Introducing a Pregnancy Mobile Application (APP):
How can App usage provide more efficient support than usual websites?

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1. Introduction

New information and communications technologies (ICTs) are widely used to create effective and innovative health promotion (Thackeray et al., 2008; Royne and Levy, 2011). According to Fisher and Clayton (2012) social media forms (that include email, texting, microblogging and smartphone applications) can be used by health professionals to increase health engagement and improve health outcomes. Moreover, they state that patient's media preferences and their level of interest in using social media for health care.

Furthermore, in today's world, mobile technology has become an inevitable part of individuals' daily lives. In the same vein, as a form of mobile technology, smartphones are widely used, particularly in pregnancy, and they represent an increasing and influential source of information. Smart phones not only offer diverse nature of pregnancy related applications, but also these apps possess a direct effect on maternity care.

Following a study conducted by Tripp et al. (2014), there are around 1600 pregnancy-related apps where 40% were informative, 13% interactive, 19% had features of a medical tool, and 11% were social media apps.

This research proposal follows the statement of Tripp et al. (2014), which while the popularity of pregnancy-related apps can be an indicator of a shift toward patient empowerment within maternity care, reliance on healthcare organizations, policymakers and pregnancy care centers seems to be reduced. Hence, this study proposes a smartphone app for pregnancy health care not only to provide a reliable source for local/national moms but also to act as an effective support tool for moms regardless of their needs and location.

According to Scheil et al. (2012) pregnant women and moms vary in their preference of reaching to healthcare information whether in hospital, pregnancy healthcare center or on an smartphone.

There are numerous studies (Kouri et al. 2005; Larsson 2009; Comer and Grassley 2010; Lagan et al. 2010; Cohen and Raymond 2011; Bates and Riedy 2012) which demonstrate that pregnant women are in regular use of the Internet to explore pregnancy-related information (health care centers) and also the online forums (reaching to other pregnant women) for support and guidance.

Reviewing the literature and background knowledge for the proposal, a lack of integrating ICTs and pregnancy health cares was noted in North America.

Problem Statement

Pregnancy is a process with lots of ups and downs, joyful and sad moments and it gets involved physical and emotional health. In the early stages of developing the proposal, a preliminary meeting with Ms. Theresa White (Executive director- of Kelowna Pregnancy Care Center) was initiated. The major point of this meeting was the ability of the care center to provide an environment for moms / moms-to-be not only in their happy moments but also in sad ones. Happy moments can be exemplified as " I'm expecting" news, knowing the baby's gender and sad moments can be named as thinking about abortion regardless of the reason and miscarriage. Looking through existing apps, there is an app called Preggie (launched 2014) that gives moms / moms-to-be an opportunity to share the experiences, ask questions and be in touch. In short, an Instagram specifically designed for moms. Following this app for a month led to the observation of presentation of 'joyful and happy' environment but less attempts on sharing sorrows were noticed. In the other hand, there are numerous apps which are only informative without interactions for moms to ask, share and integrate. As a result, this proposal seeks solution for following problems:

1. Reduction in the influence and supervision of accredited pregnancy health care centers due to increasing unreliable health Apps
2. Transition from supporting few members in care centers to so many moms who seek support in all provinces through App (According to Kelowna pregnancy care center, there are 20 active members in the gatherings !)
3. Creating an environment to impact users to be allowed to share happy moments
4. 4. How interaction with care centers is improved with better HCI and design solutions.

While conducting the research on care centers and their services on Kelowna pregnancy care center, Calgary care center and Vancouver care center, it was studied that their top requirements and needed services were adoption, parenting, abortion, education, and housing. The idea of the app was firstly based on the communicative part of moms / moms' to be lives. However, after broad research on post hoc apps, it was understood that there are apps for moms' to share experiences and be in touch (i.e. Preggie developed by ..)

2. Background

Current pregnancy apps were researched by the keyword "Top pregnancy apps 2015"in Google search engine. First ... . Links were selected.Apps were analyzed through three main categories, description, features and screenshots.

The websites are:1. http://www.livescience.com/49403-best-pregnancy-apps.html

The criteria which first resource (LiveScience) has selected is the quality of information and the information sources.

