



HouseCall:

a health-monitoring system for heart failure patients

<http://aijiayan.com/HouseCall/>

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Abstract

Heart failure is one of the most frequent causes of both hospitalization and hospital readmission among the elderly. Our project, HouseCall, explores how an in-home health monitoring system could reduce readmission for heart failure patients recently released from the hospital. Using a wireless sensor system which captures what medications are taken, when they're taken, as well as heart rate and activity level, we have designed a daily check-in system which provides the patient with resources to better understand, and thus manage their condition.

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Introduction

In this project we worked with a newly developed wireless sensor system that captures what medications are taken, when they're taken, as well as one's heart rate and activity levels. (additional details redacted) We explored how this technology could be applied to help reduce hospital readmissions among heart failure patients.

Background Research

Before deciding on heart failure (HF) as our problem area, the team conducted background research on a few illnesses and brainstormed what would be the costs and benefits to design a solution for each. The other illnesses we looked at include obesity, diabetes, and depression. The background research phase took place in December 2012.

We eventually decided to choose HF because we feel it is currently under represented by technology solutions. There are very few similar products on the market, and there is no solution that specializes on the heart failure problem. HF is also more serious than the other conditions, patients with a higher likelihood to pass away once diagnosed. Diabetes also have a lot of available solutions on the market, and so does obesity. In addition, some impact of heart failure can be mitigated through lifestyle changes. We would be able to make more contribution and impact choosing to study and design for heart failure.

What Is Heart Failure

Congestive Heart Failure (CHF) refers to a weak heart that is not pumping as much oxygen as is needed for the body to function properly, so a number of physical problems can manifest.

The most common ones are:

- congested lungs (due to heart not pumping enough, kidney not properly excreting sodium so body starts retaining fluid),
- shortness of breath, difficulty breathing at rest, hacking cough/wheezing),
- kidney failure (not enough blood getting to vital organs, toxins can't be flushed),
- fluid/water retentions in other areas of body (i.e. swollen ankles-edema), and
- rapid/irregular heart beats (beating faster to try and compensate for not pumping enough blood for body).¹

Heart failure is present in 2% of those 40-59 years old, 5+% those 60-69, and 10% those older than 70.² There are currently 5.8 million heart failure patients in the US, with 400,000 new

¹ http://en.wikipedia.org/wiki/Heart_failure

² McMurray JJ, Pfeffer MA (2005). "Heart failure". *Lancet* 365 (9474): 1877–89. doi:10.1016/S0140-6736(05)66621-4. PMID 15924986.

cases added each year. CHF is also the leading cause of hospital stays among people on medicare.

The congestive part is when heart not pumping hard enough and kidney not working properly so body retains fluid (legs, ankles feet, lungs, other organs).

CHF is generally caused by diseases that weaken (i.e. heart attack, coronary heart disease, artery blockages, etc) or stiffen (i.e. high blood pressure, which thickens heart) the heart.

Symptoms in advanced heart failure include:

- Kidney failure if patient can't get enough blood to vital organs
- Continual swelling may lead to severe fluid restrictions (usually reducing sodium is enough to get rid of extra fluids)
- Malaise: general feeling of ill at ease can signal change in heart condition
- Unusual fatigue
- Shortness of breath: breathing trouble leading cause of hospitalization for people with heart failure. Caused by pulmonary edema: heart can't pump properly so fluid accumulates in lungs. Some patients can't sleep lying down because of shortness of breath: may need to be propped on a couple pillows.
- Sudden weight gain (3 lbs/day or 5 lbs/wk) could be a sign body retaining more fluid, signalling decline in heart's ability to pump. Should keep written track of weight to monitor
- Palpitations, which may just be potassium deficiency caused by taking diuretics
- Fainting
- Extreme change in blood pressure

Several conditions can lead to CHF, including high blood pressure (which weakens heart over time), diabetes (high blood sugar levels can weaken heart and blood vessels around heart over time), and other heart conditions such as cardiomyopathy, heart valve problems, arrhythmias. Since many more people survive heart attacks now, their heart could be damaged from the heart attack and end up with CHF.

The New York Heart Association (NYHA) classifies CHF into four categories depending on how a patient feels during physical activity³:

³ American Heart Association.
http://www.heart.org/HEARTORG/Conditions/HeartFailure/AboutHeartFailure/Classes-of-Heart-Failure_UCM_306328_Article.jsp

Class	Functional Capacity: How a patient with cardiac disease feels during physical activity
I	Patients with cardiac disease but resulting in no limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea or anginal pain.
II	Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea or anginal pain.
III	Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary activity causes fatigue, palpitation, dyspnea or anginal pain.
IV	Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of heart failure or the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort increases.

For our project, we specifically focus on Class III patients population for a number of reasons. First, the Class I and II patients suffer minor CHF symptoms and not only it is financially costly to be given our monitoring technology, it is also medically unnecessary for them to be closely monitored. Second, Class IV patients are most likely too frail to use the technology; it may even require them to be more closely monitored in a hospital environment as their condition has become extremely critical. Class III patients, on the other hand, are capable of self-managing most part of their daily life and will benefit from our technology the most.

Life Impact of Heart Failure

CHF is the leading cause of hospitalization and readmission of the elderly; although heart failure patients only make up 14% of Medicare's beneficiaries, it accounts for 43% of Medicare spending⁴. Sadly, people only stay the same or get worse; there is no complete cure.

Socially, patients experience social isolation, fatigue, and feel abandoned and physically restricted. Fear is a big element of patients' daily living, not knowing whether they will get worse or admitted back to the hospital suddenly. There can also be a sense of losing control of one's life, as patients cannot do what they used to be able to do for themselves. Feeling of uselessness can occur. All these changes often lead to depression. Up to 75% of CHF patients are depressed, with 40% clinically depressed⁵.

⁴ <http://www.cms.gov/Medicare/Medicare-General-Information/CCIP/index.html?redirect=/CCIP/>

⁵ Blumenthal et al. Effects of Exercise Training on Depressive Symptoms in Patients With Chronic Heart Failure. | August 2012. <http://jama.jamanetwork.com/article.aspx?articleid=1273016>

Even in cases where their CHF conditions are not necessarily limiting their social life, patients can suffer from side effects from medication which impacts ability to live a normal life. For example, taking diuretics to address excess body fluid makes patients need to urinate more frequently, making their social life harder.

On the other hand, most heart problems can also be controlled by lifestyle changes, such as:

- 1 taking prescribed medicine
- 2 exercise (at least 30 min most days; however often they don't have energy to exercise)
- 3 not drinking too much water (can cause more water retention, very important to drink limited amount)
- 4 healthy weight/eating, reduced sodium
- 5 not smoking
- 6 controlling other illnesses, such as diabetes, HBP, cholesterol. This can significantly improve if CHF largely caused by these illnesses
- 7 reducing alcohol
- 8 managing depression

Our solution to the problem especially emphasizes on (1), (2), (4).

Competitor Analysis

We looked at what products are in the market that might be relevant. In this section we present our analysis on those products.

Health Buddy⁶

Health Buddy system is a four button device that is installed at a patient's household and connects to the hospital via telephone line. Every day the system starts a new session and collects the vital sign, gathers the patient's health conditions, and reinforces positive behavior. It can be configured to help with various health conditions. It has been widely used and tested by the National Veteran's Health Administration since the late 90's and has significantly reduced costs while having a very high patient satisfaction level.



⁶ http://www.bosch-telehealth.com/en/us/products/health_buddy/health_buddy.html

ViSi Mobile⁷

The ViSi Mobile System is able to measure and display all core vital signs (Blood Pressure, Heart Rate / Pulse Rate, 3-lead or 5-lead ECG, SpO₂, Respiration Rate, Skin Temperature) with monitoring accuracy and resolution, typically found in ICUs. In addition to the color touchscreen display on the patient-worn device, desktop PCs, tablet PCs and other mobile platforms can be utilized as remote viewing and notification devices. ViSi Mobile is able to wirelessly transmit data, leveraging existing hospital WiFi infrastructure, and is designed to provide information output in electronic form (i.e. EMR connectivity) as well as print-outs. Going forward, the ViSi Mobile System will also include Sotera's patented cuffless non-invasive blood pressure (cNIBP) on a beat-to-beat basis, as well as patient posture / activity as a "new vital sign." ViSi Mobile is "...a comprehensive system designed to enhance patient safety by allowing early detection of patient deterioration and connecting clinicians with their patients anywhere, any time."

BodyGuardian⁸

The BodyGuardian Remote Monitoring System (RMS) is a cutting edge approach to patient monitoring that includes a non-intrusive, wearable body sensor that allows physicians to monitor a patient's physiological data from anywhere at anytime...Developed in collaboration with Mayo Clinic, this [FDA-cleared](#) system uses sophisticated algorithms to support remote monitoring for individuals with non-lethal cardiac arrhythmias. BodyGuardian RMS allows physicians to monitor key biometrics outside of the clinical setting, while patients go about their daily lives. Important physiologic data is securely collected by a small, wearable body sensor and transmitted to physicians. It maintains a constant connection between patients and their care teams.

