The Use of Design Thinking in MNCH Programs: A Case Study of the Care Community Hub (CCH) Pilot, Ghana

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Cover photo:
Community health nurses participating in a design workshop (Volta region, Ghana).
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Executive Summary

Responding to growing interest among designers, global health practitioners, and funders in understanding the potential benefits of applying design thinking methods and tools to solving complex social problems, the Innovations for Maternal, Newborn, and Child Health (MNCH) Initiative (*Innovations*) developed and piloted innovative interventions to address common barriers to improving the effectiveness of basic MNCH health services in low-resource settings. Central to the initiative's overall strategy was experimentation and learning related to the application of "design thinking," a form of inquiry that is applied in the conceptual stages of a planning process and subsequent stages of program or product development. In spite of increased reports of the use of design thinking in developing-country settings, there is little systematically documented evidence of the value of these approaches in the form of in-depth documentation or formal evaluations that link design thinking to health program performance or health outcomes. Moreover, there are few validated metrics to assess the effect of design thinking.

A fundamental rationale for the use of design thinking is that it provides important insights into user experience, needs, and desires and helps to translate these insights into tailored interventions or products, increasing the likelihood of user adoption and reducing the risk of intervention failure. This case study focuses on the use of design thinking in the Care Community Hub (CCH) pilot project that introduced *CHN on the Go,* a mobile phone application, to improve health worker motivation and job satisfaction among community health nurses (CHN) and their supervisors in Ghana. The research design used a mixed-methods, comparative case-study approach. We constructed research propositions to describe and explain the application and influence of design thinking in the CCH pilot and focused our research using the constructs of fit, uptake, buy-in, and ownership and the effectiveness of the *CHN on the Go* mobile phone app. We refined these propositions over time and, as data emerged, constructed a theoretical pathway to illustrate the influence of design thinking on this MNCH intervention. The in-depth study methodology was intentionally designed to be exploratory and analytical but not evaluative.

Description of Design Thinking in CCH

From October to December 2013, the CCH team introduced design thinking techniques to facilitate the development and refinement of the CCH pilot design. During this period, a professional designer from ThinkPlace, working with Grameen Foundation and Concern Worldwide team members, conducted formative design research and interactive workshops in Ghana that utilized design thinking methods (e.g., formative design research, nurse profiles, user personas, journey maps, and convergent and divergent thinking) to understand better the context in which CHNs lived and worked, gain insights into their workplace challenges, and highlight areas that could be addressed through the CCH intervention. The application of design thinking occurred in four phases: Intent, Enquiry & Insights, Explore & Innovate, and Formulate & Evaluate. The CCH team synthesized insights into CHN values, desires and needs into six opportunity spaces which became the six modules that comprised the *CHN on the Go* mobile app (Learning Center, Point of Care, Event Planner, Achievement Center, and Staying Well and WhatsApp). The pilot team tested and then adapted the modules based on user feedback and inspired by the empathy with CHNs. In the case of CCH, adaptation of the design of *CHN on the Go* continued beyond the initial planning phase with a smaller group of users through user testing and feedback

sessions. We describe the different steps and approaches applied during the design phase and document in detail program managers and designers experience with design thinking in CCH focusing the way in which design thinking provided essential framing and practical insights of the end users' experience; its role in developing empathy for end users among program staff; how it compares with other forms of program planning; and program staff's perceptions of the value and drawbacks of design.

The Influence of Design Thinking
To understand the influence of design thinking in CCH we constructed a theoretical pathway or grounded theory during the course of our analysis. In this pathway, we hypothesized that that through the application of design thinking, CCH achieved fit, meaning the pilot created an essential match between key strategies—mainly the focus and content of the mobile application—and many of the CHNs' needs, desires, and aspirations that related to job satisfaction and motivation. Fit then played a role in catalyzing uptake or adoption of the *CHN on the Go* app among CHNs – a critical program outcome. As the intervention was further refined with users through feedback loops and adaptation, it achieved an even tighter fit, which influenced continued acceptance of and increased commitment to using the *CHN on the* Go app. Throughout the pilot and during the endline study, CHNs described in detail the ways in which the app addressed many of the barriers to health worker motivation and job satisfaction uncovered during the design phase. Based on these observations, we conclude that design thinking worked alongside other program elements to contribute positively to the realization of pilot outcomes related to job satisfaction and health worker motivation. In the case study report we discuss and illustrate this pathway and provide a critical analysis of the added value and limitations of design thinking in the context of CCH.

Findings
Findings from the endline study of the effectiveness of CCH indicate high levels of adoption, sustained use, and satisfaction related to the *CHN on the GO* application among CHNs. The *CHN on the Go* app gained remarkable traction among the majority of the CHNs and supervisors over only an 18-month implementation period and became widely used. Among those surveyed, 94 percent of CHNs reported that the *CHN on the Go* app met their needs and half the CHNs reported using the app more than five times per week by the end of the pilot. The majority of CHNs interviewed for the endline survey noted that they would continue to use the phone and the app once the project finished.

With respect to reported health work motivation and job satisfaction among CHNs, direct reports from survey data indicated limited change from baseline values. Younger CHNs (< 30 years) reported only a 5 percent increase in job satisfaction, whereas older CHNs reported no change. Low levels of self-reported job satisfaction in the survey may stem from the challenge of conceptualizing the concepts of satisfaction and motivation among CHNs or the variety of workplace challenges or frustrations reported by the nurses that could not be addressed by a mobile phone application, including health worker compensation, opportunity for professional advancement, and access to resources. In contrast to the survey results, qualitative interviews with CHNs, indicate that *CHN on the Go* helped address many of the intrinsic and some extrinsic elements of health worker motivation assessed in the baseline survey and targeted in the pilot theory of change. Those included feelings about workload; CHN self-

confidence; CHN perceived respect and recognition by the community, supervisors, and peers; CHN feelings of connectedness, and job security. The link between use of *CHN on the Go* and reported changes in aspects of health worker job satisfaction and motivation were documented in both the process documentation conducted over the course of the pilot and in the qualitative data collected at the end of the pilot, providing a more complete picture of pilot performance than emerged from the endline survey of CHNs alone.

We observed that the high levels of uptake, appreciation, and use of *CHN on the* Go found in the endline survey and consistently reported in interviews with key informants were clearly linked to the learning and empathy that emerged from the initial design phase and the translation of this learning to an app that facilitated work tasks, enabled continued learning, provided a resource for service delivery, and built a supportive network for the CHNs. The design thinking experience also had a notable influence on the program staff who took part in the design phase and then went on to manage the pilot. Their continued commitment to the use of CHN- and supervisor-centered reflection and feedback loops to inform iteration of the content of the modules also helped the app gain a tighter and tighter fit with CHN needs and desires. Although user testing is common in software development, the Grameen team was especially dedicated to extending the design thinking ethos of codesign and iteration beyond the design phase, so that it became one of their major program strategies.

Design thinking influenced the CCH pilot in many positive ways, but we cannot conclude that design thinking was the sole driver of positive processes and outcomes of CCH. Other critical practices or strategies worked with design thinking to lay the foundation for an effective pilot intervention and for sustained interest and commitment among the nurses and supervisors for continuing to develop, extend, and support *CHN on the Go.* These included engaging GHS in the introduction and adaptation of the app, working closely with the GHS to make the app compatible with the GHS community health care protocols, linking the Learning Center module to the continuing education system and opportunities for CHN professional advancement, and taking important steps to get the smart phone hardware and software functioning effectively. In this sense, design thinking was a positive addition to the package of other equally important program implementation strategies.

Design thinking in the context of CCH was an effective strategy for gaining meaningful insights into the problem of health worker satisfaction and motivation, effectively tailoring interventions to address those needs, and promoting a culture of adaptation and learning with end users that contributed to a strong fit between the intervention and the end user needs, early and sustained uptake of the intervention, and program effectiveness.

1 Introduction

The Innovations for Maternal, Newborn, and Child Health (MNCH) Initiative (*Innovations*) developed and tested innovative interventions and strategies to address common barriers to improving the effectiveness of basic MNCH health services in low-resource settings. Central to the initiative's overall strategy was experimentation and learning related to the application of "design thinking" in MNCH programs. Design thinking is a methodology that designers use to solve complex problems and find desirable solutions for clients.[1] The *Innovations* Initiative responded to growing interest among designers, global health practitioners, and funders in understanding the potential benefits of applying design thinking methods and tools—normally reserved for developing and marketing products—to solving complex social problems, such as improving access to life-saving health services among women and children in the developing world (Brown and Wyatt 2010). In this social innovation space,[2] it is assumed that design thinking can enhance traditional public health planning and implementation strategies and thereby improve their effectiveness and the pace at which improvement takes place. Although there is a growing collection of experience in applying design thinking in global health in countries such as India (IDEO 2009), Uganda, Senegal (Fabricant, Milestone, and Qureshi 2014), and Nicaragua (Villa and Hammer 2013), there is a need for focused documentation and analysis of the practical challenges and benefits of the approach and evidence of its influence. In spite of increased reports of the use of design thinking in developing-country settings, there is little systematically documented evidence of the value of these approaches in the form of in-depth documentation or formal evaluations that link design thinking to health program performance or health outcomes. Moreover, there are few validated metrics to assess the effect of design thinking.

This case study focuses on the use of design thinking in the Care Community Hub (CCH) pilot project that designed and introduced a mobile phone application to improve health worker motivation and job satisfaction in community health services in Ghana. It documents and analyzes the application of design thinking methods and tools within the CCH pilot and its influence on problem definition, pilot design, implementation, and outcomes. Specifically, the case study examines the pathways through which the CCH intervention has succeeded or failed in achieving its objectives, focusing on the role that design thinking played at the different stages of the development and implementation of the intervention. This document presents one of four case studies of the Innovation Initiative's experience with design thinking. A companion document—a comparison of all four cases—analyzes the evolution of design thinking concepts in the *Innovations* Initiative and compares experience across all four cases to generate learning and stimulate discussion on the use of design thinking methods and tools in MNCH programs in

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[1] http://www.tonchevassociates.com/blog-bedford/2015/6/24/what-is-design-thinking
[2] For the purpose of this protocol, we define social innovation as: "The process of inventing, securing support for, and implementing novel solutions to social needs and problems."(Phillis et al. 2008)

different settings and for different purposes. The findings of the individual and comparative case studies are intended to inform future investment in design thinking in global health in developing country settings.

2 Design Thinking Defined

Design thinking is a form of inquiry that is applied in the conceptual stages of a planning process and subsequent stages of program or product development (Box 1). The process of design thinking is described as open-minded,[3] iterative, and human-centered and is intended to result in new, innovative, and groundbreaking solutions. It is used to help define problems from the user perspective, explore user needs and desires with respect to a particular issue or problem, and identify solutions to address those needs and desires. In the context of global health, design thinking is emerging as an approach to enhance the effectiveness of health program interventions. It helps to tailor program interventions to user needs and desires in order to improve the uptake and sustained use of health products, services, and behaviors. The application of design thinking methods and techniques is often referred to as human-centered design (HCD). For the purpose of this case study, we will use the term "design thinking" to describe the application of design thinking methods and tools in the CCH pilot.

Central to the design thinking approach is that designers gain insights into the lives of end users and other key actors to develop empathy for them. In CCH, end users were community health nurses (CHNs) in most cases; other key actors were mainly their supervisors. Empathy is defined in various ways,[4] including the image of "standing in the shoes of others." In the context of design thinking, it allows designers to "connect with people on a fundamental level" (Brown 2009). Empathy, Brown notes, is "the most important distinction between academic thinking [or modes of inquiry] and design thinking." Design thinking introduces techniques that build empathy in order to create emotional as well as practical links between designers and users and generate ideas or solutions that are readily taken up by users.

> **Box 1: Design thinking described**
>
> - "…an analytic and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback and redesign…"(Razzouk and Shute 2012)
> - " …a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success" (Brown 2009)
> - "Design thinking is a powerful approach to innovation that can be used to generate breakthrough ideas." *(Brown 2009)*
>
> **Characteristics of design thinking**
>
> - A human centered approach
> - A process of inquiry that involves divergent and convergent thinking
> - Iteration of ideas or designs to refine them before widespread use

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[3] i.e., receptive to new and different ideas or the opinions of others. (The American Heritage Dictionary of the English Language 2009)

[4] Cognitive empathy is understanding someone's thoughts and emotions, in a very rational, rather than emotional sense. Emotional empathy is also known as emotional contagion, and is 'catching' someone else's feelings, so that you literally feel them too.(http://www.skillsyouneed.com/ips/empathy.html)

Empathic understanding goes beyond knowledge: when empathising you do not judge, you "relate to [the user] and understand the situations and why certain experiences are meaningful to these people" (Battarbee 2004), a relation that involves an emotional connection (Battarbee and Koskinen 2005).

A second element of design thinking is the use of facilitation techniques to stimulate divergent thinking where possible by multidisciplinary teams to generate a wide range of possible ideas for addressing a particular challenge or complex problem, followed by convergent thinking to gradually eliminate options and integrate concepts such as viability and feasibility into the process of refining solutions.

Finally, design thinking often integrates the iteration of ideas and solutions on a small scale to test ideas and refine them with end users before introducing them on a wider scale. Iterative approaches, using co-creation or codesign techniques, often take the form of visualization and prototyping.[5] They are nonlinear and cyclical processes of design in which designers test designs, assess effectiveness, define lessons learned, and apply these lessons to refine the design and/or implementation over time. Feedback from stakeholders is used to create further iterations of the product/solution and to make designs more compelling for end users and programs more effective within their target populations (IDEO 2009), increasing the pace of uptake and reducing the risk of program failure.

Figure 1: **Overlapping lenses in design thinking**
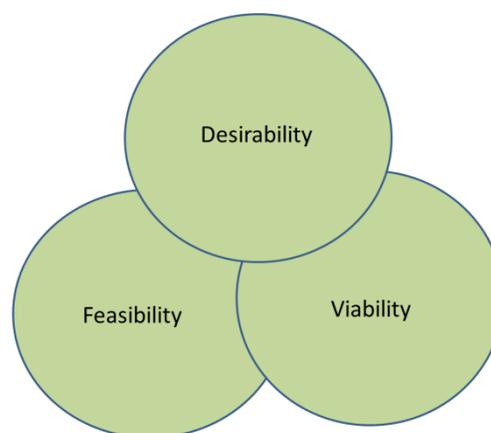
The use of design thinking at the early stages of programs represents a different approach to conceptualization and planning than is traditionally used in public health programming. Design theory, for example, notes that the design process often starts by using a "desirability lens" to examine the needs, desires, and behaviors of the people that designers want to affect with solutions. The desirability lens is used throughout the process and is critical to designers' developing and maintaining empathy for end users, which increases the likelihood of creating a solution that is responsive to unmet or latent user needs and desires. During the later phases of the process, designers bring in the "feasibility lens" and "viability lens" to refine their solutions based on financial, capacity, and other considerations. Figure 1 presents a conceptualization of the overlapping lenses of design thinking. For additional information on the practice of design thinking see Annex A.

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[5] Prototyping is the act of turning ideas into actual products, services, and systems that are then tested, iterated, and refined. It is an iterative technique for quickly testing a rough and low-cost version of a solution and using the test data to make improvements (Kasper and Clohesy 2008). Prototypes are disposable tools used throughout the concept development process to validate ideas, to help generate more ideas, and to help designers to think in realistic terms about how users would interact with the concept (IDEO 2009). Prototypes go through stages of testing, learning, and refining, inspired by a notion that it is acceptable to fail because failure moves one closer to a better design. As the project nears completion and heads toward real-world implementation, prototypes tend to increase from low fidelity to high fidelity.