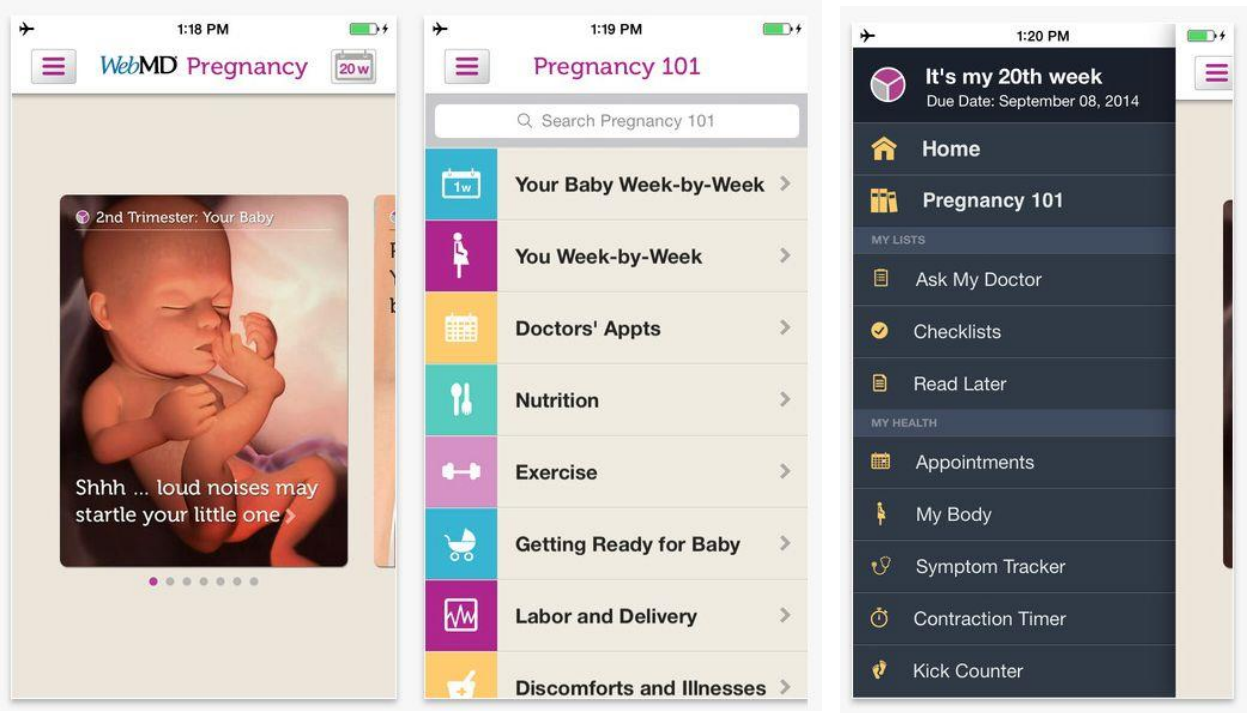
1. WebMD Pregnancy

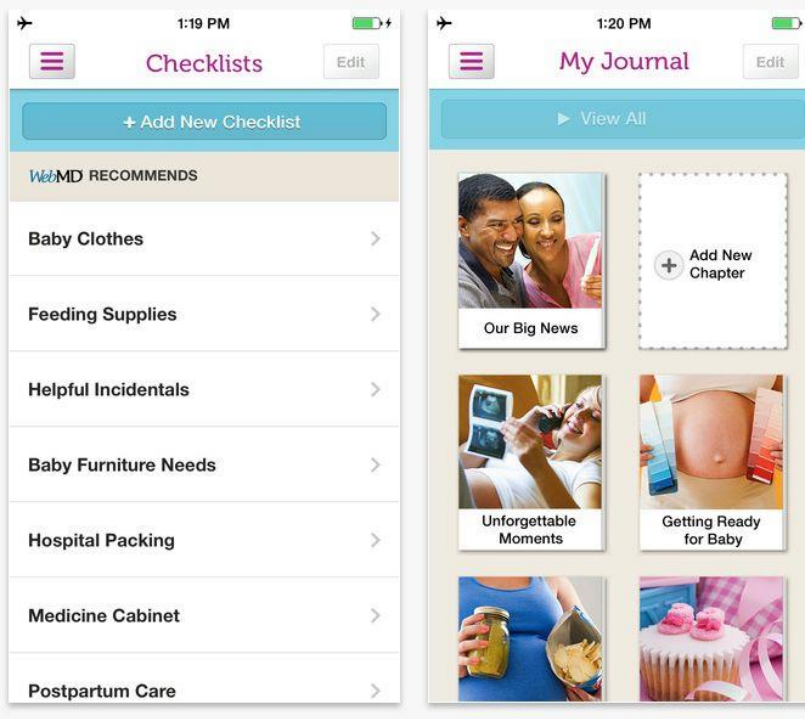
This app is a part of medical reference website (WebMD) includes information on week-by-week development, a checklist of suggested questions for prenatal visits, a weight tracker and kick counter, contraction timer for once labor begins.

Features include pregnancy 101 that draws on expertise from doctors and the articles are either reviewed by doctors or include footnotes from medical sources to explain the information origin. Pregnancy 100 contains “Your Baby Week-by-Week”, “You Week-by-Week” and “ Getting Ready for Baby”, information on nutrition, exercise and prenatal tests.

From design perspective, the graphics which are included in week-by-week sections are designed clearly so that they enable clicks for factoids about that stage of pregnancy with little buttons. Moreover, the app’s screen is uncluttered and provides easy navigation. Home screen showcases the illustrations of fetal development based on user’s due date. Checklists: This section helps the user to investigate the required supplies for the baby. It also provides information on nursery and postpartum-care, appointment calendar and an album to snap and store mom’s belly photos.Symptom tracker is a feature where enables expecting mom to enter pregnancy symptoms and their severity on daily basis. Kick counter and contraction timer are additional feature. In addition to these medical features, WebMD embraces an emotional side of pregnancy as well by including a journal feature. Expecting moms can record their feelings on their pregnancy process, their memories and birth stories. For safe backup, these entries can be exported via email. Expecting moms can either fill their journal entries at their leisure time or in a weekly basis in response to specific prompts on the home screen. Last section is a small category dedicated to dads,” Just for Dads”. In this section, various ways to support a pregnant

partner, dad's role in labor and the transition to parenthood is discussed.





2. My Pregnancy Today

One feature WebMD's pregnancy app does lack is a social component. This might be a blessing or a curse — many women report getting support from baby "birth month" clubs on online forums, but arguments and judgmental comments can run rampant on these message boards. If you can shrug off the drama and want the opportunity to chat with other moms and moms-to-be, your best bet is another free app: M y Pregnancy Today (i OS, A ndroid) , by BabyCenter.

Description: My Pregnancy Toda y is a parenting resource where user can enter b a b y ' s d u e d a t e a n d u s e t h e a p p a s a g u i d e f o r e x a c t d a y o f p r e g n a n c y . T h e a p p is information and communication based. Th e pictures of a baby's development will grab your attention and hold it. I ts full of of videos, articles and healthy recipes for meals during pregnancy and breastfeeding. However, the spotted issue with these articles within this app was the vagueness in their sourcing and recommendations. For example, one article may contain three different opinions and recommendations. This can be more confusing than being informed.

Features:

• User's pregnancy process day by day: Learn body changes, what's ahead, and how to cope

• Fetal development images with details

• Capture mom's growing belly with our Bumpie tool

• Pregnancy checklist that includes reminders to keep the user up on track with decisions and appointments

• Videos that enables user to watch the baby grow in the womb, and witness other moms giving birth

• Due date calculator

• Nutrition guide

• Track your progress

Design: M y Pregnancy Today's layout is a bit more cluttered than WebMD's,

Apart from being informative, this app provides a place for moms to share their frustrations, ask about symptoms and look for advice.

Track your pregnancy day by day

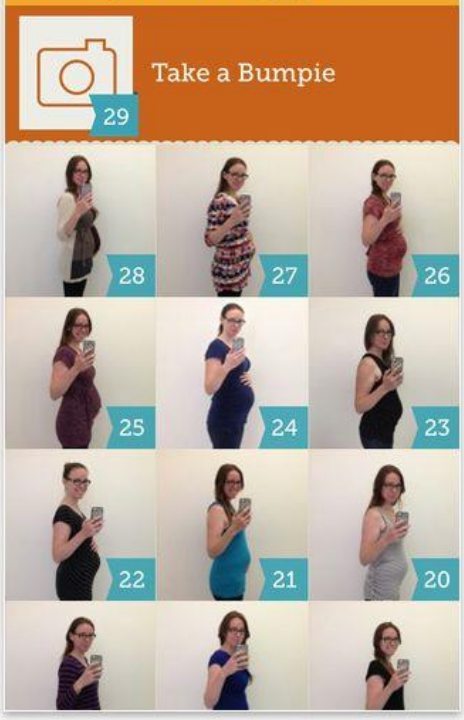
babycenter

Trusted by over 100 million moms

See how your baby is growing

Watch award-winning videos

Snap selfies and watch your bump grow



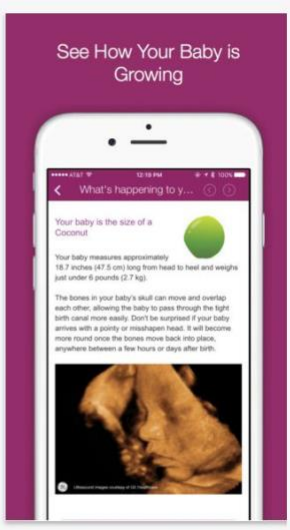
3. I'm Expecting

“I’m expecting” is a free app that guides the user through every single day until the due date. It provides updates with pregnancy videos, articles, tips and etc. It tracks user’s pregnancy symptoms and provides answers to user concerns through the most active online health communities. To initiate the interaction, user is required to enter the pregnancy due date. Features are divided to two categories; daily / weekly pregnancy information and pregnancy communities. For second category, the app provides answers to pregnancy questions and gets support and motivation from other expecting moms.

