

Crowdsourced Alternative Healthcare:  
Mobile Applications for User-Generated Natural Remedies

by

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## Abstract

Smartphone applications have the ability to improve population health, mostly because of their widespread use; their rapid technological advancements and updates; and their use of features such as geolocation, video and audio recording, and internet access. In recent years, the internet has given rise to a phenomenon known as user-generated content (UGC). This paper explores usage of natural remedies, user-generated content, and user reviews and how the three concepts can be leveraged in the creation of a mobile application.

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## Chapter 1: Introduction

Since the beginning of time, human beings have devised ways to ease pain, heal sickness, and improve energy levels through the use of various medicinal substances. These attempts initially began by applying items found in the local environment—such as plants, minerals, and animal parts—and later evolved to include a variety of vitamins, minerals, and phytochemicals. Today, an unprecedented range of natural therapies is available. It is estimated that up to 80% of the world’s population (mostly consisting of those living in the developing world) relies on herbal medicines as a primary source of healthcare (Ekor, 2013).

In many cases, conventional medicine only treats symptoms—typically with surgery or drugs—with little discussion of methods for preventing diseases and curing them. While sometimes necessary, drug therapy often leads to long-term management: symptoms are temporarily relieved, and side-effects may be experienced, which often require more drugs. Conversely, naturopathic medicine—also known as complementary and alternative medicine (CAM)—aims to treat the root cause of the disease so that the body can eventually heal itself. Results are typically achieved when prescription drugs are reduced or eliminated, vitality is restored, and the disease has been completely reversed.

Perhaps the most important aspect of naturopathy is its reliance on food-based therapies. Many natural remedies include mixtures derived from herbs, vegetables, and fruits. The U.S. Department of Agriculture’s Economic Research Service tracks trends in organic farming and agriculture via their Organic Market Overview. The report notes that

while organic food sales account for only four percent of total U.S. food sales, since the 1990s yearly demand continues to show growth in the double digits. “Organic products are now available in nearly 20,000 natural food stores and nearly 3 out of 4 conventional grocery stores” (Greene, 2017, para. 1). The emergence and growth of natural food stores such as Whole Foods Market in the early 1990s has helped make organic fruits and vegetables more readily available (Glaser and Thompson, 1999).

The statistics mentioned above highlight the growing popularity of alternative medicine and the pursuit of a healthier lifestyle. Another example is given by Yusarek (2016), who notes an increased use of acupuncture for pain relief in light of the current U.S. prescription painkiller overdose epidemic. Unlike traditional medicine, which relies mostly on scientific studies to determine whether a treatment is effective, “most CAM [complementary and alternative medicine] therapies are based on longstanding practice and word-of-mouth stories of success” (Gavin, 2014). Word-of-mouth is the verbal transfer of information from one person to another in a way that influences their behavior towards a brand, product, or service.

User-generated content (UGC) such as online reviews are considered an electronic form of word-of-mouth. Reviews are commonly posted by consumers who volunteer to share their opinions after evaluating a product or service. Stackla (2017) conducted a survey of over 2,000 adults in the United States, United Kingdom, and Australia to examine how content is created and shared online, and to determine what factors influence users’ purchasing decisions. They found that content created by fellow consumers is more influential and viewed as more authentic than content created by

companies. User-generated content is extremely powerful because it helps establish the trustworthiness and reliability of a product or brand.

As more people in this digital era turn away from conventional medicine, it is important that resources be made available to aid users in finding natural treatments for various illnesses. An estimated 429 million people worldwide use mobile devices, most of which are smartphones (Cisco, 2017). This paper discusses a research study that was conducted with the objective of exploring how user-generated content and user reviews could be leveraged in the creation of a mobile application. The study hypothesized that users will look for and use natural remedies that are highly rated by other users; that users will use natural remedies if they are shown where to obtain them; and that if natural remedies are provided in a mobile format, users will be more likely to purchase them while shopping.

## Chapter 2: Review of Literature

The *Merriam-Webster Medical Dictionary* defines naturopathy as “a system of treatment of disease that avoids drugs and surgery and emphasizes the use of natural agents (as air, water, and herbs) and physical means (as tissue manipulation and electrotherapy)” (2016, p. 511). Braun and Cohen (2015) define herbal medicine as “both the science and ... art of using botanical medicines to prevent and treat illnesses, and the study and investigation of these medicines” (p. 14). Hechtman (2014) lists six maxims of naturopathy: 1) the healing power of nature; 2) identification and treatment of the cause; 3) treatment of the whole person; 4) do no harm; 5) doctor as teacher; and 6) prevention.

“Super bugs” are specific types of bacteria that are capable of resisting antibiotics. These pathogens are on the rise, so it has become increasingly difficult to treat illnesses such as strep throat and ear infections. The problem becomes potentially deadly when we consider more dangerous bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA). Because of this, clinicians and patients alike are beginning to explore alternative ways to treat these diseases. Thousands of scientific studies have been conducted on natural remedies. A PubMed search on the terms “natural remedies,” “herbal medicine,” and “complementary alternative medicine” yields a combined total of over 59,000 results.

Eisenberg, et al. (1993) studied the prevalence, costs, and usage of alternative medicine in Americans 18 years of age and older. One in three of their respondents reported using at least one form of alternative medicine within the past year. The researchers concluded that “Americans made an estimated 425 million visits to providers

of unconventional therapy” in 1990, exceeding the number of visits to all primary care physicians in that same year by almost 40 million (p. 250). A considerable number of Americans were interested in natural remedies in the early 1990s. So much so that in 1991, Congress created the Office of Alternative Medicine (OAM) at the National Institutes of Health with a two-million-dollar budget to study and evaluate alternative medical practices. Over 20 years later, in 2014, the OAM was expanded and renamed the National Center for Complementary and Integrative Health (NCCIH, 2019).

In 2016, scientists at the NCCIH published a review of clinical trials regarding the safety and efficacy of natural remedies for chronic pain. The researchers searched the PubMed/MEDLINE database, which is the U.S. National Library of Medicine’s premier repository of over 25 million references to biomedical studies. They looked for trials conducted between 1966 and 2016 on seven natural remedies: tai chi, acupuncture, massage therapy, meditation techniques, natural supplements for pain (such as glucosamine and chondroitin), spinal manipulation, and yoga. A result was considered positive if the remedy led to statistically significant improvements in pain, and negative if there was no difference between the remedy and control groups. The researchers discovered that acupuncture, massage therapy, and relaxation techniques had more positive than negative results for the management of back pain, osteoarthritis, neck pain, and severe headaches (Nahin, Boineau, Khalsa, Stussman, & Weber, 2016).

Another major finding by Lu, Samuelson, Rasco, and Konkel (2012) showed that garlic is 100 times more effective at fighting *Campylobacter jejuni* (*C. jejuni*) biofilms than two popular antibiotics. *C. jejuni* is a common cause of bacterial gastrointestinal disease. The results were a follow up to another study that showed that garlic concentrate

was effective in preventing the growth of *C. jejuni*. The scientific study of herbs and natural products adds to previous knowledge and reiterates traditional “word of mouth” claims describing the efficacy of these remedies.

Recognition and use of natural remedies is increasing worldwide. The World Health Organization (2013) reports that the number of its Member States with national research institutes devoted to the study of traditional medicine almost quadrupled between 1999 and 2012. In developing countries, widespread use of natural remedies is usually due to “its being present on the ground and readily affordable” whereas in developed countries, natural remedies are used complementary to more conventional treatments (p. 27).

In 2012, \$83.1 billion was spent on traditional Chinese medicine, an increase of over 20% from 2011. In Korea, annual expenditure on traditional medicine grew from \$4.4 billion in 2004 to \$7.4 billion in 2009. Spending on natural remedies in the U.S. was approximately \$11.7 billion in 1990 (Eisenberg, et al., 1993) and \$14.8 billion in 2008 (World Health Organization, 2013). In Australia, visits to CAM professionals increased by over 30% between 1995 and 2005.

With the popularity of natural remedies ever increasing (Ekor, 2013), technology can be used to further advance the knowledge and use of these nontraditional healthcare approaches. The following sections discuss how “word of mouth” recommendations can be translated to the digital era via user-generated content and product reviews.

### **User-generated Content and Crowdsourcing**

Information meant for public consumption has traditionally been created by authoritative sources such as government agencies, academic institutions, and public

interest organizations. In recent years, however, the internet has given rise to a phenomenon known as user-generated content (UGC). User-generated content comes from people who voluntarily supply information, media, or data that is then presented to others in a valuable or engaging way; for example—wikis, videos, and product ratings. Companies use UGC “to understand customers and develop better products” (Lukyanenko & Parsons, 2015, p. 1). UGC is also known as crowdsourced, or crowd-contributed data. Jeff Howe (2006) coined the term “crowdsourcing” to describe the outsourcing of work that was once done by employees to a large group of external people in the form of an open call. The use of such content has grown rapidly in the last two decades, partly because it’s cheap (users typically supply it for free), and because it promotes user engagement. Content creators find the process to be rewarding “because it lets them receive recognition for their contributions” and consumers benefit from accessing “real data from other people” without bias from commercial producers and corporations (Krumm, Davies, & Narayanaswami, 2008, p. 10).

Cook (2008) describes UGC as what he calls the “user contribution system” (p. 62). He provides working definitions for *users*, their *contributions*, and the *system*. Users can be employees of a company, customers, or even random people with no connection to the company or product. Contributions can be either *active* or *passive*. Active contributions are those that users provide willingly and intentionally, such as videos, comments, or user reviews. Passive user contributions are provided unintentionally. The terms entered by millions of people into Google’s search engine, which help power its search results algorithm, are examples of passive contributions. Another example of passive contributions is when a user’s purchasing behavior or viewing history determines

product recommendations on websites such as Amazon or YouTube. The system would be the platform—such as the internet—used to generate those contributions.

Although there are many benefits to user contributed content, Lukyanenko and Parsons (2015) discuss some of its flaws as well as ways to improve them. Since UGC is typically generated by external users, it can be difficult for corporations to control the quality, content, and form of the data produced. There are often no validation or control mechanisms in place. Additionally, “the purposes for which UGC is produced may differ substantially from the way organizations intend to use it” (p. 2). Lukyanenko and Parsons (2015) propose that “contributor-focused” *information quality* (IQ) research should be conducted where organizations employ theories of human psychology to leverage UGC more efficiently. Understanding human motivation and behavior equips organizations to design better methods of engaging content producers.

### **Product Credibility and How Users Review Products Online**

Online consumer reviews are the modern-day versions of “word of mouth” recommendations and are significantly more trusted than generic product descriptions (eMarketer, February 2010). They can remove any doubts potential customers may have about a product and aid the user in making a selection. To reap the full benefits of reviews, it is necessary to consider both positive and negative ones. Positive reviews reaffirm “that the investment...made in the customer’s experience has been worthwhile” (Digital Doughnut, 2014, para. 2). Conversely, negative reviews provide insight into areas that can be improved upon. An investigation into how users review products online is useful in understanding the best way to add such a feature to mobile applications.



In order to understand how users review products online, one must first explore consumer psychology and the customer's journey. One of the first elements a user notices while browsing a site is the overall rating of each product. The shopper then starts to read the reviews, looking out for each product's strengths and weaknesses. Sixty-eight percent of consumers "trust reviews more when they see both good and bad scores," while 30% "suspect censorship or faked reviews when they don't see bad scores" (Reevoo, 2013, p. 5). Most shoppers expect to see a good mix of both positive and negative reviews; not having any negative feedback is a red flag that can work against a company's or product's credibility.

Another way to dissect online reviews is by quantity of reviews versus overall score. Powell, Yu, DeWolf, and Holyoak (2017) found that when two similar items have a comparable number of average ratings, consumers are more likely to select the one with the most ratings. They noted that even in cases where both products received low ratings, shoppers preferred the one with the highest number of reviews, because a large number of reviews indicates popularity, and people tend to buy what they perceive as popular. Hanson and Putler (1996) produced similar results. In their study, they artificially increased the visible download count of software files and presented them to consumers for purchase. They discovered that the software with artificially high counts were more likely to be further downloaded by users compared to control files with lower initial download counts. In psychology, this phenomenon is known as herd mentality. The results of both studies suggest that people are more likely to select products they deem popular because they "ascribe outsized importance to the choices of others" (Powell, Yu, DeWolf, & Holyoak, 2017, p. 1441).

In a similar vein, the previously cited article by Digital Doughnut (2014) advises organizations to be transparent about their product ratings. Overall ratings of products should be featured prominently on the platform. Negative reviews should not be censored because users are more suspicious of companies and products that receive no criticism whatsoever; and shoppers should be able to dig deeper into reviews to see whether a reviewer is a confirmed purchaser, as well as other products they've reviewed. Haralabopoulos, Anagnostopoulos, and Zeadally (2016) discuss challenges associated with the credibility of user-generated content. One of their proposed solutions is to provide a way for content to be reviewed by other users of the platform as soon as it is generated. This is done by way of a reputation system similar to those used by question-and-answer forums such as Stack Overflow (<http://stackoverflow.com>). A user's submission (e.g. review, answer) is upvoted or downvoted by other users, and that "reputation" is then attached to their profile. Another solution they proposed is for the content to be labeled and categorized. Other users can filter the content they see based on these labels, and administrators of the platform can also apply filters according to the theme of each page section. Based on the filters and labels, content is tailored to the user's preferences, and relevant content is more prominently positioned.

A number of studies have been conducted to explain the psychological motivations for crowdsourcing behavior in the offline world. However, researchers have been unable to reach a consensus on the effects of motivation and rewards on those behaviors (Borst, 2010). The challenge remains to explore motivations behind online user-generated content such as reviews, and what effect—if any—rewards have on them.

**Motivation and rewards.** In psychology, *intrinsic* motivation refers to the act of engaging in specific behaviors because they are internally rewarding—for example, playing a game or sport because you find it enjoyable. *Extrinsic* motivation refers to the engagement of behaviors to either avoid punishment or gain rewards. In other words, extrinsic motivation is contingent upon external factors. One example of extrinsic motivation is driving at or below the speed limit in order to avoid receiving a ticket.

Borst (2010) researched several online platforms and found that the effectiveness of rewards depends on the motivation profile of the user generating the content. In one of the platforms Borst studied—an information technology news website called Tweakers.net—a web survey was administered to measure the intrinsic and extrinsic motivation of its users. On Tweakers.net, users are not financially compensated for contributing to the site’s forum. They do, however, receive reputation rewards based on their activity level. The website’s reputation system is based on the number of posts and page views a user generates as well as their “Karma” (an indication of each post’s value to other users based on votes). Cherry (2017) states that “intrinsic motivation can be increased in situations where people gain satisfaction from helping others... [and also in] cases where they are able to compare their own performance favorably to that of others.” Tweakers.net does this by publishing a list of its top contributors based on number of posts, page views, and “Karma” on the site.

