Ux Design of a Mobile Food App for Pregnant Women
Mixed-Methods Approach

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Abstract. Background: As a special group, the nutritional status of pregnant women not only directly affects their own health, but also has a close relationship with the growth and development of the fetus. More and more young people in China choose takeout food as their daily diet, which involves nutrition and food safety issue [1]. App Design: Nutritionist builds standard meal plans which could meet most pregnant women’s daily needs; the app collects all the physical exam results and the advices from obstetrician; after the data collection, nutritionists could use the suggestion from algorithm to customize each pregnant woman’s daily or monthly meal plan; finally, the chief will cook the meals and deliver them to the customer. Conclusions: After testing the app with 120 pregnant women in a hospital located at Zhenjiang City, Jiangsu Province, we plan to promote it to several cities nearby. The research suggests that this app can connect obstetrician, pregnant women, nutritionists, and chiefs so that pregnant women can be proactive in nutrition intake and control the food resource. Pregnant women highly appreciated the evidence-based pregnancy information, nutritionist’s opinions and convenient food delivery.

1. Introduction

1.1 Design Background
Since the development of Chinese society, the pace of our life is getting faster and faster, which rises a lot of chances and problems, like the prosperous development of takeout food [2]. Looking back the last 5 years, Chinese people’s eating behavior is changing rapidly. As a UX designer, although there are many principles to follow, the healthcare industry (like pregnant women eating behavior) is still at the starting point to catch up with the rest of tech industry. In compliance with the user habits, it is a great opportunity to bridge down the huge gap between pregnant women, obstetrician nutritionist and chiefs.

2. Food Safety Issue
China is increasingly using food as an indicator of lifestyle. People have high expectations for food: excitement, novelty, experience and inspiration. For the Chinese, food is a way to live in the moment and embrace it. Parenthood has changed the way people treat food and made them pay more attention to safety, health and quality. As the special group, pregnant women are even more careful about what they and their children eat, especially in China [2].

The Chinese are well aware of food safety concerns that have become increasingly apparent in recent years. Most people are trying to avoid street food and cheap restaurants because these foods have a poor quality. Gastrointestinal cancer is one of the most common cancers in China, which most people believe was caused by dirty food [4]. Although people know the danger of the takeaway food, China's takeaway market grew rapidly (up 23 percent) to 204.6 billion yuan ($31.9 billion) in 2017 [1].
A fast lifestyle compels people to adopt this approach because they need to optimize their time schedule. The other reason is because the rapid development of express delivery services, Chinese people especially the young, are becoming more and more accustomed to ordering food instead of cooking for themselves. Most takeout foods and drinks are high in fat, salt and sugars and various food additives [5]. This kind of food may be delicious, but if people eat it regularly, it will do great harm to their health, needless to say how this can affect a pregnant woman and her fetus.

2.1 User Needs Shifting
Our current maternal industry which mainly focused on providing independent and traditional information, has been unable to meet the current needs of new mothers. Professional knowledge and expert’s advice are the most needed parenting knowledge for new mothers [3]. During the entire pregnancy, new mums normally have at least nine physical exams, but it does not include seeing a nutritionist. An obstetrician still mainly focuses on physical health, instead of tracking the diet and nutrition intake amount.

New mums are always seeking more health information; they may look for additional and complementary information to deal with uncertainty and anxiety [8]. Maternal-child websites/apps are main channels for new mothers to obtain parenting knowledge [9]. Most new mothers reduce the use of computers after being pregnant, the importance of mobile internet is further highlighted. To meet the needs of women, a large number of maternal and child health apps have appeared in the Android app market and Chinese app stores [9]. However, none of these apps provide one-stop service, from medical records, nutrition advice to food delivery.

Our concentration is to solve the problems: 1) Although pregnant women pay enough attention to nutrition intake, they still have no choice but to take wrong diets; 2) Designing an App not only focuses on offering professional maternal knowledge, but also to use algorithms that connect obstetrician, pregnant women and nutritionists so that pregnant women can be proactive in nutrition intake and control the food resource.

2.2 Objectives
The aims of this study were to (1) investigate app usage of Chinese women during pregnancy, (2) gain a better understanding of their views and attitudes toward ordering foods through this app, (3) explore their concerns about data privacy and security, and (4) inform the development of a healthy food promotion program through an app.

3. Design Process

3.1 User Persona Analysis
The subjects of this survey were 150 pregnant women, all from the Red House Obstetrics and Gynecology Hospital of Zhenjiang City, Jiangsu Province. Their visiting time was from May 2019 to October 2019. A total of 120 questionnaires were returned with a recovery rate of 80%.

All women enrolled in this research must attend regular antenatal examinations and at least eight face-to-face antenatal education sessions throughout their pregnancy.