3 Mapping the Influence of Design Thinking in MNCH Programs

The use of design thinking in MNCH programming is a new phenomenon with limited evidence or documentation of the way in which it is intended to affect the shape, execution, and outcome of MNCH programs. Thus, we found it necessary to construct research propositions (e.g., hypotheses) to describe and explain the application and influence of design thinking in the CCH pilot and to focus our research. We refined these propositions over time and, as data emerged, constructed a theoretical pathway to illustrate the influence of design thinking on MNCH programs. Below, we present our original research propositions and research focus. The pathway of the influence of design thinking in CCH is discussed in Section 7.

3.1 Research Propositions and Focus

The case study was guided by the following general research propositions (i.e. hypotheses) that focus on the application and influence of design thinking in MNCH programs. The concepts in these propositions were then adapted for specific use in the CCH case study (see Box 2, Section 7.2).

Research propositions

The application of design thinking methods and tools will:
- Create designer empathy for end users/target population
- Result in fit[6] of problem definition with target population/user desires, needs, and barriers related to MNCH programming
- Result in fit of MNCH intervention/pilot with target population/user desires, needs, and barriers related to MNCH programming
- Result in end user buy-in and sense of ownership of the MNCH intervention
- Increase the pace of uptake of the MNCH intervention
- Play an enabling/driving role in the achievement of pilot outcomes

These propositions translated into the following foci for data collection:
- **Application** of design thinking concepts, processes, methods, and tools to:
  - Problem definition
  - Solution identification
  - Intervention design
  - Implementation
  - Evaluation

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[6] For the purpose of this case study, "fit" is defined as: Program design addresses a need or desire of the CHN or supervisor identified through the application of design thinking to the program development. General definition of fit: of a suitable quality, standard, or type to meet the required purpose. Synonyms include reflects, corresponds to, mirrors, is tailored to, is responsive to, takes into account.

- **Translation** of results of application of design thinking concepts, processes, methods, and tools to:
    - Problem definition
    - Solution identification
    - Intervention design
    - Implementation

- **Effect** of applying design thinking with respect to:
    - Designer empathy for end user/target population
    - Fit of problem definition and intervention design with end user desires and needs and barriers to MNCH programming
    - Uptake of the intervention and pace of uptake
    - End user buy-in and sense of ownership of intervention/behavior
    - Achievement of pilot outcomes

- **Role of contextual factors** on the process and influence of design thinking

- **Lessons** from applying design thinking methods and tools

3.2 Methods

The research design for the design thinking exploration used a mixed-methods, comparative case-study approach, which enabled investigators to explore the application of design thinking in MNCH programming during the *Innovations* Initiative and its influences on MNCH programs in different settings. The CCH pilot intervention in Ghana constitutes a single case of applying design thinking in the context of MNCH programming. The CCH case was selected as one of four pilots implemented in the second phase of the *Innovations* Initiative (2012-2016).

3.3 Data Sources

To complete the case study on design thinking, the research team relied on several sources of primary and secondary data. We drew on 1. the primary data collected for routine pilot monitoring; 2. a rigorous program evaluation (baseline and endline studies) to measure the effectiveness of this innovative program model in improving health worker job satisfaction and motivation and in overcoming barriers that contribute to demotivation; and 3. process documentation, consisting of in-depth qualitative interviews during implementation to document and assess the proposed and actual pathways between program intervention and program effectiveness as proposed in the pilot's theory of change, and document, prospectively, the drivers of change. We also conducted separate and focused primary data collection at the same time as process documentation to document and explore the application and influence of design thinking methods and tools. In all cases, primary data on design thinking were collected using in-depth semistructured interviews, group discussion, and observation. Data collection included three rounds of interviews and observations beginning approximately six months after the initial design thinking activities took place (focusing on the application of design thinking), continuing one year into program implementation (focusing on the influence of design thinking), and ending 18

months into program implementation. In the first round, respondents included program managers, research advisors, and program and research implementers from all partner organizations (Concern Worldwide, JSI, Grameen Foundation, ILC Africa, and Ghana Health Service). In subsequent rounds, we interviewed the same respondents, as well as CHNs and supervisors participating in CCH. In some cases, repeat interviews were conducted with particular key informants to explore the effect of design thinking over time and the evolution of the perceptions of program managers and implementers on the role of design thinking. The team conducted 155 interviews, focus group discussions, and observations. The case study team also reviewed program-related documents, program monitoring data, and the findings of the final evaluation of CCH. The study teams consisted of Ghanaian and international researchers, the majority of whom collected data and conducted analysis in all three rounds of data collection.

3.4 Analysis
The case-study method derives its analytical power from sequential development of themes and theory that are generated from an immersion in the data. Thus, data analysis to describe and explore the application of design thinking in CCH took place in stages. After the first round of document review and data collection, researchers reviewed and synthesized interviews, reports, and graphic summaries of the design thinking activities; constructed a timeline of events; and produced a brief description of each activity. These detailed descriptions of the content and process of the design thinking activities helped define and bound the specific focus of this study of design thinking in CCH. The descriptions were shared with program staff and design professionals who were involved in the activities and who then verified their accuracy. These verified descriptions then constituted the key design thinking activities whose influence was explored through subsequent rounds of data collection.

As the data collection progressed (process documentation as well as case study–specific data collection), researchers employed NVivo 10 and 11 software (QSR International 2014) to code and sort qualitative data. Codes captured the perceptions of design thinking and the influence of design thinking on designers'/program managers' perceptions of the end users and their program design and management choices. Codes were also used to capture concepts such as the fit between end user needs and desires and program design elements and the extent to which the program as designed had its intended effect (end user uptake, buy-in, ownership). To ensure coding quality, in each round two team members coded the same 10 transcripts. Coders held frequent meetings to discuss coding patterns and used NVivo to check intercoder reliability coefficients.

To synthesize findings, we first identified common themes, forming initial theories and findings and generating additional questions, which were incorporated into the next round of data collection. Researchers refined codes with each iteration of the analysis. These codes were applied at each stage to identify the emergence of or absence of evidence of fit, uptake, buy-in, and ownership and changes in these variables over time and among intervention groups. We also continued to construct program timelines, define thematic grouping and classification of the data, and triangulate primary data with other sources noted above.

Following the second round of data collection, researchers used the emerging themes to begin to construct a grounded theory about the way in which design thinking was applied in CCH and influenced the pilot. This theoretical pathway helped the research team explore the relationship between the five elements of design thinking that were assessed in each round of data collection. The pathway was further refined with each subsequent round of data collection and completed once all the data were analyzed. We validated case study findings through discussions with CCH program managers and evaluation team members and by engaging the original design professional involved in CCH to reflect on and interpret the theoretical pathway, analysis, and conclusions.

3.5 Strengths and Limitations

Many reviews and evaluations of program experience in the health sector in low-resource settings use mixed methods to assess program outcomes and effectiveness, combining objective quantitative measures with qualitative exploration of implementation pathways to explain and explore aspects of program success or failure. The *Innovations* CCH case study is unique for the volume of data collected over time to understand the influence of design thinking in the pilot through a range of data sources. The mixed-methods approach enabled triangulation of results, and the extended time frame allowed researchers to explore nascent themes with key respondents and program managers as they emerged, confirming or adapting them as needed and integrating new questions into subsequent rounds of data collection. The second methodological strength of the study design was its focus on description and reflection of pilot experience with the use of design thinking across four programs. The ability to make explicit comparisons and contrasts among different experiences of design thinking found in each of the four *Innovations*' pilot during the research offered a strong methodological advantage over the use of a single case to reflect on experience.

There were limitations as well. The in-depth study methodology was intentionally designed to be exploratory and analytical but not evaluative. The findings should not be interpreted as a statement on the impact of design thinking, since we did not include a counterfactual or comparison case that implemented the same program without the use of design thinking. Still, the case-study methodology has uncovered information about the opportunities and challenges of applying design thinking in MNCH programming that may be relevant to other teams considering its use.

Finally, we were unable to sufficiently address a key research proposition—the influence of design thinking on the pace of uptake of the *CHN on the Go* application—because of the lack of reliable mobile phone application usage data. We were also limited in our ability to conduct in-depth analysis of all key contextual factors because of the sheer number and complexity of relationships, timing of events, and limited access to data.

3.6 Ethical Approval

Approval for this study was granted by the Ghana Ethics Review Committee (ID No. GHS-ERC: 07/09/13).

4 Care Community Hub Pilot Description

The Care Community Hub (CCH) was a pilot project that aimed to provide the government of Ghana with an innovative solution to address barriers to health worker motivation through the use of information and communications technology (ICT), specifically, through the development of a mobile phone application called *CHN on the Go*. In general, CCH sought to use a mobile technology application to provide knowledge, learning, decision support, and motivational and communication tools to community health nurses (CHNs) and community health officers (CHOs) who work in the Community-based Health Planning and Services (CHPS) system and subdistrict health centers in Ghana in order to improve health workers' well-being and connectedness and to decrease their feelings of demotivation. There was an unwritten desire that this intervention would in turn contribute to improved quality of care; however, no explicit steps were taken to focus the intervention beyond the improved job satisfaction and health worker motivation.

The initial CCH concept was defined in 2012 by the *Innovations* for MNCH project team, and in 2013 the implementing partner and intervention sites were chosen in collaboration with the funder and representatives of the Ghana Health Service (GHS). Project planning took place in early 2013 resulting in an inception report and a research monitoring and evaluation (RME) plan to guide the project management team and partners. To refine the project plan and in the spirit of innovation that defined the *Innovations* for MNCH Initiative, the project engaged a professional designer from ThinkPlace who worked with CHNs, supervisors, Grameen Foundation and Concern Worldwide program and technical staff, and district and regional health managers to apply human centered design and with digital technology staff to help shape the various aspects of the CCH intervention and specifically the mobile application that stood at the center of the pilot theory of change. The learning and experience that emerged from this four-month design phase were incorporated into the official project plan. Following the initial design phase, the Grameen Foundation team conducted 15 additional workshops between January and June 2014 to further refine and adapt the design with end user inputs. Through this process software developers built the *CHN on the Go* app and the app went through a series of adaptations and iterations drawing on data and information collected through feedback sessions with the CHNs. This additional engagement with CHNs and supervisors included a visual interaction design workshop with CHNs and supervisors to assist the software developers to define the user interface of the app. This workshop explored how the end user would move through each of the mobile application's five modules while using the application. Through the process of refining the Point of Care module, CHNs expressed that they wanted to be able to more easily move through the diagnostic protocols in this module without having to go step by step. They wanted to be able to jump to a particular point in the protocol in instances where the beginning portions were unnecessary. From this feedback, the team modified the module to allow CHNs to navigate the module more easily when dealing with their clients.

The mobile application *CHN on the Go* was launched in June 2014 in five rural districts in Ghana: Ada East, Ada West, and Ningo Pram districts in Greater Accra Region and South Tongu and South Dayi districts in Volta Region. The application consisted of five independent modules (Learning Center, Point of Care, Event Planner, Achievement Center, and Staying Well) and WhatsApp, a free Internet-based mobile messaging tool. The Learning Center enabled CHNs access to e-learning courses for various

topics such as newborn and infant care and family planning. Point of Care was designed to be an interactive diagnostic tool to help CHNs determine the best course of action for sick patients. It further provides CHNs with visual aids to show clients during counseling. The Event Planner helped CHNs plan their home visits, clinic outreach, etc., while the Achievement Center was created to help CHNs track their progress with individual targets related to their daily work. The Staying Well module was constructed to be the "stress relief" module, providing CHNs with inspirational material, personal wellness tips, and other nutrition and fitness recommendations. Lastly, WhatsApp, including the various groups that were formed, was used as a platform for CNHs to share ideas, thoughts, and challenges with peers, colleagues, and supervisors, facilitating easy communication with staff across each district.

There were five iterations of the *CHN on the Go* app over the course of the CCH pilot between the launch in June 2014 and the end of the pilot in May 2016. Version 1 included all six modules that emerged from the design thinking process with the basic content. In version 2, the team introduced target setting in the Event Planner module, updated graphics, added postnatal care quick reference content to the Point of Care module, and bolstered the content in the Staying Well module. Version 3 included a rebuilt Staying Well module that contained additional activities and content tailored to the user's personality. Version 4 included a revised Achievement Center module that added a feature focusing on target setting at the facility level. It also improved user ability to update events and added content and topics to the Learning Center. The fifth and final version of the app removed the Target Setting module and introduced a content management system for the Point of Care module that made the content dynamic and downloadable.

As the *CHN on the Go* app went through a series of iterations, drawing on data and information collected through feedback sessions with the CHNs as well as Magpi surveys, in-depth process documentation, and monitoring data to inform each adaptation and the program strategy. The pilot was completed in May 2016, after 23 months of implementation. Figure 2 maps the pilot timeline including changes made in the design of the pilot and the mobile application.

Figure 2: CCH pilot development and implementation timeline

Design process
(Oct 2013 – Jan 2014)

Version 1 of app deployed
(June 2014)

Version 3 deployed
(April 2015)

Version 5 deployed
and end of project
(May 2016)

Intent
Workshop

Ideation Workshop
Codesign Workshops
Concept Development
Workshop
Prototyping Workshop
Develop User
Stories, Pathways, &
Interaction Models

Development of
application and user testing
(March – June 2014)

Version 4 deployed
(Feb 2016)

Formative Research
Analysis & Synthesis
Workshops
Understanding the
System Workshop
Understanding the
User Workshop

Validation Workshops
Refine Blueprint

Version 2 deployed
(Nov 2014)

5 Description of the Application of Design Thinking in CCH

From October to December 2013, the CCH team introduced design thinking techniques to facilitate the development and refinement of the CCH pilot design (Figure 3). At various stages, this process engaged a range of pilot stakeholders from different teams and representing different disciplines: technology and public health experts from the Grameen Foundation, health program experts from Concern Worldwide, M&E experts from John Snow Inc., design experts from ThinkPlace, and the various beneficiaries, including CHNs, their supervisors, and staff from the district and regional levels of the GHS. During this period, a professional designer from ThinkPlace, working with Grameen Foundation and Concern Worldwide team members, conducted formative design research and interactive workshops in Ghana that utilized design thinking methods specifically to better understand the context in which CHNs live and work, gain insights into their workplace challenges, and highlight areas that could be addressed through the CCH intervention. In addition to the formative design research and exploration of CHN and supervisor needs, desires, and experiences, the team conducted a series of synthesis and ideation activities involving multiple stakeholders to refine the program design and to co-design[7] and test a mobile application to support health care workers by addressing barriers in their everyday work. Over 110 people took part in the research, design, testing, and build phases, including 60 CHNs, 12 nurse supervisors, 18 pregnant women and nursing mothers, and more than 20 stakeholders from the partner organizations (Alva, 2016). In all stages, the design thinking techniques aimed to generate empathy among program managers and software designers to engender deep understanding of the CHNs' situation and experience related to workplace motivation and job satisfaction. We describe below the specific activities that constituted the design thinking process in CCH and report the experience through the observations and perspective of the program managers and designers during this period.

The application of design thinking occurred in four phases: *Intent*, *Enquiry & Insights*, *Explore & Innovate*, and *Formulate & Evaluate*. Table 1 summarizes the design thinking activities, mapping out the purpose of each, the tools and methods used, intermediate findings, and the resulting design decisions. Each decision represents an adaptation or addition to the original program model. Annex B provides more details and visual outputs of the design thinking process at different stages, illustrating the ways in which design thinking helped program staff gain insights into user needs, desires, and experiences and shape these insights into design decisions.