Using a six-point Likert scale, Borst’s (2010) survey assessed participants’ level of motivation by asking questions about their decisions to contribute to the forum, their quantity of contributions, usefulness of contributions, and novelty of contributions. They learned that users who found the topic of the site pleasurable and challenging were more

likely to contribute to it. They also saw a significant positive correlation between the desire to receive recognition from their “Karma” score and the decision to contribute. These results suggest that people with low extrinsic and high intrinsic motivations perform the best in unrewarded tasks. In other words, because participants were not being financially compensated for posting to the forum, they were more motivated by intrinsic factors such as personal enjoyment and a desire to help others.

### **Technology and Healthcare: Related Mobile Applications**

In the last decade, smartphone technology has changed the definition of mobile phones. When combined with social media, people can now publicize their observations and activities from anywhere and at any time. Mobile phones are no longer just communication tools; they are also an essential part of people’s daily lives. According to the Cisco VNI Global Mobile Forecast 2016–2021 (2017), “average smartphone usage grew 38 percent in 2016” (p. 2) and “by 2021 there will be 1.5 mobile devices per capita” (p. 3). In 2016 global mobile data traffic also grew by 63 percent, confirming that more people are using their phones for data-driven tasks such as checking emails, browsing the internet, and downloading and using apps (Cisco, 2017).

Two of the most popular operating systems for developing mobile apps are Android and Apple iOS. Central to most development platforms are their software development kits (SDK) and application programming interface (API) frameworks. SDKs enable developers to create applications that run on each platform. They usually include “libraries, debuggers, and handset emulators” (Holzer & Ondrus, 2009, p. 3). Some operating systems restrict access to their source code, while others disclose their entire code repository. Android and iOS developers are given access to both platforms’

frameworks. This provides developers with powerful sets of tools for creating mobile applications. Both operating systems simplify reuse of their components; apps can access and use these same components provided they adhere to a set of standard security protocols (Ma, Gu, & Wang, 2014). This principle is at the core of the “open source” model. Holzer and Ondrus (2009) advise that creating mobile apps for as many different operating systems as possible will attract more consumers.

**Applications for nutrition and natural remedies.** In their 2009 research paper, Lertnattee, Robkob, and Sornlertlamvanich sought to address the problem of collecting herbal and natural remedy information in a central location. Crucial to their research was the desire to create a knowledge base that would appeal to a wide variety of cultures. Lertnattee’s team developed the Knowledge Unifying Initiator for Herbal Information (KUIHerb) website as an intercultural social media platform for collecting herbal data. The site was created using the PHP scripting language tied to a MySQL database for storing its content.

KUIHerb’s interface displayed each herb’s scientific name and image, as well as information about its usage, contraindications, toxicity, and methods of preparation (Lertnattee et al., 2009). Information about each herb was generated via a “wiki” system by preregistered users. A wiki is a type of website that allows users to collaborate and add and edit content. KUIherb used a popular voting system in cases where multiple entries or opinions were provided. Users had the ability to either upvote or downvote other users’ posts. Similar to Borst’s (2010) “Karma” system, posts that were deemed more valuable were given greater weight, while posts that other members disagreed with received negative votes (Lertnattee et al., 2009). The website had one major drawback,

however: although it accomplished the research team's initial goal, it was difficult to access from smartphones because it wasn't mobile-friendly.

Bird, Fozzati, Harrison, and Marshall (2013) argued that “the context in which dietary information is received is as important as the information itself” (p. 1049). They conducted two studies with the aim of providing grocery shoppers with nutritional information and successfully influencing their purchasing behavior. In the first study, they designed a mobile shopping application known as the Lambent Shopping Trolley, that shows users the nutritional profile of the food they place in their shopping carts. The application was a barcode scanner built into the shopping cart's handle. When a shopper scanned a grocery item on the Lambent Shopping Trolley, various types of information were shown on its 16-LED display. For example, the number of miles it took for the product to get to the store, whether it was organic or not, and how it compared to items in other shoppers' grocery carts.

Eighteen study participants were asked to purchase groceries from two different shopping lists—one shopping trip using the Lambent Shopping Trolley, and another without. The LED display encouraged shoppers to select foods with lower travel miles. If users were shown that the foods they selected had higher than average food miles (compared to other shoppers), they were more likely to scan other products until they found ones with lower miles. The research team was able to demonstrate that “...providing appropriate and salient information at the point of decision making can influence the products that shoppers choose” and that “...social norms are an effective technique for influencing shoppers' [behavior]” (Bird, et al., 2013, p. 1049).

Participants in The Lambent Shopping Trolley study were limited to selecting products in the shopping lists they were given so it is not clear how they would have performed if they had used their own lists. Also, their purchasing behaviors during the study could have been influenced by the novelty effect of having the LED device attached to their shopping carts. In addition, widespread adoption of the device by supermarkets would raise questions of cost and reliability of product information (Bird, Fozzati, Harrison, & Marshall, 2013). To address these limitations, Bird's research team developed a second application that shoppers could download to their own mobile devices. The mobile app provided users with nutritional information about their grocery selections via a phone-enabled barcode scanner tied to a much larger database of items. The second study followed participants for two months. The first month tracked their normal shopping routine without the mobile app; the second month recorded their shopping habits using the app to get information about all the foods in the supermarket. The mobile app calculated the weekly amounts of various food categories (e.g. meat and dairy, fruit and vegetables) and notified the user when they were close to reaching the limit for each.

Similar to the Lambent Shopping Trolley, the weekly allowances acted as "social norms" to potentially influence participants' purchasing behaviors. Bird's research team observed that the amount of fruits and vegetables purchased by the study's participants almost doubled when using the app. On average, the amount of sugar and treats they purchased reduced as well. The study showed that "mobile devices can provide people with nutritional information" and "can have a significant influence on what people buy and therefore what they eat" (Bird et al, 2013, p. 1054).

**Apps using user-generated content.** Lausen, Rittenbruch, Mitchell, Horton, and Foth (2016) describe the results of a study exploring the design of a mobile application “to crowdsource information related to ‘risk.’” For the purpose of the study the researchers relied on their participants’ personal and subjective perceptions of risk. The stated goals of the app were twofold: 1) to provide functionality for users to gather and submit data, and 2) to engage and motivate users to participate in data collection. CrowdRisk, the mobile prototype, was developed using modern scripting languages and development toolkits such as Apache Cordova, Angular 2, and NodeJS. Its code is open source and available in an online repository. The application allowed users to create risk reports and comment on other users’ reports. It also included a map interface showing all reports, as well as statistics about contributions made by each user.

After CrowdRisk was developed, the researchers conducted an expert workshop to test the app and its user-generated content. They gathered 44 crowdsourced risk reports and held a follow-up discussion with participants regarding the app’s usability and design. Similar to Tweakers.net (Borst, 2010) and KUIHerb (Lertnattee, et al., 2009), CrowdRisk researchers received feedback that “a reputation system could be implemented by awarding users points for providing meaningful reports and helping with management tasks related to already existent risk reports” (Lausen, et al, 2016, p. 4). One participant suggested that gamification could also be used as a method to reward users for identifying and suggesting ways to resolve risks. However, “gamification elements need to have a clear meaning and added value” for the platform’s audience (Moser, Peterhansl, Kargl & Tcheligi, 2015, p. 659).

### **Bringing it all Together**



Smartphone applications have the ability to improve population health, mostly because of their widespread use; their rapid technological advancements and updates; and their use of features such as geolocation, video and audio recording, and internet access (Hebden, Cook, van der Ploeg, & Allman-Farinelli, 2012). One way to harness this potential would be through the creation of a mobile application that showcases user-generated natural remedies.

As stated earlier, the study by Powell, Yu, DeWolf, and Holyoak (2017) emphasizes how review volume has implications on product sales via the popularity effect. Product ratings can be increased with a number of tools and techniques. For example, a user who has just submitted a review is five times more likely to review other products they've purchased. In a mobile application for user-generated natural remedies, a simple written request on the confirmation page of the recently submitted review can make the task easier to accomplish. This technique has been shown to increase review volume by 50 to 100 percent (eMarketer, 2010).

There are some limitations to the use of smartphone apps, however. They can be expensive to develop, and their use is often short-lived if content is not engaging and updated regularly. If a mobile application's target behaviors require long term commitment, features such as crowdsourced data, product reviews, and a reputation system can be implemented to prolong users' motivation to continue using the app.

### Chapter 3: Methodology

A research study was conducted with the aim of exploring how user-generated content and user reviews could be leveraged in the creation of a mobile application for natural remedies. The study hypothesized that users will look for and use natural remedies that are highly rated by other users; that users will use natural remedies if they are shown where to obtain them; and that if natural remedies to various ailments are provided in a mobile format, users will be more likely to purchase them while shopping.

The proposed app is comprised of two parts: a crowdsourced database of treatments and the illnesses they're used for, as well as a remedy "builder" that allows users to create a customized herbal mixture based on symptoms they select from a list (e.g. "migraine headache", "nausea", "dandruff", etc.). Since Stackla (2017) showed that content created by fellow consumers is more influential and viewed as more authentic than content created by companies, we felt that a crowdsourced database of treatments would be more effective. We incorporated the remedy builder because it provides people with treatments based on the electronic "word-of-mouth stories of success" of other users (Gavin, 2014). Similar to the CrowdRisk mobile app (Lausen, et al., 2016), content in the herbal remedy app would only be generated by authenticated users. The builder portion would be interactive: after the user has created their mix, they would be presented with links and resources to learn more about each remedy and where to buy it. The database section of the mobile app would serve as a mini online community where users rate the effectiveness of each herb or remedy, and what ailment it treated.

The study commenced with a survey of the target demographic to: a) gauge interest in the topic (natural remedies); and b) evaluate mobile app usage. The survey was followed up with testing of an interactive prototype of the mobile application.

### **Preliminary Research**

The National Health Interview Survey (2007) showed that men and women between the ages of 30 and 69 were the biggest users of complementary and alternative medicine, so we initially limited the target audience of our application to that age range. The second largest age group, 18- to 29-years-olds, overlaps with the demographic that spends the most time using smartphone applications (Comscore, 2017). Hence, we later expanded our target audience to include anyone over the age of 18 who has an interest in natural remedies. Within this group is a quite diverse subset of users. Some of them are healthy and simply seeking maintenance regimens, while others will be currently suffering from an illness and seeking a specific treatment for it. Others are expert users who are knowledgeable of natural remedies and thus want to submit content to the app. Another subset of users for the app are people who are interested in researching treatments for the purpose of advising or helping sick loved ones or friends. A competitive analysis of similar existing apps was conducted, personas were developed, and a site map was drafted.

### **Competitive Analysis**

We began our research by conducting a competitive analysis. Competitive analyses are used to identify strengths and weaknesses of similar applications and to

gauge them against one's own product. We analyzed three mobile apps: Home Remedies Plus, Herbal Guide/Phytotherapy, and Earth Clinic.

**Home Remedies Plus.** The “Home Remedies Plus” app (Figure 1) is an upgraded version of the “Home Remedies Lite” app. It features an alphabetical list of ailments, a search (with autocomplete), and a favorites list. The app's strengths include its nice, clean layout, and its ability to accept remedy submissions from users. It has a companion website, social media sharing capabilities, and an autocomplete search function. One of its weaknesses is that it doesn't show enough information about each remedy or ailment. It simply lists remedies and how to use them. The source for the app's remedies and ailments is unclear.

This app is very straightforward in that, instead of wasting valuable screen real estate by writing a full summary of each remedy, it simply lists them with instructions. So, it gets straight to the point. Each ailment's page offers tabbed navigation at the top for users to easily view their custom remedies for the ailment, the app's default remedies, and questions submitted by other users.

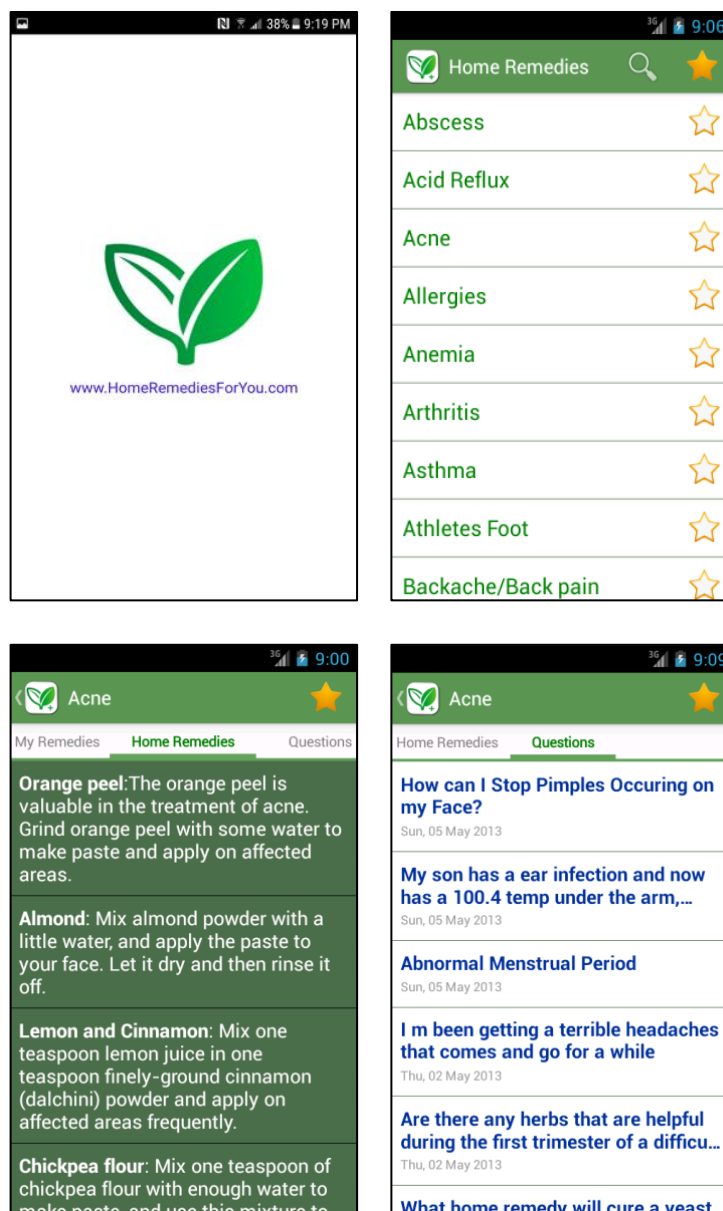


Figure 1. Screens from the Herbal Remedies Plus app. Top row: splash screen and home screen with list of ailments. Bottom row: remedies tab within each ailment page and a questions tab from within each ailment page.

**Herbal Guide/Phytotherapy.** The Phytotherapy guide (also known as “Herbal Guide”), shown in Figure 2, is an app that allows users to learn more about medicinal plants and the various ailments they treat. It features colorful illustrations, a featured “Plant of the Day”, and browsable lists of ailments organized by category (e.g. muscular,

digestive, circulation, etc.) It has a well-designed UI and a nice, clean layout. Herbs and plants are organized into categories of ailments and there are plenty of beautiful, professional illustrations.

Unfortunately, it features some icons in a bottom navigation tray that are difficult to decipher. The magnifying glass icon is misleading because it does not really allow users to input terms to search; instead clicking on it navigates to another section that lists ailments by theme via a horizontal slider feature. Another weakness of the Phytotherapy app is that users are forced to browse ailments by arbitrary themes instead of alphabetically or through a search bar.