VOX Telehealth⁹

VOX has the first proactive, digitally based system that will facilitate the Patient-Provider partnership like never before. Creating programs that utilize premiere content, VOX Telehealth's procedure-specific programs engage the patient through all pre and post procedural stages; providing education, preparation, customized recovery plans and 24/7 clinical monitoring through a digital platform.

Privacy Policy

⁷ <http://www.visimobile.com>

⁸ <http://www.preventice.com/products/bodyguardian/>

⁹ <http://www.voxtelehealth.com/programs/overview>

The system we are designing falls under the definition of a PHR (personal health record), “an electronic record of an individual’s health information by which the individual controls access to the information and may have the ability to manage, track, and participate in his or her own health care”¹⁰. Where does the PHR come from makes a difference in the privacy policy. According to the U.S. Department of Health & Human Services, if the PHR is offered by a HIPAA-covered health care provider or health plan, then it falls under the scope of HIPAA Privacy Rule. If our system delivers data via the tablet which is offered by Our Sponsor, who is not a covered entity, and patients grant permission to their care delivery teams to view that data within the PHR, it will not be subject to HIPAA Privacy Rule.

Our Sponsor ensures that the data is safe and secure by leveraging industry standard security protocols (encrypted bluetooth, SSL, OAuth) to protect access to data. A trusted third party, Accuvant, has audited the system to assess the security and integrity of the data.

Primary Research

We conducted primary research with medical professionals and patients in order to know more about the HF condition. We learned about why and how it happens, how it is treated in hospitals, how it is communicated to patients, how patients cope with the condition, and how it impacts the patients’ lifestyle. We discovered design opportunities along the way.

We gained access to the medical professionals through personal connections, Our Sponsor connections, and references that they further gave out after meeting with us. We gained access to the patients through advertising, which will be further discussed in the Usability Testing section.

We will outline our findings with medical professionals in this section, whereas responses and inputs from patients will be discussed in our design sections.

In January 2013 we first met with Our Sponsor who is designing the provider-facing aspect of the solution. We talked to the Director of Clinical Affairs from Our Sponsor and confirmed our design assumptions and learnings from background research. We primarily learned about the basics of heart failure, symptoms, and some design opportunities. We learned that managing medication is hard. We need to incentivize people to take meds more effectively. They also do not understand how the medications work. Actions need to be identified and any red flags need to be clearly raised. We also learned that patients’ diet is salt sensitive and managing salt is critical to their health. The complexity of HF lies in the interaction among change of lifestyle, medication management, and the technical device. It usually takes more than the individual to

¹⁰ U.S. Department of Health & Human Services. “Personal Health Records and the HIPAA Privacy Rule”. <http://www.hhs.gov/ocr/privacy/hipaa/understanding/special/healthit/phrs.pdf>

comprehend all of that, and nursing support and/or caregivers will help with the shared understanding.

The current HF programs are personnel intensive, requiring a high touch. There is also a health disparity driven by the social-economic conditions of the patients. People with less income are those less likely to be followed up by specialists, less likely to have guideline, or to have HF medication. It is less likely for younger patients to have HF failure. When they do, it is usually because of less common causes such as viral infection. Since HF worsens over time, patients in class I and II are usually younger, and they may be more open to behavioral changes and more technology savvy. There are two major causes of HF: diastolic and systolic (because of pumping problems of the heart). African Americans are a big population that suffer from diastolic HF because of hypertension (high blood pressure).

We also learned more in depth about diuretics, which is a medicine that HF patients usually take to get rid of extra water in the body. Sometimes the dosage of diuretics needs to be adjusted if the patient has gained weight, a process known as titration. The doctor may give the patient guidelines for doing this themselves if the doctor believes the patient is capable of managing that on his/her own. We thought this would be both a good point to address in our design and a good design opportunity to simplify the process.

We then met with a program officer at a **Gordon and Betty Moore Foundation**, which is a Bay Area grantmaking foundation whose mission is to advance medical research and advocate for patients. We got a lot of information regarding hospitals and other medical programs we should be talking to. We learned about the current telehealth products in the market and how they were received by the patients. For example, the Philips Telehealth device has a narrow strip of patients for whom it works. It is cost effective and produces positive outcomes. It mainly works for people who have enough symptoms that daily interventions can make a difference in how they are doing, but are not so sick and impaired that they cannot engage with technology. Of all those who are eligible for the product, only a subsection of patients adopt and engage with it. Therefore selecting a HF population is critical for our design to get used and produce real results. We feel to have selected on Class III HF patients is a right decision. Given the fact that HF patients vary so much, upon release of the solution it would be important to conduct a thorough trial to the patient population. We can only focus on a defined strip of population and it cannot be a broad solution for solving HF management.

We also learned that caregivers are also more involved with the HF population compared to other diseases, and it would be important to involve them in the design in some way. However, there are certain interactions that only the patients can do, for example when we try to get direct input from the patient, and the patient may be uncomfortable giving the answer to someone else to input to the device for privacy or personal reasons.

We learned more about measurements. There are the clinical measures including the four HF classes from New York Heart Association Functional Classification. These measurements focus more on the treatment of the disease and whether patients are eligible for clinical interventions. Then there are measures for more global understanding, such as health related quality of life (QoL), which understand the functional status of a person. These measurements include the Minnesota Living with Heart Failure questionnaire, and the SF-36, but they are normally used to assess the effect of medical trials or studies, and will not be directly useful for our day-to-day patient interactions. Also if we do a daily check in with the patients, understanding the QoL is less important in terms of to draw information regarding how the patient is doing on a certain day. However, it is important to understand the “symptom bother”, or how much are one’s symptoms bother oneself, as opposed to just understanding how severe they are. The most important things to know about a patient include self-reported shortness of breath and fatigue.

Another big area to draw information from in HF management is patient engagement measures, also known as patient activation, which measures how confident and knowledgeable people are in managing their own disease. It is important to check whether they know what to do.

In February, We then met with Pat Teske from **Avoid Readmissions Through Collaboration** (ARC), a partnership between the Center for Quality System Improvement (CQSI) the California Quality Collaborative (CQC)¹¹. We learned that technology does not often have a critical role in hospitals. If something is not mission critical, it often ends up being forgotten. The quality of telehealth solutions really depends on the quality of the implementation as opposed to the device itself. Some say the technology is effective in cutting readmissions, but the implementer must build a process, policy, training, and follow ups in order for it to work. We confirmed again that medications are difficult for patients to manage. When the patient gets discharged from a hospital, the medication is usually changed. Having a list of changes and new medications would be extremely helpful because people confuse their prescriptions and cause readmission a lot. We were told to specifically look for ankles (swelling), breathing, and weight for HF patients. We should try to have patients guide themselves through the treatment process.

Because **St Mary’s Medical Center** (San Francisco) is also in the ARC network, we spoke to two nurses who work with heart failure patients at the hospital in late February. We learned that a critical education issue for HF patients is weight. People do not understand why they have to weigh themselves every day, and do not understand it is a way to monitor fluid retention (but instead think it's about eating too much). If they don't understand why, they tend not to do it. If people can't stand on scale, they are taught to press on their ankles and see if they're swollen, but people often say they are not when they in fact are.

¹¹ “About Us”. <http://www.avoidreadmissions.com/about-us.html>

Diuretics are a big problem too. Not everyone who has HF takes diuretics, but most do. Hypertension patients are also prescribed diuretics. Patients think that the frequent urination is a side effect, but it's the point of the medication, to get excess fluids out of you. People will not take it if they are planning on going out for lunch with friends, but they can get up early and take it in that case.

High sodium level is also a point that a lot of patients miss. Lots of elderly people are no longer capable of cooking for themselves from scratch so end up eating a diet high in processed foods, but that's the worst in terms of salt. Even soups that say "low sodium" and "heart healthy" are often way above suggested levels and are very misleading.

In early March, we talked to a nurse at **Palo Alto Medical Foundation** (PAMF), which has a Innovation Center that has been developing and using various technology-enabled solutions for healthcare¹². We were recommended to include blood pressure monitoring, but we are leaving that out of our design which is considered a minimum viable product for now. We were also advised to have a simple UI where an action can be completed in one or two touches, given the elderly patient population we are designing for. We asked about how patients would receive a technology design like ours for their health, and were told to expect really mixed feedback. A recent iPhone health app design was done by PAMF and tested on a mixed patient population, and it received mixed feedback where some loved it while others had lots of technical problems. When asked patients if they wanted to keep going with the study, which started May of 2012, two thirds wanted to keep going, suggesting very high retention.

Regarding looking at data, it really varies between people. Some do see their numbers, notice a pattern they did not know before, and start to ask questions. These patients understand their health problems better with data. Meanwhile, some patients are simply reluctant to look at data, either being lazy or thinking they are hard to understand.

We understand that we are designing for an extremely diverse population. Their age tends to be old but there are younger patients with HF too. Most of them are not tech savvy but some are, and we have met one of them during our user interviews. Some of them would like to know as much information as possible, but some are reluctant to see things that could confuse them. More importantly, some of them have very high self-efficacy, strong willingness to improve their conditions, and strong mental capacity to take care of their own health, but we must recognize that there are those HF patients who are weak and indolent. We aim to produce a design that can rely on as few of these assumptions as possible. Our goal is to design something that even the least-interested user can still operate, yet a highly-engaged user can still learn and have fun using.