Design:

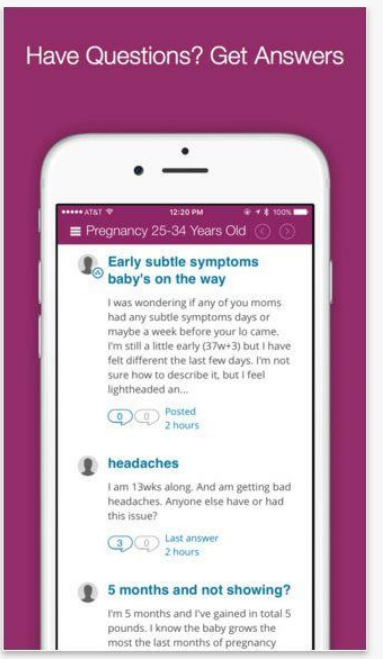
The home screen contains newborn photos in order to reduce users’ worries. This is a strong detail in home screen design since amid all the aches, pains and worry that are binded with pregnancy, these photos easily reminds the upsides of pregnancy and having a newborn.


Track Your Pregnancy Day by Day
I'm Expecting
197
11
February 3, 2014
What's happening to your baby?


See How Your Baby is Growing
What's happening to y...
Your baby is the size of a Coconut


2 New Video Per Week
Fetal Development We...


Track and See Your Pregnancy Weight Range
Weight Chart
Weight change - Normal
3
130
125
120
115
110
12/31 1/1 1/2 1/3 1/4 1/5 1/6


Have Questions? Get Answers
Pregnancy 25-34 Years Old
Early subtle symptoms baby's on the way
I was wondering if any of you moms had any subtle symptoms days or maybe a week before your lo came. I'm still a little early (37w+3) but I have felt different the last few days. I'm not sure how to describe it, but I feel lightheaded an...
Posted 2 hours
headaches
I am 13wks along. And am getting bad headaches. Anyone else have or had this issue?
Last answer 2 hours
5 months and not showing?
I'm 5 months and I've gained in total 5 pounds. I know the baby grows the most the last months of pregnancy

4. Pregnancy ++

Description

This app has the option of customizability for dads, grandparents and other family members. This app covers daily pregnancy information, color and scan images, personal diary, personal weight log, log doctor appointments, diet, exercise and labor information and more.

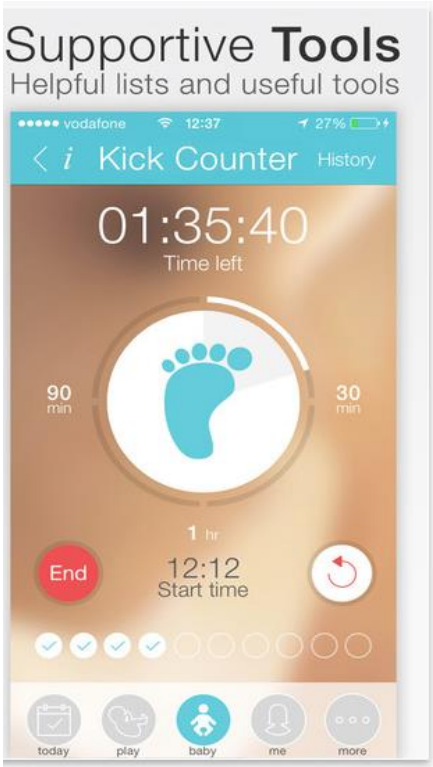
On the other hand, this app does not offer community forums however it includes a section on baby naming that lists popular names from around the world.

Design

There is an animated fetus with golden glow floats behind the information on the home screen. Menu options are easy to navigate. This app provides images of real fetuses from every week of pregnancy as form of computer animation, a 2D ultrasound scan or a 3D ultrasound scan.


Beautiful images
All 42 weeks beautifully illustrated
vodafone 15:20 25%
Week 10
today
play
baby
me
more


Personal Dashboard
Reasons to come back every day
15:58 33%
Today
Hello Sophia, you are 6 weeks and 2 days pregnant.
44 days
week 6
1st trimester
Will Pregnancy Help Your Ma…
Read our daily blog
Jan
Due date: Jan 6, 2016
today
play
baby
me
more


Supportive Tools
Helpful lists and useful tools
vodafone 12:37 27%
Kick Counter
History
01:35:40
Time left
90 min
30 min
1 hr
End
12:12
Start time
today
play
baby
me
more


Clear & Informative
Visualized like never before

5. Sprout Pregnancy :

This app provides week-by-week graphics. Some of the basic tools are kick counter, a contraction timer, hospital bag checklists and a doctor visit planner, where user can add questions for her provider. The app does not have any community forums or above-and-beyond features.v ivid images of baby development will enchant you first and foremost.

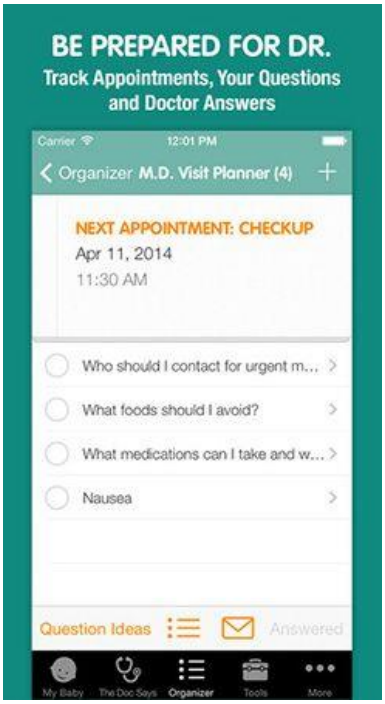
Design:

This app has a clear and also balanced screen of images and information This leads to easy navigation through screens. Maybe colors ...


CAPTURE MEMORIES
Journal records all the special moments you have along the way
Carrier
12:08 PM
My Journal
21 w
21W 3D
JAN 28, 2015
19 w
Entry Ideas
Export
My Baby
The Doc Says
My Journal
My Pregnancy
More


PREGNANCY TOOLS
Easy-to-use Weight Tracker, Kick Counter and Contraction Timer
Carrier
12:01 PM
Cancel
Enter Weight
Save
128.5
lbs
127
128
129
130
SPROUT
lbs
kg


COMPREHENSIVE
Written by doctors along with mothers-to-be
Carrier
12:01 PM
The Doc Says • 31W
Shortness of Breath
Beginning early in your pregnancy you may have noticed some mild shortness of breath, particularly associated with exercise. This is caused by increased blood volume and cardiac output, the physical effects of an expanding belly and added weight. Try to stay well-rested and don't place excess demands on your body. Take your time walking and stop for frequent breaks. Any acute change in your breathing pattern, severe shortness of breath, difficulty breathing associated with leg pain, chest pain, fever, or new cough should be reported to your doctor immediately.
Create a Birth Plan
It is important to establish a birth plan
My Timeline
Weekly
Daily
My Baby
The Doc Says
Organizer
Tools
More


BE PREPARED FOR DR.
Track Appointments, Your Questions and Doctor Answers
Carrier
12:01 PM
Organizer
M.D. Visit Planner (4)
NEXT APPOINTMENT: CHECKUP
Apr 11, 2014
11:30 AM
Who should I contact for urgent m...
What foods should I avoid?
What medications can I take and w...
Nausea
Question Ideas
Answered
My Baby
The Doc Says
Organizer
Tools
More

