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A Qualitative Analysis of Coronary Heart Disease Patients' Views of Dietary Adherence and of Web-Based and Mobile-Based Nutrition Tools

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Title: A qualitative analysis of coronary heart disease patients' views of dietary adherence and of web-based and mobile-based nutrition tools

Word Count: 3167

5 **Structured Abstract (250 words)**
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7 **Purpose:** Dietary adherence can be challenging for patients with coronary heart disease (CHD),
8
9 as they may require multiple dietary changes. Choosing appropriate food items may be difficult
10
11 or take extensive amounts of time without the aid of technology. The objective of this project
12
13 was to (1) examine the dietary challenges faced by patients with CHD, (2) examine methods of
14
15 coping with dietary challenges, (3) explore the feasibility of a web-based food decision support
16
17 system, and (4) explore the feasibility of a mobile-based food decision support system.
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23 **Methods:** Food for the Heart (FFH), a website-based food decision support system, and Mobile
24
25 Magic Lens (MML), a mobile-based system, were developed to aid in daily dietary choices.
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28 Three CHD patient focus groups were conducted and focused on CHD-associated dietary
29
30 changes as well as the FFH and MML prototypes. A total of 20 CHD patients and 7 informal
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32 caregivers participated. Qualitative, content analysis was performed to find themes grounded
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34 in the responses.
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39 **Results:** Five predominant themes emerged: 1) decreasing carbohydrate intake and portion
40
41 control are common dietary challenges, 2) clinician and social support makes dietary adherence
42
43 easier, 3) FFH could make meal-planning and dietary adherence less complicated, 4) MML could
44
45 save time and assist with healthy choices, and 5) additional features need to be added to make
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47 both tools more comprehensive.
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52 **Conclusions:** FFH and MML may be tools that CHD patients would value in making food choices
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54 and adhering to dietary recommendations, especially if additional features are added to assist
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56 patients with changes.
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5 **Condensed Abstract (50 words)**
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8 The Food for the Heart (FFH) website and Mobile Magic Lens (MML) application were
9
10 developed to aid in dietary adherence. Coronary heart disease patients and their caregivers
11
12 (N=27) discussed diet, FFH, and MML. Participants felt adherence was challenging, but FFH and
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14 MML may be time-saving tools and assist with adherence.
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7 **Introduction**
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10 Coronary heart disease (CHD) often results in angina, shortness of breath, myocardial
11 infarctions, and heart failure. Currently, it is the leading cause of death among Americans, and
12 is a common diagnosis of individuals participating in cardiac rehabilitation. Coronary heart
13 disease is becoming increasingly prevalent, with 17.6 million individuals diagnosed, costing an
14 estimated \$177.1 billion in 2010.¹
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22 Many of the hospitalizations, morbidity, and mortality associated with CHD are
23 preventable through lifestyle changes, such as: quitting smoking, making dietary changes,
24 losing weight, and engaging in physical activity.² Adherence to the dietary changes can be
25 difficult for patients with CHD, since recommended changes include reducing sodium intake to
26 less than 2.4 grams per day (approximately one teaspoon of table salt)⁴ or less than 1.5 grams
27 per day,³ reducing saturated fat intake to less than seven percent of total calories,² and
28 increasing consumption of fresh fruits, vegetables, and low-fat dairy products.^{2,4}
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40 Heart healthy dietary changes have been found to lower blood pressure and reduce the
41 risk of CHD, myocardial infarction, and stroke.⁵⁻⁷ However, adherence to dietary
42 recommendations is poor among patients with CHD^{8,9} and other diseases.^{7,10,11} Without
43 adherence to lifestyle and dietary recommendations, CHD progresses, requiring the use of
44 additional medication therapy^{2,4} and increasing the risk for adverse drug events, undesirable
45 side effects, and increased healthcare costs.¹²
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56 Patients with CHD are likely to have additional comorbidities (e.g., diabetes,
57 hypertension)^{1,2} further complicating dietary adherence. Dietary choices associated with these
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Patient Views on Diet and Electronic Nutrition Tools