¹² "Our Work". <http://innovation.pamf.org/our-work/>

In addition, we attended two HF seminars held in St Mary's hospital, one session on nutrition and another on medication. We learned the concept of the Salt Shocker game from a nutritionist, and thought it could be included in our design. It is a fun way to educate someone about how much salt is present in a typical food item. We also obtained a booklet from St Mary's that had valuable information about HF, from where we learned about the three-zone classification which was incorporated into our design. The original can be found in the appendix.

Secondary Research

Zones

Best practices for heart failure dictate that patients be taught to understand what their symptoms mean and what they can do to mitigate them. Zone guidelines are a useful tool for doing this. It divides a patient's condition into 3 zones: green, meaning they have no symptoms of concern; yellow, meaning they have some symptoms of concern but are not critical, and red, meaning they have critical symptoms and should go to the doctor or hospital right away. Patients are given a list of symptoms and what zone they belong in and are taught to gauge their own symptoms every day to better understand how they are doing.

Self Efficacy

An important concept in positive psychology, self-efficacy¹³ is the belief that one has the power to produce that effect by completing a given task or activity related to that competency. Self-efficacy relates to an individual's ability to manage symptoms, treatment protocols, physical and psychosocial consequences, and lifestyle changes inherent to living with a chronic condition. It is the belief that one is capable of performing in a certain manner to attain certain goals; it is the expectation that one can master a situation, and produce a positive outcome.

Literature¹⁴ has shown that patients with better control of their care are often more educated about their disease and more engaged in their own management of these risk factors. Effective self-management has three components:

- 1 manage the medical aspects of their condition
- 2 maintain, change or create new behaviors based on the challenges or restrictions of their condition
- 3 manage the emotional impact of his or her condition

¹³ Hannah Katch, Holly Mead. "The role of self-efficacy in cardiovascular disease self-management: a review of effective programs". Patient Intelligence. October 2010 Volume 2010:2(Default) Pages 33 - 44

¹⁴ *ibid.*

One study found that only 50% to 60% of patients adhered to prescribed medications over a one-year period. Medication non-adherence in chronic diseases accounts for 10% of hospital readmissions in the United States.

Promoting Health Literacy in Older Adults

According to one study¹⁵, older adults:

- process info at slower pace, and can process less at one time (learn more slowly)
- often have short-term memory loss
- have difficulty translating abstractions into specifics
- have reactions and response times much slower
- experience physical changes: bad eyesight requiring high-contrast and large text, reduced ability/dexterity, and the need for big buttons.

Because of all this, when designing for an elderly population, it's suggested to use the same strategies as are used when designing for low-literacy populations. The following adaptations for changes are recommended:

- Minimize distractions
- Repeat essential info (teach back)
- Ask them how they learn best, adapt for that
- Communicate DESIRED action rather than action to AVOID
- Teach in 3-5 point "nuggets"
- Divide teaching across several lessons; thorough review of what was previously taught
- Use concrete verbiage ("3 times day" rather than "several times a day")
- Start with simple/familiar, move slowly to complex/unfamiliar
- Link new info to familiar/past experiences
- Reinforce how what they're learning will benefit their lives; also, help them identify past learning successes, build self confidence

Reducing HF readmission

One study¹⁶ highlights four ways to reduce readmission rate:

- 1 Enhanced admission assessment for post-discharge needs
- 2 Enhanced teaching and learning
- 3 Patient and family-centered handoff communication
- 4 Post acute care follow-up.

¹⁵ Speros, C. I., (Sept. 30, 2009) "More than Words: Promoting Health Literacy in Older Adults" OJIN: The Online Journal of Issues in Nursing Vol. 14, No. 3, Manuscript 5.

¹⁶ D. McCarthy, University of California, San Francisco Medical Center: Reducing Readmissions Through Heart Failure Care Management, The Commonwealth Fund, November 2012.

The second one is directly relevant to our design. Heart failure patient education has four core topics derived from evidence-based guidelines for self-care:

- 1 Routinely taking a diuretic medication (“water pill”).
- 2 Limiting salt intake by avoiding certain foods.
- 3 Monitoring and reporting weight gain to the doctor.
- 4 Calling the doctor when there is a change in health.

Design Approach

This section explains our design methodology and the major steps we took through our 5-month process.

Sponsor Relations

This project started to explore how sensor technology, specifically the patch and medicine sensors from Our Sponsor, can be applied in and beneficial to a patient population. We maintained regular contact with them.

In October 2012 we proposed our project proposal to Our Sponsor and got feedback. We had two meetings in October and November of 2012 with Our Sponsor to brainstorm about project directions and learn more about the technology. They asked us to focus on how their technology could be used to help patients better understand and manage their conditions. They gave us a short list of conditions they were interested in us exploring and after initial research we choose heart failure.

On March 7, 2013 we presented initial findings and design concepts to Our Sponsor to seek feedback. We received generally positive feedback and were asked challenging questions. We were also told to push the boundary and not to be restricted by what Our Sponsor currently does. We confirmed that titration is a big opportunity for education and automation. We were encouraged to stay focused on a solution which would be unique to heart failure.

On April 19, 2013 we met with Our Sponsor again to present our low fidelity prototypes. We were told that the design lacked focus and decided to trim down features that are arguably not essential for version I.

Our Sponsor also generously sponsors us compensation for patient interviewees. We obtained \$50 Visa gift cards from Our Sponsor which we used to advertise and look for patients. Each interviewee was awarded one of these gift cards.

Affinity Diagramming

In early March, 2013 the team decided to start the design process by producing an affinity diagram of the important pieces of information we had already known by then. We produced this diagram below by first individually coming up with features and key points we each thought was important and then posted them on the whiteboard.



Next, through explanation and debate we selected the ideas and grouped them together in a few clusters as below:

1. Ecosystem

Our research shows that a single technology solution alone would not be sufficient for a healthcare solution. We hear again and again that caregivers, doctors, and the patient form a bigger system which works together to help the patient improve on the condition. We want to provide a communication channel through our design to enable information flow through the system.

2. Motivation

We recognize that a lot of patients will perceive the technology as a foreign concept or will be too lazy to use it. We hope to motivate the patients through some behavioral change mechanism, such as gamification and emotional design.

3. Education

Research suggests that education should be a key component for the HF patients. We have two ways to implant educational materials: to either provide a library of readings and videos, or to integrate educational information into our design. We think the latter is a more innovative

design. Education should be embedded throughout the system, and it should be delivered in small pieces so that they are memorable for the elderly population.

4. Reminders

Since many in this population have short term memory loss, having good reminders is necessary. Some of the reminders are nudges, a concept from behavioral change defined as making it easier for them to do what they already want to do. Since some impact of HF can be mitigated by lifestyle changes, we hope to use these nudges to help patients acquire better lifestyles and thus become healthier.

5. Self-management

We hope to empower the patients with the ability to self manage. We are designing for something to be used at the convenience of their homes, and research suggests that the patients improve and learn better when they do it by themselves. Through the self-management features they will become more confident at managing their conditions too and stay out of the hospital as long as possible.

6. Feedback loop

Providing feedback promptly is important for the design to be usable. The system should be able to converse with the patient to a reasonable extent, given the social isolation that could happen with the HF population. Ideally the system should even learn the usage pattern of the user and be as flexible, non-intrusive and intelligent as possible.

7. User interface (UI)

Simple and easy to use are the mandate of the UI design. We make no assumption of the computer literacy of our user population, and we aim to make the design as easy as possible.

Personas

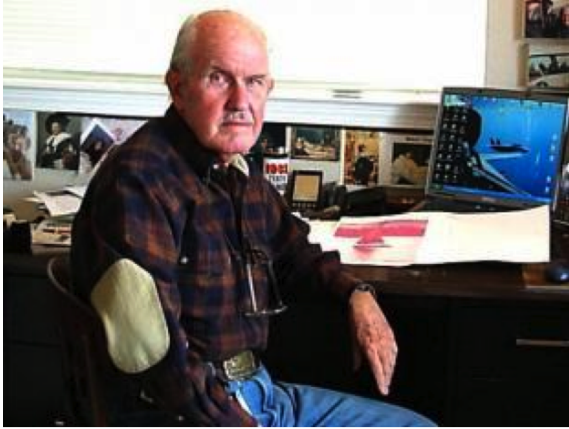
To help guide our design, we came up with two personas who would be our target users.



Gertrude McCallister is 83 years old and lives alone in Sacramento in a small senior-only condominium complex. She lives about 15 minutes away from her daughter, who works part-time and has 2 children of her own. She was diagnosed with heart failure 2 years ago when she suddenly found herself exhausted after walking short distances. She takes the water pills most days and has tried reducing the amount of sodium in her diet, but she often forgets. She doesn't have the energy to cook, so mostly eats canned and frozen foods. Last month she suddenly found herself unable to breath and wheezing heavily, so called her daughter who picked her up and took her to the hospital. It turns out she had fluid build up in her lungs and was in the hospital for a few days.

Her daughter wants her to move to a care facility but Gertrude wants to continue to live independently. She is determined to keep a better eye on her heart failure, and is interested in using the new sensor-based system that her doctor told her about.