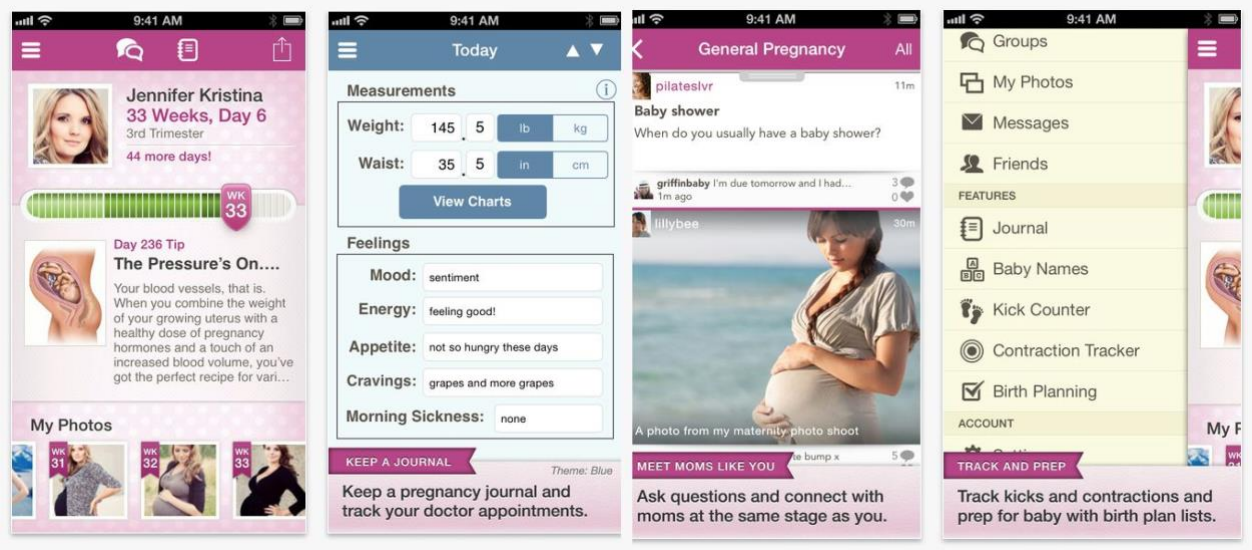
6. BabyBump:

The free version of the app provides daily pregnancy tips, week-by-week pregnancy and fetal development information, a daily journal for measuring symptoms, cravings, personal memories, and access to community forums.

One of differentiating advantages of BabyBump's social forums is that they are categorized into support groups for specific situations such as military families, high-risk pregnancies and dads-only community.

Design:

The design is informative but friendly. Useful screens are easily accessible via dropdown menus and readable tabs.

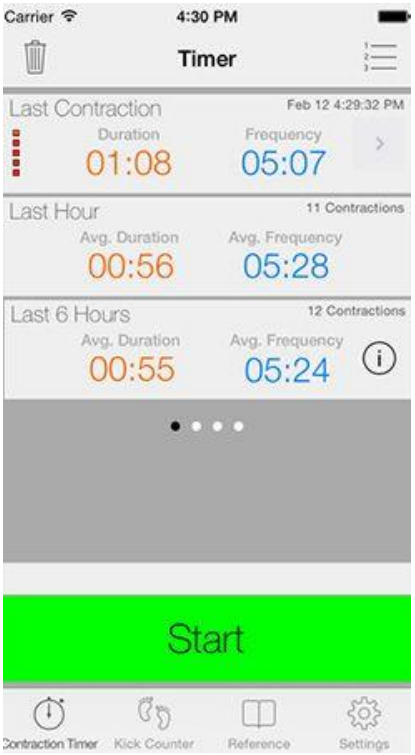


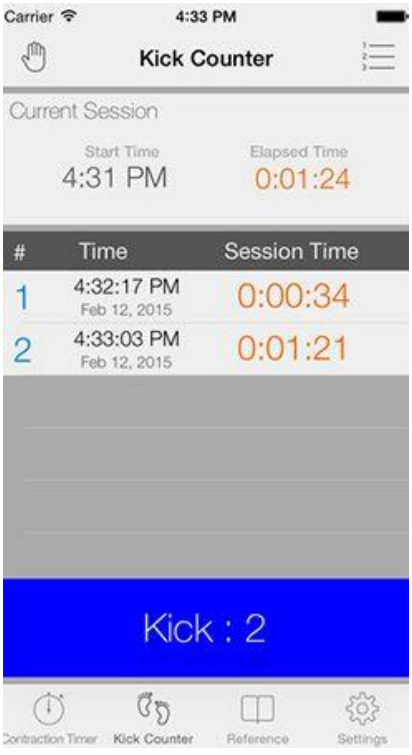
http://www.healthline.com/health/pregnancy/top-iphone-android-apps#2

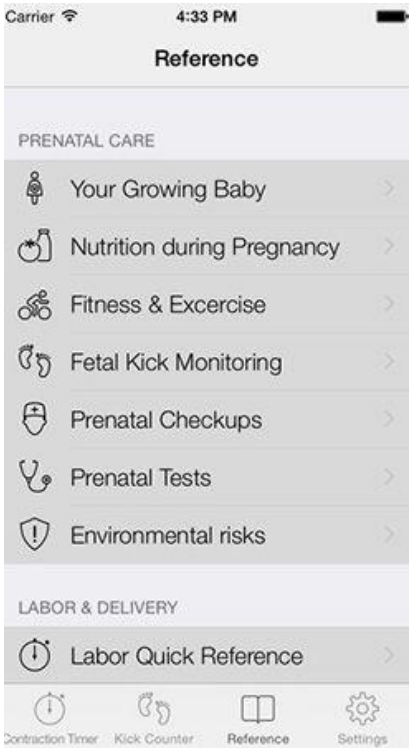
7. Full Term

Description: This app includes a timer, timing log, kick counter and fitness and nutrition information.

Design: Despite the simple design, information seems to not be easily accessible.







8. Pregnancy Assistant

Description: This app has designed to track pregnancy in weekly basis. A clean interface makes it easy to navigate around the app to get the information you need fast so you can quickly get back to baby preparations.

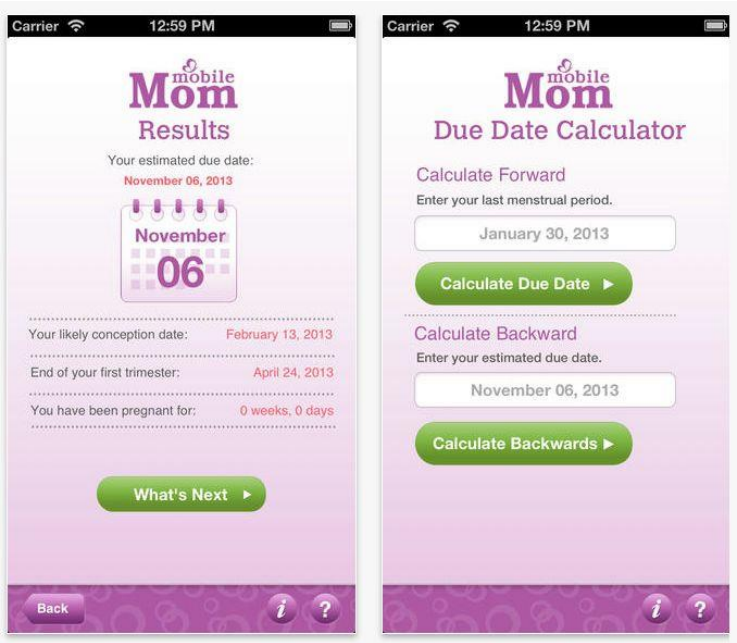
Design: This app has a clear interface that makes the navigation easy. The first time you open the app, user is asked to note the first day of last menstrual cycle (this is the true start of pregnancy, not the missed cycle). Moreover under the Pregnancy tab, there is a detailed weekly notes to share with doctor, or just to keep that as a log.