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[7] Scrivener stresses that the term 'co-design' manages to set out a framework for debate, without constraining thinking into too narrow a mold: it is an 'umbrella term' covering both 'community design' and 'participatory design'.19 As such, co-design broadly refers to the effort to combine the views, input and skills of people with many different perspectives to address a specific problem.

**Figure 3: Timeline of application of design thinking in CCH**
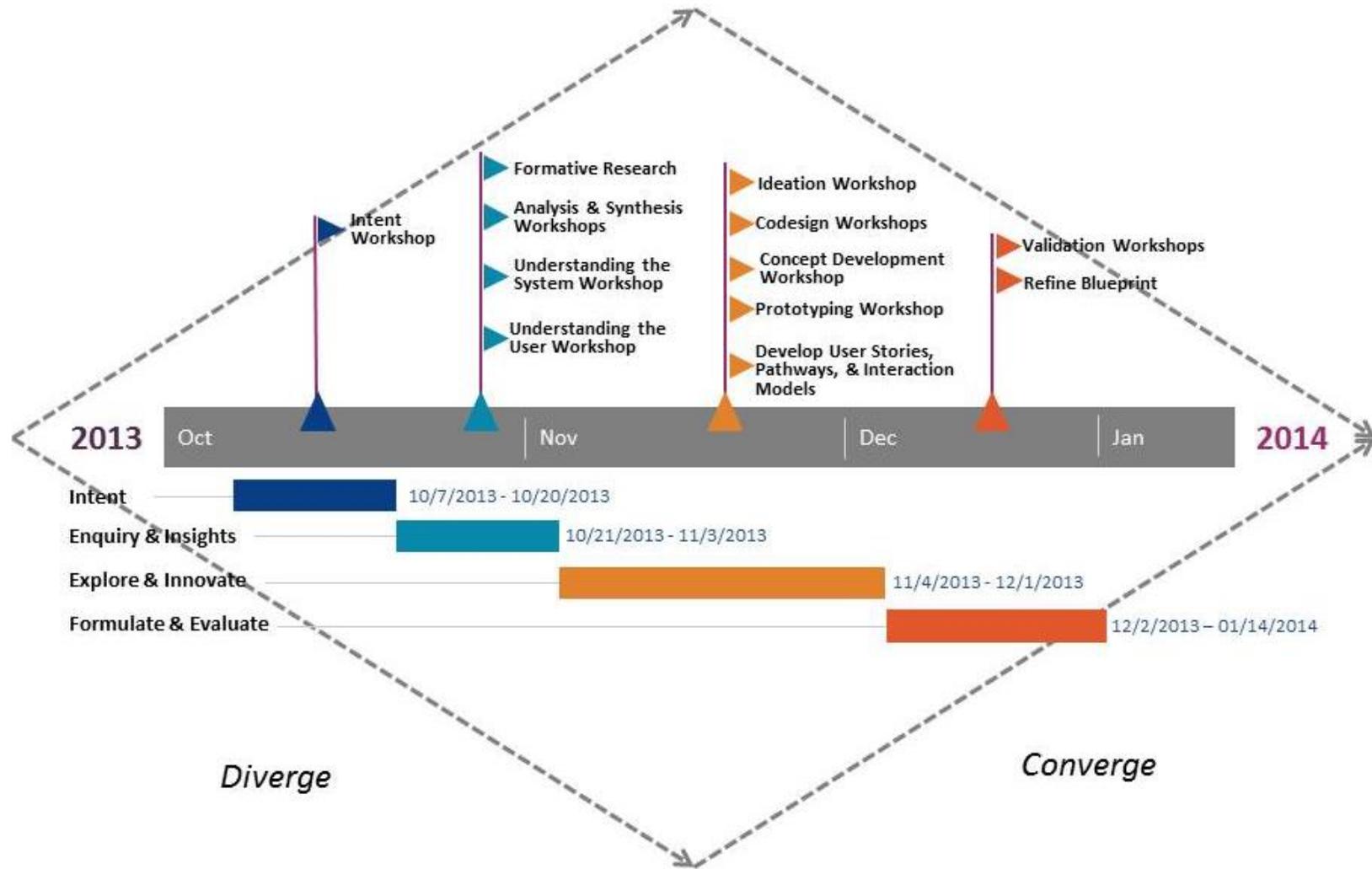
Table 1: Summary of application of design thinking tools and methods in the CCH pilot

Activity	Location	Participant Roles/ Organization	Purpose/ Goals	Tools/ Methods	Findings	Design Decisions	Time-line
Intent Workshop	Grameen Offices- Accra	ThinkPlace, Grameen, Concern	Determine the current state and define the desired future state and reach a shared understanding of the project's intent	• Intent statement tool: describe current and intended future state and hypotheses to accomplish desired outcomes	A short project initiation document was delivered to key stakeholders outlining the project activities, deliverables, and intent statement with the following outputs: Project intent statement, project timeline, project Scope	Intent Statement incorporating desired end state from all stakeholder perspectives	**Intent**
Formative Research	Facilities: Greater Accra & Volta Regions, Ghana	ThinkPlace, Grameen	Gain an understanding of the "users" and their experiences of the system	• One-on-one interviews with supervisors • Focus groups (clients & CHNs) • Process mapping (with CHNs) • Health worker profiles	There were 12 key areas of interest: respect, monitoring & supervision, clinical targets & performance, data & reporting, career progression, nurse training & mentoring, supervisor training & mentoring, recognition & appreciation, being connected, resource limitations, client & community relations, nurse drivers & roadblocks	Used the information to map out the system, the relationships between different players, segment users, and capture their lived experiences of the system.	**Enquiry & Insights**
Analysis and Synthesis Workshops (2)	Grameen Offices Accra La Villa Boutique Hotel Accra	ThinkPlace, Grameen ThinkPlace, Grameen, Concern	Synthesize field research and summarize key themes that emerged from the research. Bring all parties that didn't participate in field research up to speed on findings and empathy.	• Post-it note synthesis • Clustering • Harvesting	Top 5: drivers, barriers, most important things to nurses; identified 10-12 themes that emerged from the field research.		
Understanding the System Workshop	La Villa Boutique Hotel Accra	ThinkPlace, Grameen, Concern, nurses	Utilize the process and experience maps to understand the system from different perspectives of the generated personas	• Brainstorming • Process map review • Persona development	Brainstormed dozens of questions around how to improve the relationship between supervisors and nurses during supervisory visits	Developed challenge questions	
Understanding the User Workshop	La Villa Boutique Hotel Accra	ThinkPlace, Grameen, Concern, nurses	Work with nurses to see if they identified with the personas	• Empathy building • Brainstorming • Storyboards • Persona validation • Process mapping	Determined motivating factors for different health worker personalities	Health worker personas finalized to be used in ideation and concept development	
Ideation Workshop	La Villa Boutique Hotel Accra	ThinkPlace, Grameen, Concern, mHealth expert	Utilize challenge questions to generate solutions to challenges identified in formative research. Review and discuss potential mHealth solutions that exist	• Idea sheets • Iteration • Clustering • Harvesting • Score cards (for ranking)	Determined guiding principles and design criteria, refined emerging concepts, refined opportunity spaces	Identified 10 opportunity spaces, which could potentially be developed into application modules.	**Explore & Innovate**
Codesign Workshops (2)	La Villa Boutique Hotel Accra	ThinkPlace, Grameen, nurses, supervisors	Utilize the nurses and supervisors to help further develop, refine, and identify opportunity spaces	• Roleplaying • Scoring • Voting • Process mapping	Refined the 10 opportunity spaces to six	Nurses and supervisors validated personas and which of the 10 opportunity spaces to take forward, as well as providing input into ways to improve the ideas.	

Phase	Location	Participants	Objective	Tools	Insights	Outcomes	Stage
Concept Development Workshop	Mindindi Hotel Accra	ThinkPlace, Grameen, Concern, ILC, tech developers, mHealth NGOs, non-mHealth NGOs	Further develop the six opportunity spaces by utilizing the various perspectives brought to the table in order to assess the viability of the options	• Storytelling • Concept templates		Ultimately determined the modules that would be created for the application and outlined their content	**Explore & Innovate**
Prototyping Workshops	Mindindi Hotel Accra	ThinkPlace, Grameen, Concern, ILC, tech developers	List out all activities needed for each of the opportunity spaces to happen and get a sense of what will be realistic to build, technically and organizationally.	• User stories template	Modules needed to be scaled based on nurses' capacity to utilize them, as well as cost and resources required to build them	Decisions such as using the work planning calendar instead of a GPS component to track nurses' clients Developed a roadmap for developing the code, training, and deployment of the tool High-level work plan to move the project forward	
Develop User Stories, Pathways, and Interaction Models	Grameen Offices, Accra	ThinkPlace, Grameen, Concern	Synthesize information and outcomes from all of the workshops.	• Visualization			
Validation Workshops (2)	Mindindi Hotel Accra	ThinkPlace, Grameen, Concern, Ghana Health Service District and Regional Directors	Validate proposed intervention with GHS district and regional representatives. Ensure that they feel the intervention will work as proposed and they support the use of the CCH application among CHNs and supervisors.	• Storyboards	Supervisors need to be involved in this program as well. Animosity if nurses are getting smart phones and supervisors are not. Supervisors are older and generally less tech savvy.	Creation of a computer-based supervisory dashboard to accompany the CCH application	**Formulate & Evaluate**
Refine Blueprint	Nairobi, Kenya	ThinkPlace, Grameen	Flesh out details of application content so that document could be used by Grameen to start building the application to incorporate information generated by the design process				

5.1 Intent

At the beginning of the design process, the designer facilitated an *Intent Workshop* to frame the main objective for the project focusing on assessing the current state, formulating a shared understanding of the future desired state, and hypothesizing the desired outcomes. At this workshop, the participants created an "Intent Statement"[8] that served as an anchor to ensure that the pilot remained on track to achieve the intended goals through the course of the design process. The Intent Statement was further refined through the design process and the final statement and guided programmatic decisions through the course of the pilot.

> Intent Statement: To enable a more motivated frontline health workforce, resulting in better quality of maternal and child health care for rural women in Ghana through a mobile technology innovation

5.2 Enquiry & Insights

Following the Intent phase, insights were gleaned and empathy was evoked through a process of formative design research. This step helped the design team put themselves in the shoes of the nurses when they are providing care at the community level. The team collected nurses' personal stories prompted by a storyboard template they could fill out, completing phrases such as: "A time I felt most satisfied in my work was when …" or "A time I felt most frustrated in my work was when …." The team then used these stories as a launching pad for discussions in focus group discussions and individual interviews. They also provided the nurses with a "nurse profile" template asking them to list their professional goals, personal aspirations, and the roadblocks or barriers they faced to achieving their goals. These stories, which captured the language of the nurses, kept the project team grounded in the words of the CHNs during the subsequent steps of analysis and decisionmaking.

Several design decisions for the CCH intervention emerged from the following key areas of interest that became the focus of the Explore & Innovate phase of the intervention development: respect, monitoring and supervision, clinical targets and performance, data and reporting, mentoring, supervisor training and mentoring, recognition and appreciation, being connected, resource limitations, client and community relations, and nurse drivers and barriers. Figure 4 illustrates the consolidated areas of interest related to CHNs that emerged from the formative design research.

Based on the learning during the formative design research, it became clear that CHNs faced challenges with career advancement and desired opportunities to advance their skills through further education and training. CHNs also expressed a desire to receive feedback and encouragement on their performance and to connect and collaborate with other health care providers. Additionally, because many of the CHNs were posted to communities where they did not have social connections, they indicated the need to relax and decompress from their work life to reduce stress. CHNs were also concerned about interacting productively with their communities and clients. They expressed a need for

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[8] An Intent Statement is a term coined by ThinkPlace and is akin to a purpose/outcome statement

help in planning their daily interactions and ensuring that clients are available when they make home visits.

Finally, CHNs expressed a strong desire to provide good care to their clients and for tools that could aid them in diagnostics, treatment, and counseling.

Figure 4: Main findings from the formative design research

RESPECT ME
- Enabling nurses to feel respected by their peers, supervisors and in their communities
- Setting appropriate and achievable targets that are reflective of what is happening on the ground in communities

REWARD ME
- Using data-based evidence for appreciating nurses and supervisors rather than enabling favouritism
- Showcasing the extent of nurse efforts, not just their clinical results, by tracking their movements and daily activities.

TEACH ME
- More in-depth, one-on-one supportive and facilitated supervision time for nurses
- More helpful feedback mechanisms for nurses following supervisory interactions
- Minimizing the wait time between supervisory interactions and feedback for nurses to improve themselves

INFORM ME
- Strengthening nurse knowledge and capacity at the frontline with easy access to relevant information and clinical support
- Stronger emphasis on data accuracy and integrity

CONNECT ME
- Building close, authentic and trusting relationships between nurses and clients
- Improving communication channels between nurses and supervisors
- More cooperative and less adversarial relationships between nurses and supervisors
- More peer-to-peer learning, sharing and collaboration among nurses
- Stronger engagement with communities and their volunteers

EQUIP ME
- Minimizing the time and human resources involved in data collection and analysis processes
- More strategic approach in identifying and caring for high priority cases
- More effective scheduling and coordination between nurses, their clients, community volunteers and supervisors
- Aiding supervisors in making informed decisions regarding the allocation of limited resources

INSPIRE ME
- Stronger resilience in the face of trouble and system challenges

BELIEVE IN ME
- Greater empathy and understanding among supervisors toward nurses and their challenges

Analysis and Synthesis Workshops followed the formative design research phase, during which the CCH team empathized with the end users by analyzing and summarizing the information from the stories and profiles, field interviews, and focus group discussions. The workshops were highly collaborative and interactive, designed to push boundaries and challenge participants in their thinking. From those workshops, the design team identified the main themes and key findings that would guide the development of the CCH intervention and *CHN on the Go* application. They also identified the top five motivators and demotivators for the CHNs. The team decided that they should not only focus on eliminating demotivating factors but should build upon and amplify existing motivating factors in order to produce a successful intervention.

Through *Understanding the System* and *Understanding the User Workshops*, the program staff and software developers took a deeper dive into nurses' stories, process maps (Figure 5) created during the formative design research, and other information gathered during the formative design research to better understand the barriers and enablers to CHN job satisfaction and motivation, as well as their pathways through different CHN tasks (home visits, supervision, group outreach). They immersed themselves in the findings and were prompted to experience the nurses' stories as "I" rather than "they," as they walked through the raw data posted on workshop walls, all of which helped them build empathy for the CHNs.

The team then created CHN personas to depict the intrinsic motivating factors that influenced the way in which CHNs approached their work. Personas are hypothetical archetypal users that represent the needs, goals, values, and behaviors of larger groups of users in a system.[9] By identifying human drivers of motivation, personas bring users to life by giving each one a name, personality, and face. To develop personas, the group started with five or six distinctive common character traits of a CHN and clustered them based on the patterns that emerged from the CHN stories. This clustering resulted in three main CHN personas: Purpose-driven & Resilient (Naana), Purpose-driven & Dispirited (Mary), and Paycheck-driven & Dispirited (Michael) (Figure 6). In a later phase, the team walked several CHNs through each of the personas, and they validated them because they were able to identify with the resulting personalities. The team also developed personas for supervisors (see Annex B).

From reflecting on the experience maps and personas, the design team produced several "challenge questions" (i.e., posting questions such as "How might we…?") that were later used in the Explore & Innovate phase to provoke and generate ideas and steps for addressing the workplace challenges faced by CHNs.