Her hobbies are reading newspapers and watching TV. She has a computer and checks her email a couple times a week. She has a smart phone which her daughter bought her, but only uses it for phone calls and getting texts from her grandchildren.



Don Dameron is a 62-year-old man who lives in San Jose with his wife in their house. His children live on the East coast and call their parents once every few weeks. Don retired as a mechanical engineer and is recently diagnosed with heart failure. He tries to manage most of the things by himself and is reluctant to ask for help. He misses having an active lifestyle and being productive. Don wants to keep his condition under control and is very cooperative with his doctor.

Don has an okay understanding with technology. He bookmarked a few news websites on his computer and reads news online once every other day. When he has a question about his condition, he tries to search and do his homework online first. He likes to be independent.

Storyboarding

One activity that we did was storyboarding in order to gain ideas of how the technology can be used by our personas in context of their day-to-day life.



We have also built scenarios to guide our understanding of how our design is used. We built our high fidelity prototypes based on these scenarios.

Usability Testing and Iterations

We recruited patients as interviewees, asked them about how they manage their conditions and how HF affects their daily life. These interviews were incentivized at \$50 each.

The interviewees were recruited by the team from senior centers and community centers around the bay area. We designed and distributed flyers (see appendix) in those centers; we have also posted advertisements on Craigslist. We encountered difficulty recruiting subjects in the beginning of the project, and we expanded our search criteria from looking for just HF patients to looking for anyone with a chronic heart condition, because of the similarity in the way that the patients' life is impacted and the same level of difficulty with regard to interacting with technology. Interviewees had to sign a consent form (see appendix) and the interviews were recorded per their consent.

We built interactive low fidelity prototypes using Balsamiq and tested those designs at the end of our interviews too. They provided feedback and critique on our design, which guided us through our iterations. We tracked the feedback in a spreadsheet and included design changes and recommendations. The interviewees tested our diverging ideas, some of which were cut out from our final design and can be found in the Future Considerations section below.

Final Design and Decisions

While we had some potentially useful features in the initial prototypes, we realized that they were distracting us from the core functionality of the system: a daily check-in process which leads the patient through the process of getting their weight and answering a few quality of life questions.

We stripped off all the modules and features to focus on the check-in flow for our final design. The design consists of a solid check-in process which is meant to take place every morning and an easy-to-use home screen. The check-in flow will interact with the patient and gather and analyze health data. Research shows that regular check-in ensures that the patient is closely monitored and all critical information is collected and analyzed.

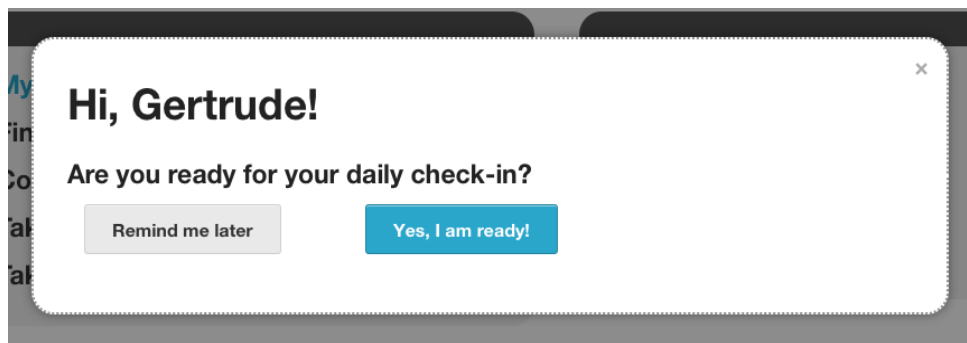
We did not include screens or demonstrations about set ups, caregiver sharing, or the provider's view because they are not where the value of our design lies. Additionally, Our Sponsor has developed solutions for these processes in their other product offerings which

have been heavily tested already. In this section we will walk through our design with our persona, Gertrude, and explain the design decisions we made.

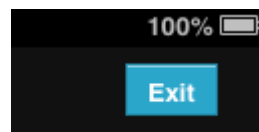
We give consideration of the elderly population we are designing for throughout our UI. We use sharp contrast, large typefaces, and large buttons so that the system is friendly and easy to use.

Check-In Flow

Each morning the system shows up on Gertrude's tablet and she is prompted to check in with the doctor.

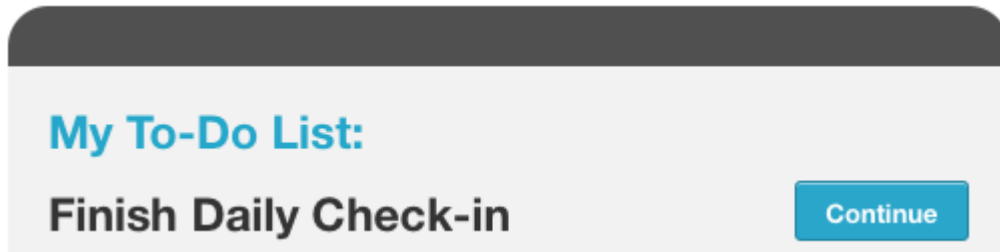
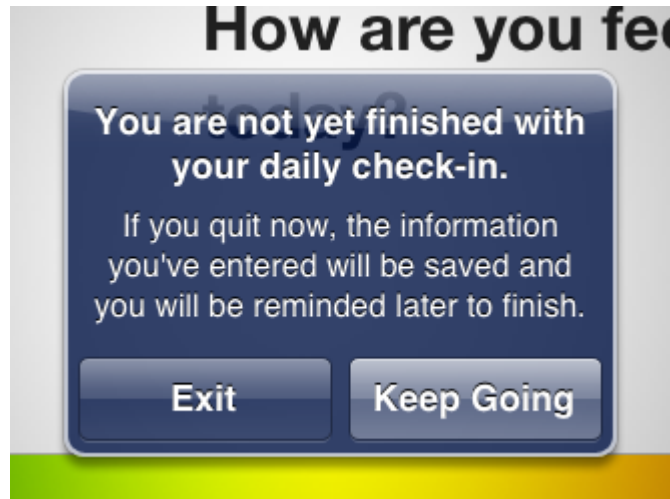


Gertrude can either choose to check in right away, or do the check-in later. During the check-in process, she can also quit anytime she wishes by tapping on the Exit button on the screen.



It is by design that Gertrude can exit the flow anytime, even though the check-in is a critical component of the system. The reason is that we want to enable the user and make the system as flexible and accommodating as possible. During our interview with a HF patient who is also a Health Buddy user, we found out that the fact that she cannot exit out of the check-in flow of Health Buddy made her uncomfortable.

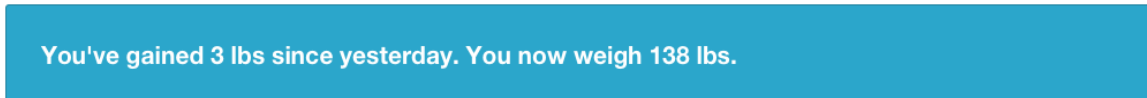
The exit action will be confirmed before taking place. When Gertrude does exit from the flow, a reminder will appear on her home screen for her to go back into the check-in, starting at where she left off.



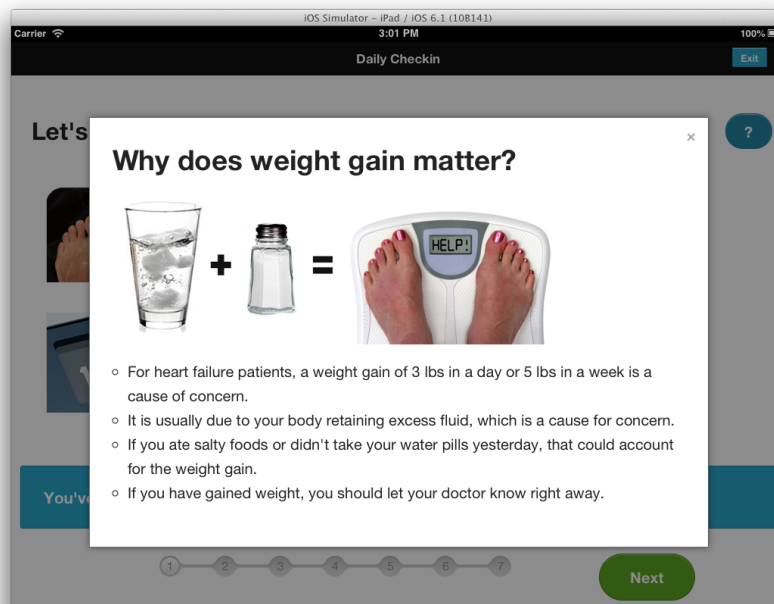
There are 7 steps in total for the check-in process, and each step is clearly indicated by a progress bar on the bottom of the screen, so that Gertrude can always know where she is in the process.



The first step in the check-in flow is **getting the user's weight**. Weight is a critical measurement for HF patients because an increase in weight could mean that the body is retaining extra fluid and the patient's health is in danger. Gertrude simply needs to step on her smart scale, which will take her weight and communicate that to the table through bluetooth. She will be notified by both sound and screen display when the weight is registered.