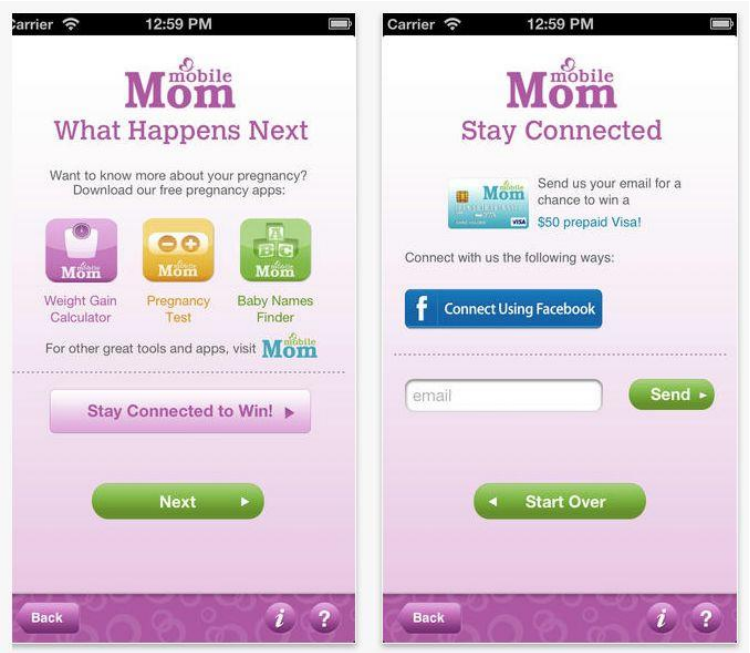
9. Pregnancy Due Date Calculator:

Description: This app helps users to calculate their baby's birthday, when trimesters begin and how many weeks pregnant the users are. This app is also being used by medical staff to calculate due dates through simple few taps.

Design: The aim is so clear so that the design. It starts with prompting user to enter the last

menstrual period.



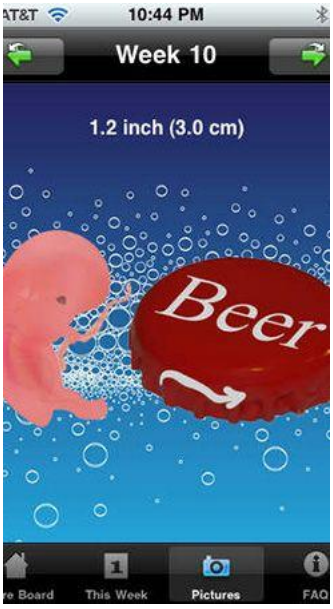


10. mPregnancy- for Men with Pregnant Women

Description: This app is designed for fathers or male partners of pregnant women. It also

contains information on growing embryos and pregnancy health.This app utilizes father's hobbies or interests to provide the information.

Design: Des

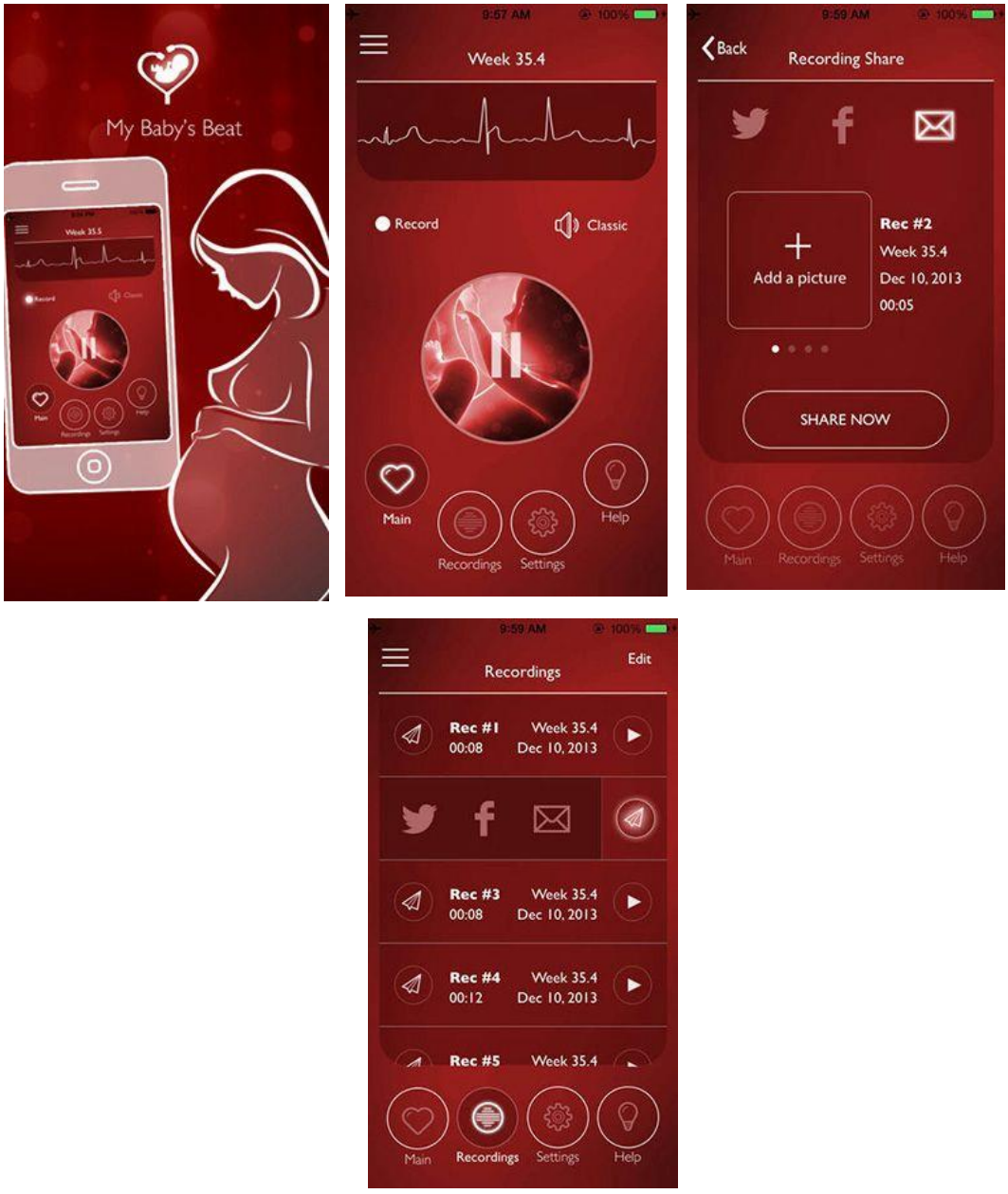


11. My Baby's Beat

Description: This app has deep red screens which reminds the purpose of the app that is tracking the baby's heart sounds and beats.

