Infant and Child Care App: Designing an Interactive Mobile App to Engage Caregivers with Infant Development and Nutrition Priorities in Peru

Stephanie Angharad Jones

In partial credit for the award of MSc Computing

Supervised by Dr Nervo Verdezoto Dias
Moderated by Dr Alia Abdelmoty

School of Computer Science and Informatics
Cardiff University

05/11/21

Table of Contents

Abstract *4*

Acknowledgements *5*

Introduction *6*

Aims and Objectives *7*

Primary Aim: **7**

Secondary Aims: **7**

Objectives: **7**

Background *8*

Infant Health in Peru **8**

Anaemia 8

Exclusive Breastfeeding 11

Complementary and Responsive Feeding 12

Related Work *13*

Infant Health Strategies in Low to Middle-Income Countries **13**

Infant Health Strategies in Peru **13**

CRED Appointments and Vaccination 13

Commitments 15

Community Health Promoters 16

Covid Related Complications to Infant Health Access 18

Infant Health Applications **19**

Infant Health Applications in Low to Middle-Income Countries **20**

Road to Health App 20

Infant Health Apps in Peru **21**

Yico 21

Technology to promote reflection **23**

Multimodal Tracking 23

Approach *24*

User-centred Design **24**

System Design **25**

Gather Initial Requirements 25

User Interface Design **39**

Review Design with Nutrition Expert **42**

STAMINA and Focus Group Feedback on Design 4 ..... **47**

Qualitative Analysis of Data **52**

Phase 1: Paper Health Card 52

Analysis of Phase 2: Breastfeeding, Iron Supplement and Complementary Feeding Diary 55

Phase 3: Prototype 4 Evaluation 58

Screen by screen evaluation of feedback and required changes 59

Final Design Evaluation: Design 5 ..... **62**

Implementation ***65***

Backend **66**

Database Design 66

Functionalities of Implementation **68**

Focus Group 3: Demonstration of App **73**

Discussion ***79***

Principal findings **80**

Limitations of the Study **81**

Future work **82**

Reflection ***83***

Conclusion ***85***

References ***88***

Appendices ***91***

Appendix 1: Design 3 ..... **91**

Appendix 2: Design 4 ..... **94**

Appendix 3: Design 5 ..... **98**

Appendix 4: Focus Group Response Translations G1 ..... **108**

Appendix 5: Focus Group Responses and Translation G2 ..... **126**

Appendix 6: Final Prototype Demonstration to Healthcare Professionals **134**

Abstract

Infant healthcare in Peru is centred around CRED controls which are infant care check-ups. Caregivers are provided with paper cards to record medical information and milestones of the child. Peru has experienced a double burden of malnutrition and anaemia in recent years (Santos et al. 2021). Strategies to combat these issues include agreeing on goals with caregivers to improve infant nutrition and the provision of iron supplements. This project aims to design an interactive mobile application that resembles the paper card to engage caregivers with infant development. Designs were created using a user-centred design model with proxy stakeholders: healthcare professionals and nutritionists evaluating each iteration. The feedback received suggested possible benefits to implementing a digital system such as the application. However, some barriers may need to be worked on in future iterations. Further studies should evaluate caregivers' perceived utility and usability to gain further insight into possible benefits and solutions to barriers.

Acknowledgements

First and foremost, I would like to thank my supervisor Dr Nervo Verdezoto Dias, whom the completion of my dissertation would not have been possible without. I am incredibly grateful for all the support, guidance and encouragement throughout the project.

I would like to extend my deepest gratitude to Rossina Pareja MSc of the IIN in Peru, whose invaluable insight, feedback, and guidance cannot be overstated. Gracias Rossina.

Special thanks to the STAMINA Project group for all their feedback and support during my dissertation.

Finally, thank you to all focus group participants for their time. Gracias

The primary language in Peru is Spanish; some documents included in the appendices may be in Spanish, and data from focus groups may be translations.