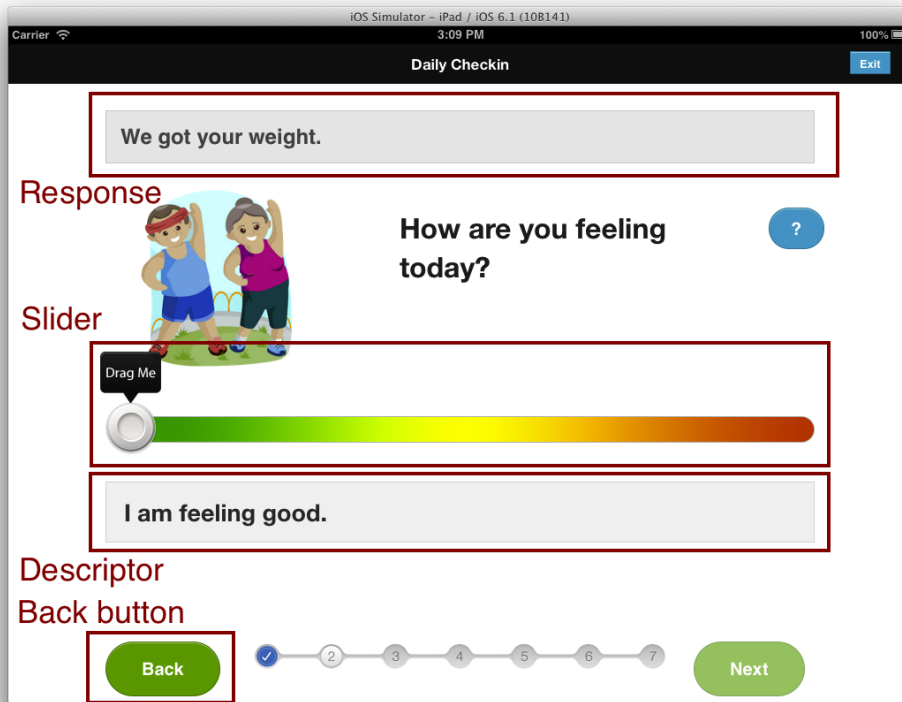
We embedded the question mark buttons in almost every screen to provide instant help and additional information to the user if she is interested. In this case, we reveal to Gertrude why keeping track of weight is important. Embedding extra knowledge in this way gives those who are curious to learn the opportunity to do so, yet is not distracting to those who are not interested in learning more.



Even though taking the weight is the first step in the check-in flow, we do not intend the design to be too rigid. For example, Gertrude can step on the scale without interacting with her tablet, the scale tells her that the weight is taken, then she goes to do something else before doing her check-in on our app. We specifically designed for this situation, which we believe will not be unusual in the real setting of a patient's day-to-day life. In this case, the tablet syncs the data collected by the scale and upon starting her check-in, Gertrude will be directed directly to the second screen, with the below message greeting her.

Looks like you've already been on the scale today. You've gained 3 lbs since yesterday. You now weigh 138lb. [Retake](#)

The 2nd screen is measuring the **feeling** of the patient, which assesses Gertrude's overall well-being. It is an important metric based on the QoL research.



There is a response panel at the top of the screen, which interacts with Gertrude in the form of conversation. Any feedback from the previous screen is repeated in this panel. A slider bar is how the user indicates the degree of severity of their symptoms. We carefully considered how this information should be input, and believe the slider is a good interaction strategy to use on a tablet. It is easy for the patient to use, and it maps to the mental model of the user. The left corresponds to the good extreme, while the right corresponds to the bad extreme. The good to bad transition is also shown using the gradient colors. A tooltip that says “Drag me” floats on top of the button, giving a hint to the user. The button is also enlarged to make the interaction easier.

There are four levels that can be indicated by the slider. For this first question they are “I am feeling good”, “I am feeling a little tired”, “I am feeling very tired”, and “I am feeling exhausted”. These levels are displayed in the descriptor panel below the slider. These phrases demonstrate to Gertrude what verbiage to use to describe her symptoms and conditions. As Gertrude drags on the slider, the corresponding phrase will appear below to clearly indicate the response she is inputting. This interaction is simple, elegant, and effective.

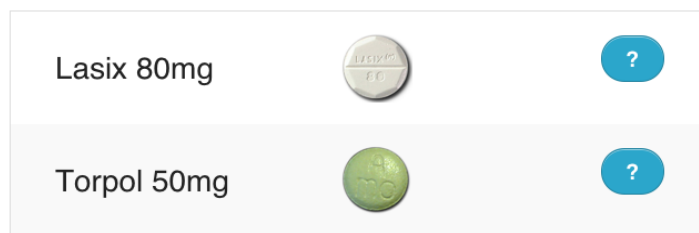
Each screen has a “?” button where the user can go if they want more information about the subject of that screen. The user can also “exit” out of any screen in case something comes up

which requires them to quickly shift their attention to something else. We put this in because we heard from users that they do need the flexibility to come back to a check-in process later.

The next 2 screens instruct Gertrude to check her **swelling** and **breathing**, both of which are important measurements to collect from our research. These screens follow the same design as the Feeling screen. Walking through these questions educates Gertrude on what symptoms she should pay attention to, knowledge that is retained when she is no longer using the system.

The 5th step is the **medication** screen. Research shows that patients often forget to take their medication or confuse dosage and prescriptions, which then leads to hospital readmission. The ability to know what medications the patient has actually taken in real-time is the core differentiator of Our Sponsor's technology, and our design integrates that by assuming the pills have the sensors embedded in them. Our design also assumes the system is aware of what the patient should be taking, so it's possible to provide real-time reminders to the patients.

You still need to take a couple of pills this morning.



Even if Gertrude chooses to bypass this screen, the reminders will be available on her home screen. If she exits out of the application completely, we still push alerts to her to remind her.



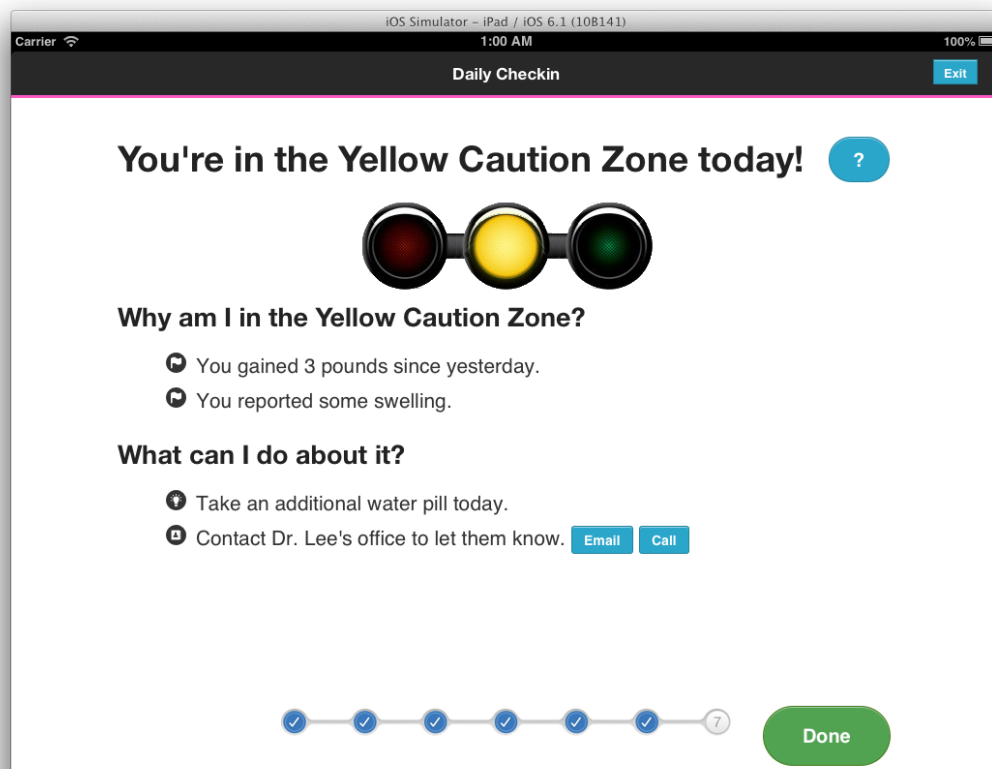
On the medication screen, there is an information popup for each prescription that has not yet been detected. Both our primary and secondary research identified that the lack of understanding about what a particular medication does hugely impacts how regularly people

take that medication. Providing the drug information here not only serves an educational purpose, but also assures Gertrude to take the pill.

The 6th step in the check-in is a one-question quiz. The goal of the quiz is not so much to assess the patient's understanding of their medical questions (although it could help gauge their knowledge level as well), but to provide another small "nugget" education and teach back. We imagine the quiz would have a different question each day except for occasionally repeating ones they got wrong to see if they are learning. The quiz could ask many different questions related to medicine, health, heart failure, and diet. Through responding to the questions, the patient learns a little bit more about staying healthy each day. Small amounts are a behavioral change requisite, and having to respond to the quiz is a way of teach back.