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

Statement of Purpose

The purpose of this pilot 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

Patients

4 Institutional review board approval was obtained prior to participant recruitment.
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6 Patients with CHD and their informal caregivers were recruited from a cardiopulmonary
7
8 rehabilitation clinic in Indiana, serving a predominately rural-based population. Any participant
9
10 who had a diagnosis of coronary heart disease was invited to participate. Caregivers provide
11
12 essential input related to dietary issues because often caregivers are overseeing and
13
14 implementing these dietary changes, so they also were included in the focus groups. Flyers
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16 were distributed by the clinic staff, and interested participants completed an authorization
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18 form allowing contact by the researchers. Participants then were asked to take part in a focus
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20 group session.
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29 *Technology: Food for the Heart and Mobile Magic Lens*

30 Two food decision support systems, Food for the Heart (FFH) and Mobile Magic Lens
31
32 (MML) were created and examined in this project. These support systems are based on the
33
34 “Dust and Magnet” (DnM) technology, as described previously.¹³ DnM technology performs
35
36 multivariate analysis to determine which items best fit the criteria from a database of items.
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38 For example, if an individual would like to select a cereal low in fat and sugar but high in protein
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40 and vitamin content, it can be difficult to choose from the extensive varieties of cereals
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42 available in the grocery store. However, with the DnM software, nutritional data are loaded
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44 into the database which allows the individual to select specific nutritional criteria (e.g., fat,
45
46 sugar, protein, and vitamins). The software then utilizes the available database and analyzes
47
48 which cereals best fit the specified criteria. DnM provides a graphic displaying all four criteria
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50 and ranks cereal(s) based on all four criteria. As a result of this technology, the individual is
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52 assisted in choosing an appropriate cereal to purchase and consume.
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4 Food for the Heart (FFH) is a web-based food decision support system based on the
5
6 DnM technology and designed to select food items based on multiple nutrition criteria allowing
7
8 the generation of a list of items to buy, i.e., a “shopping list”, or assist in creating meals and
9
10 recipes. Individuals select the dietary component(s) they monitor, such as fat or sodium, and
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12 then they can use the features of the website. FFH also has the capability to track food eaten
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14 and determine adherence to the dietary guidelines on a daily and/or weekly basis. Another
15
16 feature of FFH is an online community support group where users can share information and
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18 recipes.
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25 MML is another mobile-based food decision support system designed to inform
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27 individuals whether a food item is nutritionally appropriate by reading barcodes using a mobile
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29 device’s camera. The barcode is transmitted to a database for analysis based on the individual
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31 user’s pre-defined dietary needs. The system categorizes the scanned food item into one of
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33 three groups by using a “stoplight” visualization (e.g., green, yellow, and red) from the National
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35 Heart, Lung, and Blood Institute/National Institute of Health (NHLBI/NIH) healthy eating
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37 campaign.²³ A green color indicates that the item is a good dietary choice. A yellow color
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39 indicates that the food item is not the optimal choice for dietary adherence, yet acceptable. A
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41 red color indicates that the food item does not meet the individual’s dietary guidelines. Users
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43 are provided with alternate choices if an item falls into the red zone.
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51 *Focus Group Sessions*