The images included in the prototype designs are from Laminario del Actor (Laminario del actor social. Para las visitas domiciliarias a familias con niños o niñas menores de 1 año. 2020), Norma Técnica de Salud para el Control del Crecimiento y Desarrollo de la Niña y el Niño menor de cinco años (Ministerio de Salud 2017) and Adobe Stock.

Introduction

The Republic of Peru is a developing country located in South America with a population of 32,971,846 (2020) spread across various unique landscapes such as cities, mountains, and the jungle (Peru - Place Explorer - Data Commons.). Ministerio de Salud (MINSA), the country's health ministry, has led many campaigns to improve infant health countrywide. Peru has experienced a double burden of malnutrition and obesity in infants in recent years. Despite the decrease in infants' malnutrition and significantly improved stunting rates from 37% in 1992 to 13% in 2016, the obesity rates have risen consistently in all social groups from 1992 - 2017. (Santos et al. 2021)

At present, strategies to improve infant health include CRED appointments that focus on promoting infant development, health promoters reinforcing infant health practices and knowledge within communities, and in 2020 the introduction of digital technologies such as informational apps (INS presenta Aplicativo Móvil ¡Yico!).

In addition to the previous strategies, caregivers receive a paper health card where vaccinations, developmental milestones and measurements at CRED appointments are recorded. Also, caregivers often receive recommendations called "compromisos" or commitments during meetings. These "compromisos" are agreements for the caregiver to follow a specific goal, such as increasing the infant's intake of iron-rich food, registered on a paper-based form

In this project, I aim to explore how a digital alternative to the current paper card and commitment system could improve engagement with infant development and nutritional goals aligned with Ministerio de Salud (MINSA) campaigns. During this

project, the goals focused on, exploring how technology can enhance the intake of iron-rich foods and ferrous sulphate (Iron) supplements to combat anaemia rates, promote exclusive breastfeeding, and promote awareness of complementary and responsive feeding.

Aims and Objectives

Primary Aim:

To Design an Interactive Mobile App to Engage Caregivers with Infant Development and Nutrition Priorities in Peru

Secondary Aims:

To understand the utility and problems of the current paper-based system for Health Cards and Commitments

Objectives:

- To review the literature surrounding the current infant healthcare structure in Peru
- To understand the current challenges of the paper-based systems by engaging with healthcare professionals
- To examine existing infant health application existence
- Consider concerns and barriers to implementing an application system
- To gather requirements from the paper card and literature
- To design an initial prototype based on requirements

- To iteratively collect user feedback on prototypes from healthcare professionals
- To revise prototype design according to feedback
- To develop and evaluate a cross-platform application based on designs

Background

Infant Health in Peru

Anaemia

One of the most prevalent infant health concerns in Peru is anaemia. Infants are tested for the condition at six months during CRED appointments, and monitoring continues as needed (Laminario del actor social. 2020). Figure 1 below shows the prevalence of anaemia in infants aged 6- 35 months in Peru; we see a rate as high as 69.4% in 2019-2020 . It shows a varying prevalence from 29.2% to 69.4% across the country, with rural regions consistently at the higher end of the scale.