The last screen is a **report**, which summarizes the status that Gertrude is currently in after analyzing the inputs she entered in previous screens. Her status is indicated by a zone color. Gertrude could end up in one of 3 zones:

- Green, meaning she is doing well,
- Yellow, meaning that she needs to take caution, or
- Red, meaning she is in an emergency state and should visit the hospital immediately.



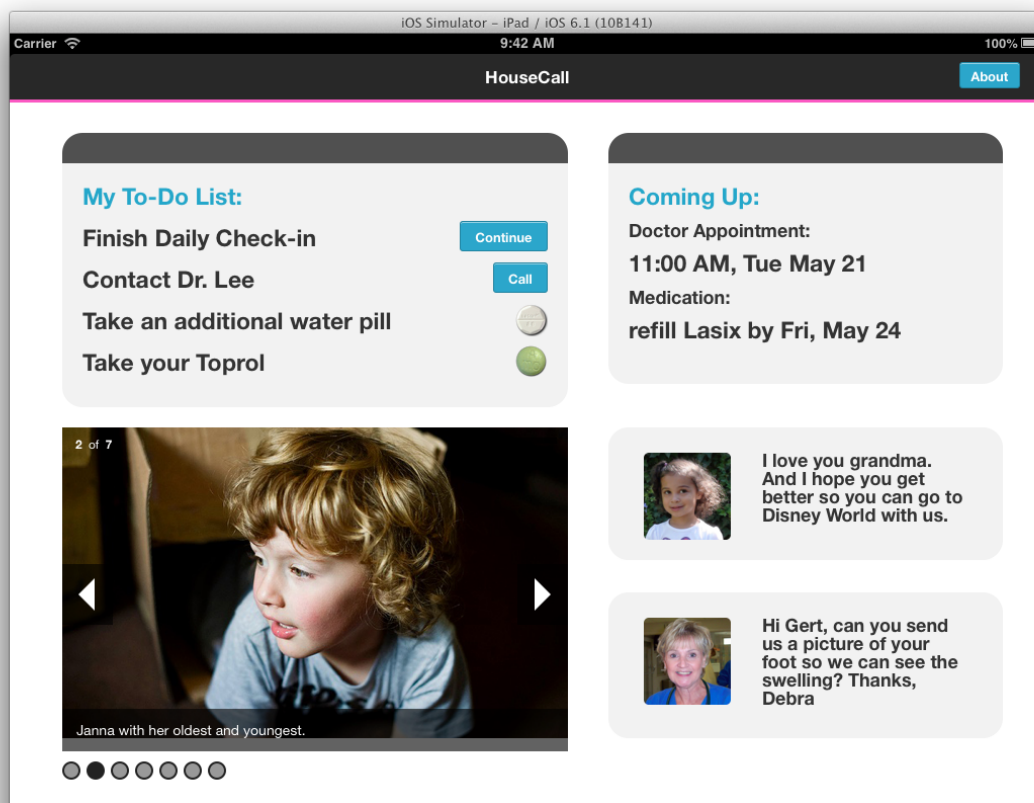
Our app further explains to Gertrude why she is in the zone and what she can do about it. Because of her weight increase and swelling, the system diagnoses that she has additional fluid

in her body. Because Gertrude's physician trusts her ability to self manage, she also put a rule into the system so that when there is a 3 pound weight gain, the patient should take an additional dose of diuretics and call the doctor as a precaution. Our design is meant to be flexible and reflect the wishes of the patient's doctor. As some doctors would not want their patients to self-titrate, they simply do not have to put in that rule and can opt to, for example, have a nurse call the patient whenever there is a 3 pound gain overnight.

After tapping on Done, Gertrude is redirected to the home screen.

Home Screen

The home screen is where Gertrude can find all her reminders and appointments. Let us walk through her screen.



She has a to-do list which spells out all the reminders. For example, if she left in the middle of the check-in, or if she needs still has medicine to take (especially if she has medicine prescribed to be taken in the afternoon and she is using her tablet in the afternoon).

Gertrude also see a few upcoming events on the screen. Remembering medical appointments is a big thing for our interviewees, which can be easily displayed on the home screen together

with weather forecast. She can see what medicine needs to be refilled soon, because the amount of remaining medicine is calculable. This inspiration is drawn from one of our interviewees who mentioned a case when he forgot to refill his medicine and missed it for the day.

The home screen also displays a slideshow of family pictures. Through our interviews we realize that families and friends are a major reason that keeps the patient going. One of our interviewees who owns an iPad loves showing us his family pictures. We believe having the pictures on the home screen provides a personal and warm touch to the app.

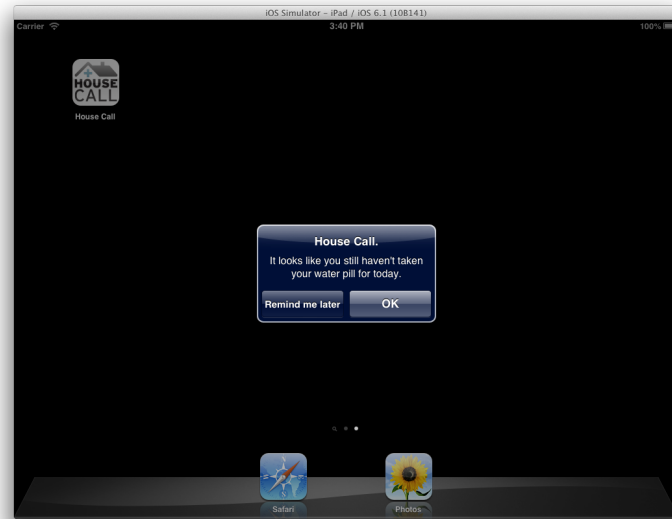
Gertrude also sees messages directed to her on the home screen. Shown in the example, her granddaughter sends her a message. Family members know that completing the check-in is important for Gertrude's health, and they send surprises to her through the app as a motivation for her to use it more often. Both research and our own understanding direct us to involve a wider circle of family and friends to help the patient get better.

Gertrude receives messages from her nurse and doctor as well. For example, since she indicated swelling in the check-in on the day before, her nurse wants to check with her. Without having to go to the hospital, Gertrude can take a picture of her foot and send it over.

Other Features

We found in our interviews that if people use HouseCall, they would want to make full use of the tablet as well. When asked whether she would participate in a program like this, one interviewee said that she would if she gets to keep the tablet and play with it. One patient in his thirties already owns a smartphone, while another older patient loves to browse his family photos and play games on his iPad. We believe that, instead of restricting the use of a fully functional tablet to just the application, providers should encourage the patients to explore and achieve more on the tablet. The more engaged the user is with this technology, the user is more likely to be comfortable using HouseCall.

For this reason we designed alerts that take place outside of the application as nudges to behavioral change. For example, if Gertrude forgot to take the diuretics but is playing with the tablet at home, she can be reminded of her missing medication.

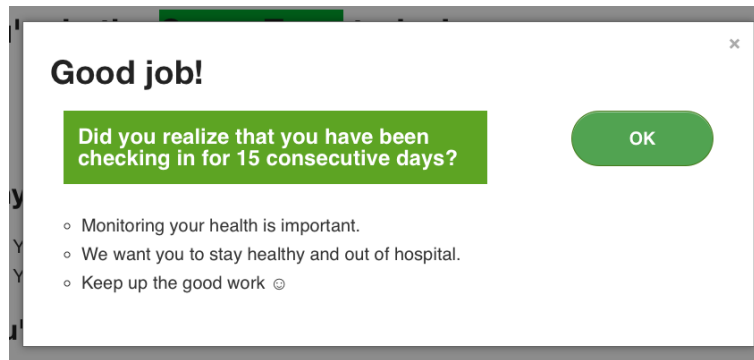


The other example is a nudge to let the patients go exercise. Our research shows that although light exercises can be beneficial to HF patients, exercising can also be hard for them; even those who are physically capable don't get enough exercises. In our design, the app knows the city Gertrude is in and the current weather. The patch also sends Gertrude's activity levels to the tablet, which will then recommend Gertrude to go for a walk when it is nice outside and she has been sedentary for a while.



This illustrates that as Gertrude spends more time with her tablet even outside the app itself, she actually gets reminders regarding her condition.

We have also designed nudges that give user feedback and comments to interact with the user and give positive reinforcement. For example, after constant checking in for 15 consecutive days and having no symptoms, HouseCall would congratulate the user. Although seemingly simple, our interviewees have been delighted by them and expressed approval of the messages.



Challenges

Throughout the research and design process we have encountered a few challenges.

As motivated as we are in the subject area, we are not graduating with a degree in medicine. Understanding the medical side of the design was challenging for us. We learned about the basics of heart failure reading materials online. We also gained some knowledge through Our Sponsor. We then reached out to hospitals and healthcare providers who have heart failure programs and/or are known for using advanced technology in healthcare. A lot of them kindly got back to us and agreed to talk to us. They also gave us valuable pointers to articles in the literature as well as additional references we could talk to. More interestingly we find design opportunities based on that domain knowledge.

We also had difficulty recruiting for HF patients to interview and do usability testing with. Eventually through our advertising effort we managed to get in touch with a very diverse set of interviewees.