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[9] Cooper, A. (1999) The inmates are running the asylum. Sams, Indianapolis. p124

Figure 5: Process map for routine home visits conducted by CHNs

USER RESEARCH PROCESS MAPPING

ROUTINE HOME VISIT
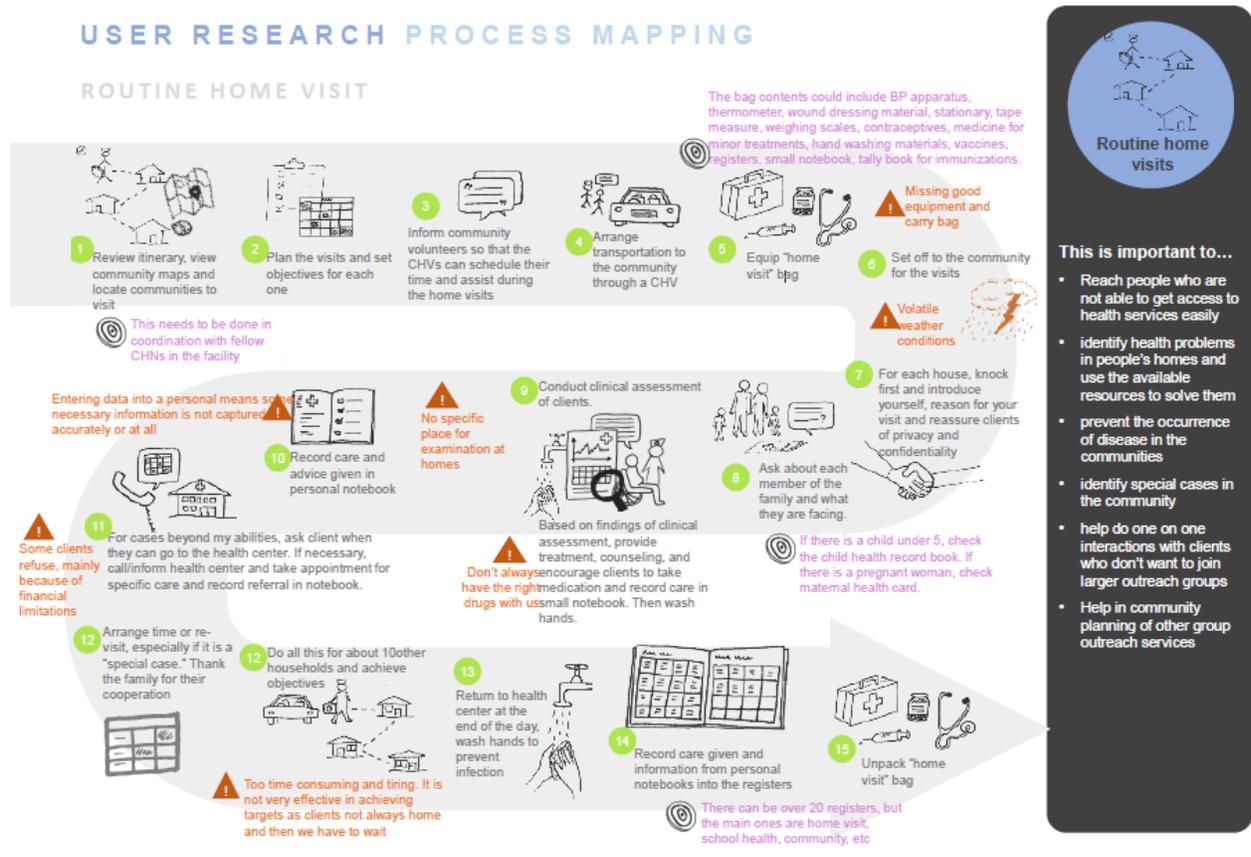
Source: ThinkPlace 2014

5.3 Explore & Innovate

In the next phase, the designer facilitated an *Ideation Workshop* to generate as many ideas as possible that were specifically focused on the use of mobile technology to address the desires, gaps, and barriers identified in the formative design research. These activities allowed the team to use the emerging themes that arose from the early stages as a launch pad. From a place of empathy, they were coached to think expansively (diverging) about the different approaches that fit with/determine the guiding principles and design criteria for the mobile technology intervention. Bounded by these parameters, the team then refined a list of 10 opportunity spaces (converging) (Figure 7), representing potential modules that could be taken forward to form the final *CHN on the Go* mobile application.

Figure 6: Three CHN user personas
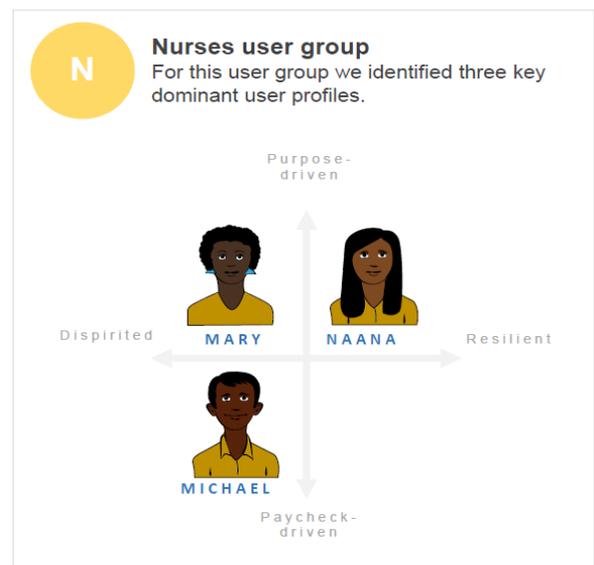
Source: ThinkPlace 2014

Figure 7: 10 opportunity spaces

1 THE LIVING MAP	2 POINT-OF-CARE SUPPORT	3 EDUCATION AND TRAINING	4 PERFORMANCE PARTNERSHIP	5 VALUE ME
6 COMMUNITY COLLABORATION	7 CLIENT EXPERIENCE LOOP	8 NURSE-TO-NURSE FELLOWSHIP	9 INSPIRING SELF-MOTIVATION	10 LIFE ASSIST

Source: ThinkPlace 2014

In order to incorporate design input from end users into the mobile app, the team held two *Co-Design Workshops* with CHNs and their supervisors. During these workshops the facilitators validated the CHN personas and used insights gleaned from these conversations to further consolidate the 10 opportunity spaces into six opportunity spaces: "learning and growing," "providing good care," "knowing how I am doing and feeling appreciated," "connecting with others," "managing my work," and "keeping well." Using the desirable, viable, possible model (an adaptation of Figure 1 above), the team zeroed in on the specific areas that could be addressed through the use of mobile technology. Three additional areas that they felt were instrumental to achieving the desired outcomes were considered beyond the scope of CCH and a mobile technology solution because they involved system-level interventions by the GHS.

During the *Concept Development Workshop*, the team then iterated on these six opportunity spaces and developed them into more robust concepts through small-group work to answer questions such as: What is the aim of each concept? How would each concept work in practice from the perspective of supervisor, client, GHS, nurse? How would each concept be experienced differently by the three distinct nurse personas? What are the technical functions required to make each concept work for the three personas?

Figure 8 illustrates the opportunities identified through the design thinking process. The final six opportunity spaces are depicted in color in the upper half of the circle. The spaces in gray in the lower half of the graphic represent areas that were important to CHN motivation but were beyond the scope of the CCH project.

As a next step, the designer facilitated a *Prototyping Workshop* to further assess the viability of the app by mapping out the technical requirements to build each module. From there the team began to assess the viability of each of the six opportunity spaces through using the agile software development method to create user stories.[10] These stories ultimately determined the various business requirements that sit within each module as part of the mobile app. This stage further helped the Grameen Foundation technology team create a framework for the application complete with the resources that would be required to build it.

Figure 8: Final opportunity spaces

This workshop also enabled the software developers to refine aspects of the mobile app such as language, look, and feel to reflect CHN and supervisor experience and perceptions. During this workshop, the team developed a high-level work plan for implementing the project. The work plan involved steps to further test and iterate on the design, develop and test the content, develop and test the software, develop and train the CHNs/supervisors, and introduce the application into existing GHS processes. This road-mapping activity allowed the team to cascade and prioritize certain activities or functions for app development. Additionally, the initial prototyping provided a foundation that helped developers to build the app infrastructure through wireframes that visualize the flow and process of engaging within the app from the perspective of the end users (CHNs).

Source: ThinkPlace 2014

5.4 Formulate & Evaluate
To integrate ideas and gain support from the GHS, the team then held *Validation Workshops* at both the district and regional levels. At these workshops the GHS participants verified that the initiative would be valuable and provided suggestions on ways to improve aspects of the app design and pilot execution. For example, the GHS participants felt that supervisors should be more involved in the pilot to reduce

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[10] In software development and product management, a user story is a description consisting of one or more sentences in the everyday or business language of the end user or user of a system that captures what a user does or needs to do as part of his or her job function. User stories are used with agile software development methodologies as the basis for defining the functions a business system must provide and to facilitate requirements management. It captures the "who", "what," and "why" of a requirement in a simple concise way, often limited in detail by what can be handwritten on a small paper notecard. (https://en.wikipedia.org/wiki/Userstory).

potential animosity among supervisors if they did not also receive smartphones. They also noted that the supervisors tended to be less technology savvy than the younger CHNs, which could pose problems related to uptake and consistent use of a mobile application. As a result, the Grameen Foundation team decided to include a computer-based supervisory dashboard to accompany the *CHN on the Go* app, enabling supervisors to monitor some of the CHN activities and become embedded in the process of solution identification.

Finally, the designer created a visual and written blueprint to synthesize all of the findings and decisions that were made throughout the CCH design process. The blueprint fleshed out the details of the app purpose and content, documenting the design inputs and decisions and establishing a road map to build the app and introduce and support it over the course of the CCH pilot. Ultimately, the findings from the design thinking phase were integrated into decisions on the final choice of modules and the development of their content, resulting in the *CHN on the Go* app containing the Learning Module, Achievement Module, Staying Well Module, Hangout Module (WhatsApp), Work Planning Module, and Point of Care Module.

6 The Experience of Using Design Thinking

The team that engaged in the design thinking phase at the early stages of the pilot included a multidisciplinary group consisting of public health, technology, development, and innovation professionals, local cultural experts, and, at times, the CHNs and supervisors and staff from the district and regional level of the GHS. As noted by Dandonoli (2013) in Andrawes et. al. 2016, "a deliberate attempt was made to seek input from the unconventional voices usually excluded from health system planning and decision-making in this context." A core group from this range of stakeholders engaged in the design thinking process throughout, from formative design research to validation of the findings with the GHS. Others joined the process at different points, depending on their availability and their role in the design process.

As part of our exploration of design thinking in CCH, we conducted interviews with 11 respondents who participated in the design thinking phase of the pilot (October 2014 to January 2015) or were integrated into the team following the design phase but were familiar with the role that design thinking played in the life of CCH. Respondents ranged from end users (CHNs and supervisors) who were present at the co-design workshops to program managers and software developers who were directly involved in shaping the CCH pilot and the *CHN on the Go* app. In many cases, the same respondent was interviewed twice, once following the design phase and next at the end of the pilot to reflect on the influence of design thinking. The respondents' experience with design thinking in CCH fell into four broad categories: essential framing and practical insights; empathy for end users; comparison with other forms of program planning; and observations of the overall value and drawbacks of design.

6.1 Essential Framing and Practical Insights

Respondents came away from the design process with a greater sense of understanding of the situation of CHNs, their working environment, and typical frustrations in the work place. These insights were framed through the formative design research and the series of synthesis and co-design workshops led by the design professional. It was described as "a journey" by some and "torture" by another. But there was general agreement among participants that the design process helped to elucidate the concept of health worker motivation in concrete and personal terms and to translate the concept into design choices for the mobile application that could effectively address the needs of the CHNs and the supervisors. As a senior technical manager noted:

> *My understanding of design process was number one: try to figure out what motivation meant for this group of people. And then try and figure out what could be addressed by a technology solution. So, going from this very abstract thing of addressing motivation with technology and being able to come to this very complete place where we identified specific modules that would help to address specific issues that have been raised.*

A senior technology advisor reported:

> *So the main purpose [of the design thinking] was trying to really get to… well there were two things. One was making sure that we can really understand the problem of motivation or demotivation for the nurses and the reasons why that was a problem … the actual ball game was the focus groups, individual interviews, and exercises we put them through which really helps you to get a very holistic view in terms of answering the question. And the second part was to make sure whatever we were developing was actually something they could use and actually address their problems. And for that we needed to both involve the nurses and the supervisors in the process of development.*

Participants in this early design thinking phase gained a deep understanding of the CHNs and learned a great deal about their work life. A Concern Worldwide manager noted: "There was really an insane level of detail and that was useful later on." The technology advisor reported: "The biggest advantage [of the design phase] was knowing who the app was for and developing it for their use."

Steps such as constructing user personas and capturing the nurses' value statements made it easy for program staff and software designers to envision the kind of mobile application that might be needed. As a program manager noted:

> *Identifying various personas was very important. Some [CHNs] are really passionate about their job regardless of challenges. Others are there because they need to be there, and others are there because "my daddy wanted me to become a community health nurse." Persona development helped develop an app so it addressed all the personalities and not just those who are passionate about their work. The various kinds of people in the system should be reflected in the design of the app.*

Some participants learned new things, as a program manager noted: "Understanding the system around frontline health workers was new to me: the complexity of the supervisor role and that the level of trust

is low." Others gained depth of understanding: "A lot of the information [we learned] we had heard through other channels, so that wasn't surprising. What was interesting was the nurses getting into details of how they work and why they are frustrated" (technology advisor).

As the design phase advanced, a program manager noted:

> *Key themes emerged: issues around respect, not feeling appreciated, not having the right information or resources to do their job well, not having good avenues of career progression, not feeling support of supervisors, and two giant system-level issues that trickled down to how nurses feel about doing their job. These were the foundation on which the six big ideas (opportunity spaces) were built and helped to frame the overall strategy of the CCH pilot.*

6.2 The Role of Empathy

One of the research propositions we explored was the use of design thinking to build empathy with the end user as part of the problem mapping and solution identification process. In addition to gaining detailed understanding of the CHNs' workplace experience and job satisfaction, participants in the design phase reported a strong affinity for the CHNs' situation, which further influenced, along with their own professional skills and experience, the design of the mobile application. A program lead described his observations of the team that had just returned from conducting the fieldwork for the formative design research:

> *They were tired but extremely energized. I think they went through a process they had never gone through before, but I think they felt reconnected to the work and had a much deeper understanding of the nurses' and supervisors' experiences and the health system in general. They were talking about the nurses and supervisors on a first-name basis and it seemed like their hearts had opened from the experience. For example, when we were developing personas, they were able to talk about the women they had met and they got really animated about it. They felt that some of these people were really special and in a really tough environment. And there was a sense that they wanted to do the best job they could to help those people.*

As the participants synthesized the field-level learning about the CHNs, they built off their perceptions of the nurses' experience in the work place. A participant reported:

> *So we started to familiarize ourselves with the information, then looked at the personas of the different nurses and supervisors with the intention of using the persons to help with the design, and to mentally have these people in the room as we designed the mobile application. We looked at the process maps. We did exercises to get ourselves into that space. It was great. It gave us an awareness that we needed to design the app for this broad base of nurses. It led us to realize that we were not designing a cookie cutter approach.*

Through the design experience, respondents had personal revelations about CHNs that later influenced their approach to their work on CCH. A Concern program manager stated: "I can relate to all the frustrations and desires that the nurses expressed. I want to be respected. I want to be inspired.