Women must meet the following conditions: (1) over the age of 18, (2) currently pregnant, (3) have a smartphone, and (4) can give a written consent to participate.

3.2 Moral Considerations
The study was approved by Red House Obstetrics and Gynecology Hospital of Zhenjiang City, Jiangsu Province. Before conducting the survey or focus group interview, all potential participants were informed of the purpose and procedures of the study, and their written informed consent was obtained from those who agreed to participate. All participants were told they had the right to refuse to participate and, if they did, they could quit at any time.
3.3 Design Methodology

Questionnaire survey, focus group interview and user testing were used in this study. According to the relevant literature, combined with the special requirement of nutritional needs during pregnancy, the questionnaire was carefully determined after expert discussion. The questionnaire consists of three parts: (1) General information, including age, educational level, occupation, nationality, family income, etc; (2) Nutrition knowledge, attitude and behavior; (3) Pregnant diet habits, mainly to investigate the frequency of pregnant women intake of various foods, nutritional supplements intake. The questionnaire was filled out by pregnant women on the spot independently. The questionnaire was checked by trained obstetricians and corrected by algorithm.

In total, we chose 12 pregnant women in their second trimester to late pregnancy to join our group interviews. Each workshop involved a maximum of four participants and lasted about 40 to 60 minutes, accompanied by a nutritionist or their obstetrician. The obstetrician recruited the participants and the following inclusion criteria were adhered to: 1) participant is pregnant more than 5 months and less than 9 months; 2) participant still lives at home and visits the hospital as obstetrician requests; 3) participant is diagnosed with pregnancy-related disease, high-blood pressure, gestational hypertension or certain food allergy 4) participant has sufficient physical abilities to participate in the workshop. The main topics discussed in focus groups include the following:

1) Dietary habits and major health issues during pregnancy;
2) Their health information sources and main considerations when ordering takeout or cooking themselves;
3) Their concerns about data privacy and security when using applications;
4) What features they want to see and use in the application.

3.4 Data Analysis

The average age of pregnant women is (25.3±1) years old, and the education level is mainly college degree, accounting for 44.6%. The occupational distribution is 65.0% of company staff, 13.1% of service industry, 4.1% of workers, 4.7% of teachers, 2.7% of civil servants and 10.4% of others. The monthly cost of diet or pregnancy related examination is less than ¥1000 for 30 cases, ¥1000 to ¥3000 for 66 cases and more than ¥3000 for 24 cases.

| Category                          | Values       |
|-----------------------------------|--------------|
| Age (years), n (%)                |              |
| Under 25                          | 46 (38.3%)   |
| 26-30                             | 52 (43.3%)   |
| More than 30                      | 22 (18.3%)   |
| Education, n (%)                  |              |
| Senior high school                | 28 (23.3%)   |
| College degree                    | 72 (60%)     |
| Postgraduate degree or above      | 20 (16.7%)   |
| Marital status, n (%)             |              |
| Single / divorced / separated / widowed | 3 (2.5%) |
| Married                           | 117 (97.5%)  |
| Household income, n (%)           |              |
| Less than ¥20,000                 | 13 (10.8%)   |
| Between ¥20,000 and ¥40,000       | 13 (10.8%)   |
| More than ¥40,000                 | 94 (78.3%)   |
| Weight category, n (%)            |              |
| Underweight                       | 33 (27.5%)   |
| Normal weight                     | 58 (48.3%)   |
| Overweight                        | 25 (20.8%)   |
3.5 Eating Behavior
The ingestion frequency of each type of food is divided into three levels: daily, regular, occasional or never. The results showed that some respondents' food intake was unreasonable and the frequency of food intake was generally low. The daily consumption of milk and dairy products was 54%, and the daily consumption of vegetables and fruits was 62.5% and 73.3%, respectively. Even 19.1% of pregnant women daily and 38.3% frequently eat dessert.

Vitamin D and calcium deficiency are common among pregnant women in urban and rural areas because of Chinese traditional dietary composition. Women aged 30 to 35 years or older who are pregnant have an increased risk of adverse pregnancy outcomes, due to an increased calcium deficiency, as well as chronic vitamin D deficiency and other micronutrient deficiencies.

| Food, n (%) | Everyday | Frequently | Occasionally or Never |
|-------------|-----------|------------|-----------------------|
| Milk and dairy products | 46 (38.3%) | 17 (14.1%) | 57 (47.5%) |
| Vegetable | 75 (62.5%) | 45 (37.5%) | 0 (0%) |
| Fruit | 88 (73.3%) | 27 (22.5%) | 5 (4.1%) |
| Meat | 90 (75%) | 28 (23.3%) | 2 (1.6%) |
| Seafood | 60 (50%) | 57 (47.5%) | 3 (2.5%) |
| Whole grains | 120 (100%) | 0 (0%) | 0 (0%) |
| Dessert | 23 (19.1%) | 46 (38.3%) | 51 (42.5%) |