Designing for a non-tech-savvy population was also another challenge. A lot of them are also older, have poor vision, and could have difficulty operating on a tablet. Through usability testing we identified many areas for improvements. We consider our end design with large buttons and big fonts is clean and easy-to-use. Help is also everywhere in the design, so the user should be able to feel support throughout using the app.

Future Considerations

We mean to treat this version of HouseCall as a minimum viable product. For its simplicity we hope it would gain traction in the market and achieve critical mass. Meanwhile, during our prototyping activities we have considered a few extra features which we later eliminated. We present those features in this section.

Point system

We designed a point system in order to encourage more usage of the app and award patients who have been taking good care of themselves. Below are some examples where points can be earned:

- First 7 check-ins
- 15 Consecutive check-ins
- Weight becomes under control because of successful titration
- Quiz is answered correctly

The points can be a status statement with which users can show off, especially after the system has gained critical mass and more social features are enabled. The points can also be a way to track one's progress.

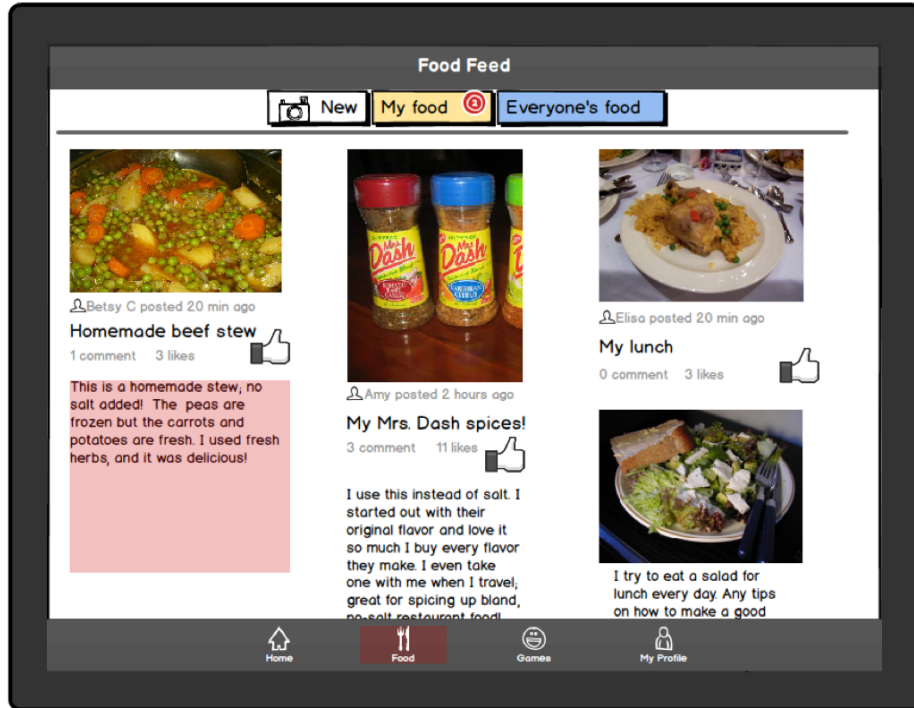
The points can also be redeemed for rewards. For example, 1,000 points can be redeemed to a \$50 gift card to congratulate and further promote the patient for making progress. We envision that insurance companies could pay for these amounts. A lot of these patients are retired and/or under financial stress, and they express that they would really engage with the system if they could get cash awards through the process. Insurance companies on the other hand save a large amount of money if the patients keep their condition under control and stay out of hospitals.

We were eventually unsure about how the point system would pan out, and we want to see if non-monetary awards could achieve the same effect. We would want to see how family photos and messages play out first. We also consulted with BJ Fogg, the behavioral scientist, and were advised to avoid the point system in our first version.

Social component

Our research shows that HF is a socially isolating disease. Elderly patients can be constrained at their homes. We wanted to deliver a social feature in our design to provide more support to our users. One way we thought of doing so is through a food module, as shown in the mock up below. Users can post pictures of their food, share recipes, and comment on each other's food giving nutritional advices.

We received mixed feedback about this component. Some patients express enthusiasm but some say that it would really have to be "fun" before they want to use it. We decided to leave this component out of our initial version since we would need a critical mass before this feature can really become functional.



Blood pressure measurement

Our research suggests that measuring and monitoring blood pressure would be useful for managing any heart conditions, including heart failure. We feel the blood pressure monitor is easy to include in the design in the future, and it would function just like the weight scale.

Smartwatch

Providing feedback is important in our design. One additional way to add to our feedback loop which we brainstormed and designed about is the smartwatch idea. We cannot expect the patient to always stay indoor and there are cases where a wearable smartwatch would be valuable. For example, over-exercising for HF patients is detrimental to their health. With a smartwatch, the high activity level can be detected in real time (from the wearable patch) and the patient can be alerted to take a rest when the heart rate is too high. The scenario is illustrated in the storyboard below. Other alerts and reminders can also be included in the watch.



Conclusion

Heart failure is a dreadful condition that impacts millions of people. Heart failure patients unfortunately have a high rate of readmission back into the hospitals, which causes a big financial drain on Medicare.

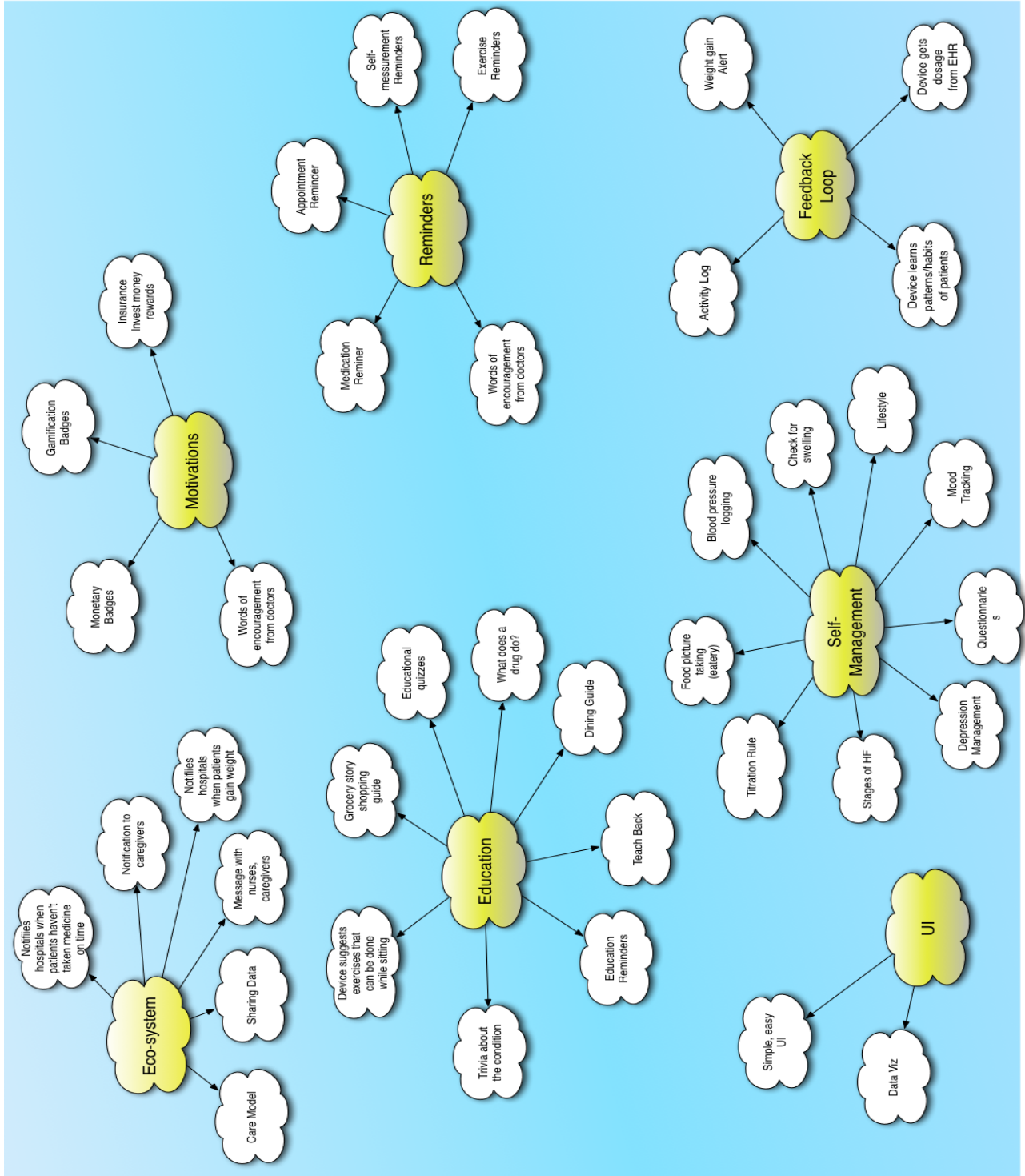
In this project we explored the readmission issue of heart failure patients by use of a combination of sensor technologies. After secondary research on medical literature and primary research with medical professionals and heart failure patients, we designed a simple, easy-to-use solution for the patient population. The design consists of a solid daily check-in process and a home screen where important reminders can be found. We embedded education opportunities and help information throughout the design.