52 Before each focus group session, participants (patients with CHD and their informal
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54 caregivers) were asked to complete a brief survey regarding responsibility for preparing meals
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56 and grocery shopping, gender, and age. Each focus group session was approximately one hour
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4 in length and was audio-taped. There were a total of three focus group sessions, held in a
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6 private conference room area of the cardiopulmonary rehabilitation clinic. They were held over
7
8 the span of a month on different days and times to accommodate participants' schedules.
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11 Moderators also took notes during the sessions.
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15 A total of 14 questions were created prior to the focus group sessions after an extensive
16
17 review of the literature related to dietary adherence and discussion amongst researchers with
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19 clinical research experience (Table 1). These questions were asked during the focus group
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21 session, along with follow-up questions based on participant responses. Each of the questions
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23 was addressed, either extensively or briefly, depending on the focus group session. During the
24
25 focus group session, participants were asked about their favorite foods, dietary changes made
26
27 since CHD diagnosis, challenges in making dietary changes, and ways of overcoming these
28
29 challenges. Participants then were shown the FFH and MML prototype and asked which
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31 components they liked and disliked, how FFH and MML could assist them in making dietary
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33 changes, as well as the potential problems with the use of FFH and MML. A pharmacist and a
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35 nurse moderated each session, allowing for follow-up on dietary, lifestyle, and medication-
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37 related discussions.
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45 *Analysis*

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47 Statistical analyses for quantitative data were conducted using PASW software for
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49 Windows (version 18.0; SPSS Inc, Chicago, Illinois) to determine frequencies, means, and
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51 standard deviations as appropriate. Tapes from the focus groups were transcribed verbatim,
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53 and content analysis of the qualitative taped data and researcher notes were performed to
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55 identify themes grounded in the responses.²⁴ The transcripts were examined by the three of
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57 the researchers independently to identify themes, drawing upon a grounded theory
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4 approach.²⁴ The three researchers then held a discussion to reach consensus on the
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6 predominant themes from the focus groups.
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10 **Results**

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12 A total of 20 patients with CHD (see Table 2) and 7 informal caregivers of CHD patients
13 participated in a focus group session. Response saturation, i.e., no new information was
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15 presented, was met (as deemed by moderators) after three focus groups, so no more focus
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17 group sessions were held. Slightly more than half of CHD patients were male (n=11) and the
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19 average age was 68.35± 10.34 years. One of the CHD patients also indicated that he is an
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21 informal caregiver for another CHD patient. (He was included in the study as a patient rather
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23 than an informal caregiver.) Nearly half of the CHD patients (n=11) prepared their own meals
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25 or assisted their spouse, with the remainder of CHD patients indicating that their spouse
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27 prepared their meals (n=7) or they dined out most meals (n=2). Many CHD patients (n=11) or
28
29 their spouses (n=6) did the grocery shopping, or they did grocery shopping together (n=3). All
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31 but one CHD patient (n=19) indicated that they, or their spouse, used a list when grocery
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33 shopping.
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44 *Qualitative Results*

45 Theme 1: Reducing carbohydrate intake and portion control were the most common dietary 46 challenges.

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48 Two of the largest challenges with the dietary changes were reducing carbohydrate
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50 intake and portion control. CHD patients indicated that their favorite foods included breads, ice
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52 cream, pizza, pasta, and red meat (steak). Many of these favorite foods are high in
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54 carbohydrates. As one participant stated, *“Not to eat the white stuff: pasta, potatoes, white*
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56 *bread. That is challenging.”* However, since their diagnosis, CHD patients have had to make
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1 Patient Views on Diet and Electronic Nutrition Tools
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4 changes such as avoiding fried foods, incorporating more whole grains, eating more fish, and
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6 eating less red meat and desserts to decrease sodium, fat, and carbohydrate intake.
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9 Participants mentioned that portion control was difficult, especially, “...during the holidays with
10 other people and going out to eat. Limiting portions.” and “Portion control. Not eating desserts.
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15 *It is hard to find healthy foods at the restaurants.*”
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17 Additional challenges mentioned included the lack of time to cook at home. As one
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19 participant stated, “*My biggest challenge is always time...it is just having the time to fix*
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22 *something healthy. It seems like it requires more. I work two jobs and am a single parent....*
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25 *When I do [eat] it is something quick and it is usually not the best thing to eat, so time is the*
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27 *biggest challenge for me.*” Other challenges mentioned were eating fewer desserts and making
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29 appropriate diet-specific choices at restaurants or family gatherings.
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33 Theme 2: Clinician and social support makes dietary adherence easier.