3.6 Nutrition Design
According to different physiological characteristics and nutritional needs during the different period of pregnancy, and the content of various nutrients in food, the meal plan is designed by a calculation method of nutrients [6]. For example, protein source, lipid source, and three-meal energy supply ratio in the diet. The nutritionist and chief modify and adjust the amount and proportion of various nutrients for pregnant women to meet their nutritional needs, so as to reduce the occurrence of premature infants, deformed infants and giant infants caused by malnutrition or over-nutrition. The monthly meal plan designed as below:

| Pregnancy Stage | Fetal Development Stage | Meal Plan |
|-----------------|-------------------------|-----------|
| 1st Month       | Blood circulation, thyroid, kidney, eyes, ears, arms and legs began to development, brain, spinal cord, mouth, the digestive tract | Compensatory calcium, iron, copper, vitamin A on the foundation of balanced diet, basically contain in red green vegetable, fish, egg, animal liver, viscera, cod liver oil |
| 2nd Month       | Brain nerve, muscle nerve, basic skeleton formation, muscles, oral-nasal development, trachea, bronchi appear | Increase the intake of fat, protein, calcium, vitamin D, milk, fish, eggs; magnesium, calcium, phosphorus, copper, vitamin A and vitamin D |
| 3rd Month       | Bladder formation, fingernail, toenail formation, lungs, thyroid hormone | Vitamin A, protein, calcium, increase the intake of animal liver, egg, milk, cheese, fish, yellow-green vegetables, red green vegetables. |
| 4th-5th Month   | Breathing Activity | Calcium, fluoride, protein, sulfur, add egg, milk, seafood, beans, fish, red and green vegetables, bone food |
6th Month | Eye development completed | Protein, vitamin A, increase the intake of animal liver, egg kind, milk, cheese, yellow-green vegetable and fish

7th–8th Month | Nervous system develops gradually | Calcium, potassium, sodium, chlorine, vitamin D, niacin acid, increase the intake of egg, flesh, fish, milk, green leafy vegetables, brown rice

9th Month | Exuberant sebaceous gland activity | Protein, adipose, candy, increase the egg in food, flesh, fish, milk, potato, rice, noodles, corn absorb scale

10th Month | Supplement iron | Animal liver, egg yolk, milk, viscera, green leafy vegetables, beans

3.7 App Usage and Sources of Food during Pregnancy
51.6% (62/120) of the respondents mainly received pregnancy related health information mainly from websites and apps, followed by health professionals 30.8% (37/120), learn from health professionals 8.3% (10/120) and printed materials 17.5% (21/120). Nearly half of the respondents use mobile social apps more than three times a day, and more than 80% use mobile social apps for more than one hour a day, WeChat Moments ranks No.1.

Combining user habits, nutritionist’s advice and market research, we built a WeChat mini program Xian Cheng without extra app download and installation. Users can use the full functions of related applications in the WeChat interface by scanning the QR code or searching for the corresponding name of the applet, and the used applet does not occupy the memory of the mobile phone.

55% (66/120) of the respondents have to order takeout food at least once per day, followed by occasionally (less than 3 times per week) 28.3% (34/120), never eat street food or order food deliver from apps 16.6% (20/120). Table 4 shows the details of the research findings:

| Table 4 Main Considerations When Ordering Takeout Food in the Survey, Zhenjiang, Jiangsu, 2019 (n=120) |
|--------------------------------------------------|
| Category                                           | Values   |
| Smartphone operating system, n (%)                |          |
| Android                                           | 53 (44.1%) |
| IOS                                               | 67 (55.8%) |
| Frequency of ordering takeout food (exclude fruit), n (%) |          |
| Everyday                                          | 35 (29.1%) |
| Less than 3 times per week                        | 52 (43.3%) |
| Barely or Never                                   | 33 (27.5%) |
| Considerations when ordering, n (%)               |          |
| Taste                                             | 22 (18.3%) |
| Nutrition                                         | 14 (11.7%) |
| The freshness of food                             | 15 (12.5%) |
| Restaurant reputation                             | 9 (7.5%)  |
| Price                                             | 18 (15%)  |
| Deliver time                                      | 9 (7.5%)  |
| Never orders                                      | 33 (27.5%) |
| Current usage of food ordering apps, n (%)        |          |
| Eleme                                             | 21 (17.5%) |
| Meituan                                           | 49 (40.8%) |
| Baidu Waimai                                      | 17 (14.2%) |
| Never orders                                      | 33 (27.5%) |

3.8 Product Design
The applet uses user’s WeChat information such as name and profile photo and requires to access GPS
location for delivery purpose. XianCheng applet user flow is shown as Figure 5. After completing the questionnaire, the user will enter the homepage of XianCheng applet, the page displays all the available food packages which are formulated for the current user by a qualified nutritionist. The main reference basis for setting the package including the user’s pregnancy cycle, BMI index, hospital examination data, health issues and etc. User can choose a package that suits her. For example, the weekly food package contains 7 different kinds of soup, 12 different dishes, and 5 different main dishes. On the package detail page, it displays nutritionists’ recommendations and nutrients content, such as calories, calcium and various trace elements, etc.