Our study's prototype would ideally have a clean user interface with similar colors, but it would not have a "plant of the day" and ailments and remedies would be listed alphabetically so that they're easier to find.

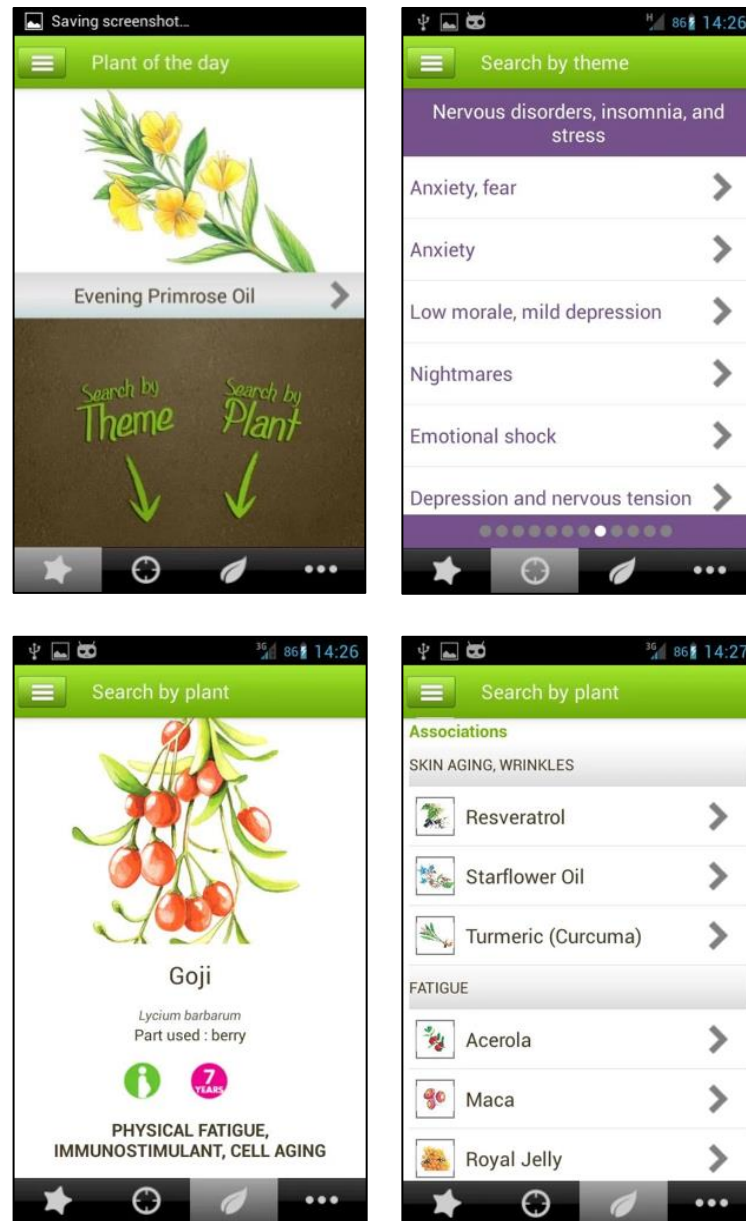


Figure 2. Screens from the Phytotherapy app. From left to right: “Plant of the Day” screen; “Search by theme” screen with list of ailments; “Search by Plant” screen in image format; and “Search by Plant” screen in list format.

**Earth Clinic.** Earth Clinic’s (Figure 3) app is a companion to its popular website that features alphabetical lists of both ailments and remedies, user reviews via comments, articles, and health resources for children and pets. The app contains a wealth of

information provided by experts in the field of holistic health and nutrition. It also links to resources such as articles and books, and users can leave substantial feedback.

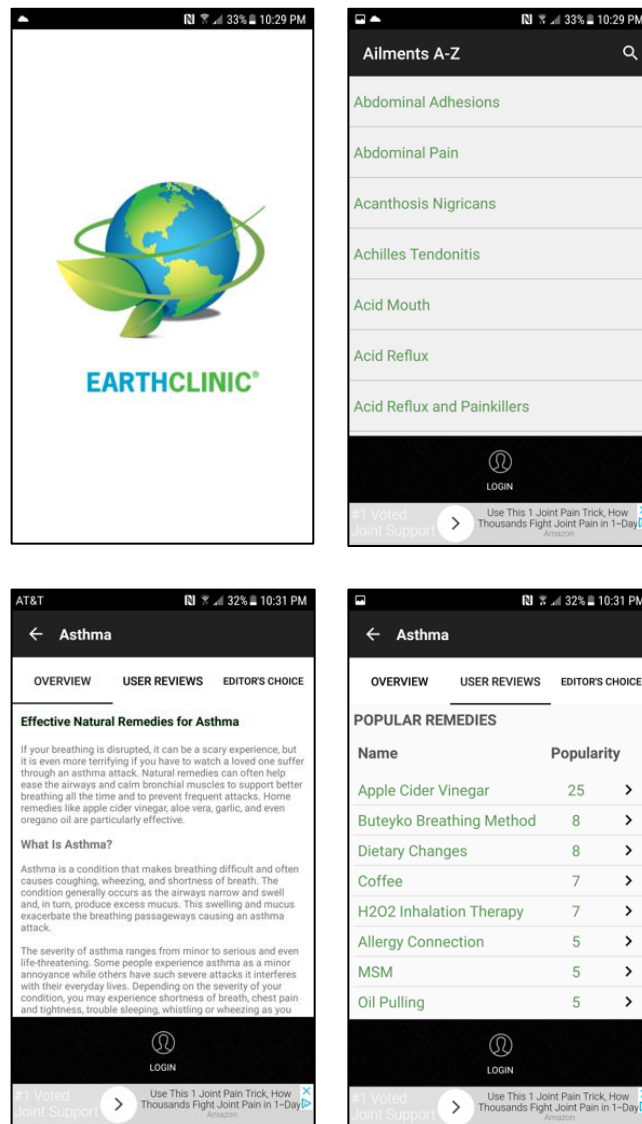


Figure 3. Screens from Earth Clinic’s mobile app. From left to right: splash screen; home screen with list of ailments; remedies screen within each ailment page; and a questions page from within each ailment page.

Its weaknesses include a bland user interface, and small, difficult-to-read text, and advertisements. A login button is displayed prominently on the bottom of each screen,



but it's unclear what benefit a user obtains from logging in versus accessing content without logging in.

### Personas and Flow Diagrams

When creating a new website or mobile app, it is very important for stakeholders and designers to understand who will be using the product. Personas are fictional representations of a product's target audience. For our research we defined three sample personas: one representing an expert user who would contribute content to the app, another representing a user who wants to treat a current condition, and another persona for a user who is interested in maintenance or helping someone else. Figure 4 shows the persona of an expert user of the app, tentatively called "HealMe." Additional personas are included in Appendix B.

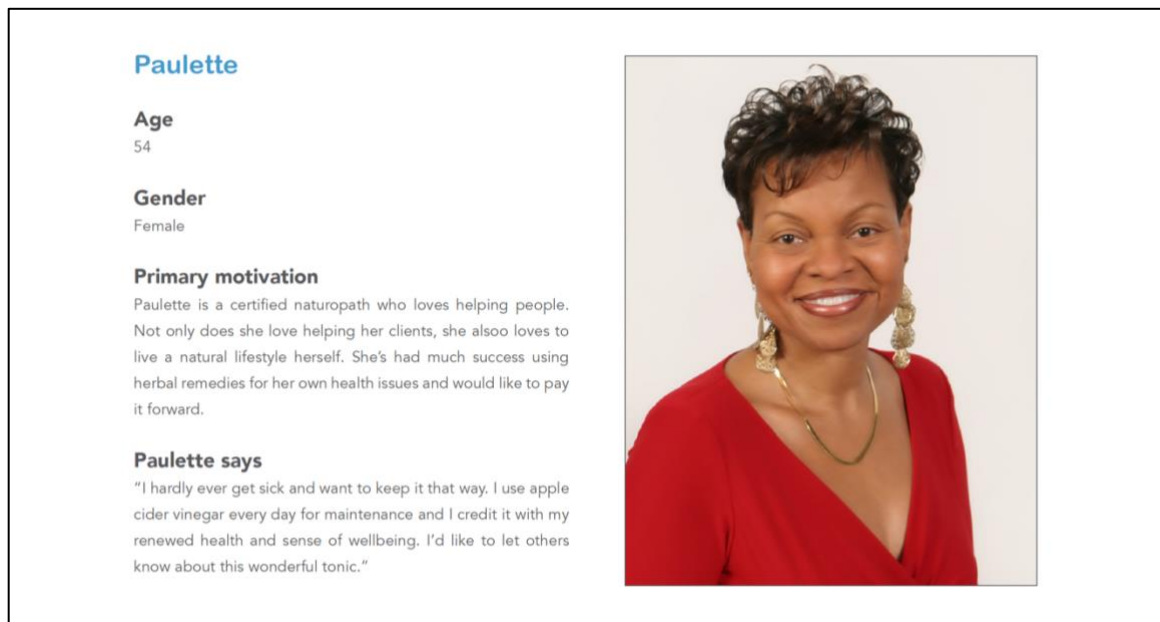


Figure 4. Persona for an expert user of the "HealMe" app.

Flow diagrams map out the flow of information for a website, process, or system. They use defined symbols such as circles, arrows, and rectangles to show data inputs, outputs, storage points and the connections between each destination. We created a flow diagram for each of our personas to assist in designing tasks for the usability study. Figure 5 shows the task flow of our expert user, Paulette, as she submits a new remedy to the HealMe app. Additional flow diagrams can be found in Appendix B.



Figure 5. An expert user's flow diagram for how to submit a remedy.

## Information Architecture

One of the most important deliverables most designers create when planning for an interactive application is a site map. Site maps list the content hierarchy and navigational structure of a website. Figure 6 shows the site map that was developed for the new herbal remedy mobile application. The app's main sections are the Home page, Remedies, Ailments, Submit a Remedy, Build a Remedy, and Favorites.

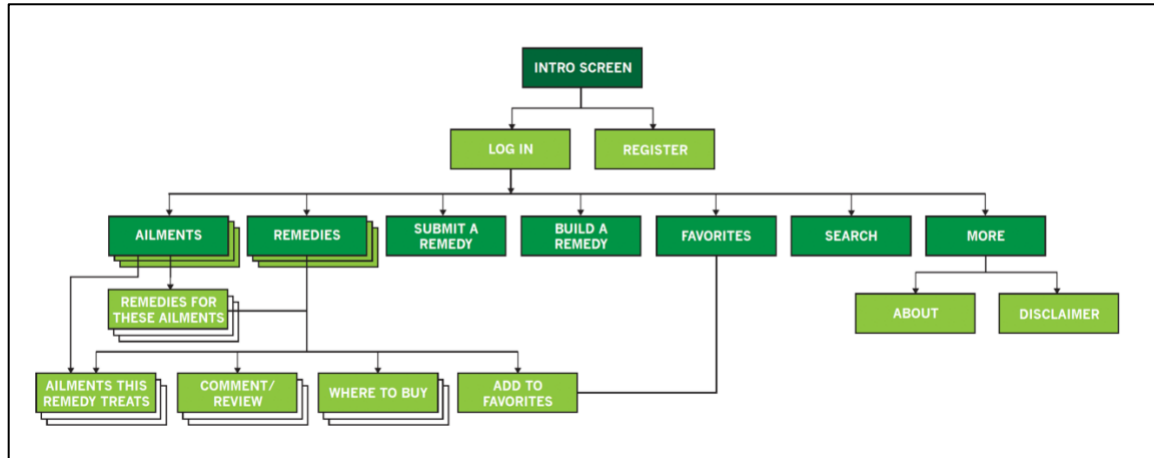


Figure 6. Site map for the herbal remedy mobile app.

## Participants

Participants were recruited through several health “subreddits” on *Reddit*, *Call for Participants*, *Curezone*, and *Natural Medicine Talk* forum. *Reddit* is an online community where people post messages and share links related to various topics. Each topic or theme is called a “subreddit” and is similar to a discussion board. *Curezone* and *Natural Medicine Talk Forum* are also discussion boards, however they are targeted to users who are interested in natural remedies. *Reddit*, *Curezone*, and *Natural Medicine Talk Forum* are all US-based websites, but they also reach people from all over the world. *Call for Participants* is a website that provides researchers with a platform for accessing a wide pool of paid or non-paid study participants. Its primary audience is based in the United Kingdom. Researchers are given a page to describe their study, and the link is then posted to the *Call for Participants* home page. Our study did not offer users compensation.

Table 1

## Survey Participant Recruitment Sources

Website	URL
Call for Participants	<a href="https://www.callforparticipants.com/">https://www.callforparticipants.com/</a>
Curezone	<a href="https://www.curezone.org/">https://www.curezone.org/</a>
Natural Medicine Talk Forum	<a href="http://www.natmedtalk.com/">http://www.natmedtalk.com/</a>
Reddit (Alternative Healthy Living subreddit)	<a href="https://www.reddit.com/r/AlternativeHealth/">https://www.reddit.com/r/AlternativeHealth/</a>
Reddit (Health subreddit)	<a href="https://www.reddit.com/r/Health/">https://www.reddit.com/r/Health/</a>
Reddit (Natural Remedies subreddit)	<a href="https://www.reddit.com/r/naturalremedies/">https://www.reddit.com/r/naturalremedies/</a>

A short message was posted on all sites with a link to the survey. Table 1 shows each website and its corresponding link. Twenty-six people in total took the user survey, but one of them chose to decline the consent form at the beginning, so for the purpose of this study, we will only discuss the remaining 25 respondents. Men and women were almost equally represented (Table 2), and they ranged in age from 22 to 74. Twenty-three of the 25 respondents chose to disclose their occupation, which included students, teachers, and entrepreneurs, among others (see Appendix C).

Table 2

*Gender of Survey Respondents*

	Number	Percentage
Female	12	48%
Male	13	52%

## Research Design

Several digital tools were used to design the research study. The survey was first drafted in Microsoft Word before it was made into a fully functional form. For the second

half of the study, sketches were created, then wireframes and an interactive prototype were finally built.

### **User Survey**

The survey was titled, “Herbal Remedy Usage Survey,” and was divided into three primary parts: Experience Using Natural Remedies, Mobile App Usage Habits, and Demographic Information. Full details and answer options for each question are listed in Appendix B.