Everything they said definitely resonated with me in the roles I have played." The technology advisor reported:

> *A surprising number of nurses had a sense of resilience about their environment. They have few resources and knowledge to execute what they need to do. When I asked them about it, they feel like this is expected [normal]. So despite all the issues they faced, they were willing to sacrifice to provide care. There was a lot of empathizing with them and being in their shoes. So in deciding about the technology, it helped us decide how to do it. For example, we had a huge discussion around enabling their social environment on the app. After speaking to them, you realize that in their down time there is really little for them to relax. So that is something we wanted to build; something that would help them escape from their day-to-day work. I fought hard to keep that in [the mobile application]. I am interested in making sure that the things that go in there are really useful.*

Several respondents reported that the design thinking inspired their interest in continuing engagement with the CHNs and the integration of regular consultation and feedback loops into the project. The empathy for the nurses engendered through the design phase infiltrated the project team as a sense of commitment to involving the CHNs and supervisors in every step of application development. It changed the way in which many team members approached their work and perceived their roles. For example, the decision to integrate WhatsApp groups into *CHN on the Go* rather than build their own Hang Out module was a direct response to staff commitment to improve communication among nurses and between nurses and their supervisors quickly. A software programmer noted:

> *We could have decided to build our own messaging tool and wait forever to do it. But we saw this [communication] problem as a human problem that is affecting [the CHNs] now. So I would say the way [design thinking] has changed us is that it has helped us to understand how we will put the person first or what the person says first in what we are doing.*

The powerful effect of participating in the design phase was noted by the technology director when he compared team members with this experience to those that arrived in the project later:

> *[With new staff] there was a lack of nuanced understanding of what had been experienced, and that made it difficult. Because we had gone through the [design] process we knew that even though [someone suggests] a logical explanation or option, we had these gut feelings about how we needed to go about [determining our next step], and it was hard to articulate. But being able to slip into the nurses' shoes or the supervisors' shoes was easy for us in the process, but not so much for the newer staff.*

6.3 Comparing Design Thinking with Traditional Planning

Program staff and stakeholders who engaged in the design process often described it as transformative and unique. Many felt the process was considerably different from the typical process used to develop public health interventions, because the planners or designers returned frequently to end users and to their voices which were captured during the design phase, to inform and refine program strategies. The CHNs were always present in person or in spirit as information was synthesized and decisions were

made surrounding the design of the mobile app. The design leader described the process as follows, invoking the use of the desirability lens to frame the approach:

> *So we brought back all of our material and post-it noted the hell out of it. We synthesized as much as we could without losing the words that the nurses and the supervisors used themselves. We used quotes that they used and then based our insights and clustered our insights around their words. We [mapped] their words to our interpretations, reflections, and observations. So it was all rooted in the voice of the user.*

Participants compared this approach with their previous experiences with program design. A program manager noted:

> *When I have done things like this before, you aren't doing the same level of research and that kind of data collection (like with the CHNs) as intensely as we did. You are kind of using the beneficiary of the program as the framework for what you are doing. In my experience you are normally given a framework, and you kind of have to fit into it.*

The M&E advisor observed: "I thought this approach was very user-centric, very beneficiary focused. Instead of focusing on what the donor wants it cares about making sure those results happen, it really focused on the nurses' experience."

A second aspect of design thinking that differs from typical planning is the commitment to shaping an intervention in collaboration with end users. A program manager stated:

> *The difference is the co-designing. A lot of projects involve the end user but they ask questions and then do the analysis away from the end user, and then tell the end user what they need. In design thinking [the designer] sets up the framework and the template for data collection and analysis for you so you are collecting it and analyzing it with them, you are designing [the program] already.*

A third difference is the testing of ideas and solutions by implementers and end users through modeling, role playing, and visualizing over several cycles. "It was iterative—not a simple leap, but an iterative process that included workshops with the two teams. It was for hearing the voices of the nurses and the supervisors in our heads. I am trying to get as much mileage out of these voices as possible," reported a program manager.

Finally, the process is also reflective, as noted by the M&E advisor: "I think a lot of time organizations jump straight into carrying out activities, but this was really trying to get people to dig deeper as to why you were carrying out the activities. This process has people stop and think at that early stage instead of using a retrospective [approach such as evaluation]."

Overall, respondents described the process as "challenging and different," "creative," "rigorous," and "deep." "I would say the HCD process was more rigorous and in-depth [than planning in other

development programs I have been involved in]. Comparing the CCH experience with Motech,[11] the technology advisor said:

> ….we did speak with some people about the design. We did some qualitative studies on how people would view the application but it really never went this far. We [talked] with pregnant women, but I don't know the different types of pregnant women and the different types of help they will need. So the content [of the application] had to just fit everyone. For CCH, I now know that there are three different types of nurses. I now know how they will each potentially use the different types of modules in the application, and how it will address different types of needs of these nurses.

6.4 Value and Drawbacks of Design

Positive feelings surrounding the design thinking process were expressed by the majority of participants. However, they also acknowledged that they had to endure a rigorous, challenging, and sometimes taxing process.

The workshops were extremely interactive and collaborative; the process was designed to push boundaries and challenge participants in their thinking. It forced participants to think more deeply about the "problem" and even to hone in on details, addressing head on the complexities of the CHNs' situation and building a mobile application that fully addressed the frustrations and aspirations of the CHNs in their workplace. An M&E advisor noted: "A lot of the time [the designer] would mention 'Oh this is a journey, trust me, I know this is frustrating but at the end you will be happy.'" One respondent reported clear frustration with the apparent lack of structure of the design process: "This is a very different way to do programming; for things to be constantly changing for the first 6 months of the project. You really don't know where to go because your starting point always changes."

In spite of the challenges, on balance, the majority of respondents felt the design process was effective. The M&E advisor noted:

> I think there was a much deeper appreciation for what the [mobile] device should look like and it was well thought out. What I appreciated about it was in the end, when you get to the end of the road it's an exceptionally well-thought-out process. So when somebody asks you 'Why did you design this module?' you feel highly confident talking about why you designed a program in such as way. It really adds to the thinking.

The Concern program manager concurred:

> I think that some of it I could have guessed from my office in New York. But what was of deeper value was that it left no sense of doubt. Whilst I know nurses are demotivated and have harsh work environments, I think [design] gave a deeper insight into their experience, which was special. It was a collective and personal insight instead of one-off kind of thing. That was powerful.

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[11] A mobile technology health intervention in Ghana.

Finally, we observed through interview data that the experience of using design thinking established a shared sense of ownership for the mobile application and its purpose not only among program staff but also among end users. A field officer reported:

> I think the purpose of design thinking was to make something in a way that the end users felt part of the process. It wasn't as if we wanted to design something and push it on them. We wanted them to tell us what they needed, what will suit them. We had to bring in some of the supervisors and some of the nurses to actually tell us what the application should look like. At the end of the day, they were the ones that were going to use it. So if you design something for them that doesn't suit their needs or what they have in mind, I think usage isn't going to be as high.

The director of technology observed that use of a different process other than design thinking to construct the mobile application might have resulted in a very different and inferior product:

> I think the question really is would it be possible to get these insights in some other way? It is sort of likely that doing it another way we would have probably gotten only one or two of those insights. If we had done a needs assessment to address this problem of demotivation… if we had not done it with design thinking we would have identified some changes needed in issues like transportation, and maybe some frustrations from the nurses that could not be addressed in an app. We might have come up with a transportation app, like pick-ups and making sure buses get there for the nurse. So maybe that would have been all that we had for [the CHNs].

7 Influence of Design Thinking in CCH

7.1 Grounded Theory

A fundamental rationale for the use of design thinking is that it provides important insights into user experience, needs, and desires and helps to translate these insights into tailored interventions or products, increasing the likelihood of user adoption and reducing the risk of intervention failure. Following our documentation of program staff experience with design thinking and working from the original research propositions noted in Section 3.1, we describe below our findings related to the contribution of design thinking in CCH using the constructs of fit, uptake, buy-in, and ownership and the effectiveness of the *CHN on the Go* mobile phone app. Specifically, we explore the potential contribution of design thinking to improved health worker job satisfaction and motivation among CHNs using a theoretical pathway or grounded theory constructed in the course of our analysis of the role of design thinking in CCH (Figure 9).

In Figure 9, we hypothesize that that through the application of design thinking, CCH achieved fit, meaning the pilot created an essential match between key strategies—mainly the focus and content of the mobile application—and many of the CHNs' needs, desires, and aspirations that related to job satisfaction and motivation. Fit then played a role in catalyzing uptake or adoption of the *CHN on the Go* app among CHNs. As the intervention was further refined with users through feedback loops and adaptation, it achieved an even tighter fit, which influenced continued acceptance and use of the *CHN*

on the Go app. In CCH, we defined this lasting influence of design as buy-in, or continued use of *CHN on the Go,* and ownership, or demonstrated commitment to ensuring continued availability and use of the app over time. Based on these observations, we propose that design thinking worked alongside other program elements to contribute positively to the realization of pilot outcomes. We discuss and illustrate this pathway below and provide a critical analysis of the added value and limitations of design thinking in the context of CCH. Specific definitions for each construct in the pathway are found in Box 2.

Figure 9: Theoretical pathway of the influence of design thinking on MNCH programs
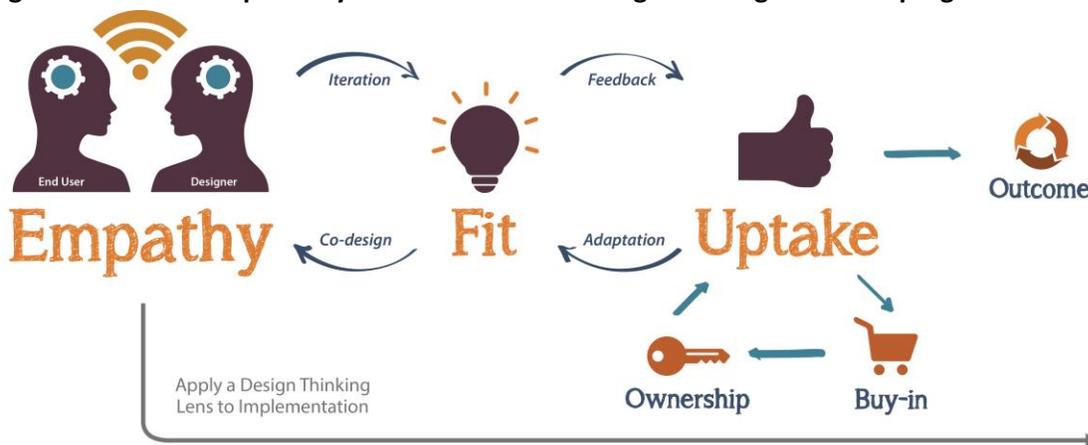
7.2 CCH Outcomes

As described above, design thinking in CCH began with a stated intent or desired outcome. In this case, the intent of CCH was improved motivation and job satisfaction among CHNs in Ghana through the introduction of a mobile technology application. Design thinking approaches were used to gain insight into the factors that affect health worker motivation by generating empathy for the end users among the program designers and managers through their participation in the design process. The design process also involved various steps and techniques (e.g., formative design research, nurse profiles, user personas, journey maps, and convergent and divergent thinking) to translate understanding of user needs and desires into intervention design (*CHN on the Go)*, including prioritizing key opportunity spaces for addressing barriers to or facilitating drivers of health worker motivation and defining practical aspects of the application such as the content and the look and feel of each module. Iteration of the mobile application design with end users (e.g., through persona validation and

Box 2: Definitions of Design Thinking Pathway Elements

Empathy: Empathy of the pilot designers for CHN and supervisor's needs and desires, generated during the design phase of the pilot.

Fit: Program design addresses a need or desire of the CHN or supervisor that was identified through the application of design thinking during pilot development that facilitates adoption and acceptance among users.

Uptake: Utilization of the *CHN on the Go* or supervisory dashboard/app. Encompasses concepts of how the app is used, frequency of use, ease of use.

Buy-in: Demonstrates a CHN's positive, emotional, or behavior reaction to the app.

Ownership: A stage beyond buy-In. Emotional or behavioral acceptance of the app/dashboard and an indication that it is something that CHNs and supervisors would fight to keep.

process and experience mapping) was used in the early planning stages. The pilot team tested and then adapted modules based on user feedback and inspired by the empathy with CHNs. In the case of CCH, adaptation of the design of *CHN on the Go* continued beyond the initial planning phase with a smaller group of users through user testing and feedback sessions.

Findings from the endline survey of the effectiveness of CCH indicate high levels of adoption, sustained use, and satisfaction related to the *CHN on the Go* application among CHNs. Among those surveyed, 94 percent of CHNs reported that the *CHN on the Go* app met their needs and half the CHNs reported using the app more than five times per week by the end of the pilot. The majority of CHNs interviewed for the endline survey noted that they would continue to use the phone and the app once the project finished. In addition, most CHNs reported that they would pay for their own airtime credit if needed to support their use of the app; however, only a few CHNs were willing to pay for the phone if they had to purchase it themselves (Alva, 2016). With respect to the intended effect of the pilot on health worker motivation and job satisfaction, results are more guarded. Younger CHNs (< 30 years) reported only a 5 percent increase in job satisfaction from baseline values, whereas older CHNs reported no change in job satisfaction. Low levels of self-reported overall job satisfaction may stem from the challenge of conceptualizing the concepts of satisfaction and motivation among CHNs or the variety of workplace challenges or frustrations reported by the nurses that could not be addressed by a mobile phone application, including health worker compensation, opportunity for professional advancement, and access to resources*.*

In spite of cautious self-reports of overall influence of the pilot on health worker motivation and job satisfaction, the *CHN on the Go* app gained remarkable traction among the majority of the CHNs and supervisors over only an 18-month implementation period and became widely used among CHNs and their supervisors. In addition, the pilot effectively addressed many of the intrinsic and some extrinsic elements of health worker motivation targeted in the pilot theory of change and assessed in the baseline survey. Those included feelings about workload; CHN self-confidence; CHN perceived respect and recognition by the community, supervisors, and peers; CHN feelings of connectedness, and job security. The link between use of *CHN on the Go* and reported changes in aspects of health worker job satisfaction and motivation were documented in both the process documentation conducted over the course of the pilot and in the qualitative data collected at the end of the pilot, providing a more complete picture of pilot performance than emerged from the endline survey of CHNs alone. Several examples are presented below.

7.2.1 Addressing Elements of Job Satisfaction and CHN Motivation

- CHNs and their supervisors reported that *CHN on the Go* is an **effective job aid** that facilitates the work of the CHN, particularly in delivery of community-level health care. CHNs indicated that the Event Planner module helped them schedule their work, improving efficiency and their ability to reach more clients. The Event Planner module specifically helped them improve their time management through use of the calendar and calendar alerts. The Learning Center module was a tool used for professional development where CHNs gained new knowledge through

courses and took refresher training on topics they covered in their original training. With the Point of Care module, CHNs had diagnostic algorithms at their fingertips and visual aids to help communicate with their patients. The phone itself was a convenient field resource that was easy to transport while conducting outreach and home visits, eliminating the need to transport heavy reference and health communication materials. It also enabled CHNs to communicate easily with both professional and personal contacts using WhatsApp while in remote areas or when they needed to contact their supervisors or peers for support and advice.

As one CHN explained about her role in the community and her use of the app, "You are everything: the doctor, the accountant, the statistician. You are everything. So the phone is good for all of them."

A program manager explained: "CHNs' perceptions of the app have changed over time. After [updating] the phones and putting more things into the app that make their work easier and faster, they have grown to love it so much."