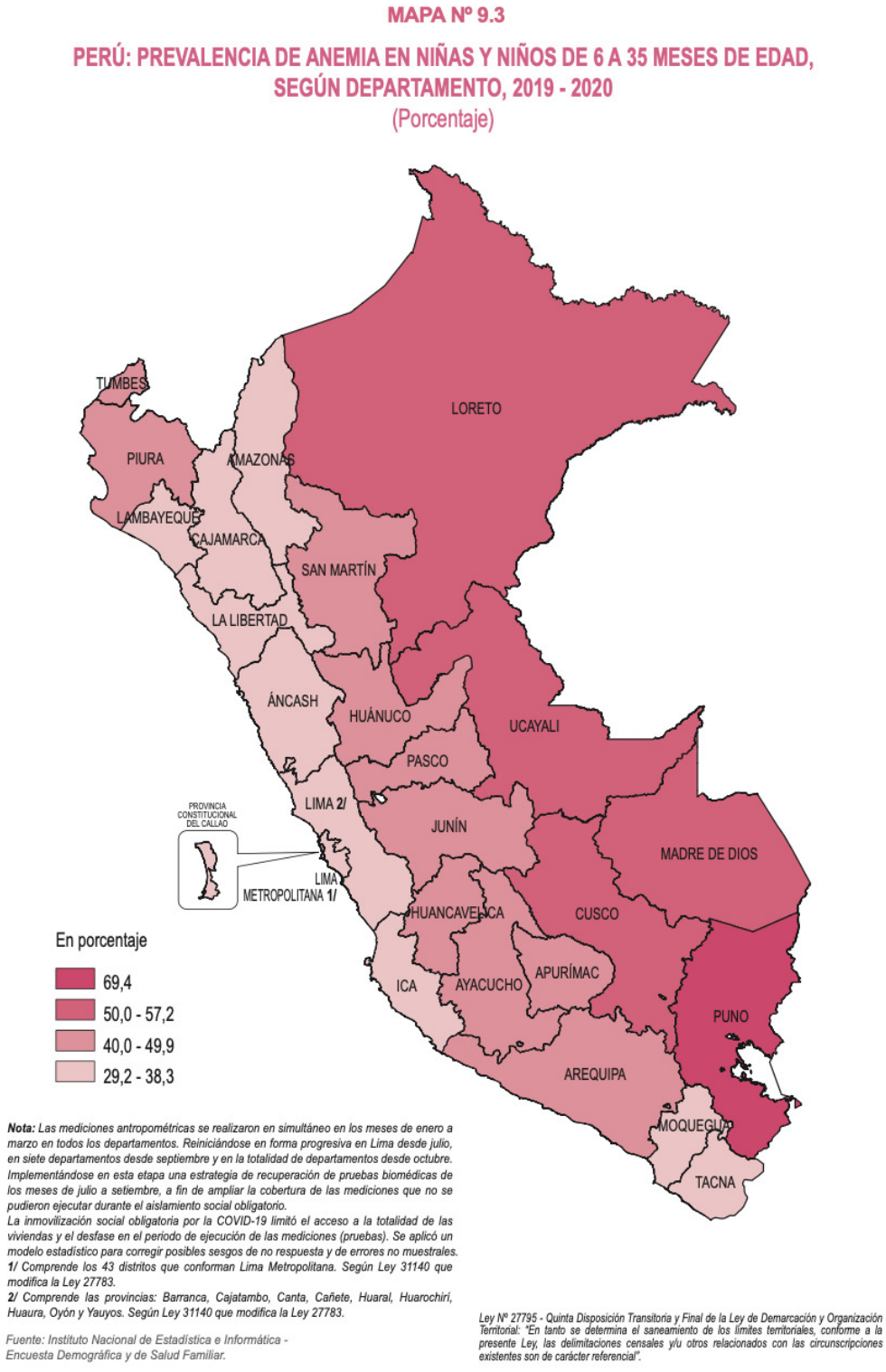
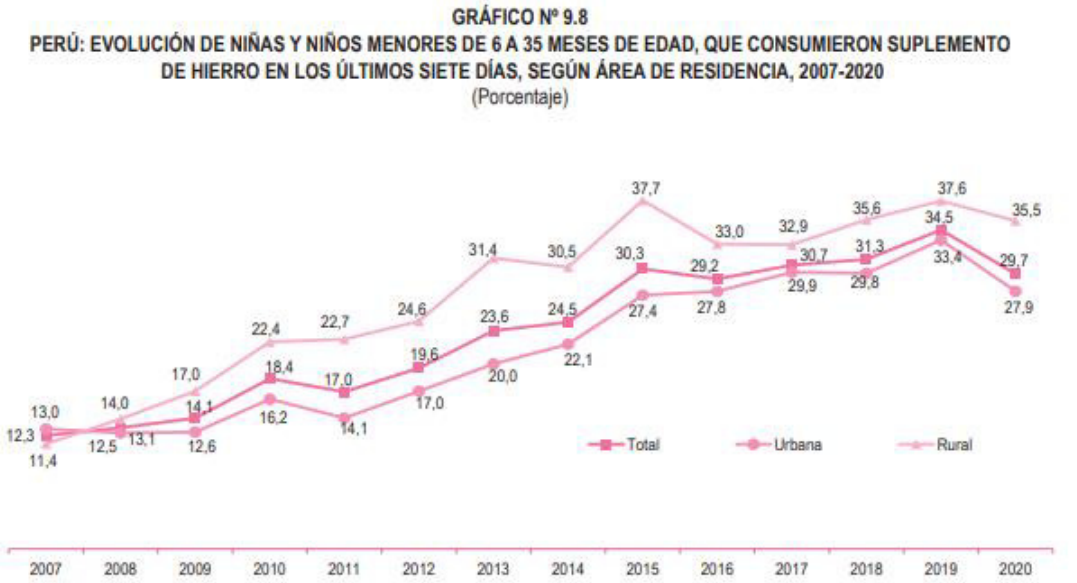