Figure 1 Xiancheng Applet User Flow Design

3.9 Final Designs and User Testing

In total, 4 key frames are considered in this applet design (Figure 6), including (1) food package browse, (2) package detail page, (3) personnel qualification, like nutritionist and chief, (4) user profile page. Participant are interviewed with XianCheng applet 1.0 version and documented their original text.
Figure 2 Xiancheng Applet Version 1.0 Final Designs

Theme 1: Professional and Convenience

It is widely accepted that a woman can accept lifestyle changes during pregnancy. In our study, all the participants said they would change their eating behaviors that might harm their children's health. To achieve the best pregnancy outcome, this app can help them make lifestyle changes in an easier way (n=20):

Yes, I know I should not eat fried chicken or street food, but I have a full-time job and don't have enough time cooking by myself. By using XianCheng, I don’t need to worry about the food resources and it delivers on time. [P10]

With this app, participants (n=12) having health issues, like gestational diabetes and dietary taboos can easily manage their diet and be proactive in sugar intake amount.

I have gestational diabetes, but none food deliver app is shown the sugar amount. It causes me a lot trouble to cook or order food. [P6]

Theme 2: Disadvantages in Apps

Although participants (n=23) took expert advice seriously and express their support of catering for pregnant women, they thought the current prices are too high and that professional information fees should not be included in meal packages.

This is too expensive... I can’t afford it. I can’t spend ¥150 per day just for food. I hope I can get the receipt that I can cook myself. [P3]

Most pregnant women (n=18) worried about the app algorithm and expert qualifications.

Are you sure this algorithm can automatically generate my meal plan based on my condition? How this thing works? My body fat and weight change every month, I don’t know... I am not totally buying it. [P6]
4. Conclusion
The study provides insights into how pregnant women use the app to buy meal plans, as well as their views and attitudes towards the applet. XianCheng applet provides evidence-based information, expert advice and tailored diets, which are highly appreciated by the users. As more women use apps during pregnancy, there are lots of commercial opportunities for health professionals, designers, and app developers.

References
[1] Chinese Food Ordering Apps: What you should Know? Available: https://ecommercechinaagency.com/chinese-food-ordering-apps/. Accessed on Feb 4, 2019.
[2] Alibaba just gave Chinese youth another reason to never leave their desk. Available: https://techcrunch.com/2018/12/27/alibaba-eleme-bilibili-partnership/. Accessed on Dec 27, 2018.
[3] Chinese Family Parenting Report 2016. Available: https://www.ipsos.com/en/chinese-family-parenting-report-2016. Accessed on Oct 11, 2019.
[4] Zhixun Yang; Rongshou Zheng; Siwei Zhang; Hongmei Zeng; Wanqing Chen. Trend and prediction of gastric cancer incidence in China. Chinese Journal of Oncology. 2019 Volume 05.
[5] Xinjie Wang. Nutrition analysis and food safety intervention measures of Chinese food takeaway in Zhejiang. Food Industry. 2018 Volume 06.
[6] Sun Na; RuqiJiang Wu. Dietary Design and Nutrition Analysis for Gravida. Farm Products Processing. 2017 Volume 1671-9646(2017)04b-0037-03
[7] Ai-Guo MA, Xue-Cun CHEN, Yu WANG, Rong-Xian XU, Ming-Ci ZHENG, Jue-Sheng LI. The Multiple Vitamin Status of Chinese Pregnant Women with Anemia and Nonanemia in the Last Trimester. Journal of Nutritional Science and Vitaminology. 2004 Volume 50 Issue 2 Pages 87-92.
[8] Na Wang; Zequn Deng; Li Ming Wen; Yan Ding; Gengsheng He. Understanding the Use of Smartphone Apps for Health Information Among Pregnant Chinese Women: Mixed Methods Study. JMIR MHEALTH AND UHEALTH.
[9] YiwEN Zheng; Hongxiao Cui; Qing Li. Study on Mobile Medical APP in Self-Management of Maternal Health. China Academic Journal Electronic Publishing House. [DOI] 10.2969/j.issn.1673-6036.2018.04.009