On CHNs use of the app for planning, a district director noted: "Before we planned outreach for them, but the app has come for them to plan, and I think it is a form of motivation. So you see, nobody plans for you but you look at your particular situation and you plan today."

- CHNs equated the use of the phone with **increased confidence in their ability to be effective caregivers**. For example, they used the calculator to calculate dosages for different clients, give advice on family planning, and estimate delivery dates. With the phone, they carried with them all required reference materials and were able to phone a friend if they needed support when serving clients. As noted by a district director,

  > Before they did not have anything like the Learning Center, something that will give them the confidence that when they meet their clients and they want to give care, they can follow it. They have the Learning Center and can go there and increase their skills and their knowledge of service delivery. They have the opportunity to read because the Family Health Unit has put all the protocols [on the app]. So it has really boosted morale.

- *CHN on the Go* also created a digital **network of peers and colleagues** that did not exist prior to the pilot. During the pilot, CHNs reported that they routinely contacted each other through WhatsApp for professional and social purposes, noting that this easy method of communication allowed for the quick exchange of information, facilitated learning, and informed their care practices. For example, CHNs reported that when they could not find an answer to a question in the Point of Care module while working with clients, they contacted their peers and supervisors through group or individual chats and received immediate support during service delivery. CHNs, supervisors, and field officers noted the importance of ease of access to information, support, and even humor and comradery through the *CHN on the Go* platform, linking it to feelings of confidence among CHNs. CHNs noted that they trusted the information they received and came to rely on their vast network of support and information sources to address work and

personal challenges A CHN noted: "The app has created some kind of friendly atmosphere that CHNs are supervised and whenever we need something, we can easily talk to [the supervisors] using the WhatsApp." A program coordinator reported: "We have enhanced the communication within the districts, among district-level users in terms of communicating with WhatsApp."

- CHNs indicated that through *CHN on the Go* they gained an **increased sense of professional security** that stemmed from easy communication with peers and supervisors and access to learning and reference materials. They used the app to look up treatment protocols and explain concepts to their patients through visual materials contained in the phone. In explaining how she used the Point of Care module, a CHN explained: "So you just open [the module], take a quick glance at what you are saying, be sure you are sure about what you are doing, and you are done with the person." CHNs also reported that clients appreciated their use of the phone during home visits or in clinics and linked its used to perceived quality care. In addition, supervisors could view each CHN's Event Planner, and through this planning tool CHNs demonstrated to their supervisors how they managed their schedules and completed their assigned duties. CHNs and their supervisors reported a direct benefit from taking refresher courses through the Learning Center that translated to day-to-day service delivery. As noted by a program coordinator: "Nurses are reading the courses; it is enhancing their knowledge and enhancing their services."

- CHNs appreciated the *CHN on the Go* application because it provided **increased opportunities for recognition and career advancement**. CHNs valued their access to learning tools and the link between completion of Learning Center courses and renewal of their nursing licenses*.* A program coordinator noted: "In terms of their knowledge and skills assessments, the certificates [earned through course completion] are something that even supervisors and non-CHNs are fighting for so that they can also renew their licenses easily."

7.3 Uptake and Use of *CHN on the Go*

Throughout the pilot, researchers assessed use of the application by module using interviews and tracking software in the phone. Program staff reported that uptake of the app was negatively influenced in the beginning of the pilot because some phones malfunctioned and had to be replaced, and the initial version of the computer-based supervisor dashboard was plagued with functionality issues, leading to slow and limited uptake directly following the first roll-out. The dashboard was eventually converted into an app based on supervisors' feedback. Due to challenges with the digital technology and programming, the phone-based tracking data were not sufficiently reliable for assessing precisely the pace at which users initially adopted different modules.

In spite of technical hiccups, within six months of introduction self-reported frequency of *CHN on the Go* use was high among the majority of respondents, and at subsequent stages of data collection CHNs continued to report use over time and engaged in feedback sessions at the request of program staff to refine different modules. In the successive points of data collection through in-depth interviews, CHNs also reported increased familiarity with the application. CHNs spoke, in detail, about the way in which

they were using specific modules, explaining their likes and dislikes, and the advantages they gained from using individual aspects of *CHN on the* Go. For example, they reported that certain modules were more useful and appealing than others. Those modules used most often included Learning Center, Point of Care, Event Planner, and WhatsApp. The least popular modules were the Achievement Center and Staying Well. Toward the end of the pilot, some CHNs indicated that they did not use the smartphone as often as they did in the beginning, but they still felt it was important to their daily work. Additionally, many CHNs interviewed indicated that they would continue to use the app in the future after the CCH pilot ended.

Since the pilot team and the GHS did not require CHNs to use the mobile application in their work, reported and documented uptake of the app represents self-directed use rather than conformity with a workplace directive. Instead of mandating its use, the CCH team introduced the app, trained nurses and supervisors, continued to engage with them to gather feedback, and monitored usage to assess satisfaction. Uptake and frequency of application use clearly varied among the CHNs interviewed throughout the pilot. However, all CHNs interviewed reported that they used the modules to some degree, and all had a solid understanding of the purpose and content of the modules and an appreciation of the way in which it had changed their working and personal lives. Where CHNs reported a decline in use, it was often because they had absorbed the content of a learning module. Over time, some CHNs asked for additional topics to be added to the Learning Center because they felt they had already mastered the existing content. With the Point of Care module, some CHNs reported that they no longer needed the phone to interact with their clients on certain topics because they had internalized the content through frequent use.

7.3.1 Fit and Uptake
We observed that the high levels of uptake, appreciation, and use of *CHN on the* Go found in the endline survey and consistently reported in interviews with key informants were clearly linked to the learning and empathy that emerged from the initial design phase and the codesign processes used to shape the choice and content of the *CNH on the Go* modules. This link between the use of design thinking and uptake is expressed as the concept of fit as depicted in the pathway graphic (Figure 9). The influence of design thinking on fit and uptake emerges in several aspects of the CCH pilot but is best illustrated in the way in which the words and value statements used by the nurses to explain their needs, desires, and frustrations in the workplace correlate to the modules that program staff designed and built for *CHN on the Go*. As noted by a senior technical manager: "There were motivational value statements from the nurses—respect me, inform me, teach me—and then there are the modules, and you can just point to each statement through the module. Those statements that match to the modules for me show the outcome of what happened [through design thinking.]" A senior program manager added:

> *[In the   design blueprint], there was a set of 8 to 10 nurses' statements like 'Respect me,' 'Reward me.' These statements grabbed me because you know exactly what [the CHNs] were concerned about. Right off the bat everyone knows who the end users are and what it is they want …'Believe in me.' 'Connect me.' 'Equip me.' 'Inform me.' When we built the modules, we had a slide with the nurses' statements alongside, and it was very clear where the modules came from.*

Through additional exploration of fit and its link to uptake (as well as buy-in and ownership below), the influence of design thinking continues to emerge from the data. The application of design thinking approaches in the initial mapping of user experiences, persona development, and the definition of six opportunity spaces shaped the initial choice and content of each module built. In addition, the continued commitment among the program staff to the use of CHN- and supervisor-centered reflection and feedback loops to inform iteration of the content of the modules helped refine the intervention to gain a tighter and tighter fit. As explained by a program manager and a program officer respectively when considering their experience with the use of design thinking and *CHN on the Go*:

> *When you [plan] you are trying to fix a problem. But with design thinking it went through a lot of processes, and barriers were identified. It provided us with more information about what is motivating the different types of CHNs to do their jobs. It covers all the different levels, whether [the CHN is] there because [she] wants to help people or [she] is there because [she] needs money. By segmenting that information and going through those processes and coming up with the blueprint, it went a long way in helping to design the modules that they would use.*

> *I think that sometimes [CHNs] just want people who will listen. It is easier for you to present something to the person and for the person to accept it [when you have been listening.] So I think design thinking made acceptance [of the app] easy and then it also made people say how much the project was helping them. Other nurses who were not even in the project district requested the application.*

A technology advisor with experience implementing similar mobile phone–based interventions in Ghana observed that use of design thinking might have increased the pace of uptake of *CHN on the Go.*

> *Compared to other health programs, CHN on the Go was taken up faster. In terms of coordinating the details of what is to be done and all that, and the actual terms of usage, I think that it was much faster than other health programs we have done … Because users were engaged in CCH, the outcome was quite different. Motech (another mobile health phone application in Ghana) was not so easily accepted like CHN on the Go. It took time for nurses to accept what we were presenting and it took time for them to see the benefit. With CHN on the Go you have already discussed [with the CHNs] how [the app] will look, so acceptance is very easy and you really don't have to do much work in getting it to be used.*

As noted above, the ideas generated during the design thinking process converged into six opportunity spaces that reflected CHN challenges and barriers in the workplace and their aspirations for overcoming these challenges (Figure 10). The modules did not map one-to-one to each of these opportunity areas. For the most part content overlapped, cutting across opportunity spaces to address several barriers or needs simultaneously and increasing their effect. To illustrate different concepts of fit in CCH we present below six brief examples of the link between the *CHN on the Go* modules that were designed in response to the opportunity spaces and the use and appreciation of the modules by CHNs.

Figure 10: Six opportunity spaces from design thinking mapped to concept of fit
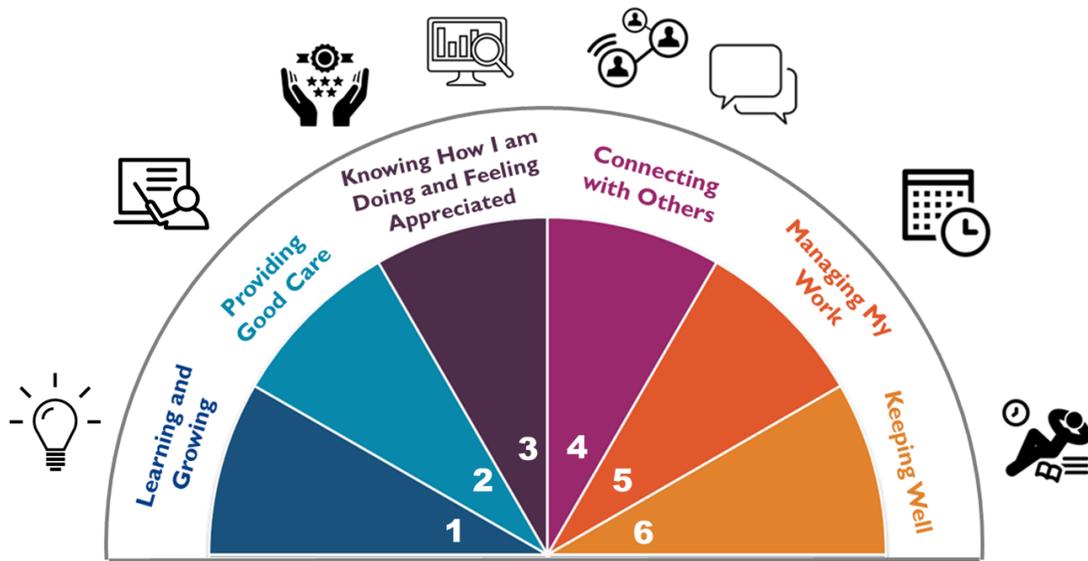
- **Opportunity Spaces: Learning and Growing & Connecting With Others**

CHNs reported that *CHN on the Go* met their desire to continue learning new skills "on the job." The Learning Center, one of the most popular elements of *CHN on the Go,* provided refresher training and references on health conditions, prevention, and treatment protocols. It was used to push out new protocols and policies so CHNs did not have to leave their posts for training. Moreover, once completing learning topics on the app, CHNs were able to renew their nursing licenses and were beginning to use the training as the basis for career advancement. As a program manager reported: "Recently a nurse told me she passed an exam at the university. A lot of people failed the exams but with the help of the [*CHN on the Go*] course in the Learning Center she was able to pass."

With this module and the Point of Care module*,* CHNs assessed and addressed knowledge gaps and used the modules to prepare for outreach and home visits in the course of providing care to mothers and children. WhatsApp connected the CHNs with peers and supervisors to pose questions and receive support. Supervisors also reported that they were able to track progress of the CHNs as they moved through each topic, increasing supervisor appreciation for the commitment of CHNs to self-led learning.

The WhatsApp group provides regular links to colleagues and supervisors, and through regular use CHNs felt more connected to their networks for professional and personal support. CHNs used the WhatsApp group to pose questions about diagnoses and treatments and share ideas about providing care. The app also facilitated the transfer of information from the district level to CHNs, including guidelines (Point of Care) and meeting schedules (Event Planner), allowing quicker roll-out of new practices and coordination of schedules. As a CHN noted, "The app has created some kind of friendly

atmosphere that CHNs are supervised, and whenever we need something, we can easily talk to [supervisors] using the WhatsApp to do the communication."

- **Opportunity Space: Providing Good Care**

CHNs reported that the Point of Care module is a reference that facilitates diagnosis and treatment while serving clients, enabling them to work more independently and efficiently. It provided easy references to technical guidelines and protocols and contained diagrams and photos to educate clients. A CHN reported: "[*CHN on the Go*] helps me to know more about what family planning is. Maybe I can educate somebody by using the application. I do not have difficulty finding the words to present [to clients] because the application is there."

The module responded directly to the nurses' desire to have a quick reference when seeing clients. A CHN reported on her experience using the Point of Care module: "So when you open the application and you show it to [the client] and explain that this phone is for work, they become happy and then they are ready to listen to you whatever you are telling them."

In building and testing the Point of Care modules, a program manager reported how CHN feedback was incorporated into the design:

> *The Point of Care [module] was created for nurses to quickly have some learning material they can refer to and engage the clients. However, there was a fear that using a phone might make them look incompetent in front of the patients because it is like opening a book and then the clients says 'You don't know what you are doing.' The design of the Point of Care module was done in a way that it could be interactive with the client. Through role play [with CHNs] we learned that it would be important to train the nurses on how to use the app and use it to interact with the clients.*

Finally, the app also addressed CHNs' desire for easier communication and rapid responses when providing care. CHNs reported that they used WhatsApp to receive alerts when a woman delivered a baby, and they could reach her within 24 hours to follow up. The calculator contained in the app also enabled faster and accurate calculations of dosages, delivery dates, and other care steps. As explained by a district director about how the app was used in his areas:

> *There was a malnourished child identified by a CHN. She just took a picture of it. After using the application to talk to her supervisor she sent her the picture. The supervisor reported it to me, we mobilized resources, a vehicle, and the child was rescued. She was kept with her grandmother who neglected the child. The child was taken to the health facility, treated, and recovered.*

- **Opportunity Spaces: Managing My Work & Feeling Appreciated**

CHNs reported that the Event Planner was accessible any time to the nurses and their supervisors. It eased work planning, provided reminders, and verified CHN work programs to supervisors. This module

responded to CHNs' expressed anxiety about supervisors' dissatisfaction with their performance and a desire to demonstrate their commitment to their job. A program manager noted:

> *We learned in the design thinking that the CHNs felt that supervisors thought they were lazy and not diligent in following up with their clients. We decided to have a digital Event Planning module where nurses can enter the plans and targets, comment on what happened with regard to the targets, and this information would be visible to the supervisors so they would be aware of the challenges that the nurses face and would know what is going on.*

The supervisor dashboard and the CHN Event Planner also allowed the supervisors to communicate easily with CHNs and join CHNs for critical events, **increasing transparency and building trust** between the supervisor and the CHN. CHNs reported that with clear documentation of their workdays through the app, they felt increasingly recognized for their efforts and found they could share their work program, increasing efficiency and facilitating work life. From the supervisor perspective, the app also helped increase accountability, an element that was more appealing to the supervisors than to the CHNs. As a CHN reported: "You set the targets. Because you know it is going to your supervisors, you know you are forced to achieve them. If you don't and it gets to them, they will come and question you."