Design: The app can be sued when user is lying and holding the phone over her stomach. Navigation seems to be easy with large tappable buttons to listen to heart sounds and record.

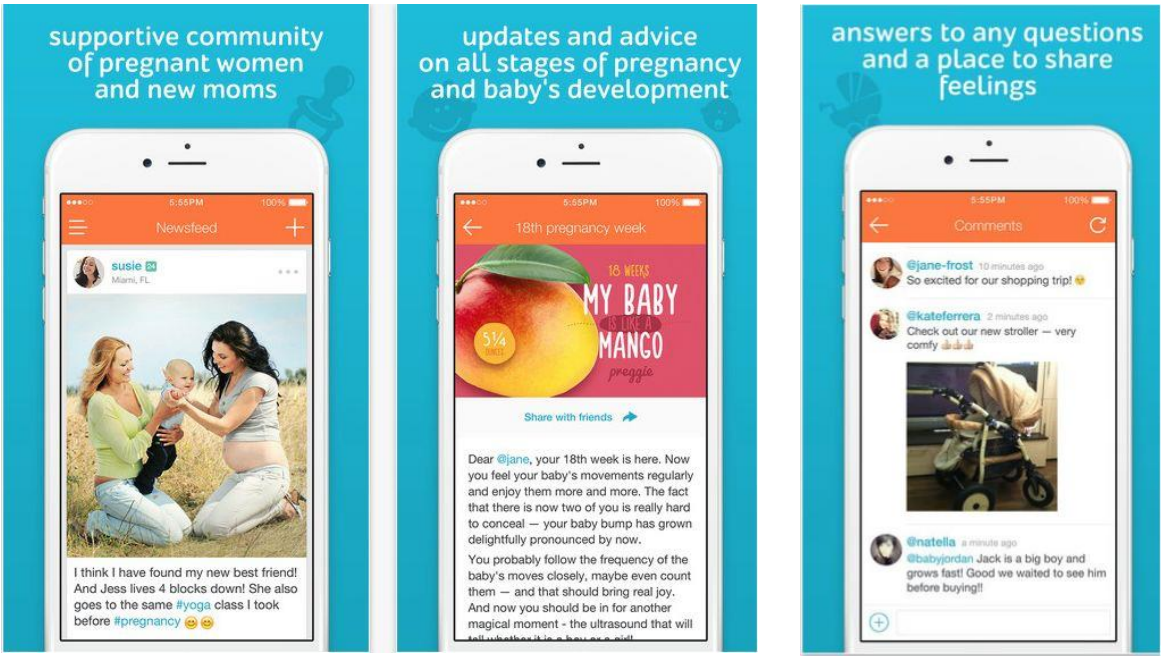
One drawback could be the color of the screens that might not be appealing and functional to eye in long term usage.

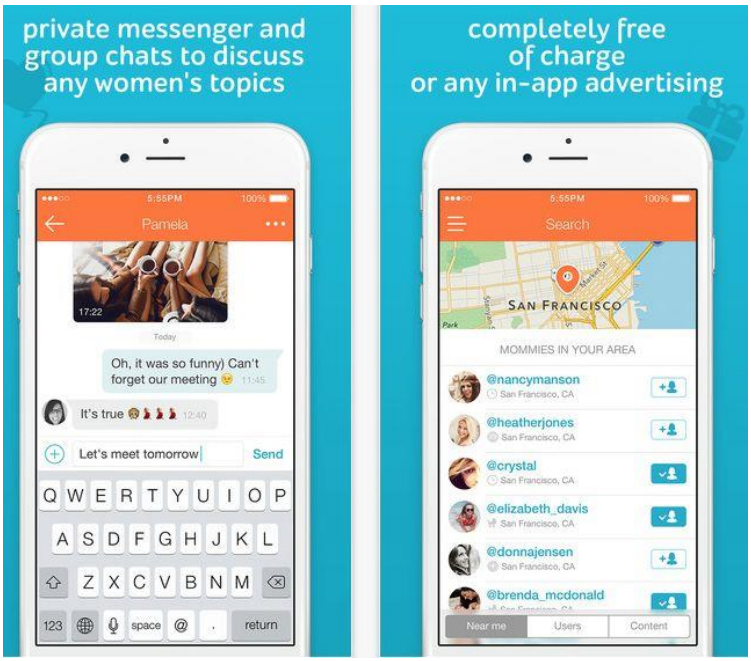


12.Preggie

Description: Preggie is considered as a first social media for moms, first time and veterans. Users can chat, ask for advice and also make new friends through this app.

Design: The main page can be considered as Facebook newsfeed. Moreover, this app enables users to post photos, videos and personal stories. Users can also like or comment on other moms' posts. Users can set up meetings with other moms in their area in order not to feel lonely.