Figure 1 – Prevalence of Anaemia in girls and boys between 6-35 months old, by department, 2019-20. (INEI - Perú: Encuesta Demográfica y de Salud Familiar-ENDES 2020.)

Government health initiatives and health workers recommend that infants start receiving iron supplements from 4 months of age and continue supplementation until the child is six years old (INEI - Perú: Encuesta Demográfica y de Salud Familiar-ENDES 2020.).



Nota:
El tema suplemento de hierro es objeto de investigación a partir del año 2007. A partir del año 2013 el suplemento de hierro comprende: hierro en pastillas o jarabe, hierro en polvo como chispitas o estrellitas, hierro en gotas y en otra presentación.
Cuadro base: Cuadro 10.10A del Informe principal de la ENDES 2020.
Fuente: Instituto Nacional de Estadística e Informática - Encuesta Demográfica y de Salud Familiar.

Figure 2: Evolution of girls and boys from 6 to 35 months of age, who consumed iron supplementation in the last seven days, according to the area of residence 2000-2020 (INEI - Perú: Encuesta Demográfica y de Salud Familiar-ENDES 2020.)

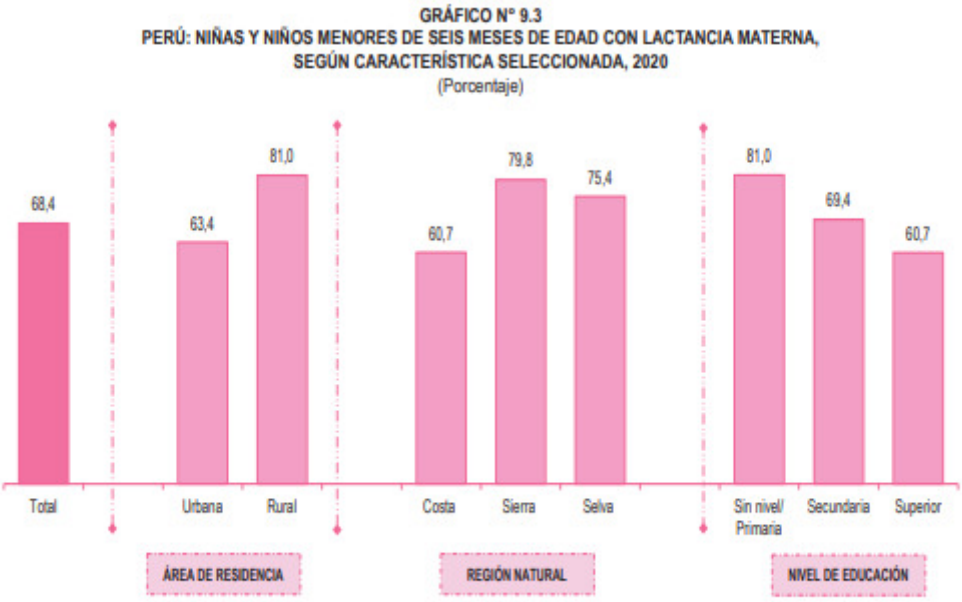
Figure 2 showed an increase in total consumption of iron supplements each year from 12.3% in 2007 to 34.5% in 2019. There was a slight decrease in 2020 to 29.7% due to Covid-19 related problems. Despite promoting supplementation by healthcare