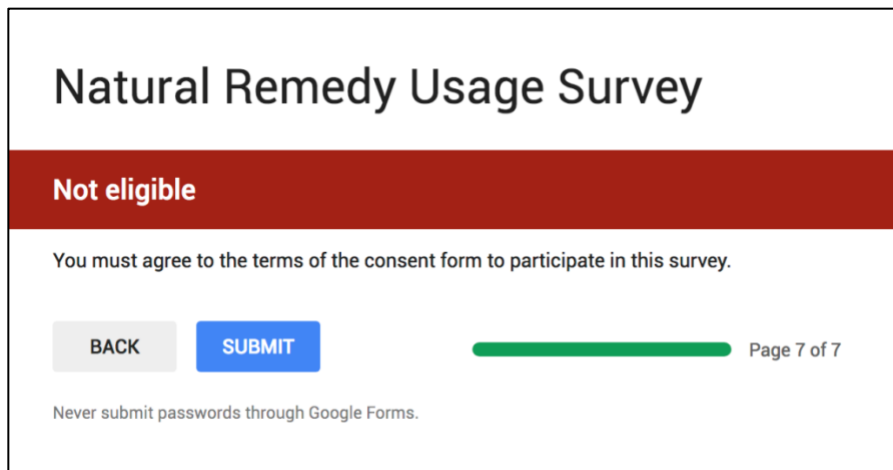
**Experience using natural remedies.** This section was used to gauge users’ familiarity with various natural remedies and their usage of them.

**Mobile app usage habits.** The answers to the questions in this section helped inform the interface design of the prototype.

**Demographic information.** These questions were asked to get a general sense of each respondent’s background.

**Consent to prototype testing.** This section was used as a convenient way to recruit participants for the second part of the study.

The opening screen of the Herbal Remedy Usage Survey presented users with a consent form and a question at the bottom asking, “*Do you consent to the terms and conditions of this survey?*” If a user selected “no,” they were presented with another screen that advised them they were not eligible to participate in the survey. If they selected “yes”, they were then allowed to proceed to the other screens. Results of the survey are discussed in detail in Chapter 4.



Natural Remedy Usage Survey

**Not eligible**

You must agree to the terms of the consent form to participate in this survey.

[BACK](#) [SUBMIT](#)

Page 7 of 7

Never submit passwords through Google Forms.

Figure 7. Message for users who declined the survey consent form.

## Interactive Prototype

Preliminary sketches and wireframes were created before the computer-based mockup was developed. In order to effectively test most features of the prototype, it was determined that the app would initially be populated with a small sample of herbal remedies in anticipation of additional, user-contributed entries.

**Wireframes.** A wireframe is a bare-bones blueprint of a website or interactive application. They allow designers to depict how and where text, images, and links should be placed on a site, and how those elements relate to each other. Figure 7 shows initial wireframes that were created in Adobe Illustrator to help explore how users might navigate through various tasks in the herbal remedy app.



Figure 8. Wireframes demonstrating a user trying to locate where to buy a remedy for migraine headaches.

**Prototype.** A number of software packages were evaluated before developing the mobile prototype. Invision, Proto.io, Principle, and Sketch were all tested but did not have the level of functionality—such as the ability to add interactive forms—needed to complete crucial user tasks. Axure was ultimately the software of choice for the app. We learned that Google’s Android mobile operating system constitutes 84% of global market share (IDC, 2017). Additionally, a majority of our survey’s respondents indicated they

were using a phone with an Android operating system, so the Axure prototype was designed to simulate an Android interface.

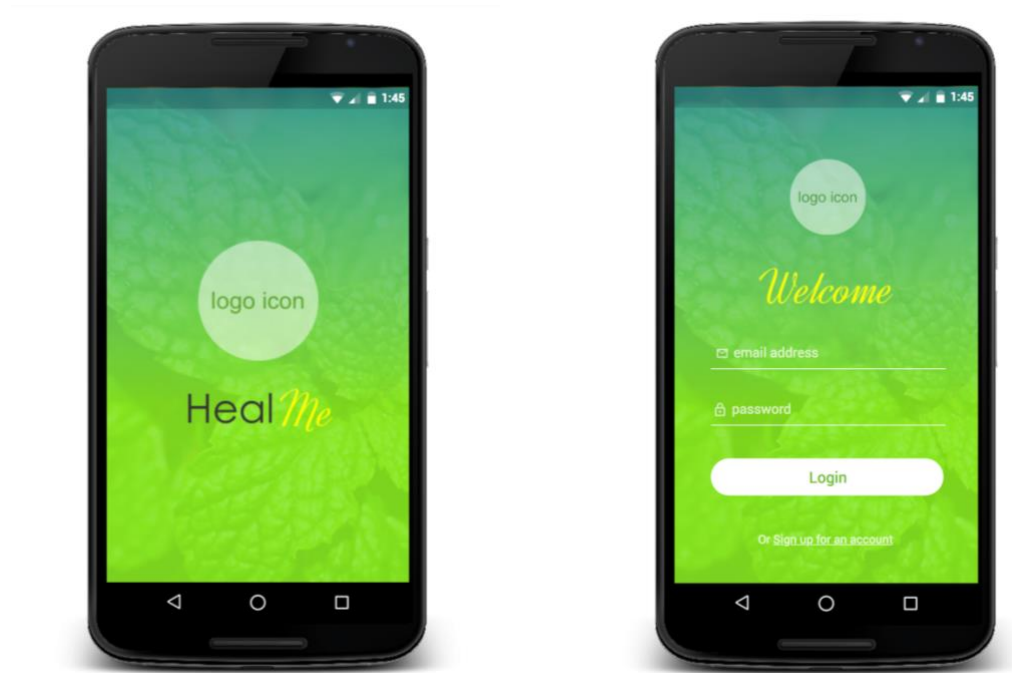


Figure 9. Splash and log in screens of the "HealMe" app displayed within a Google Nexus phone mockup.

**Tasks.** Ten tasks were designed to assess how users would interact with various features of the mobile app, beginning with logging in, and concluding with logging out. A script was also developed to be read to each participant beforehand. The full list of tasks can be found in Appendix H.

### Procedure

Google Forms was used to create the survey to save costs. The survey could have been made available for an extended period of time to obtain more respondents, but due



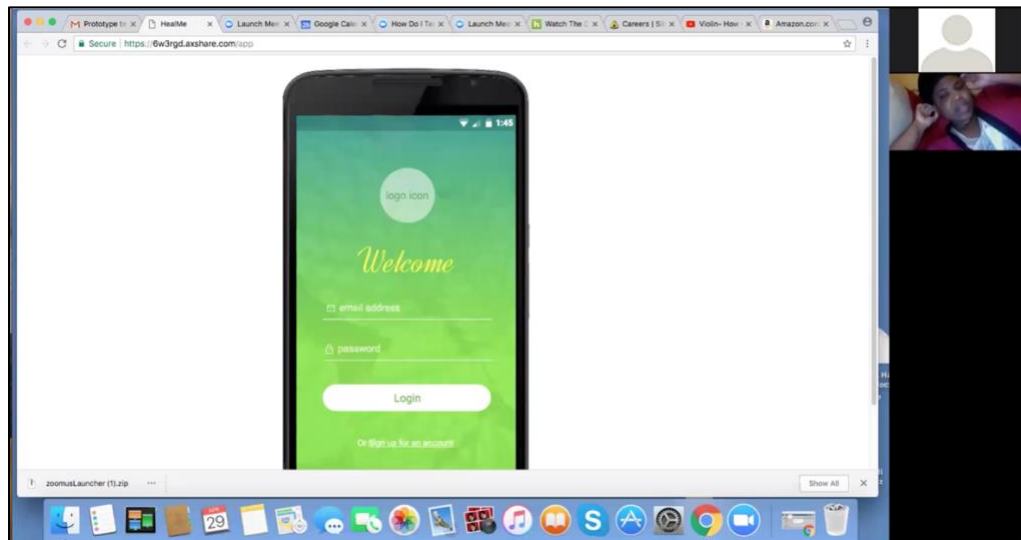
to time constraints, it was only left open for a week. When the survey period ended, a “thank you” message was sent to all participants who provided their email addresses. Those who indicated that they were interested in taking part in the prototype usability study were told that they would be contacted when it was ready.

Since our research participants lived in many different parts of the world, the prototype tests were conducted remotely. We evaluated a number of video conference solutions beforehand including Google Hangouts, Skype, GoToMeeting, and Zoom. Google Hangouts and Skype proved to be problematic because users have to sign up for an account before they can use them. They also don’t allow the ability to record meetings without the use of an outside piece of software. Both GoToMeeting and Zoom enable screen recording but GoToMeeting charges users for their basic plan. Zoom turned out to be the best solution because it offers unlimited, free conferencing for one-on-one meetings and users do not have to sign up for an account.

A spreadsheet was then created to schedule users for the usability tests. Participants were sent a follow-up email with a link to the schedule. At that point they were also informed that they would not have to appear on camera as they would only be sharing their screens while completing the study’s tasks. Twelve spaces were allotted on the schedule, but only nine spaces were initially filled. The nine participants were six women and three men between the ages of 22 and 66 years old. Once users chose a time slot, they were emailed 24 hours in advance with instructions to ensure they would be able to use Zoom. They were also sent a PDF version of the consent form (Appendix F) to fill out with their digital signature. Once they confirmed that the software was working on their computers, the meeting for the test was finally set up. On the day of the test, each

user was emailed approximately one hour beforehand to make sure they were still available.

Once each session began, the researcher introduced herself and instructed the participant to share his or her screen. They were then sent a link to the Axure prototype, which had to be opened in a browser window (Figure 10). At that point the researcher pressed the record button on Zoom and read a script (found in Appendix G) introducing herself and the study to the participant. Tasks were read individually by the researcher and users were encouraged to “think out loud” as they navigated through the app and completed each task. The “think out loud” protocol is used by user experience professionals as a highly effective and cost-efficient way to test a site or application’s usability. It gives the test moderator insight into the user’s thought process while moving through the user interface and exposes any potential disconnects between how a user expects an interface to behave versus how it responds to their input.

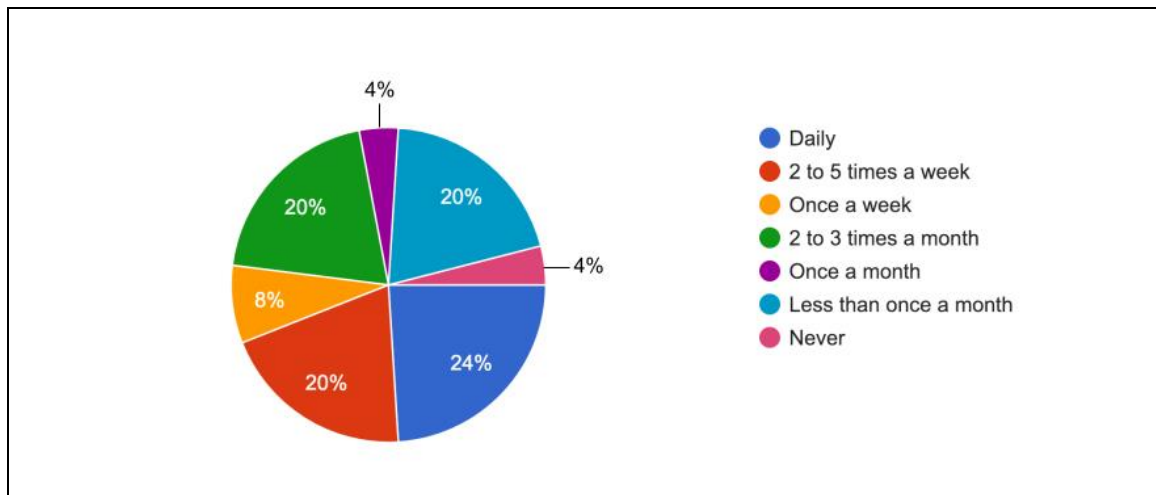


*Figure 10.* Screenshot of a user's Zoom screenshare during a usability test. Image used with user's permission.

## Chapter 4: Results

**Survey Responses**

As previously mentioned, 25 men and women between the ages of 22 and 74 completed the Herbal Remedy Usage Survey. Figure 11 shows a breakdown of the responses to the first question about the frequency of use. Almost half of all respondents (44%) said they use herbal remedies either daily or two to five times a week. Eight percent said they use them once a week and another 20% said they use them two to three times a month.



*Figure 11.* Breakdown of responses to “During the past 12 months, how frequently have you used herbal and natural remedies?”

The next question sought to identify the source from which respondents received information on herbal remedies. Eighty percent of participants selected the internet as their answer (Figure 12). In second place at 44% was “Family,” and the third highest response (32%) was “Friends.”

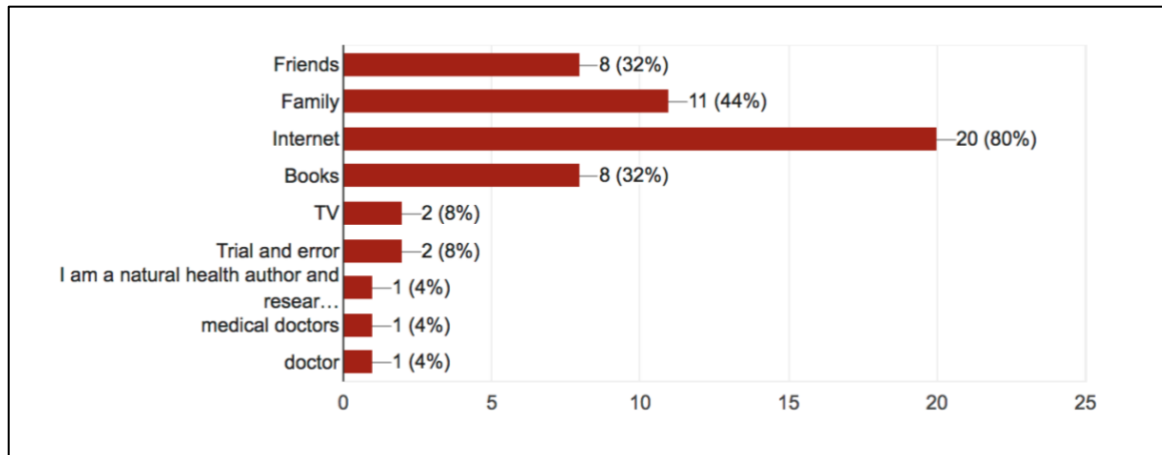


Figure 12. Responses to the question, “Where have you received information about using natural remedies to treat various illnesses? Select all that apply.”

The next question was, “*For each statement below, indicate on the scale how much you agree or disagree.*” A Likert Scale was used with responses ranging from “Strongly Agree” to “Strongly Disagree” (Figure 13). See Appendix B for a full breakdown of the survey questions and response options. Most respondents agreed that they felt comfortable using herbal remedies and that they preferred to do so over conventional medicine. A majority felt that, of the two options, herbal remedies were easier to obtain. However, a majority were also neutral on the question of whether herbal remedies work better and are cheaper than conventional treatments.