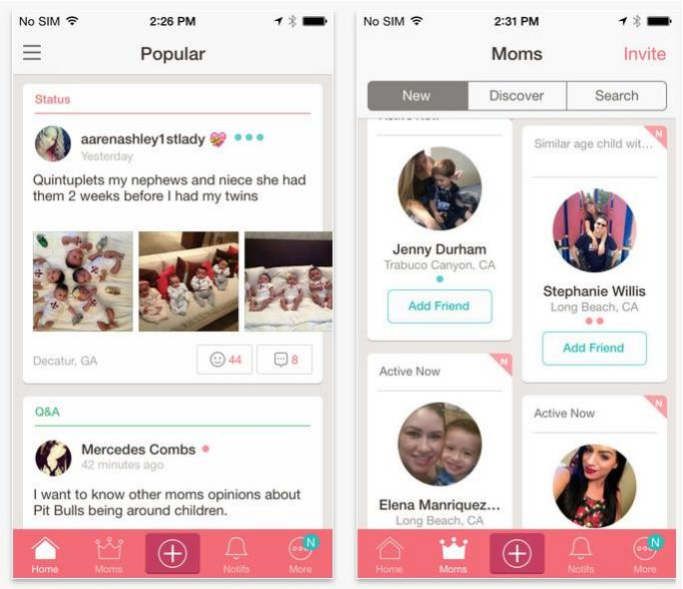


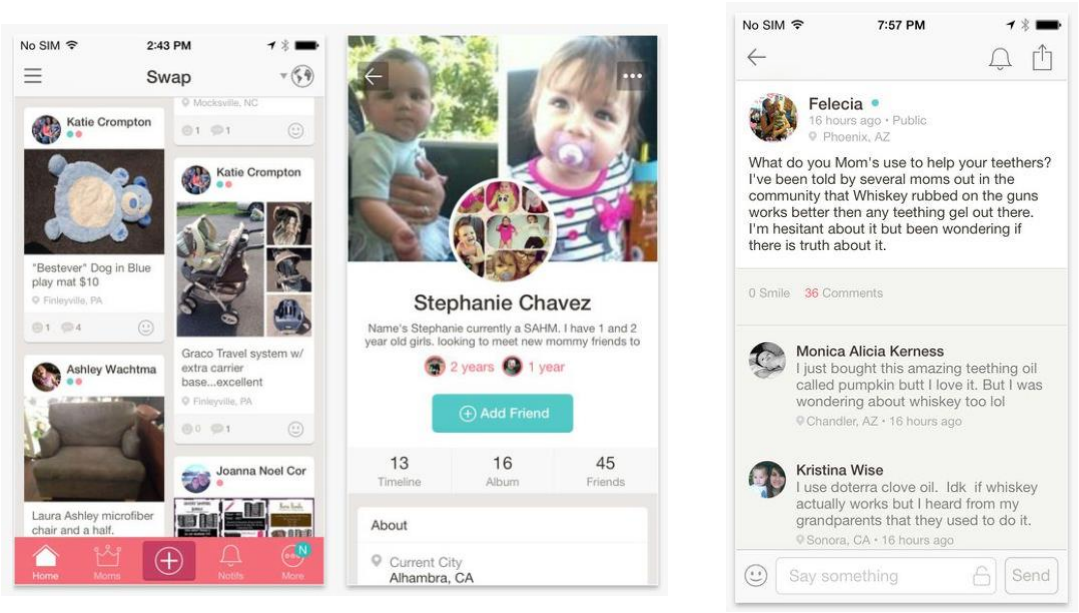
13.Smile Mom - local moms comunity

Description: The main aim of this app is to connect moms to other moms with similar age children in their local area to get parenting advice. Another feature of this app is buying and selling used baby and kids items. Users can arrange meetup and playdates. The idea of the app is to provide a platform for moms to overcome isolation after giving birth, busy working moms to exchange tips on parenting and make friends for their babies.

Design:

There is a profile feature just for mothers to state whether they are working mom or stay-at-home. They can declare their interests and connect to other moms based on their common interests. Friends feed is another section to share photos and know about their stories. Real-time messaging enables moms to chat with other moms and share photos through one on one or group messaging.





2.1.1 Summary

All of these thirteen apps were analyzed through their purpose, design and user satisfaction.

Based on this research, apps can be categorized to two groups; informative and communicative.

Informative apps such as WebMD My Baby's Beats provide helpful features for moms to track their health and their babies. In contrast, communicative ones such as Preggie cover the social aspect of pregnancy by enabling moms to share, chat and ask each other questions.

While some designs provide easy navigation, such as Pregnancy ++, clutter screens may lead to frustrations (i.e., Pregnancy Assistant).

Color codes for the screen must be selected with care and precision to the context. For example, My Baby's Beats has chosen a dark red color for all the screens to track baby heartbeats. However, red is a color that resembles warning and danger; hence, it can easily influence a user's mood.

Images and their context should be picked carefully. For example, pregnancy, which is designed for male partners, includes a screen with a beer cap and a fetus to demonstrate the fetus's size. While this comparison context can be controversial to some parents, images must be designed less provocatively due to the high sensitivity of the app context.

2.2 Personal Interviews (Conversations on the Go)

During this project, three personal interviews were conducted as pilot research to identify the possible needs. These interviews were conversations with moms regarding their parenting app usage. These interviews were with moms and regarding the apps they use.

The gathered data demonstrated that first-time moms are very concerned with their first experience of giving birth and parenting; hence, they search for any information that they think may be helpful. Similarly, they ask other moms about their experiences and the tools they have used during their pregnancy.

These conversations were not planned and occurred on the go. Therefore, the common points in their conversations were highlighted and considered during the design phase.

These points were:

1. All three moms – all first-timers – are very interested in sharing experiences and asking their questions with other moms. Two moms mentioned they asked their mom's friends before contacting a medical center.

2. One of three moms was informed about the pregnancy care center in Kelowna, yet she did not know enough about their resources, services and support.

3. Two of three moms indicate the importance of the emotional side of pregnancy rather than physical. One of them highlighted that there were times when they did not want to talk to their partner, a doctor, but a mom in a very similar situation.

2.2.1 Summary

3. Methodology

Based on the literature review and background studies, interviews were the best fit for the scope of this research. According to Harris & Brown (2010), semi-structured interviews are widely used in mixed-method studies to generate confirmatory results despite differences in data collection, analysis, and interpretation methods. There are three types of interviews: in-depth interview, focused interview and formal survey interview (Yin, 2009). In brief, these types can be described as:

• In-depth interview. This interview type may take place over an extended period and more than one meeting. In interview sessions, interviewees are asked about the facts of a matter and their opinions about the research context. Moreover, they can also be asked to propose their insights. They can also suggest other persons to interview.

• Focused interview. This type of interview contains open-ended questions and covers a conversational manner. However, the researcher asks a particular set of questions derived from background research and pilot study.

• Formal survey interview. This type of interview includes structured questions through a formal survey that entails

Both the sampling procedures and the instruments in regular surveys. The difference would be the survey's role in other sources of evidence (see in-depth interview). Then, the formal survey would only be a part of the total interview/overall assessment.

A common question about doing interviews is whether to record them. Using recording devices is a matter of personal preference. Audiotapes produce a more accurate rendition of any interview than any other method. However, a recording device should not be used when (a) an interviewee refuses permission or appears uncomfortable in its presence, (b) there is no plan for transcribing or systematically listening to the contents of the electronic records – a process that takes enormous time and energy, (c) the investigator is clumsy enough with mechanical devices that the recording creates distractions during the interview itself, or (d) the investigator thinks that the recording device is a substitute for "listening" closely throughout an interview.

The proposed research methodology for this study is a case study, for the central feature of case study research design is the investigation of one or more specific 'instances of' something that comprise the cases in the study (Yin, 2009). Moreover, case studies answer 'how' and 'why' questions, yet, that case study research comes into its own (Yin,1998) for both theory building and theory testing.

Furthermore, case study research can also facilitate a holistic perspective on causality since it treats the case. As a result, it offers the possibility of investigating causal complexity where there are many relevant factors with even few observations.

A. Hypotheses Testing

Based on the aforementioned sections, several research paths are anticipated. Based on heuristics evaluation of human-computer interaction (HCI) research (Carins & Cox, 2008), controlled experiments are a widely used approach to evaluating styles of interaction (e.g., Coyle et al., 2007) and to investigate the cognition in the interactions with systems (Li et al., 2006). Furthermore, HCI research possesses a broad range of methods to support the design and evaluation of interactive systems. Evaluation methods are considered important in HCI research since they capture the user experience. These methods can be broadly categorized as follows (Carins & Cox, 2008);

1. with or without the active involvement of users
2. with or without a running system
3. with or without a realistic context of use

The current proposal scope is well aligned with the second category (with or without a running system) since it requires the active participation of users with a running system in a laboratory setting. Hence, the following information can be produced for the hypothesis testing approach:

Population 1 is Moms who have used the proposed App to seek help in better ways because of the design characteristics

Population 2: Have mothers used the usual website of pregnancy care centers to seek help because of HCI principles? Drove higher usage and better navigation flow?

Population 3: Find a way to compare to other public websites for pregnancy information or patients like me.

Hypothesis 1: The mean of support gained from the pregnancy care center of Population 1 is, on average, higher than the mean of support gained from the pregnancy care center of Population 2

Hypothesis 2: Better design principles drove better usage, flow and navigation through the sites and mobile app.

Null hypothesis: The mean of support gained from the pregnancy care center of Population 1 is, on average, no different from the mean of support gained from the pregnancy care center of Population 2

B. Variables for the Causal model

In this study, variables can include:

- Independent variables (IV) or predictors are the variables that represent the inputs or causes or are tested to see if they are the cause.

