. You weigh in the morning before you eat breakfast then you weigh after you eat your supper just before you go to bed, you could break that down and see how much weight you gained in a days' time…" and "I think it is good to be able to see it [weight and blood pressure] especially if you can switch it over to a graph so that you

can take a look at it and see…." Several of the participants indicated a need for the FFH website to check for interactions between food and their medications. As one stated, "I think that (knowing interactions between) medicine in combination with supplements will be very good because a lot of people don't know that if you take iron with this or that it doesn't absorb. If you take that with this, and I think knowing that helps." They also wanted to be able to track calories in addition to the nutritional components such as sodium, fat, and sugar.

Theme 4 and 5: The Mobile Magic Lens (MML) is user-friendly, faster than reading labels, and would help patients make healthy choices—Focus group CHD participants also were shown a MML prototype, and indicated that it was user-friendly, faster than reading labels, and would help them make healthy choices. Participants mentioned "It's fast. Instead of going through all the labels and having to figure out… serving sizes, and it would just help speed up the process" and "It helps you to make healthy choices. Seems like it is fast. It would be faster than picking up a can and reading it." Overall, participants liked the instant feedback that could be incorporated into devices most individuals already own, ie, a cell phone. One participant remarked on the practicality for family members or friends who pick up groceries by simplifying appropriate food items choices without knowing their dietary recommendations. They recommended developing additional programming options allowing for individualization regarding specific dietary needs (ie, celiac disease), syncing to the FFH website, and assistance in choosing restaurant items.

DISCUSSION

Patients with CHD in these focus groups recruited from a cardiac rehabilitation center face difficulty changing their dietary habits, with the most common challenge of reducing carbohydrates. Previous studies have found that patients have difficulty changing their habits and adhering to dietary recommendations, for many perceive the recommended diets as tasteless and less enjoyable than the higher fat and carbohydrate items.[7–11] A challenge faced by participants in the focus groups also were related to the length of time required to plan and prepare healthy meals, since unhealthy food items tended to be more convenient, which is consistent with other research.[25–27] Participants who made appropriate dietary choices found that support from their family, friends, and clinic staff improved their adherence. Support has been found to improve adherence and the lack of support can be detrimental.[28,29]

One of the purposes for this pilot study was to examine if tools such as FFH and MML are useful for patients with CHD, as most technological tools have been tested as replacements for food diaries rather than for dietary adherence.[17–21] The FFH website and the MML application appear to be tools that CHD patients perceive as valuable in making food choices and in dietary adherence, as they would help them make faster decisions when shopping and for allowing adjustments to stay within dietary recommendations. The incorporation of technology into diet and lifestyle interventions can decrease participant burden, be more efficient, and be highly accurate.[14–20]

Further development is needed to allow interaction between FFH and MML and to make both prototypes more comprehensive in addressing both dietary and lifestyle changes. Patients indicated that they wanted to be able to utilize the technology to monitor their CHD in its entirety, including their physical activity and medication-food interactions. Future work on this project should incorporate suggested components and pilot test upgraded prototypes in CHD patients to examine the usability and efficacy in dietary adherence.

Some limitations include a small sample size of CHD patients and a lack of generalizability of results, since the focus groups were conducted in a single cardiopulmonary rehabilitation clinic in Indiana serving a rural population. However, no new additional information was received after the third focus group, so response saturation was met. This project also was intended to be a preliminary examination of the feasibility of the FFH website and MML application. Future research should address these limitations by pilot testing the updated software in a more representative population to gather additional feedback on usability and efficacy. Ways to address the dietary challenges mentioned by patients with CHD and to reduce the time commitment associated with dietary adherence also should be examined in future research.

Patients with CHD face many challenges in adhering to complex dietary recommendations, such as reducing carbohydrate intake from favorite food items and finding the time to prepare and eat healthier food. Support from family and friends can help make dietary adherence easier. Technology tools such as the FFH website and the MML application may be useful tools for patients with CHD, by providing support to patients and reducing the complexity of making multiple dietary changes simultaneously.

Acknowledgments

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Table 1

Focus Group Questions

Question	Objective(s) Addressed
1. Tell us about your favorite food(s). [Warm-Up or "Ice-Breaker" Question]	To determine the dietary challenges faced by patients with CHD.
2. What type of changes have you been told to make to your diet since you were diagnosed with heart disease?	
3. What have been some of the challenges in making these changes to your diet?	
4. What and/or who has helped you to make these changes?	To determine methods of coping with dietary challenges for patients with CHD.
5. How can Food for the Heart help you make changes to your diet?	To explore patient opinions regarding a web-based food decision support system.
6. What do you like about Food for the Heart?	
7. What do you think are some problems with Food for the Heart, if any?	
8. What do you dislike about Food for the Heart?	
9. How can Mobile Magic Lens help you make changes to your diet?	To explore patient opinions regarding a mobile-based food decision support system
10. What do you like about Mobile Magic Lens?	
11. What do you think are some problems with Mobile Magic Lens, if any?	
12. What do you dislike about Mobile Magic Lens?	
13. Do you have any suggestions for improving either of these technologies?	To explore patient opinions regarding a web-based food decision support system. To explore patient opinions regarding a mobile-based food decision support system.
14. Is there anything we should have talked about, but didn't?	

Table 2

Participants with CHD Demographic, Meal Shopping and Preparation Information

N = 20	n (%)
Gender	
Male	11 (55%)
Female	9 (45%)
Meal Preparation	
Self	9 (45%)
Spouse	7 (35%)
Self + Spouse	2 (10%)
None, Eat Out	2 (10%)
Grocery Shopping	
Self	11 (55%)
Spouse	6 (30%)
Self + Spouse	3 (15%)
Utilize Shopping List	
Yes	19 (95%)
No	1 (5%)