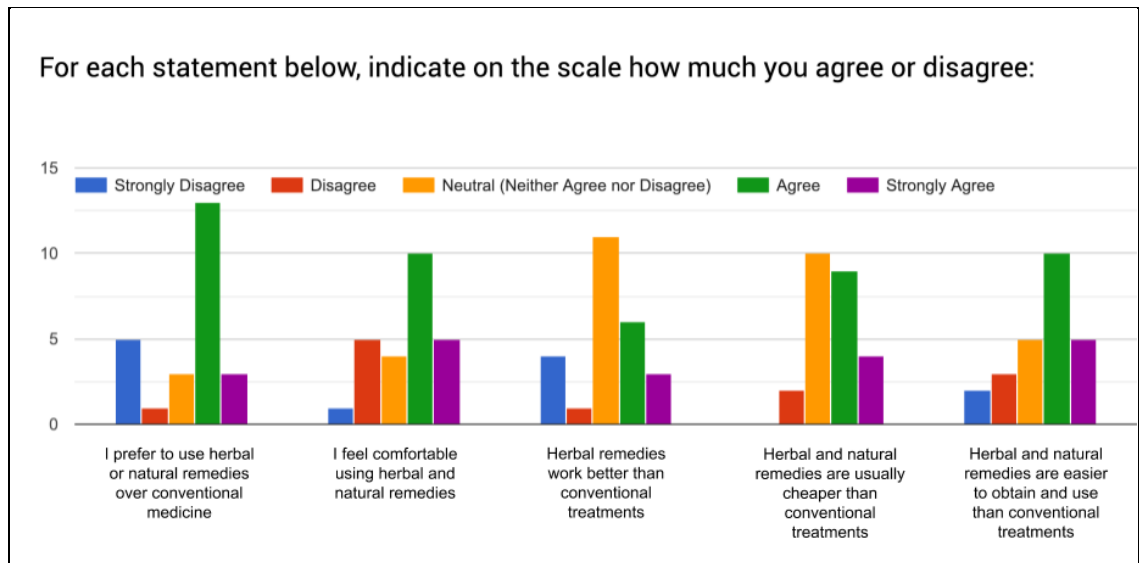


Figure 13. Responses to the question, “For each statement below, indicate on the scale how much you agree or disagree:”

The survey then listed 26 natural remedies and asked users whether they were familiar with each, had used it before, or had never heard of it. Users were allowed to select multiple answers for each item. The remedy users were most familiar with was “acupressure/acupuncture” while the one they were least familiar with was “colloidal silver.” The most used remedy was garlic. However, it is unclear whether garlic was used specifically as a remedy to an ailment or whether it was used in cooking.

One hundred percent of survey respondents indicated that they use a smartphone, with 88% being Android users and 28% being Apple iOS users. It appears that some users had more than one type of phone since there were 29 responses to this question even though there were only 25 respondents to the survey itself. One user filled in the “Other” field with the words “Samsung Galaxy S8”, suggesting they did not understand the terminology describing each phone type’s operating system.

All respondents said they used apps on their phone. A majority (88%) responded that they use apps daily. The next question, “*In the past month, approximately how many times have you downloaded NEW apps to your phone?*” allowed users to specifically write in a number. Most of the users denoted that they had downloaded new apps to their phone approximately four times in the past month.

Users were then asked to list the top five mobile applications they use the most. The most used app was the social media platform Facebook. WhatsApp, a messaging and voice call service, came in second. Internet and email were the third and fourth most popular apps respondents said they use on their phone.

When asked, “*Do you use your phone while shopping to complete tasks related to your purchases?*” a majority of respondents (80%) said “Yes.” Most users (75%) indicated that they use their phone to research products before buying them. Seventy percent said they use their phone to make purchases, and 65% said they create and check shopping lists on their phone. Only 5% used their phone to find coupons and discounts.

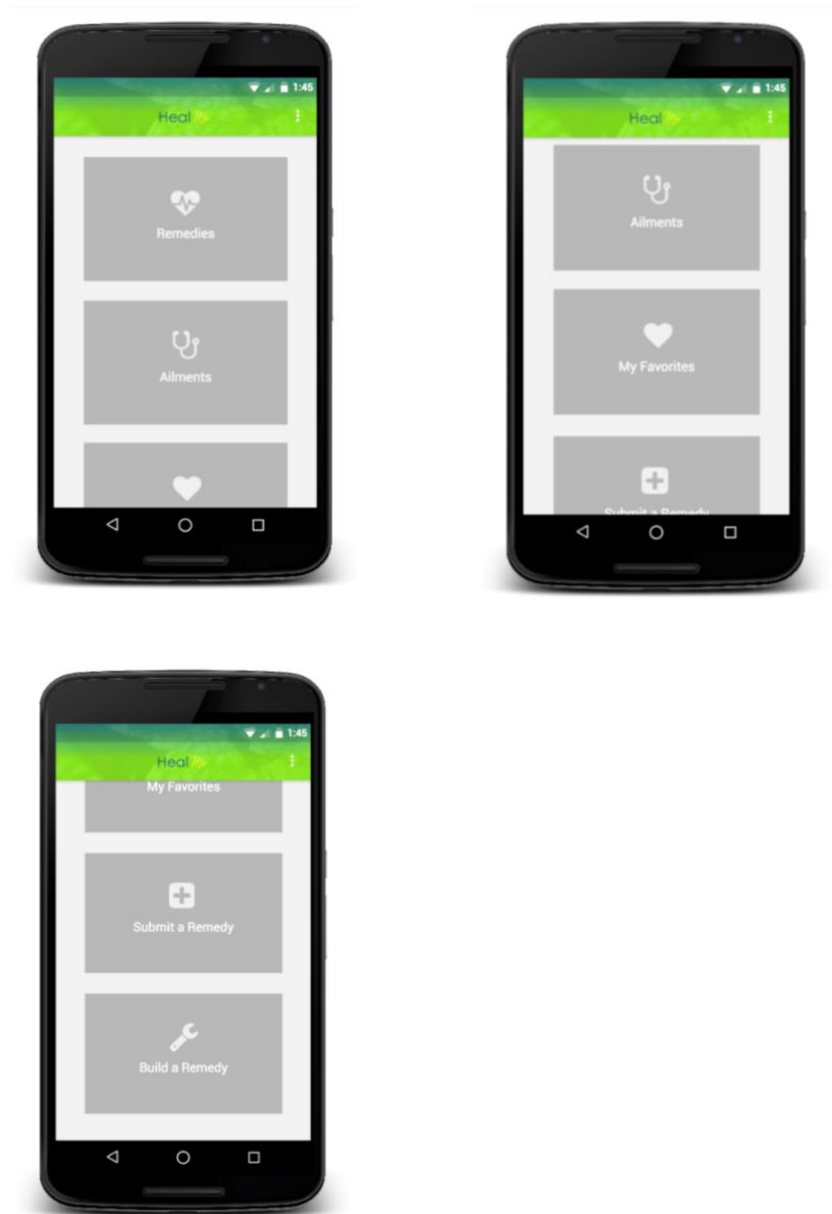
The Herbal Remedy Usage Survey concluded by asking if users were willing to participate in the second part of the study—testing the mobile prototype. Nineteen people indicated that they were interested in doing so and provided their email addresses.

### **Prototype Testing Findings**

Nine participants tested the initial draft of the Axure prototype. They were six women and three men between the ages of 22 and 66 years old.

*Task 1.* The first task was to log into the HealMe application. All participants were able to successfully complete this step since the log in screen appeared immediately

after the initial splash screen. One participant asked about the non-functional “Sign up for an account” link, but users were instructed to pretend they already had accounts and to use fake credentials for the “Email” and “Password” fields. Once logged in, they were taken to the “Home” page of the app to complete subsequent tasks.



*Figure 14.* Home page of HealMe app showing navigation blocks as they appear when the user scrolls: “Remedies”, “Ailments”, “My Favorites”, “Submit a Remedy”, and “Build a Remedy.”

*Task 2.* The second task presented test subjects with the following scenario: “*You have been taking magnesium for the last three months and it has cured your migraine headaches and helps you sleep better at night.*” They were then asked to *submit a new remedy* called “magnesium” to the app (Figure 15). One user did not immediately scroll down on the homepage, and so initially had trouble finding the option to “Submit a Remedy.” Once she found it, she became confused between the labels “Submit a Remedy” and “Build a Remedy” and was unable to successfully complete the task. All other users were successful, with one user specifically saying she would scroll through all the items first to see everything that was available before making her selection.

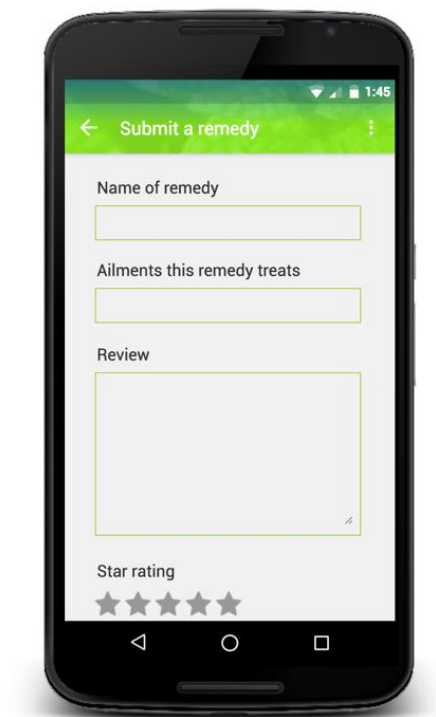
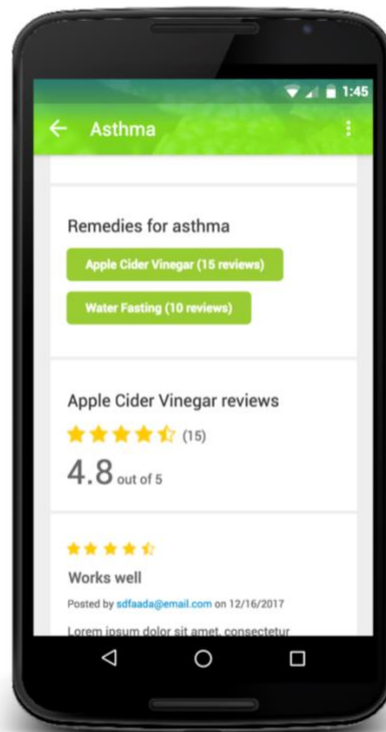


Figure 15. The "Submit a Remedy" form.



*Task 3.* In the third task, users were instructed to find a remedy for asthma: *You have just been diagnosed with asthma and you want to look up some natural treatments. Find a remedy you like and where you can buy it.* Six out of nine participants completed this task successfully. One of the successful users remarked that she selected her remedy based on the number of reviews it had. Two of the users who failed to complete this task expressed confusion as to whether to select “Remedies” or “Ailments” from the home screen. One of the two found a remedy listed on the “Asthma” page, but then couldn’t tell that the remedies were clickable buttons, and so did not proceed to the following page to find where to buy it (Figure 16).



*Figure 16.* Screenshot of the Asthma ailments page, where one user failed to recognize the remedies as clickable buttons.

*Task 4.* After the user found a remedy for asthma, the next task was to add it to their “favorites” list: *Add the remedy you like for asthma to your favorites.* Again, scrolling was an issue for the two users who failed to complete the task because the “Add to Favorites” button was at the top of the Remedy’s page after finding where to buy it from task 3. An option to add the remedy to their favorites was also available by clicking on a heart symbol next to the item in the list of remedies, but some users did not recognize that feature. Two users stated they recognized the heart symbol from other social media sites, and that it denoted “liking” or “loving” something on a page. The three users who were unable to complete this task were over the age of 50, while the users who referenced social media were in their 20s. This suggests that the heart symbol alone may not be recognizable to older users—a demographic that is less likely to use social media (Anderson & Smith, 2018).

*Task 5.* After adding a remedy to their “Favorites” list, the user was then presented with the following scenario: *You bought that remedy for asthma, have tried it, and you love it. Write a review for it.* All users succeeded in completing this task. One user attempted to leave a review by clicking on the stars at the top of the remedy page (Figure 17). She thought that they would lead her to the review form, but they weren’t clickable. She proceeded to scroll down to the form and submitted a review successfully.

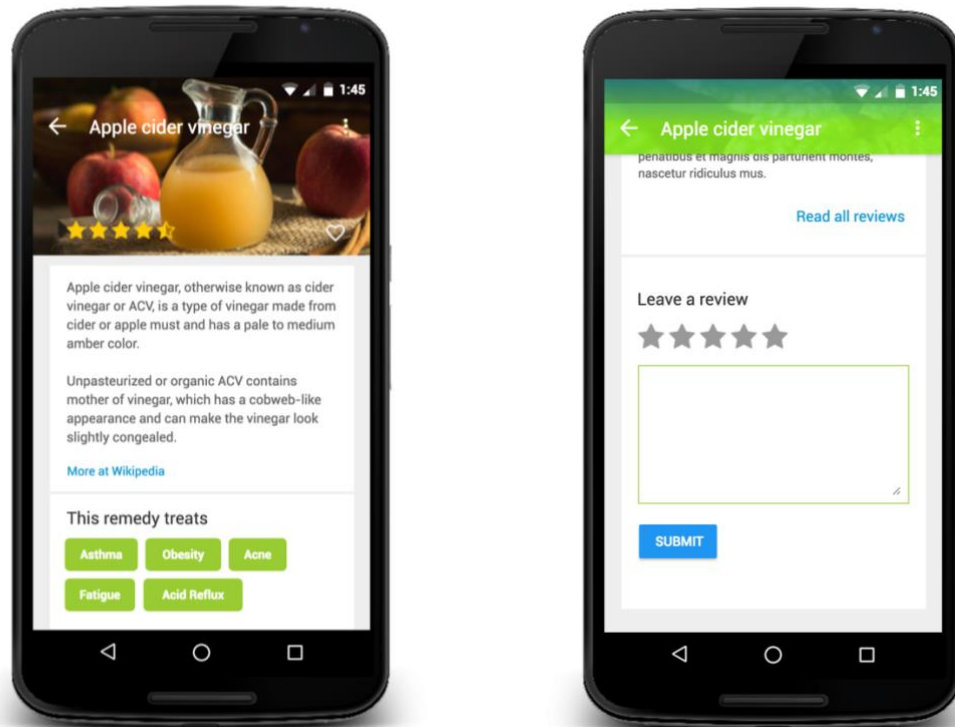


Figure 17. Left: The top of a Remedy page, showing the average number of reviews. A user in task five attempted to click on the stars to leave a review. Right: the feedback form at the bottom of the page.

*Task 6. You have a friend who is suffering from high blood pressure and muscle cramps. Build a remedy that will treat those two ailments.* Only one user was unable to complete this task. Most users easily found the “Build a Remedy” option on the home screen. The one user who could not complete the task failed to scroll down long enough on the screen to find it. Instead, she initially selected the “Ailments” option and tried to find “high blood pressure” or “muscle cramps” in the list. When she couldn’t click on those illnesses in the ailments list, she attempted to click the link to add those ailments. Figure 18 shows the “Build a Remedy” option on the home page versus the “Add an Ailment” link at the top of the “Ailments” section.