In this study, IV is the information interface and levels of variation in design principles. Navigation flow, ???. The proposed App and website encompass a set of design principles that will be tested.

- Dependent variables (DV) or outcomes are the variables that represent effect or outcome. In this study, as measured by moms, DVs have better usage satisfaction and perceived value for the sites.

Data Collection

Through the initial stages of the research proposal, internet resources and a literature review were studied to investigate the demand and identify the requirements phase of the App. Due to a lack of ethics approval, interviews (Appendix A) are organized with executive directors of pregnancy care centers to explore the match between the proposed app and the center policies.

Data collection embraces interviews of 4 (or 5) executive directors of pregnancy care centers in Canada (Ongoing stage) to frame the study design for perceived important interaction principles. The initial interview was conducted with the executive director of Kelowna Pregnancy Care Center. The Kelowna Pregnancy Care Center notified Calgary and Vancouver Pregnancy Care Centers about the project through the snowball method. The following interview would be with the Canadian Association of Pregnancy Support Services (CAPSS), who assist local pregnancy centers in reaching clients facing issues related to unplanned pregnancies, post-abortion stress, and sexual health. Based on time availability, interviews will be expanded to Alberta, Kamloops and Toronto pregnancy care centers.

Design Process

This proposal designed the design process according to the Dix et al. ( ) figure.

Context in brief

In a few words, this App would facilitate the moms' reach to pregnancy care centers. After conducting interviews, the idea of merging care centers into one whole place was created so that any mom needing help could submit her inquiry, regardless of location, to the app under the required resource. This would be the care center's decision to select the option to meet the inquiry (i.e., Counseling, Housing, Food, etc.); they can direct the inquiry to their executive directors in other provinces (based on the need and availability), volunteers, counselors and moms. Moms seeking help can also mark their inquiry as urgent or non-urgent.

In other words, moms who are seeking help, regardless of their location and need, can either contact their local pregnancy care center or any of the care centers in Canada by preference. Based on availability and access, any care center could provide the support as needed.

Moms can connect with executive directors, counselors in care centers or other moms in the province.

A. Requirements

Based on the conducted interviews, pregnancy care centers' resources range from / but are not limited to their members:

- housing
- education and employment
- food
- pregnancy process and childcare
- counseling emotional support
- legal / justice services
- basic needs resources

- fitness
- post-abortion / post-partum depression

Due to the project timeline, it was impossible to address all the resources in the proposed app; hence, executive directors were asked to identify the top three resources to be addressed in the complementary App of their center. These resources were:

1. Counseling (abortion and post-abortion, adoption, parenting, etc.)
2. Housing
3. Health (basic needs and food)

Moreover, the proposed App will be informative and communicative; hence, through this app, moms / moms-to-be would be able to exchange information, share experiences (happy or sad moments), or ask for help if they would rather.

What is the app for? Who is the audience?

The primary goal of this app is to create a reliable virtual environment for moms and mom-to-be to enhance the support from an accredited care center in a short time. Moreover, this app could connect moms from other provinces of Canada through this reliable source to share information and questions.

Anti-requirements

What is the app NOT for? Who is NOT the audience?

This app is not for medical purposes, medical recommendations and physical health of moms-to-be and moms. Physicians, hospitals and health organizations are not the audience of this app.

B. Analysis

Following the top three requirements, this stage embraces creating scenarios- usage visualizations- for moms. (Hand-drawn / to be attached). The scenarios demonstrate different personas - descriptions of an example user- who submit their need through the App.

C. Prototyping

The prototyping stage was initiated after an initial interview with the executive director of Kelowna Pregnancy Care Center. The prototyping process started with paper prototypes and progressed to a digital mockup.

D. Design

In particular, the design section focused on Shneiderman's eight rules because they were complete and easy to follow in the project's timeline.

1. Strive for consistency.

Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus, and help screens; and consistent commands should be employed throughout.

2. Enable frequent users to use shortcuts.

As the frequency of use increases, so does the user's desire to reduce the number of interactions and increase the pace of interaction. Abbreviations, function keys, hidden commands, and macro facilities are very helpful to an expert user.

3. Offer informative feedback.

For every operator action, there should be some system feedback. The response can be modest for frequent and minor actions, while for infrequent and significant actions, the response should be more substantial.

4. Design dialog to yield closure.

Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback after a group of actions gives the operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and options from their minds, and an indication that the way is clear to prepare for the next group of actions.

5. Offer simple error handling.

As much as possible, design the system so the user cannot make a grave error. If an error is made, the system should be able to detect the error and offer simple, comprehensible mechanisms for handling the error.

6. Permit easy reversal of actions.

This feature relieves anxiety since the user knows that errors can be undone, thus encouraging exploring unfamiliar options. The units of reversibility may be a single action, a data entry, or a complete group of actions.

7. Support internal locus of control.

Experienced operators strongly desire the sense that they are in charge of the system and that the system responds to their actions. Design the system to make users the initiators of actions rather than the responders.

8. Reduce short-term memory load.

The limitation of human information processing in short-term memory requires that displays be kept simple, multiple-page displays be consolidated, window-motion frequency be reduced, and sufficient training time be allotted for codes, mnemonics, and sequences of actions.

Data Analysis

This study uses a mixed method approach; qualitative case study content analysis and quantitative data analysis (heuristics evaluation) approaches will be used. NVivo will be used to capture the textual analysis and frequency coding.

Moreover, following Miles and Huberman (1994), a tally table is proposed to analyze and compare the usability of the usual website and the proposed app. In order to test usability, eight Shneiderman rules were followed.

8 rules of Shneiderman	Usual website		Proposed App
	Pregnancy Care Centers (PCC)		
Consistency	Kelowna PCC		
Providing Shortcuts			
Informative feedback	Calgary PCC		
Dialogue to yield			

closure			
Offer simple error handling	Vancouver PCC		
Easy reversal of actions			
Internal locus of control	CAPSS		
Reduce short term memory load			

Expected Conclusions

This research will provide a comparative case study of better design principles, such as Schniderman's rules, scenario planning, navigation, interface, better design/analysis/build/test cycles, and interaction techniques, to increase mother's value of and satisfaction with the website and mobile app being built with these design principles. The Hypothesis will be supported if the analytical table demonstrates that the design principles produce better outcomes (e.g., satisfaction and value of site) for the mothers and pregnancy care centers. This is important research because these sites cannot afford much and will rely on this study to provide the top three resources most efficiently. The design scenarios will inform the care centers about investing wisely to produce the best effect over the most significant number of mothers and centers.

Ethics Approval

As central components of ethics principles, consent forms and confidentiality will be provided in this research to both parties, developers and users.

Limitations

Due to the lack of ethics approval, the collected data might not represent the end users (moms and moms-to-be); hence, generalizability issues might be investigated.

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Appendix A - Interview Questions to executive directors

1. Who are your clients?

2. What does your care center offer? What are resources?

3. Does your center provide any follow-ups on all moms? or special case?
    - if yes, how / by which means?

4. What are the guidelines and policies of your care center?The response will be used to determine app features and context.

5. Who are volunteers? What is involved in the range of their tasks?

6. Does your center holds regular gatherings? How often?

7. What is the range of discussed subjects in the gatherings?