professionals and government campaigns, anaemia is still prevalent. Although increasing, consumption of iron supplements remains low.

Exclusive Breastfeeding

Feeding infants under six months solely with breastmilk in Peru is an infant health concern promoted by WHO and MINSA campaigns. For mothers who can breastfeed, the advice is to give only breastmilk until the infant is six months. After that age to introduce food into the diet while breastfeeding until the infant is two years old. (Laminario del actor social.. 2020)

ENDES 2020 shows that 68.4% of infants younger than six months old received breastmilk in 2020. The figure below also shows that breastfeeding rates were higher in rural areas at 81% compared to 63.4% in urban areas. Mothers who received the lowest level of education had the highest rates of breastfeeding compared to mothers with secondary or tertiary education.



Nota:
Cuadro base: Cuadro 10.3B del Informe principal de la ENDES 2020.
Fuente: Instituto Nacional de Estadística e Informática - Encuesta Demográfica y de Salud Familiar.

Figure 3: Girls and boys younger than six months who received breastmilk, according to selection characteristics, 2020 (INEI - Perú: Encuesta Demográfica y de Salud Familiar-ENDES 2020.)

Complementary and Responsive Feeding

In response to the high rates of anaemia and obesity prevalence in the Infant population, MINSA focus on encouraging the inclusion of iron-rich food and reducing high fat/sugar food.

Complementary feeding should begin at six months of age and start with small quantities of soft foods. Gradually working towards a more solid texture and increasing the portion as the infant grows (Laminario del actor social. 2020). At six months, the infant's iron stores start to deplete, and the inclusion of iron-rich foods is needed as breastmilk is not a good source of iron (Fewtrell et al. 2007).

A 2014 study by Penny et al. found that fruit and vegetable consumption in peri-urban Lima was lower than the WHO recommendations. Consumption of the recommended amount was as low as 23%. Children and adolescents aged 1-17 years eat more fruit than vegetables.

The study's suggestions concluded that promoting traditional recipes high in vegetables' would be a complementary strategy moving forward to complement existing five a day campaigns in Latin America. (Penny et al. 2017)

Related Work

Infant Health Strategies in Low to Middle-Income Countries

Successful existing strategies to improve infant health include educational programs. In India, the educational intervention improved macronutrient intake in infants compared to a control group, and that responsive complementary feeding education improved developmental outcomes (Vazir et al. 2013). A similar intervention was implemented in Peru, where nutritional education improved nutrition and stunting rates. (Penny et al. 2005)

Infant Health Strategies in Peru

CRED Appointments and Vaccination

Infants in Peru attend CRED appointments, which monitor the child's development by measuring height and weight. Health professionals also follow up with the caregiver on any issues they have noticed with developmental milestones or health issues. During these appointments, the healthcare professionals provide the caregiver with a paper card to record the infant's height and weight, developmental milestones, medical information and vaccines.