Acknowledgements

First, we would like to thank everyone who works in the medical field and has generously given us valuable knowledge, comments and recommendations. We thank all our interviewees who have agreed to talk to us and provide feedback and criticism on our designs. We are grateful to Our Sponsor, who has offered advice, commentaries, and financial compensation for interviews throughout the project. Our gratitude goes out to our advisor, Tapan Parikh, for his support and guidance. Last, we thank our classmates at the I School who have provided us with useful feedback on our design.

Appendices

Affinity diagram



Interview flyers



Do you have a chronic heart or health condition? \$50 for an interview!

UC Berkeley graduate students are developing new tools for people with chronic conditions and want to learn more about how people manage their chronic health problems. If you are willing to share your story, we'd like to hear from you!

The interviews will last up to 90 minutes and be held at the North Oakland Senior Center.

Recruiting until April 30, 2013.

email: heartproblemstudy@gmail.com

or call: (415)378-9092

\$50 for interview! 415.378.9092
or heartproblemstudy@gmail.com

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or heartproblemstudy@gmail.com

Heart failure patients: \$50 for an interview!

UC Berkeley graduate students are developing digital tools for managing heart failure and want to better understand what it's like to live with it. We are seeking a few people for 90-minute in-home interviews.

If you are interested or know someone who is, please email heartproblemstudy@gmail.com or call (415) 378-9092

★ \$50 for interview if have chronic heart condition (SF Bay Area)

Hi! We're graduate students at UC Berkeley doing research for our thesis and are offering \$50 for in-home interviews with people over 55 who are living with a chronic heart condition. We want to better understand the impact having and managing the condition has on your lifestyle; we are exploring ways technology can be used to improve it.

If you would be willing to talk with us, please email us and tell us what your diagnosis is, how long you've had it, and anything else you think is relevant for us to know. If selected, the interview will last 60-90 minutes and you will be compensated \$50 for your participation. All your information will be kept completely confidential.

Thanks very much for your interest in our project!

- Location: SF Bay Area
- it's NOT ok to contact this poster with services or other commercial interests
- Compensation: no pay

Posting ID: 3711148018

Posted: 2013-04-15, 1:41PM PDT

Edited: 2013-05-05, 7:34PM PDT

[email to a friend](#)

Interview questions

GENERAL BACKGROUND, THEIR UNDERSTANDING OF HF

- Tell us about how you were diagnosed with heart failure.
- Have you been to the hospital for your heart failure? If so tell us about that visit.
- How would you describe what heart failure is? (trying to get at their mental model of disease)
- Did your lifestyle change in any way after you were diagnosed? If so, how?
- When you were diagnosed, did they suggest that you do anything different to take care of yourself?
- If you were talking with a friend who'd recently been diagnosed, what would you advise them to do to manage it?
- Are there any other health issues that you are dealing with? If so, what are you doing to manage them? Which are more bothersome to you, that or HF?
- Is there anybody that helps you with your HF, like someone that takes you to the doctor or grocery store, or does things for you that you can't do anymore? If so, tell us more about them and your relationship with them. If not, what kind of assistance would be of most use to you?

THEIR OWN SELF CARE

- On a scale of 1 to 10, how good would you say you are at managing your HF? (1 = very bad, 10= very good)
- What do you do now to manage your HF? Tell us when you do them, and how you remember to do them (how is HF self-management integrated into their life? Associated with other things?)
- What things do you do for your heart failure that are the easier ones to do? Which are the harder ones?
- Do you take water pills for your HF? If so, do they have any side effects? If they have side effects, do they impact your activity? Do you know what they do? (why prescribed; do they understand it's related to salt intake)
- Do you ever forget to take your pills? Do you ever choose to not take them, because of their side effects or some other reason? How do you remember to take your pills?

- Do you eat any differently than before you had HF? If so, what do you do differently? (do they know about watching salt, how much do they know)

- Did the doctors suggest you make any changes to your diet after you were diagnosed? If so, what did they tell you to do?

- Did they suggest you keep track of your weight? If so, do you (and how do they)? How often do you weigh yourself? What do you do when you see you've gained a couple pounds?

MEDICAL OVERSIGHT

- When was the last time you went to the doctor for your heart failure? What did they tell you about your HF? (were you doing worse, better?)

- Was that feedback surprising to you? If so, why?

- Are there things the doctors/nurses want you to do that you don't like doing, or don't do?

- How often do you hear from the nurses? Do they call you regularly? What do they want to know, and what do they tell you?

- What kind of things do you wish the hospital + doctors could do better?

TECHNOLOGY

- Do you have a cell phone? If so what kind?

- Do you have a land line?

- Do you have an email address? If so, where / how often do you check it?

- Do you have a computer at home?

- How computer savvy would you say you are?

- (explain system in a basic way) If your doctor wanted you to use this system, and it included a patch you wear on your stomach and a tablet to look at the data, and could track your pills, and it didn't cost you anything, is this something you'd be interested in?

- Would you have any interest in looking at data about your activity? what kind of information would be useful to use?

ADDITIONAL:

- would you play games? (do you play any games now?)

- badges?

- how motivating would awards of cash be?

- what kind of metrics would you want to see on a watch?

- have you ever used a pedometer?

Interview consent forms

Heart Failure Research Interview Consent Form

We are a group of graduate students from the UC Berkeley School of Information exploring how sensor technology can be used to support a healthier life for heart failure patients. This project is being done for our thesis and will conclude May 2013.

As an interview subject, we are asking you to discuss your experience as a heart failure patient with us as honestly as possible. This will allow us to design a solution that takes into account the realities of living with heart failure. The interview will last up to 90 minutes and will be audio recorded. Your participation is completely voluntary and anonymous and your name or identity will never be linked to any information we glean from the interview. The transcripts and audio recording from the interview may be excerpted for the purpose of explaining our findings to interested parties, but your individual identity will remain anonymous. Upon completion of the interview you will be compensated with a \$50 gift card that can be used any place that accepts credit cards.

Statement of Consent

I have read the above information, and received answers to any questions I asked. I consent to take part in the study.

Your Signature: _____

Date: _____

Your Name (printed): _____

Interest in Further Participation

I am willing to be contacted again for the purpose of providing feedback on a prototype. I understand that I will receive additional compensation for this.

Your Signature: _____

Phone number: _____

Email address: _____


Scenarios

Day	Narration	Scene	Screen	Screen requirements
	Gertrude was recently released from the hospital...(background, context)			
Day 1	She does daily check-in (need scale!), gets green zone	Shows her going through all check in, somewhere in house	Daily check-in	
	Because she's going out to lunch with friends, she chooses to not take her diuretics this morning.	Takes all medication except for diuretics	Medication	showing diuretics not taken
	She goes out to lunch with friends or grandchild. She had some really salty food			
	She comes back home	Sits on couch, (audio alert) walks over to the tablet, Checks on her tablet, see alert for missing medication	Home screen with alert	new alert: missing diuretics
	She takes the medicine	Takes the medicine	Home	Reminder goes away on home screen
Day 2	Gertrude has some breakfast, and takes weight	@kitchen, takes weight		
	Starts the daily checkin process for the day	@kitchen. check-in, already taken weight, jump to yellow zone screen	Daily check-in, "looks like you've already taken your weight for today"	
	report swelling in feet		Swelling screen	
	Read about yellow zone		yellow zone	Yellow zone because gained 3 lb
	She takes titrated medication because of yellow zone recommendation	She takes extra pill	yellow zone	
	The application knows it is sunny and warm outside, and Gertrude has not had much activity for the past few days. She was prompted to go for a walk	Sits in her couch, looks at the tablet.		Prompt: go for a walk and earn points?
Day 3	On day 3, Gertrude receives a message on her tablet to take a picture of her foot because of the swelling she reported yesterday	Looks at her tablet	Home screen, nurse message that asks about a foot picture	

	Takes picture	Takes picture of her foot		
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Heart failure zones

WHICH HEART FAILURE ZONE ARE YOU TODAY? Green, Yellow or Red



St. Mary's
Medical Center™
A Dignity Health Member

EVERY DAY

Weigh yourself in the morning before breakfast, write it down, compare to yesterday's weight. Is your weight up?
Take your medicine the way you should.
Check for swelling in your feet, ankles, legs & stomach... feeling bloated?
Eat low salt foods.
Limit fluids if recommended by your doctor.
Balance activity and rest periods.

GREEN

THIS ZONE IS YOUR GOAL!

Your symptoms are under control. You have:

- No weight gain.
- No shortness of breath.
- No swelling of your feet, ankles, legs or stomach.
- No chest pain.

YELLOW

CAUTION! THIS ZONE IS A WARNING!

Call your doctor if:

- Feeling uneasy, you know something is not right.
- You feel tired or more tired, have less energy.
- You have a weight gain of 3 pounds in 1 day or 5 or more pounds in 1 week.
- You have new or more shortness of breath.
- You have new or more swelling in your feet, ankles, legs or stomach, feel bloated or full.
- Dry hacky cough.
- Dizziness.
- It is harder for you to breathe when lying down.

RED

**EMERGENCY CALL 911
if you have ANY of the following**

- Unrelieved shortness of breath while sitting still.
- Struggling to breathe.
- Chest pain.
- You are confused or can't think clearly.