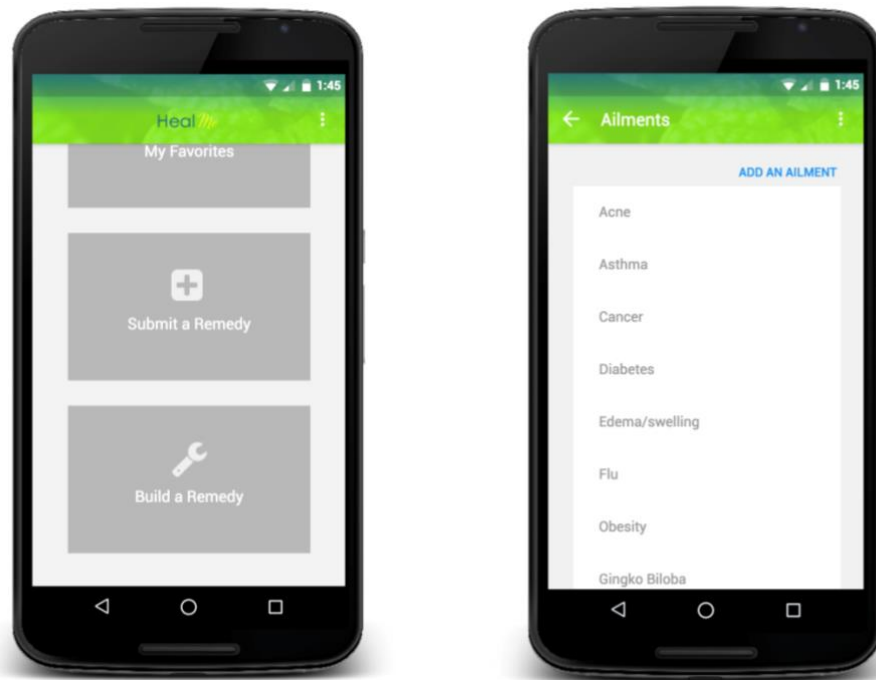
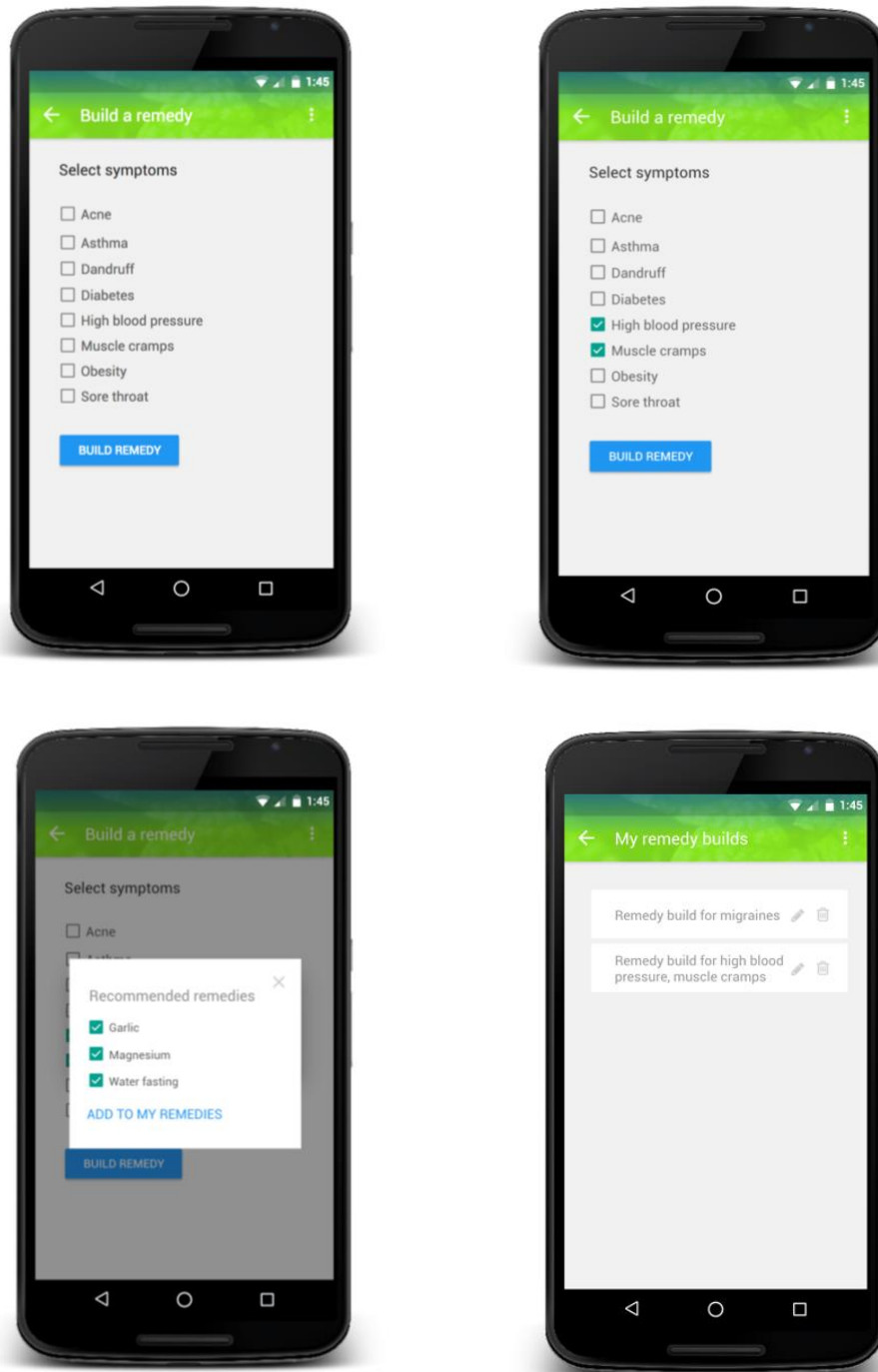


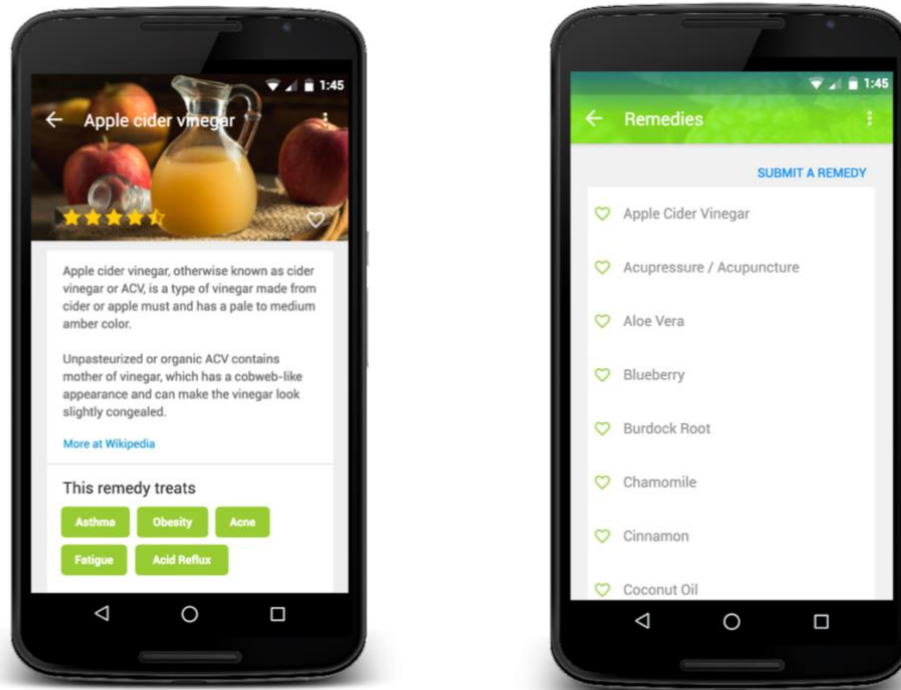
Figure 18. Left: The "Build a Remedy" option from the home screen. Right: The Ailments screen with a link to "Add an Ailment" at the top right.

*Task 7.* Seven out of nine users completed the seventh task: *You previously built a remedy for migraine headaches but now you no longer need it. Remove the remedy build for migraines from the list.* Although most users were able to complete task seven, this task revealed a flaw in the design of the app. There was no way to get to a user's remedy builds except by clicking the "Build a Remedy" option and building a remedy first. All seven successful users were also successful at completing the previous task, which was to build a remedy. Since they were already in their remedy build screen after having completed task six, it was easy for them to complete task seven (Figure 19). The two users who were unable to complete this task were not on this screen after having completed task six, and thus were unable to find it.



*Figure 19.* Top left: The "Build a Remedy" section. Top right: An example of selecting "high blood pressure" and "muscle cramps" to build a remedy for task six. Bottom left: The confirmation message of recommended remedies. Bottom right: The resulting screen after building a remedy. Users who successfully completed task six could complete task seven by deleting the migraine build.

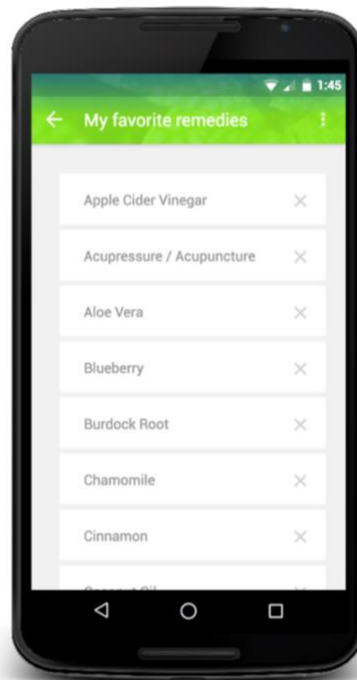
*Task 8.* In the eighth task, users were asked to *Add a few more remedies to your favorites list*. Two out of the nine test-takers could not complete this task. Both of them clicked on “My Favorites” from the home screen and were taken to the section that contained previously added favorite ailments; they did not realize they needed to go to the “Remedies” section to add more. Two successful users added items to their favorites by clicking the heart symbol at the top of a particular remedy’s page, whereas most of the others who were successful added favorites directly from the “Remedies” list (Figure 20).



*Figure 20.* In task eight, users could add items to their favorites list by clicking the heart symbol at the top-right of a specific remedy's page, or by clicking the heart symbols on the main “Remedies” page.

*Task 9.* All nine users completed task nine successfully, which was to *Delete “garlic” and “witch hazel” from your favorites*. One user accidentally deleted the wrong item first, exposing another flaw in the design—there was no mechanism in place to

confirm a user's choice to delete an item. In task seven, the icon for deleting items from the "Remedy Builds" section was a trash can, whereas in this task, an "X" symbol was used (Figure 21). One user remarked that the same icon should be used in both sections to maintain consistency throughout the app.



*Figure 21.* To delete items from the Favorites list in task nine, users had to click an "X" icon, whereas on the Remedy Builds section (see Figure 18), they had to use a trash can icon.

*Task 10.* With most of the tasks complete, test subjects were asked to sign out of the application. All users completed this final step successfully by clicking the three-dotted icon on the top-right of the prototype (Figure 22). Two users said they were familiar with this icon from other mobile apps. Table 3 shows that each task yielded a success rate of 67% or more.

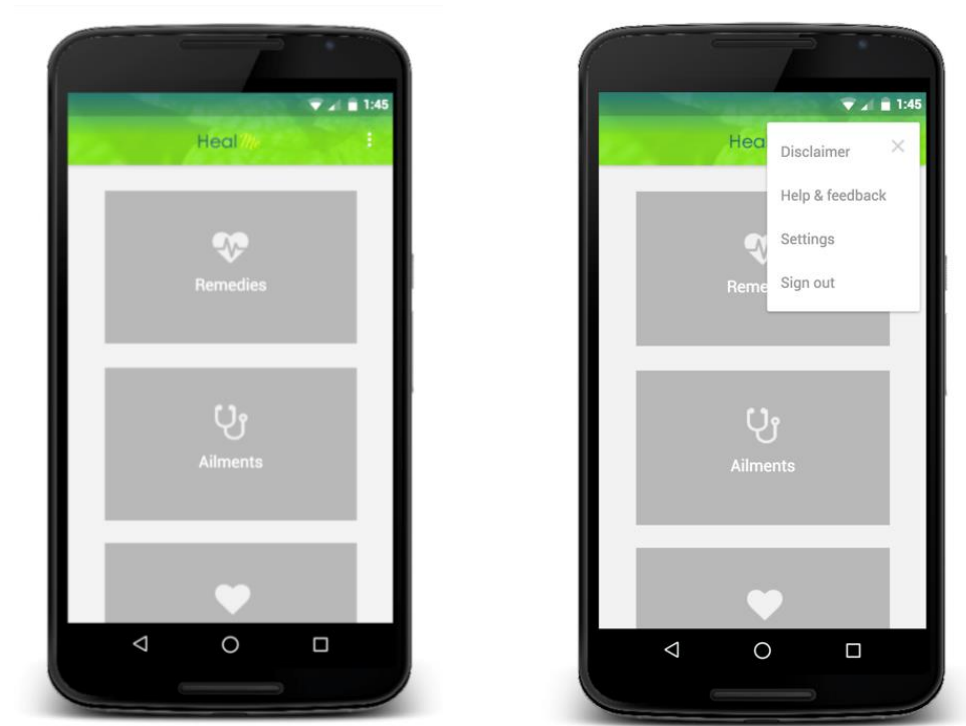


Figure 22. Clicking on the three dots at the top right of the screen allowed all nine users to successfully log out of the app in task ten.