- **Opportunity Space: Knowing How I am Doing**

In the words of a program manager, the Learning Center and Point of Care modules have also **"helped some of the CHNs to have more recognition for their work and more respect**. When they are informed, it makes the person more confident. It is easier for the CHNs to answer questions when she is asked and that gives her respect from the community members, because she seems to know her stuff well and she doesn't fumble to answer."

- **Opportunity Spaces: Staying Well and Connecting With Others**

CHNs reported that the Staying Well module, social networking through WhatsApp, and the ease of accessing technical information and learning opportunities **reduced the stress associated with their** work and with living away from their relatives and friends**.

7.4 Lasting Change: Buy-in and Ownership
Our analysis went on to explore the influence of design thinking on two concepts related to fit: buy-in and ownership of the *CHN on the Go* app. We posed this question: Did the use of design thinking in this pilot sow the seeds for long-term and sustained changes in behavior or practice? In other words, was there an indication that design thinking also influenced the integration of *CHN on the Go* into CHNs' and supervisors' work life so that they came to rely on it and became vested in its continued use, adaptation, and improvement?

At the final stage of data collection, CHNs and key stakeholders reflected on the extent to which CHNs had integrated the application into their work. A district director noted: "With the *CHN on the Go,* when you ask [the CHNs] they say 'We've gone high tech.' It is very popular with the CHNs." Examples of their commitment included interest in continued improvement of the app. CHNs continued to engage when asked in feedback sessions and surveys on their perceptions of the app to improve its functionality and content. Several respondents linked CHN commitment to the initial and continued engagement of the nurses in designing, reviewing, and improving the application as important to the sustained use of *CHN on the Go*. A program manager noted:

> *If they had not been involved and we had just gone at any point in time and [suggested changes in the app], I don't think the involvement [of the nurses] would have been as it is now. We sit with them and ask "What do you think should change or what do you think should be included or should be taken out to make things better?"*

Respondents also requested additional content for the Learning Center and the Point of Care modules throughout the course of the project, as they exhausted the existing information and raised questions about other areas of care that were not included in the initial design. As noted by the technology director: "I think using the Learning Center tool and learning the courses, and I think the fact that they keep using those tools and taking the courses, is the way they have shown their commitment to the app."

When discussing the likelihood of continuing to use the app once the pilot ended, some CHNs reported that they had become used to having *CHN on the Go* and without it their work life would be more difficult. Other respondents felt that without the app, things would go back to the way things were before the pilot, making it more difficult to communicate with supervisors and peers and forcing them to revert to the use of large text books as references and long periods without receiving support. In addition, the nurses reported that they would miss the opportunity to advance their learning. As a senior technical manager reported: "They use the Learning Center. They will do an exam 10 times because they want a correct score. They do the pretest and the posttest until they get 100 percent. When they run out of [phone] credit, they buy credit themselves."

Some observers noted that commitment to *CHN on the* Go could be linked to the opportunity to possess a smartphone for professional and personal use at no cost to the CHN. However, the data depict a growing sense of reliance on the app as well as personal commitment among CHNs to ensuring its continuity beyond the CCH pilot. CHN respondents had strong reactions to the idea of losing access to the phone app and reported that they would miss out on opportunities without access to the Learning Center, Event Planner, and Point of Care modules in particular. Some nurses expressed concerns about being transferred outside the district and losing access to the phone. Others reported that they paid for additional phone credit out of pocket to ensure they could use the app throughout the month after project-funded data were exhausted. As a program officer reported:

I think that the best is people wanting to have the application on their personal phones or people willing to pay for the phones in order to have the application. We have people who have damaged devices but they are still using the application on their personal phones. That shows how committed they are to the application. Because really, if they didn't want to use it, once the device was damaged they wouldn't use it anymore.

At the final round of data collection near the end of the project, nurses indicated that they wanted to continue to have access to the app beyond the CCH pilot. Some asked to have it loaded on their personal phones. Other CHNs expressed willingness to purchase the app and, in some cases, the phone, in order to facilitate continued use of the application once the CCH project ends. The sentiment of three CHNs is found below:

It will be helpful, I will be happy if we will continue using the app and if there are new things in the system, they put it or they update on the phone so we will continue learning.

I will buy it; we buy malt and drink, so I will sacrifice because I get something out of the phone, so why shouldn't I buy it. Maybe 4 cedis a month is nothing, so I will buy it.

I'm so much interested in [keeping the app]… I love it, it makes my work quite easier. So please don't take it away.

8 Design Thinking Influence Beyond *CHN on the Go*

The design thinking experience, while directly influencing the shape and feel of *CHN on the Go,* also had a notable influence on the people who took part in the design phase and then went on to manage the pilot. For example, the Grameen Foundation team introduced the first iteration of *CHN on the Go* in June 2014 and over the course of the pilot's implementation demonstrated extensive commitment to iterating and improving the app through engagement and user testing with CHNs and supervisors. They conducted five major updates of the application before the end of the pilot in May 2016. Prior to each update, the team gathered information from the CHNs and the supervisors on their experience with the app and fed that information into the next design phase. Although user testing is common in software development, the Grameen team seemed especially dedicated to extending the design thinking ethos of codesign and iteration beyond the design phase, so that it became one of their major program strategies. Senior managers, technology professionals, and field managers professed their appreciation of the value of codesigning with the nurses and supervisors, as summed up by a program manager and a program coordinator:

We can draw insights from design thinking for public health; everything that followed [from the design research] involved going back to nurses on a consistent basis under the umbrella of user testing from the content side, involving the GHS every step of the way. This may not feel like design but the way we have these conversations has a design feel about it. … The way we got feedback is design, like using role play and process mapping. We would stay with the user personas as possible. We try to take a step back and say 'Are we forgetting the voices of the nurses?

In a typical project, we do the design and we push it to them; whether it's going to make an impact on their lives, we just do it. But this particular project has not followed this trend; it's like we are constantly in touch with our end users because we don't want to design something or don't want to put something together that won't be used or that won't have a positive impact on them.

Even the technical director who had used design thinking approaches to develop software applications in other settings noted that the CCH experience went further than he had imagined one could go and, in his opinion, transformed the way the team approached their work in the CCH pilot:

It occurred to me that the app is going to have a lot of the elements of the design [thinking process], but that is going to be an imprecise way to look at what the process meant for getting to the final app design. In the sense that for me, doing that design research and going through that whole process basically created a whole new world with a whole new language for those of us who were in the process; it created a worldview in which we were working and a language that we could use to communicate. I feel like even talking to you now, I am not sure that it came across well, but that is where I see the strength in design thinking. It would be really hard to look at the app and look at the [design] process we did and capture fully that [whole] process that has been brought into making the app.

9 Reflection on Design Thinking in CCH

Prior to introducing the *CHN on the Go* mobile application, CHNs expressed to program staff a range of frustrations related to their work life and defined needs and aspirations for improving their situation working and living at the community level in Ghana. Following the 18-month pilot phase that introduced and refined the *CHN on the Go* application, it is clear that some of these frustrations remain. However, it is also clear that nurses readily used *CHN on the Go* in their work and personal lives and appreciated many elements of the application for transforming the way in which they work. They consistently provided examples of how the application made their work easier, improved their ability to serve clients, and linked them through digital networks to people and knowledge.

At the outset of the CCH pilot, a design thinking approach helped program managers and software developers gain a profound understanding of the expressed and latent desires of CHNs related to work life satisfaction and motivation. These insights and the process of codesigning the pilot with the nurses and supervisors influenced their choice of program strategies and design elements in the smart phone application, sowing the seeds for high levels of uptake of *CHN on the Go* and a solid sense of appreciation and ownership for the app among CHNs. As noted by a program coordinator: "If you constantly engage the CHNs you make them feel a part of the process, they are always there to support you. They feel they own it, they feel that the ownership of that project belongs to them and they push things and you just stay behind and follow. So I think this is what has led, from where I am seated, to the success of this project."

As such, design thinking introduced to the pilot a powerful needs assessment and intervention mapping process that helped the pilot team design an effective intervention. The program managers and software developers themselves highly valued the insights they gained through the design process and the empathy gained for the nurses' working conditions and aspirations. The design experience also inspired them to continue to test and iterate the application with the end users well beyond the design stage to further refine the way in which the application and the pilot fit with the nurses' aspirations and improve both the practical functions and personal rewards nurses experienced in the workplace. The intensive and powerful experience with the design process at the beginning left a pilot culture that valued and maintained a commitment to prioritizing user input and gaining user acceptance, which was expressed in frequent and multifaceted feedback steps and consultations with CHNs and other stakeholders. In the view of some respondents, this cultural shift might have extended too far, noting that the extensive use of codesign and feedback processes with the nurses and supervisors, while effective, took a considerable amount of time and would be difficult to sustain for a long period in a post-pilot stage. However, the overall consensus among respondents pointed to a net positive influence of design thinking.

From our analysis of this case study we conclude that design thinking influenced the pilot in many positive ways, but we cannot conclude that design thinking was the sole driver of positive processes and outcomes of CCH. Through review of program documentation and analysis of interview data we learned that the pilot team implemented several equally critical practices or strategies that together with design thinking have laid the foundation for an effective pilot intervention and for sustained interest and commitment among the nurses and supervisors and GHS officials for continuing to develop, extend, and support *CHN on the Go.* These included engaging GHS in the introduction and adaptation of the app, working closely with the GHS to make the app compatible with the GHS community health care protocols, linking the Learning Center module to the continuing education system and opportunities for CHN professional advancement, and taking important steps to get the smart phone hardware and software functioning effectively. In this sense, design thinking was a positive addition to the package of other equally important program implementation strategies.

With design thinking, the CCH experience went beyond traditional health program planning, allowing space for user-led program design, iteration, and adaptation. Successful uptake and acceptance of *CHN on the Go* emerged not only from use of design thinking techniques to focus the pilot on CHN needs and aspirations but also because the project team embraced the ethos of design thinking, creating an enabling environment for adaptation and codesign that tightened the fit between the intervention and end user interests and desires. They also built a strong working partnership with all stakeholders, including supervisors and district and regional managers, integrating health system requirements (such as use of approved health care protocols and standardized training curricula) into the mobile application while ensuring the relevance and accessibility of the app to the CHNs. Design thinking in the context of CCH was an effective strategy for gaining meaningful insights into the problem of health worker satisfaction and motivation, effectively tailoring interventions to address those needs, and promoting a culture of adaptation and learning with end users that contributed to a strong fit between the

intervention and the end user needs, early and sustained uptake of the intervention, and program effectiveness.

ANNEXES

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Annex B: Detailed Description of Design Thinking Methodologies and Visual Products

Phase I: Intent

Intent Workshop

Activity Purpose

The goal of the Intent workshop was to frame the main objective for the project by assessing the current state, formulating the desired future state, and hypothesizing steps to produce the desired outcomes.

Activity Description and Methods

This process was facilitated to develop an intent statement tool which allowed participants to determine what ''success'' looked like for different groups of people that would be involved or impacted by the project. The output was a one page intent statement,[12] which included a clear description of the current state and barriers to health worker motivation and hypotheses on how a change could be achieved. The statement was shared with all of the project stakeholders.

Findings and Decisions

The intent statement served as an anchor for the project that was used for reference throughout the formative design research process to ensure that the project remained on track for achieving its intended goals. It was further refined through the course of the design phases and resulted in a final intent statement that incorporated the desired end state as defined by the project stakeholders. It was then used to guide programmatic decisions throughout the life of the project.

Phase II: Enquiry & Insights

Formative Design Research

Activity Purpose

The aim of the Formative Design Research was to collect detailed information on the supervisory structure, general workflow for routine tasks performed by the CHNs, and situational context in order to identify opportunities for the CCH intervention to improve health worker motivation and support the CHN's ability to provide quality services. Through this exploration, the design teams gained a better understanding of the process of providing community-level care and mapped the existing supervision processes from the perspective of both the CHNs and their supervisors.

Activity Description and Methods

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[12] An Intent Statement is a term coined by ThinkPlace and is akin to a purpose/outcome statement

The design team used a series of tools to facilitate the formative design research. They conducted interviews and focus groups of CHNs, supervisors, and clients to understand the context of the CHNs' working environment. These interviews and focus groups aimed to identifying the facilitators and barriers to heath worker motivation and job satisfaction and to understand, in detail, elements of routine tasks performed by the CHNs and their supervisors. They also served to highlight potential areas for improving health worker motivation.

Information gleaned from the interviews and focus groups was further refined through the use of process mapping (Figure A1) related to CHNs and supervisors. The process maps explored the steps involved in different routine CHN tasks such as group outreach, home visits, data collection and reporting. The mapping exercise allowed the designers to understand CHN experience in detail, to identify frustrations and potential starting points for ideating solutions to improve CHN motivation and job satisfaction. The team further explored and refined the process maps during the Understanding the System and the Understanding the User workshops.

Figure A1: CHN process maps
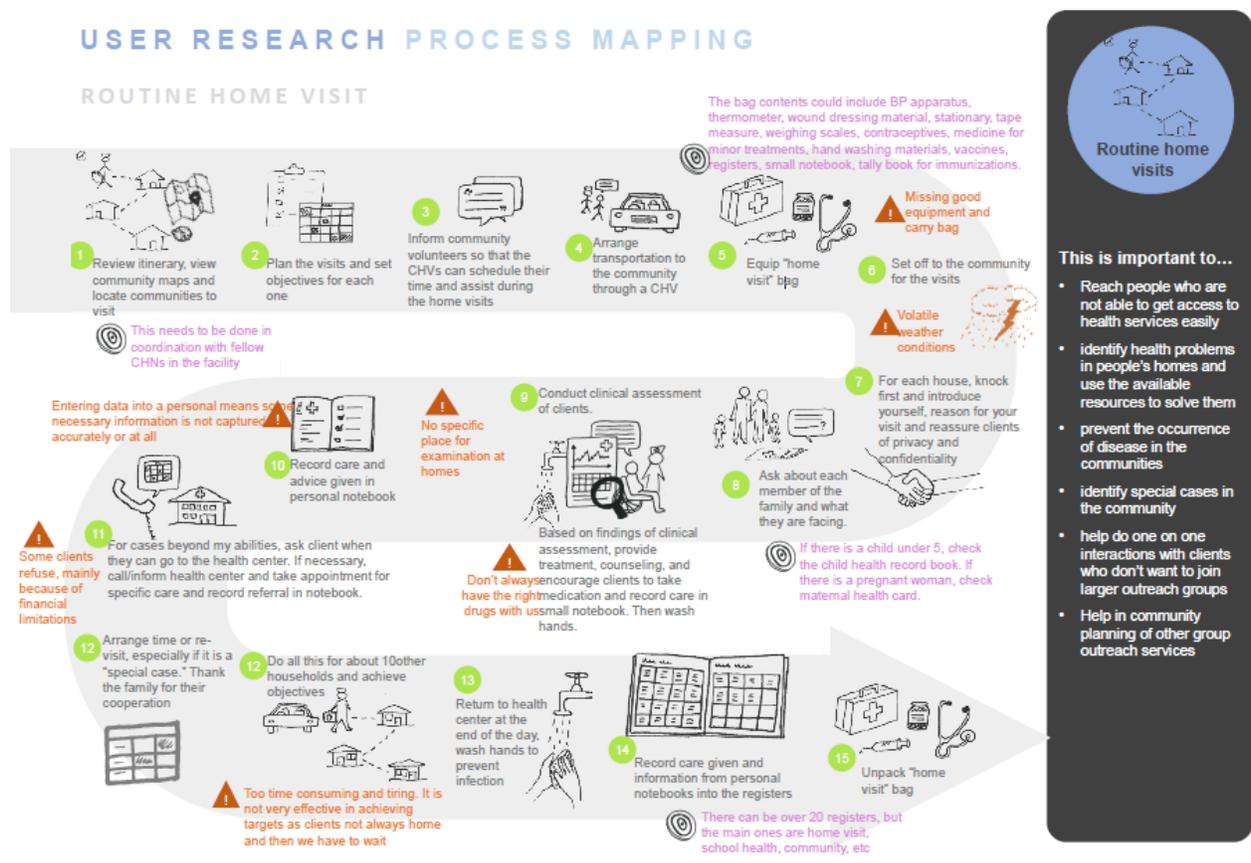
...es using information collected from interviews and the process mapping exercises. They answered questions about health care workers, such as what matters most to them at work? what makes them happy at work? and what frustrates them at work?.