34 Patients often received clinic staff support and spousal, family, or friend support (i.e.,
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36 social support) to deal with dietary challenges, which was very important. Clinic staff may play
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38 a large role, as participants mentioned, “*There is a nurse over here and she kicked me in the*
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40 *bottom and told me this is the way it is going to be (buddy) and that is what you got to do.*” and
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45 “*...Your class (Cardiac Rehab) because they stressed what is really bad for you and what is good*
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47 *for your [sic] so that makes you stop and think when you are even buying your groceries to*
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49 *make sure you are getting the right stuff.*”
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52 Social support may assist in managing dietary changes. One participant stated, “*If I don’t*
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54 *understand anything, if I think I am doing something wrong, I will call my sister and say ‘is this*
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56 *the way it should be.’ She is diabetic, so that way we help each other.*” Several husbands
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59 indicated that their wives monitored their diet very carefully and reminded them to adhere to
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4 dietary recommendations. As one said, *“Well she (spouse) has me tied down too tight on salt, I
5 had no salt whatsoever. I had a lot of Mrs. Dash and pepper and stuff like that but no salt... She
6 would sit there every morning and say ‘you gotta [sic] do this, and you gotta do this, you gotta
7 eat this, did you take all your medicine, did you take your blood test.’ It is like a recorder you
8 know, it pushes you.”*

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17 Other patients with CHD who had less support indicated difficulty adhering to diet
18 changes due to time constraints, such as longer time needed to find and prepare healthy food
19 items. Other methods of coping included using reference books, making seasoning
20 substitutions, and logging dietary intake. One participant stated, *“We got one thing that really
21 works good [sic] and that is go to the diabetes center and get one of their exchange books and it
22 shows you the exactly what you might eat...”* Overall, participants indicated that in spite of
23 using these resources, it is still difficult to adhere to their diets.
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36 Theme 3 and 5: The Food for the Heart (FFH) website may make meal-planning easier but
37 needs additional features.
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39 Focus group participants were shown a prototype of the FFH website and the different
40 features available were mentioned, such as online community support, recipe builders, and diet
41 monitoring. CHD patients liked the ability to self-monitor their diet as well as the online
42 community support options. They also liked the capability to build meals and recipes based
43 upon their own specific dietary recommendations. As one participant mentioned, *“...we could
44 use it for meal planning, so you could put your meal plan together ahead of time and adjust it if
45 it looks like they are out of whack [sic].”*
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57 CHD patients recommended additional options such as a “ask a healthcare professional”
58 page, the ability to track overall health (e.g., weight, exercise, and blood pressure), the option
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1 Patient Views on Diet and Electronic Nutrition Tools

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4 for healthcare providers to log in and view the patient’s history, and the opportunity to
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6 individualize the website according to each person’s chronic disease(s). Participants stated, “I
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8 *think it is very important to do something like that because then you can watch your weight*
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10 *week to week or day to day you know [sic]. You weigh in the morning before you eat breakfast*
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12 *then you weigh after you eat your supper just before you go to bed, you could break that down*
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14 *and see how much weight you gained in a days’ time...”* and “*I think it is good to be able to see*
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16 *it [weight and blood pressure] especially if you can switch it over to a graph so that you can take*
17
18 *a look at it and see....”* Several of the participants indicated a need for the FFH website to check
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20 for interactions between food and their medications. As one stated, “*I think that (knowing*
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22 *interactions between) medicine in combination with supplements will be very good because a*
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24 *lot of people don’t know that if you take iron with this or that it doesn’t absorb. If you take that*
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26 *with this, and I think knowing that helps.”* They also wanted to be able to track calories in
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28 addition to the nutritional components such as sodium, fat, and sugar.
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38 Theme 4 and 5: The Mobile Magic Lens (MML) is user-friendly, faster than reading labels, and
39 would help patients make healthy choices.