Table 3

*Axure Prototype Task Completion Data*

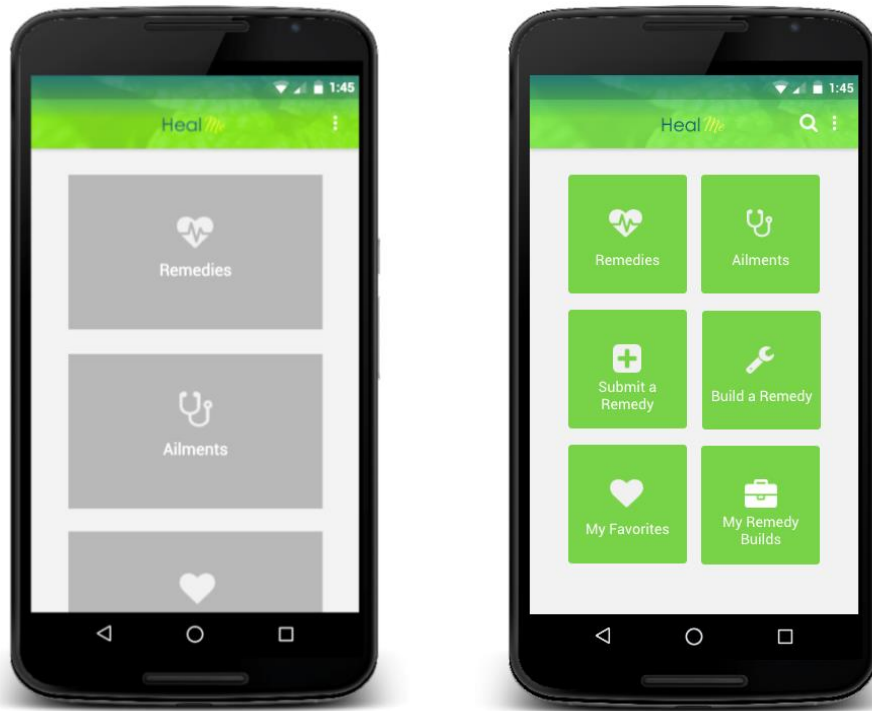
Task	Success	Fail
1. Login	9	0
2. Submit a new remedy called “magnesium” to the app	8	1
3. Find a remedy you like for asthma and where you can buy it	6	3
4. Add the remedy you like for asthma to your favorites	6	3
5. Write a review for your asthma remedy	9	0
6. Build a remedy for high blood pressure and muscle cramps	8	1
7. Remove the previous remedy build for migraines from your remedy builds	7	2
8. Add a few more remedies to your favorites list.	7	2
9. Delete “garlic” and “witch hazel” from your favorites.	9	0
10. Logout	9	0



## Chapter 5: Discussion

### **Design Revisions**

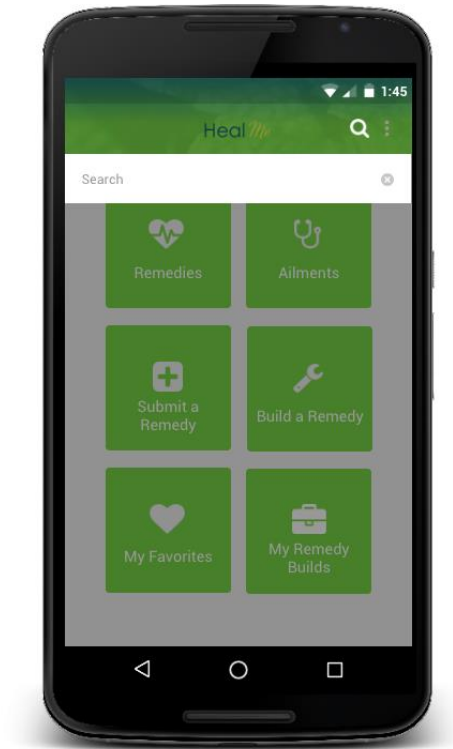
Based on the remote testing results and user feedback, a number of changes were made to the Axure prototype and a follow-up test was conducted. Scrolling was an issue for a number of users during the first usability test. For example, some users were unable to complete certain tasks because they did not scroll long enough to reach a certain section of the screen. Users who had trouble completing task two did not scroll down the home page; they immediately clicked “Remedies.” This could be due to the format of the prototype, since the mobile interface was being viewed on-screen instead of a handheld phone. Nevertheless, we changed the layout of the home page from a stacked list of options to a grid that could be viewed within the viewport without scrolling (Figure 23).



*Figure 23.* Left: first version of the home screen where users had to scroll to view all options. The revised version (right) is presented in a grid format to fit all options within one viewport.

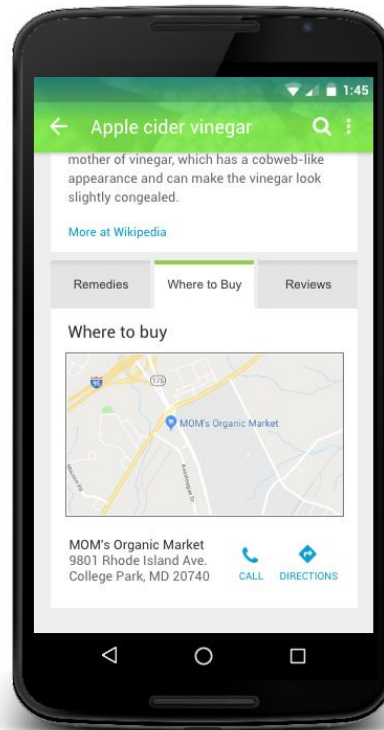
Another modification we made was to add a “Search” icon to the top bar.

Although not fully functional, we wanted to provide an additional way to find content on the app and to see if test participants would attempt to use it to find remedies and ailments. Clicking on the magnifying glass icon reveals and hides a search bar below (Figure 24).



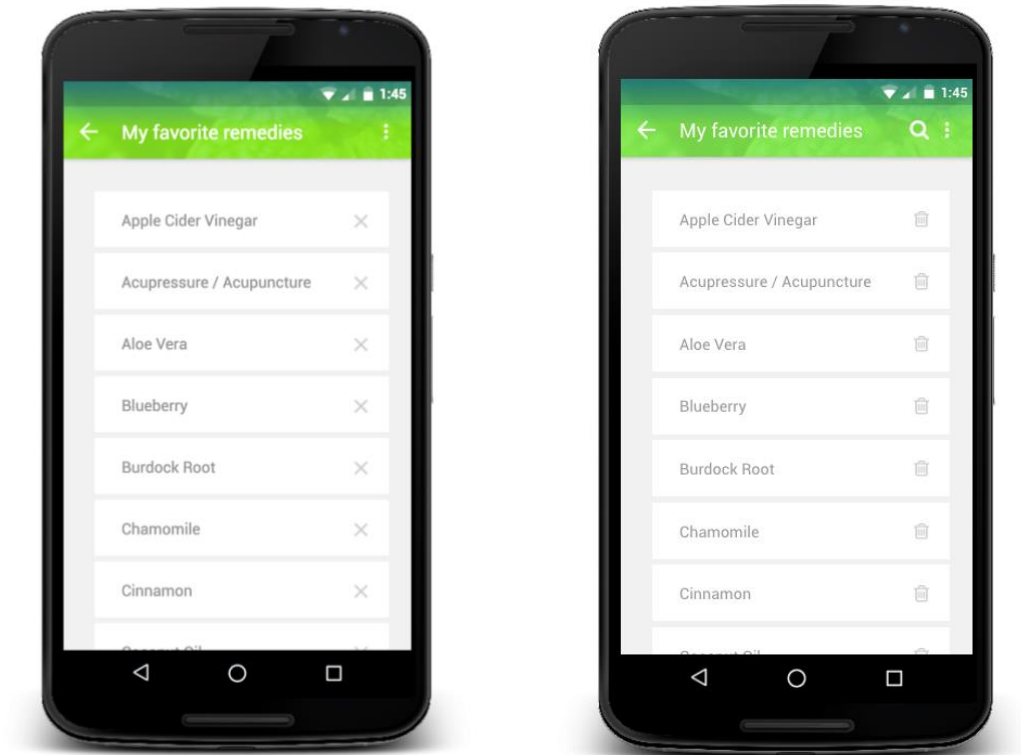
*Figure 24.* Clicking the magnifying glass icon on the top header reveals a search bar against a darkened overlay.

We added tabbed navigation to each remedy page to prevent the need to scroll to the “Where to Buy”, “User Reviews”, and “Leave a Review” sections (Figure 25). On each “Ailments” page, we eliminated the reviews for each remedy because we felt they were redundant to the ones found on those respective “Remedy” pages.



*Figure 25.* Tabs eliminate excessive scrolling and consolidate content into smaller sections.

In the first version of the prototype, users deleted items by clicking an “X” symbol in the “My Favorites” section and a trash can icon in the Remedy Builds section. We made the revised version more consistent by using only the trash can icon wherever a user needs to delete an item (Figure 26). Our initial usability test showed that the trash icon was easily recognized by 100% of users. In task nine, one user clicked the delete button too fast and accidentally removed an extra item. We added a confirmation screen after each deletion. In the future we plan to add checkboxes that allow for bulk removals.



*Figure 26.* In the first version, an "X" symbol was used for the delete button. The prototype was updated to match the remedy builds section by using a trash can icon.

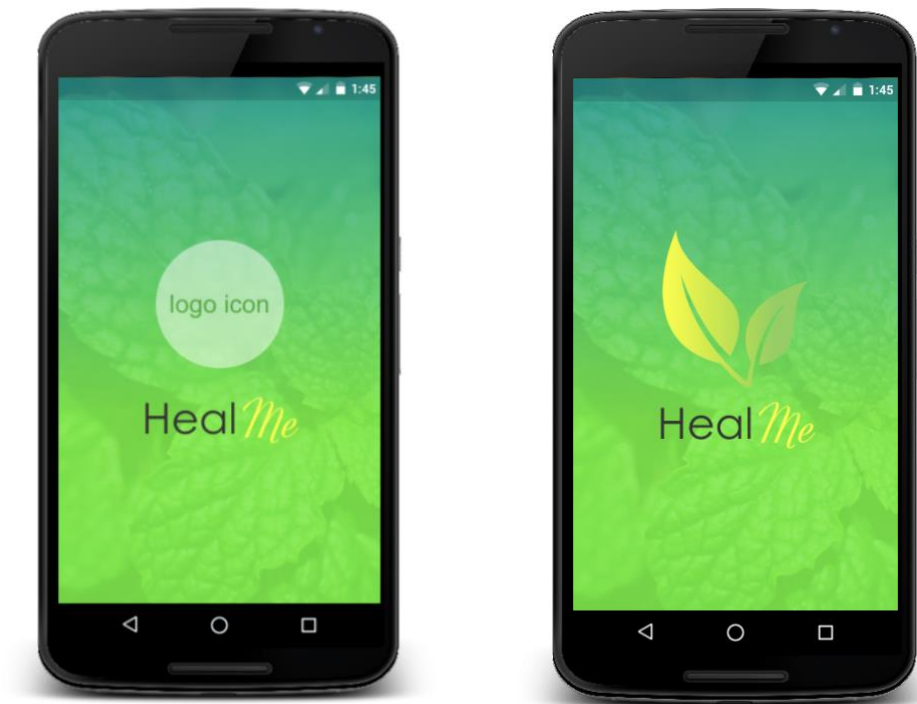
We found that participants over the age of 50 were less likely to recognize the heart symbol as the way to add a remedy to their favorites list. The proposed solution to this issue was to add the word “Favorites” below the symbol so that its function was more explicit for all users.

Task seven revealed that there was no way to access the “Remedy Builds” section unless a user had already built a remedy, so we added a button for it on the home page, and a “Build a Remedy” button to each Remedy and Ailments page.

The wording of some tasks was changed to prevent confusion and leading. For example, “Find a remedy” was replaced with “Find a treatment for...” and “Submit a

remedy” was changed to “Add a treatment” since the keywords “Remedy” and “Submit” are explicitly written in the prototype’s navigation options.

Finally, we removed all placeholder content from the application. A logo image was developed for the splash screen (Figure 27) and readable sample content was used in the user reviews sections in lieu of “Lorem ipsum” text.



*Figure 27.* In the second version of the prototype, the placeholder logo was replaced by an image, and all placeholder text was replaced with readable text.

### **Follow-Up Testing**

Three additional users were tested after these revisions were made. All three were able to log in (task one) to the app. The following sections briefly describe how participants fared during subsequent tasks.

*Task two: Add a new treatment called “magnesium” to the app.* Since we changed the wording of this task to omit the phrase “Submit a remedy...”, participants took longer to find the correct section compared to the first usability study. Two users clicked on the “Remedies” section first and found the link to the “Submit a Remedy” form at the top of the list. The other user found the form from the home screen.

*Task three: Find a treatment for asthma and where you can buy it.* All users clicked the “Remedies” button first. One user happened to find a remedy for asthma by clicking on a remedy first (apple cider vinegar) and discovering that it treated asthma. The other two users left the “Remedies” screen, went back to the home page, clicked “Ailments,” found Asthma, and then selected a treatment.

*Task four: Add the remedy you like for asthma to your favorites.* Surprisingly, task four had the highest failure rate during the first usability study. With the addition of “Add to Favorites” at the bottom of the heart icon, 100% of users successfully completed this task in the second study.

*Task five: Add a review for your favorite remedy (from the previous task).* All three users were able to complete this task by clicking the new “Add a Review” tab at the top of the remedy’s page.

*Task six: Create a remedy that will treat high blood pressure and muscle cramps.* One user clicked the “Build a Remedy” link and completed the task. The other two went to the Ailments section first, clicked on “High Blood Pressure,” and clicked on the newly added “Build a Remedy” button on that page.

*Task seven: Remove the remedy build for migraines from the list.* All users clicked the trash can icon to delete the item and successfully complete this task.

*Task eight: Add a few more remedies to your favorites list.* Adding the label “Add to Favorites” next to the heart icon proved once again to be successful because every user completed this task without much effort.

*Task nine: Delete “garlic” and “witch hazel” from your favorites.* All three participants completed this task successfully. The newly implemented confirmation alerts uncovered a new issue: when deleting multiple items, the alerts are cumbersome.

*Task ten: Log out of the app.* All three users successfully logged out of the app using the three-dotted icon at the top right of the screen.



## Chapter 6: Conclusion

In the future, additional changes can be made to the HealMe app to extend its functionality and make it available for download. To ensure the integrity of HealMe's user-generated content, we will maintain the requirement that users be authenticated, and provide multiple ways to log in. Users will have the option to create an account from the login screen, as well as the ability to log in with their Google, Yahoo, and Facebook accounts. Those services provide scripts for developers that can be applied in the build of the application to add additional buttons (e.g. "Log in with Google" or "Continue with Facebook") to the app's home screen (Figure 28).



*Figure 28.* "Sign in with Google" and "Continue with Facebook" buttons will be added as additional login options on the HealMe app.

Another issue that should be addressed is how duplicate submissions will be verified and labeled. If two users attempt to submit the same remedy, there should be a mechanism in place to determine which entry is accepted and how users are notified of a duplicate. Autocomplete is a user interface feature that provides users with a dropdown list of results as they type a query into a search bar or text box. It works by matching the word being typed against an internal database of already existing terms.

In order for the autocomplete feature to be successful, it needs to be prepopulated with a set of remedies and be displayed on the "Submit a Remedy" form in two ways.

First, if the remedy doesn't already exist as a page in the app, the user's submission would be matched against a list of terms to help standardize its spelling and format. Secondly, once the user completes the form and submits the remedy, it then gets added to the list of existing remedies in HealMe. This newly-submitted entry would become a clickable link (appended with the words "Already exists") within the autocomplete dropdown that takes the user to its corresponding page. The Natural Medicines Comprehensive Database by the Therapeutic Research Center provides an extensive library of diseases and health conditions that can be used as a guide for standardizing ailment and remedy names. The database contains over 1200 vitamins, herbs, and minerals listed alphabetically with a description of each, as well as information on safety, effectiveness, and potential interactions.

Improvements will be made to the remedies and ailments lists to allow for sorting alphabetically and by most popular. We look forward to implementing the "Where to Buy" feature on each remedy page with geolocation services tied to the item's Universal Product Code (UPC). Eventually we would like to expand HealMe into a social network, where authenticated users receive "top contributor" points for credibility and trustworthiness of content.

Use and acceptance of natural remedies continues to grow worldwide (Ekor, 2013). At the same time, cell phone applications play a significant role in the lives of many people, and they "are the primary driver of digital media consumption" (Comscore, 2017). With increased global interest in complementary and alternative medicine comes the opportunity to make natural healthcare resources available on mobile devices. The HealMe app addresses this concern by allowing users to submit, build, and rate the

effectiveness of remedies. Our study participants successfully completed these crucial tasks a majority of the time during our first prototype test, and 100% of the time during the follow-up test. Accordingly, HealMe demonstrates that crowdsourced data and user reviews can be successfully used to provide natural remedies in a mobile format.