Findings and Decisions

Reflection and learning during the formative design research influenced several design decisions for the CCH intervention. Based on the interviews and focus groups conducted, the design teams identified the following key focus areas for the ideation phase: respect, monitoring and supervision, clinical targets and performance, data and reporting, mentoring, supervisor training and mentoring, recognition and appreciation, being connected, resource limitations, client and community relations, nurse drivers and barriers.

Through the formative design research it was clear that CHNs faced challenges with career advancement and desired opportunities to advance their skills through education. They also expressed a desire to receive feedback and encouragement on their performance and the ability to connect and collaborate with other healthcare providers. Additionally, nurses indicated the need to relax and step away from their work life because many of the CHNs were posted to communities where they lack social connections.

CHNs were also concerned about interacting with their communities and clients. They asked for help in planning community interactions and ways to ensure that clients are available when they make home visits. CHNs indicated their desire to provide good care and for tools that could aid them in diagnostics and treatment. These findings influenced the development of the modules comprising the *CHN on the Go* app: Learning Center, Point of Care, Event Planner, Achievement Center, and Staying Well and WhatsApp.

Analysis and Synthesis Workshops

Activity Purpose

The purpose of the Analysis and Synthesis workshops was to consult and engage participants who were not able to participate in the formative design research and accelerate the emergence of findings and decisions. It aimed to build empathy for the CHNs and supervisors among participants and engage the whole group in synthesizing the information collected during fieldwork.

Activity Description and Methods

The workshops included Post-it note synthesis, whereby quotes or insights from the formative design research were written on individual Post-it notes and posted and grouped on the wall. The process was described as "rough and messy" but allowed the group to cluster ideas on the notes based on the emerging themes of the design research. From there, the group was able to harvest 10-12 main themes.

Findings and Decisions

The themes generated from the Analysis and Synthesis workshops guided the development of the CCH intervention. The team also identified the top five motivators and roadblocks for the CHNs and determined that the program design would should not only focus on removing the demotivating factors but also build upon the existing motivating factors to achieve success.

Figure A2: Main Findings from the formative design research

RESPECT ME

- Enabling nurses to feel respected by their peers, supervisors and in their communities
- Setting appropriate and achievable targets that are reflective of what is happening on the ground in communities

REWARD ME

- Using data-based evidence for appreciating nurses and supervisors rather than enabling favouritism
- Showcasing the extent of nurse efforts, not just their clinical results, by tracking their movements and daily activities.

TEACH ME

- More in-depth, one-on-one supportive and facilitated supervision time for nurses
- More helpful feedback mechanisms for nurses following supervisory interactions
- Minimizing the wait time between supervisory interactions and feedback for nurses to improve themselves

INFORM ME

- Strengthening nurse knowledge and capacity at the frontline with easy access to relevant information and clinical support
- Stronger emphasis on data accuracy and integrity

CONNECT ME

- Building close, authentic and trusting relationships between nurses and clients
- Improving communication channels between nurses and supervisors
- More cooperative and less adversarial relationships between nurses and supervisors
- More peer-to-peer learning, sharing and collaboration among nurses
- Stronger engagement with communities and their volunteers

EQUIP ME

- Minimizing the time and human resources involved in data collection and analysis processes
- More strategic approach in identifying and caring for high priority cases
- More effective scheduling and coordination between nurses, their clients, community volunteers and supervisors
- Aiding supervisors in making informed decisions regarding the allocation of limited resources

INSPIRE ME

- Stronger resilience in the face of trouble and system challenges

BELIEVE IN ME

- Greater empathy and understanding among supervisors toward nurses and their challenges

Understanding the System Workshop

Activity Purpose

The Understanding the System workshop utilized the process maps and health worker profiles generated during the formative design research to describe and understand the health system from the point of view of the various health workers personas.

Activity Description and Methods

The group further took steps to refine health worker profiles and develop personas of different health care workers based drivers of motivation. They created personas collaboratively by immersing team members in the CHNs' stories of satisfaction and frustration gathered during the research phase and then brainstormed what emerged as the differentiating motivators.

The team also reviewed the process maps created in the previous steps to allow participants to "step into the shoes" of the user and understand CHN work activities from different perspectives based on the health worker personas. They grouped Post-it notes by major themes, allowing participants to engage with the raw data and form insights while they worked in groups during brainstorming. During this process, as participants walked through each of the process map pathways, they could see the frustrations and the joys experienced by the CHNs and identified a challenge question to focus the ideation process and define an appropriate solution. In particular, the group generated dozens of ideas on how to improve the relationship between nurses and supervisors.

Findings and Decisions

This workshop produced several challenge questions that focused on issues related to the relationship of the CHNs and their supervisors as well on barriers that CHNs face in their daily work. These findings were applied to the Explore & Innovate phase of the design process.

Understanding the User Workshop

Activity Purpose

The design team used the Understanding the User Workshop to dive deeper into the health worker personas and to elicit feedback from CHNs.

Activity Description and Methods

The team reviewed and validated the process maps with the CHNs to continue to build empathy among the designers for CHN experience. They used storyboards to present findings from previous workshops.

For the process of persona development, the team started with about five to six personalities and grouped them based on the patterns that emerged from the CHN stories. The result was three main personas for CHNs (Figure A3): Purpose-driven and Resilient (Naana), Purpose-driven and Dispirited

(Mary), and Paycheck-driven and Dispirited (Michael). They then walked the CHNs through each of the personas to determine whether they could identify with the personas.

As secondary users to the system, the team also created personas for supervisors: Empathetic and Highly engaged (Madeline) and Apathetic and Disengaged (Jeanette).

Findings and Decisions

Insights gleaned from the feedback provided by the CHNs allowed the team to refine the motivating factors for each of the different health worker personas. With this refinement and validation, the team finalized the personas and used them in subsequent ideation and concept development activities.

Phase III: Explore & Innovate

Ideation Workshop

Activity Purpose

The purpose of the Ideation workshop was to utilize the challenge questions that were developed in the Enquiry & Insights phase and generate potential mhealth solutions to address the barriers to motivation and job satisfaction identified in the formative design research.

Figure A3: Three CHN user personas

Source: ThinkPlace 2014

Activity Description and Methods

The team broke into small groups and began to ideate and refine the challenge questions. Each person on the team was given a set of challenge questions and idea sheets which they used to help organize the ideation process. Participants were asked to become familiar with the mindset of each persona and generate as many solutions as possible related to each challenge question.

Solutions were then clustered into emerging themes. Once the main themes were established, the team was asked to generate ideas would be considered impossible to implement, based on their understanding of the constraints in the health system. This strategy allowed them to push the boundaries of possible solutions, and generate ultra-creative ideas.

Findings and Decisions

Through the Ideation workshop, the team was able to refine the themes that emerged from the formative design research. They determined the guiding principles and design criteria for the CHN intervention and refined a list of opportunity spaces. The 10 opportunity spaces (Figure A4) that were identified represented potential modules for development in the *CHN on the Go* mobile application.

Figure A4: 10 Identified opportunity spaces

1 THE LIVING MAP	**2** POINT-OF-CARE SUPPORT	**3** EDUCATION AND TRAINING	**4** PERFORMANCE PARTNERSHIP	**5** VALUE ME
6 COMMUNITY COLLABORATION	**7** CLIENT EXPERIENCE LOOP	**8** NURSE-TO-NURSE FELLOWSHIP	**9** INSPIRING SELF-MOTIVATION	**10** LIFE ASSIST

Source: ThinkPlace 2014

Codesign Workshops

Activity Purpose

The Codesign workshops aimed to utilize the insights gained from the supervisors and nurses to refine and develop the 10 opportunity spaces generated in previous workshops. One Codesign workshop was held with CHNs and the other was held with a supervisor.

Activity Description and Methods

The design team engaged in process mapping exercises with both the supervisor and CHNs which allowed validation of the processes depicted in the maps. When it was clear that this approach was not yielding the desired insights, the program team used role playing with the CHNs and the supervisor which helped the team understand more clearly the interaction between CHNs and their supervisors, including areas of frustration and discomfort. They also asked the CHNs and supervisor to score different potential interventions and then vote on the most appealing ones.

Findings and Decisions

The Codesign workshop validated the process maps and personas and helped the design team to reduce the 10 opportunity spaces to 6 opportunity spaces: "learning and growing," "providing good care," "knowing how I am doing and feeling appreciated," "connecting with others," "managing my work," and "keeping well." (Figure A5)

Concept Development Workshop

Activity Purpose

The Concept Development workshop was used to further refine the six opportunity spaces and assess the viability of each of the options presented.

Activity Description and Methods

Participants of the workshop were split into small groups and applied a concept template which asked questions such as "How would this work in practice?" "What are the implications of implementation?", and "What is the flow of the system?"   These steps helped the group assess the proposed model for *CHN on the Go* and consider how and if it would work in the health system context. The group also explored avenues for building each module through collaboration with health system partners. The team added this information to the concept templates and synthesized learning around project-level complexity, potential partners, and resources needs from all participants.

Next the facilitator used storytelling, asking participants to take on each of the personas that had been developed and walk through the health system tasks reflecting the views of each type of health worker. The process was difficult for the participants, but the stories they created were recorded and used by the software developers to define the requirements for the mobile application (Figure A6).

Findings and Decisions

Learning from this workshop ultimately determined the type of modules that would be built as part of the *CHN on the Go* mobile application and framed the application for the technology team which allowed them to define resources requirements.

Figure A5: Six refined opportunity spaces

KNOWING HOW I'M DOING AND FEELING APPRECIATED

CONNECTING WITH OTHERS

OUR SEMI-CIRCLE OF CONTROL
What the CCH mobile innovation can achieve

PROVIDING GOOD CARE

Tools for more rigorous self-assessment and performance monitoring from supervisors, while integrating a recognition scheme

An interactive and participatory online space that supports ongoing forum-driven conversation, material sharing and collaboration.

MANAGING MY WORK

A set of decision-support tools and clinical guidelines for diagnosis and care of clients.

Poor supervisory feedback and recognition mechanisms for nurses

Resource constraints limiting peer-to-peer learning and sharing.

A simple and intuitive work activity planning and scheduling tool with automation and reporting features.

Limited access to relevant clinical support for nurses at the frontline.

Inefficiencies in the way the nurses organise themselves and their days and schedules

KEEPING WELL

LEARNING AND GROWING

A range of distance learning courses and training materials accessible anywhere, anytime.

Limited prospects for professional growth and development

A range of tools which allows for nurses to take charge of inspiring themselves and coping with work and non work issues

Poor levels of resilience in the face of challenges

1 2 3 4 5 6

Opportunity Challenge

9 7

8

CAREER PROGRESSION POLICIES

A review of career pathway options for Community Health Nurses and how good performance can feed into promotion considerations

Nurses felt restricted by the limited career pathways available to them

Nurses felt restricted by the poor quality of their supervisory relationships and interactions

Comprehensive frontline leadership training to support supervisors in their role in motivating the nurses.

SUPERVISOR CAPACITY AND SUPPORT

Nurses felt restricted by the lack of and inconsistent availability of resources required to do their jobs.

Forward planning and improved management and allocation of tools and devices required for nurses to carry out their jobs.

OUR SEMI-CIRCLE OF INFLUENCE
What GHS strategic and operational policies can achieve

RESOURCE ALLOCATIONS

Source: ThinkPlace 2014

Figure A6: User stories for the learn and grow module

Source: ThinkPlace 2014

Prototyping Workshops

Activity Purpose

The Prototyping workshops were used to determine how CHNs' expressed user needs could be translated into a mobile app, assess resources required to build the mobile application, and determine the viability of moving forward with each proposed module.

Activity Description and Methods

The team was split up into groups; each group was assigned to a particular work streams. The groups employed user stories to outline the steps for implementing the mobile application including design, technology requirements, training, implementation, and sustainability. The goal was to develop a high level work plan. Preliminary plans were synthesized and shared with the GHS to assess the viability of the intervention.

Findings and Decisions

The findings From the Prototyping workshop were used to write the work plan, specifying next steps for implementing the project. The work plan involved steps related to developing the code, training, and introducing the application, helping the team frame the scope and scale of the pilot and the application.

The team decided that each of modules should work at scale, and made adjustments to the plan to add a calendar and remove a GPS component.

Develop User Stories, Pathways, and Interaction Models

Activity Purpose

The program developers at Grameen Foundation worked with the ThinkPlace web designer to visualize the user and technical requirements for building the application. This visualization enabled the developers to further define the language, look, and feel of the application.

Activity Description and Methods

The web designer worked with the Grameen developers to review the findings and products from the Enquiry & Insights and Explore & Innovate workshops, and they were able to specify technical requirements for the application.

Findings and Decisions

The web designer assisted the developers to build the application infrastructure through wire frames, visualizing the flow of the internal processes contained in each module.

Phase IV: Formulate & Evaluate

Validation Workshops

Activity Purpose

Validation workshops were conducted to confirm that the GHS would support the use of the *CHN on the Go*. They were held at both the district and regional levels in order to test whether the initiative would function as proposed and to receive feedback on aspects of the project.

Activity Description and Methods

The team used storyboards to present the project to the GHS. The storyboards introduced the CHN and supervisor personas and the process mapping that was created. They also demonstrated how each module would work and how it would benefit the CHNS

Findings and Decisions

The GHS confirmed their support for the program. However, they felt that supervisors should increase their involvement in the pilot. They sought to avoid any animosity between supervisors and CHNs and recommended that both receive the smartphones. They also noted that the supervisors tended to be less tech savvy, which could be challenging in terms of adoption of a mobile app. Consequently, the

design team decided to create a computer-based supervisory dashboard to accompany the *CHN on the Go* app allowing supervisors to monitor CHN activities.

Refine Blueprint

Activity Purpose

ThinkPlace created a blueprint to synthesize all of the findings and decisions made throughout the design process. The blueprint fleshed out the details of the application purpose and content and created a roadmap for the development of the application as well as the implementation of the CCH initiative.

Visual Interaction Design

Activity Purpose

Visual Interaction Design was used to help the app design team at Grameen explore the user interface of the app. It explored how the user would move through and between each of the modules.

Activity Description and Methods

No particular method was used for this activity. The process incorporated feedback from the CHNs on improvements they felt could be made to facilitate use of the app.

Findings and Decisions

Through the process of refining the Point of Care module, CHNs expressed the desire to move more easily through the diagnostic protocols without having to follow the same steps each time. They wanted to be able to jump to a particular point in the protocol as required. Based on this feedback, the team modified the module and enabled the CHNs to easily navigate the module when dealing with their clients.