40 Focus group CHD participants also were shown a MML prototype, and indicated that it
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42 was user-friendly, faster than reading labels, and would help them make healthy choices.
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45 Participants mentioned “*It’s fast. Instead of going through all the labels and having to figure*
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47 *out...serving sizes, and it would just help speed up the process”* and “*It helps you to make*
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49 *healthy choices. Seems like it is fast. It would be faster than picking up a can and reading it.”*
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53 Overall, participants liked the instant feedback that could be incorporated into devices most
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55 individuals already own, i.e., a cell phone. One participant remarked on the practicality for
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57 family members or friends who pick up groceries by simplifying appropriate food items choices
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4 without knowing their dietary recommendations. They recommended developing additional
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6 programming options allowing for individualization regarding specific dietary needs (i.e., celiac
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8 disease), syncing to the FFH website, and assistance in choosing restaurant items.
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11 **Discussion**

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16 Patients with CHD in these focus groups recruited from a cardiac rehabilitation center
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18 face difficulty changing their dietary habits, with the most common challenge of reducing
19
20 carbohydrates. Previous studies have found that patients have difficulty changing their habits
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22 and adhering to dietary recommendations, for many perceive the recommended diets as
23
24 tasteless and less enjoyable than the higher fat and carbohydrate items.⁷⁻¹¹ A challenge faced
25
26 by participants in the focus groups also were related to the length of time required to plan and
27
28 prepare healthy meals, since unhealthy food items tended to be more convenient, which is
29
30 consistent with other research.²⁵⁻²⁷ Participants who made appropriate dietary choices found
31
32 that support from their family, friends, and clinic staff improved their adherence. Support has
33
34 been found to improve adherence and the lack of support can be detrimental.^{28,29}
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42 One of the purposes for this pilot study was to examine if tools such as FFH and MML
43
44 are useful for patients with CHD, as most technological tools have been tested as replacements
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46 for food diaries rather than for dietary adherence.¹⁷⁻²¹ The FFH website and the MML
47
48 application appear to be tools that CHD patients perceive as valuable in making food choices
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50 and in dietary adherence, as they would help them make faster decisions when shopping and
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52 for allowing adjustments to stay within dietary recommendations. The incorporation of
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54 technology into diet and lifestyle interventions can decrease participant burden, be more
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56 efficient, and be highly accurate.¹⁴⁻²⁰
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4 Further development is needed to allow interaction between FFH and MML and to make
5 both prototypes more comprehensive in addressing both dietary and lifestyle changes. Patients
6 indicated that they wanted to be able to utilize the technology to monitor their CHD in its
7 entirety, including their physical activity and medication-food interactions. Future work on this
8 project should incorporate suggested components and pilot test upgraded prototypes in CHD
9 patients to examine the usability and efficacy in dietary adherence.
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19 Some limitations include a small sample size of CHD patients and a lack of
20 generalizability of results, since the focus groups were conducted in a single cardiopulmonary
21 rehabilitation clinic in Indiana serving a rural population. However, no new additional
22 information was received after the third focus group, so response saturation was met. This
23 project also was intended to be a preliminary examination of the feasibility of the FFH website
24 and MML application. Future research should address these limitations by pilot testing the
25 updated software in a more representative population to gather additional feedback on
26 usability and efficacy. Ways to address the dietary challenges mentioned by patients with CHD
27 and to reduce the time commitment associated with dietary adherence also should be
28 examined in future research.
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45 Patients with CHD face many challenges in adhering to complex dietary
46 recommendations, such as reducing carbohydrate intake from favorite food items and finding
47 the time to prepare and eat healthier food. Support from family and friends can help make
48 dietary adherence easier. Technology tools such as the FFH website and the MML application
49 may be useful tools for patients with CHD, by providing support to patients and reducing the
50 complexity of making multiple dietary changes simultaneously.
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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?	

5
6 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%)