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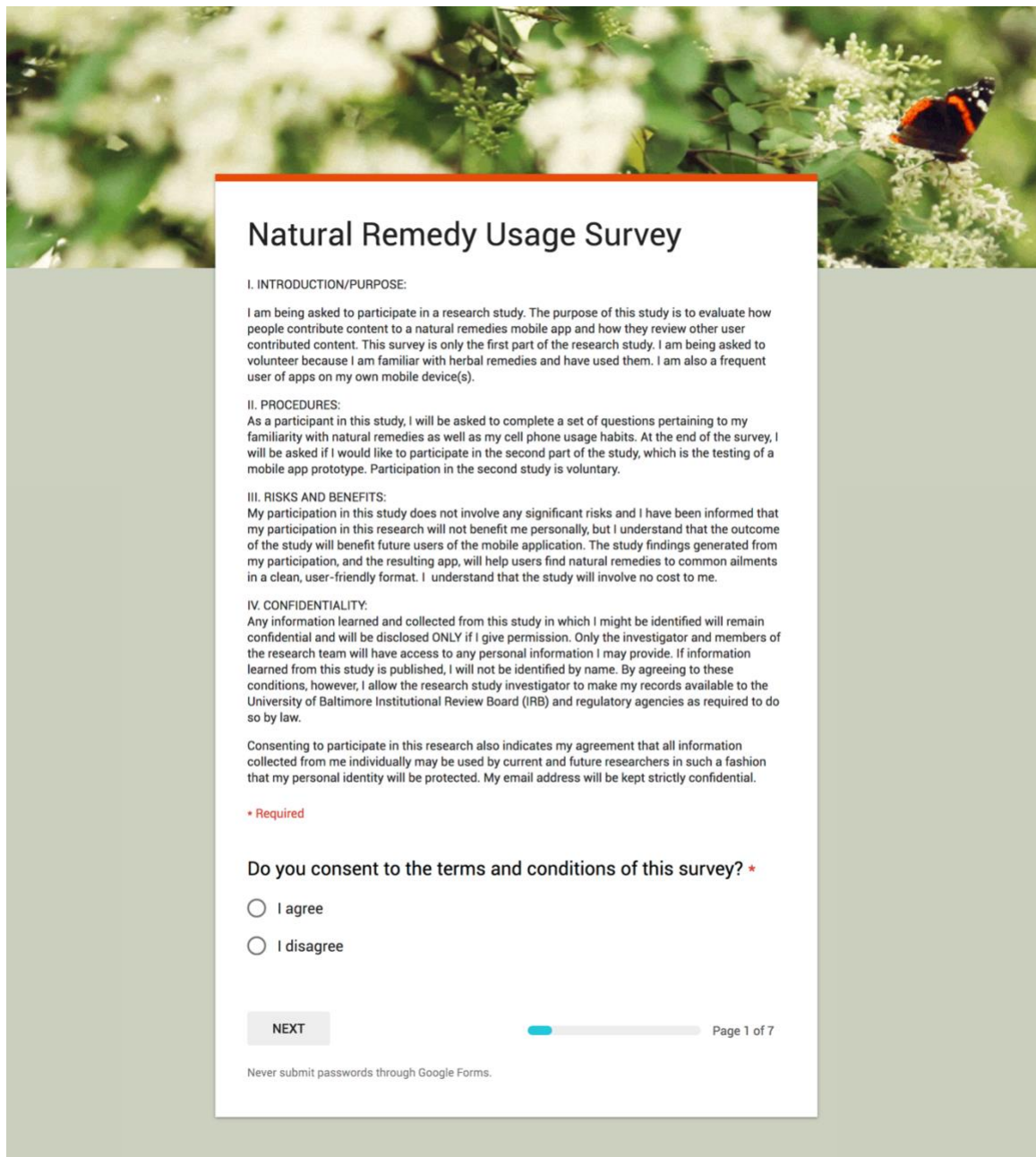


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## Appendix A: Herbal Remedy Usage Survey Consent Screen



## Natural Remedy Usage Survey

**I. INTRODUCTION/PURPOSE:**

I am being asked to participate in a research study. The purpose of this study is to evaluate how people contribute content to a natural remedies mobile app and how they review other user contributed content. This survey is only the first part of the research study. I am being asked to volunteer because I am familiar with herbal remedies and have used them. I am also a frequent user of apps on my own mobile device(s).

**II. PROCEDURES:**

As a participant in this study, I will be asked to complete a set of questions pertaining to my familiarity with natural remedies as well as my cell phone usage habits. At the end of the survey, I will be asked if I would like to participate in the second part of the study, which is the testing of a mobile app prototype. Participation in the second study is voluntary.

**III. RISKS AND BENEFITS:**

My participation in this study does not involve any significant risks and I have been informed that my participation in this research will not benefit me personally, but I understand that the outcome of the study will benefit future users of the mobile application. The study findings generated from my participation, and the resulting app, will help users find natural remedies to common ailments in a clean, user-friendly format. I understand that the study will involve no cost to me.

**IV. CONFIDENTIALITY:**

Any information learned and collected from this study in which I might be identified will remain confidential and will be disclosed ONLY if I give permission. Only the investigator and members of the research team will have access to any personal information I may provide. If information learned from this study is published, I will not be identified by name. By agreeing to these conditions, however, I allow the research study investigator to make my records available to the University of Baltimore Institutional Review Board (IRB) and regulatory agencies as required to do so by law.

Consenting to participate in this research also indicates my agreement that all information collected from me individually may be used by current and future researchers in such a fashion that my personal identity will be protected. My email address will be kept strictly confidential.

\* Required

Do you consent to the terms and conditions of this survey? \*

☐ I agree

☐ I disagree

NEXT

Page 1 of 7

Never submit passwords through Google Forms.

## Appendix B: User Survey Questions

### **Experience using natural remedies.**

1. During the past 12 months, how frequently have you used herbal and natural remedies?
2. Where have you received information about using natural remedies to treat various illnesses? Select all that apply.
3. For each statement below, indicate on the scale how much you agree or disagree:
4. From the following list of natural remedies, tell us whether you are familiar with it, have used it, or have never heard of it.

### **Mobile app usage habits.**

1. Is your mobile phone a smartphone? (Uses data and WiFi, can access the internet, etc.)
2. If you answered “Yes” to the previous question, what brand of phone do you use?
3. Do you use apps on your phone?
4. How often do you use apps on your phone?
5. In the past month, approximately how many times have you downloaded NEW apps to your phone?
6. List the top 5 mobile apps you use the most.
7. Do you use your phone while shopping to complete tasks related to your purchases?
8. If you answered “Yes” to the previous question, what shopping related tasks do you use your phone to complete? Select all that apply.

**Demographic information**

1. What is your gender?
2. What is your age?
3. What is your occupation?

**Consent to prototype testing.**

1. This survey is the first of a two-part research study. Would you be interested in participating in the second part of the study, which involves testing a prototype for a cell phone app?
2. [If “Yes” was selected for the previous question] Your email address.

## Appendix C: Occupations of Survey Respondents

Natural Health Author/Website Owner
Student
PhD Student
IT Professional
Student
Finance
Public Agent
Sys Admin
Partnership Officer
Engineer
Unemployed
Economist
Lecturer
Stock Counter
Bartender
Receptionist
Retired
Secretary
Mechanic
Restaurant Manager
Teacher
Office Assistant
Judge/Entrepreneur

## Appendix D: Additional User Personas

**Stacy****Age**

32

**Gender**

Female

**Primary motivation**

Stacy is a mother of two who works as a waitress. She's suffered from migraine headaches for many years and is on prescription medication for them. Unfortunately they have terrible side effects.

**Stacy says**

"This migraine medicine I've been taking has been a nightmare. I always feel awful afterwards. I wonder if there's a natural supplement I can take to relieve some of the pain or make them go away completely?"

**Frank****Age**

48

**Gender**

Male

**Primary motivation**

Frank is in reasonably good health. He doesn't smoke, only drinks occasionally, and exercises about three times a week. The only issue he has had is eczema, which has now cleared up after he started using a remedy he found on the HealMe app.

**Frank says**

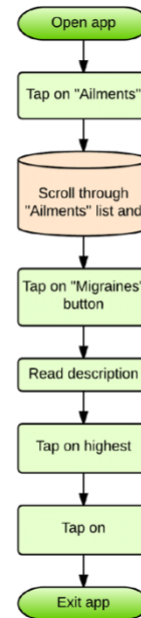
"The coconut oil eczema cure that I found through HealMe worked wonders and I am so grateful! Now I'm ready to leave a glowing review because I want others to know how well it worked for me!"



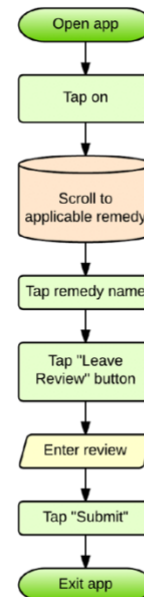
## Appendix E: Additional User Flow Diagrams

**Stacy's User Flow Diagram:  
Find a Remedy****Problem**

Stacy has suffered from migraine headaches since she was in elementary school. The migraines are so bad that she has been prescribed medication to control them. Unfortunately, the medicine has horrible side effects such as heartburn, jitteriness, and dizziness. Stacy believes that there have got to be other more natural, side effect-free remedies or cures. She downloads the HealMe app to her Samsung Galaxy S5 in the hopes of finding an alternative remedy.

**Frank's User Flow Diagram:  
Leave a Review****Problem**

Frank has suffered from horrible eczema all of his life. The dry, scaly, rough patches of skin appear the worst in the crooks of his arms and behind his knees. Last year he began searching online for natural remedies for eczema. He started using organic coconut oil as a moisturizer for his skin every day and the scales, scabs, and itchiness on his body have miraculously disappeared! Frank is elated and wants to make sure other people know of this great cure, so he opens up the HealMe app on his phone to leave a glowing review.



## Appendix F: Prototype Test: Consent Form

**CONSENT FORM FOR PARTICIPATION IN RESEARCH ACTIVITIES****Crowdsourcing Alternative Healthcare: A Mobile Application for User-Generated Natural Remedies****I. INTRODUCTION/PURPOSE:**

I am being asked to participate in a research study. The purpose of this study is to evaluate how people contribute content to a natural remedies mobile app and how they review other user contributed content. I am being asked to volunteer because I am familiar with herbal remedies and have used them. I am also a frequent user of apps on my own mobile device(s). My involvement in this study will begin when I agree to participate and will continue until 3/11/18. About 10–15 persons (myself included) will be invited to participate.

**II. PROCEDURES:**

As a participant in this study, I will be asked to complete a set of tasks on an interactive mobile prototype to evaluate its user-friendliness. I will be requested to meet with the researcher online via Google Hangouts or Skype. My participation in this study will last for approximately two hours. I will only need to meet once unless there is a problem with my initial test, in which case I may be asked to meet a second time to retake the test. My voice will be heard on the recording, but my face will not be visible.

**III. RISKS AND BENEFITS:**

My participation in this study does not involve any significant risks and I have been informed that my participation in this research will not benefit me personally, but I understand that the outcome of the study will benefit future users of the mobile application. The study findings generated from my participation, and the resulting app, will help users find natural remedies to common ailments in a clean, user-friendly format.

**IV. CONFIDENTIALITY:**

Any information learned and collected from this study in which I might be identified will remain confidential and will be disclosed ONLY if I give permission. All information collected in this study will be stored in a locked file cabinet in a locked room. Only the investigator and members of the research team will have access to these records. If information learned from this study is published, I will not be identified by name. By signing this form, however, I allow the research study investigator to make my records available to the University of Baltimore Institutional Review Board (IRB) and regulatory agencies as required to do so by law.



Consenting to participate in this research also indicates my agreement that all information collected from me individually may be used by current and future researchers in such a fashion that my personal identity will be protected. Such use will include sharing anonymous information with other researchers for checking the accuracy of study findings and for future approved research that has the potential for improving human knowledge.

Check if images or video are recorded during the research study:

☐ Yes, I give permission to use testing video in scientific publications or presentations.

☐ No, I do not give permission to use my testing video in scientific publications or presentations

Check if voice recordings are used during the research study:

☐ Yes, I give permission to use my voice in scientific publications or presentations.

☐ No, I do not give permission to use my voice in scientific publications or presentations

**V. SPONSOR OF THE RESEARCH:**

This research study is for a master's thesis.

**VI. COMPENSATION/COSTS:**

My participation in this study will involve no cost to me.

**VII. CONTACTS AND QUESTIONS:**

The principal investigator(s), Ada Uzoma, has offered to and has answered any and all questions regarding my participation in this research study. If I have any further questions, I can contact Ada Uzoma at (202) 489-2755 or [ada.uzoma@gmail.com](mailto:ada.uzoma@gmail.com)

For questions about rights as a participant in this research study, contact the UB IRB Coordinator: 410-837-6199, [irb@ubalt.edu](mailto:irb@ubalt.edu).

**VIII. VOLUNTARY PARTICIPATION**

I have been informed that my participation in this research study is voluntary and that I am free to withdraw or discontinue participation at any time.

*I will be given a copy of this consent form to keep.*

**IX. SIGNATURE FOR CONSENT**

The above-named investigator has answered my questions and I agree to be a research participant in this study. By signing this consent form, I am acknowledging that I am at least 18 years of age.

Participant's Name: \_\_\_\_\_ Date: \_\_\_\_\_

Participant's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Investigator's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## Appendix G: Prototype Test: Script

Thank you for agreeing to take part in my research study. My name is Ada Uzoma, and I'm a graduate student at the University of Baltimore in Baltimore, Maryland, USA. During the rest of the session, I'll be reading from a script to ensure that my instructions to everyone who participates in the study are the same.

My objective today is to test the usability of an herbal remedy mobile app. During the session, I will ask you to perform a set of tasks on the app and observe you while you complete them. Before I give you each task, I'll be giving you a little bit of context behind it, such as why you might be doing it and what you hope to achieve.

Please remember that I am not testing *you*; this is all about the prototype and what works and what doesn't. There are no right or wrong answers. Feel free to let me know at any time if there's something you like, dislike, or are confused about. While you are completing each task, I would like you to "think out loud" as much as possible. This will help me get a sense of your thought process. For example, you may be looking at a screen, suddenly see something you didn't see before and want to click on it. In that case, saying something like "this caught my eye so I'm going to see what it is" would be very helpful.

If at any point you have questions, please don't hesitate to ask. Do you have any questions right now before we begin?

Okay, let's get started.

## Appendix H: Prototype Test: Tasks

1. Login
2. You have been taking magnesium for the last three months and it has cured your migraine headaches and helps you sleep better at night. Submit a new remedy called “magnesium” to the app.
3. You have just been diagnosed with asthma and you want to look up some natural treatments. Find a remedy you like and where you can buy it.
4. Add the remedy you like for asthma to your favorites
5. You bought that remedy for asthma and you love it. Add a review for it.
6. You have a friend who is suffering from high blood pressure and muscle cramps. Build a remedy that will treat those two ailments.
7. You previously built a remedy for migraine headaches but now you no longer need it. Remove the remedy build for migraines from the list.
8. Add a few more remedies to your favorites list.
9. Delete two items from your favorites.
10. Sign out of the app