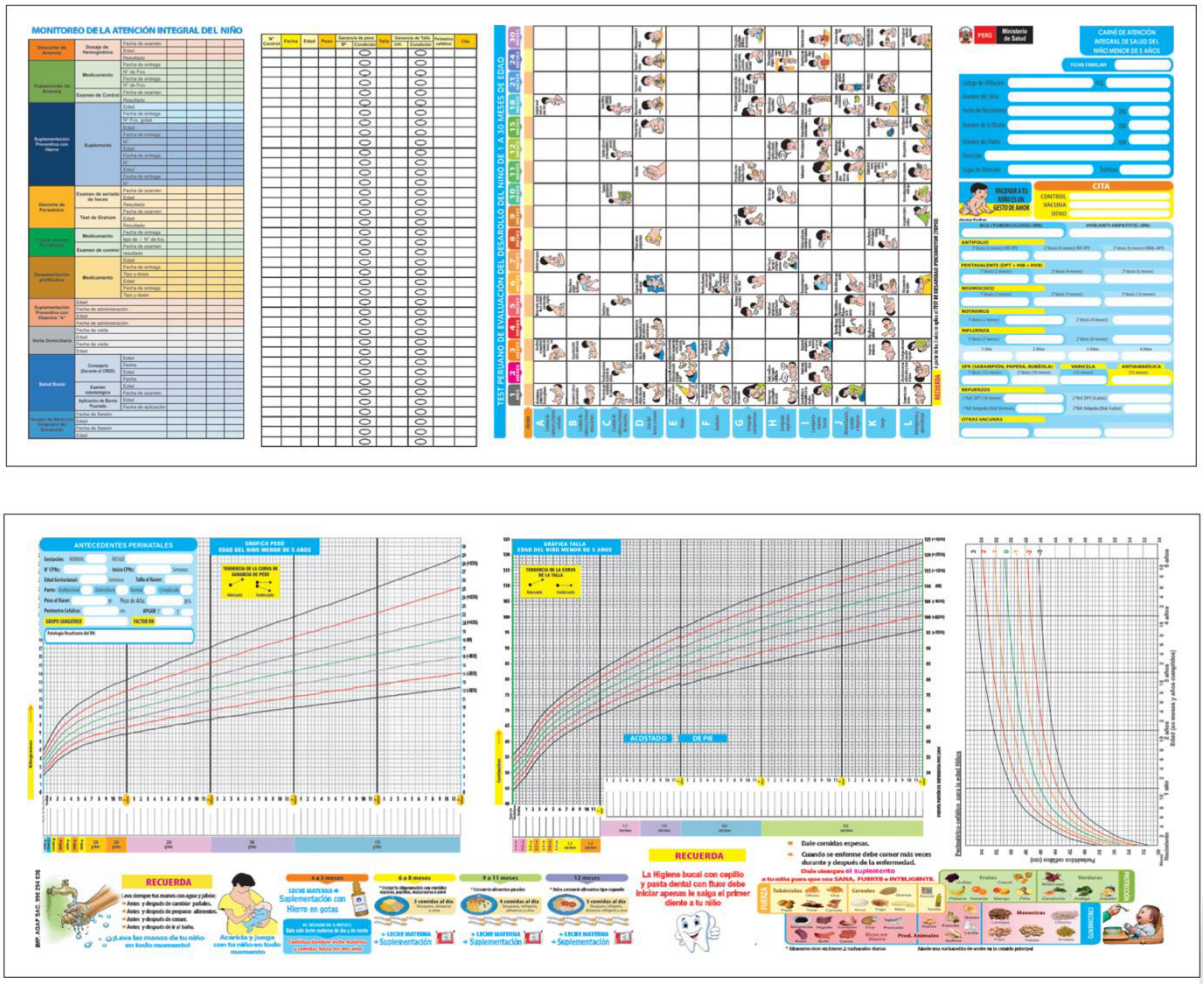


Figure 4: Paper-based Infant Health Card from Normativa CRED (Ministerio de Salud 2017)

The card features a large graph to visualise the infant's growth, filled in with measurements taken at the clinic by the healthcare staff. There are sections to include vaccination information and medical test/history, which are also filled in by staff at the appointments. The caregiver is advised to add the date the child reaches a specific milestone to the side containing graphical depictions and descriptions of an infant's milestones according to age at home. The healthcare staff can observe any delays in development when the card is presented at the next appointment.

There is a small section containing information about complementary feeding and food groups featured on the card. However, this section is minimal. The same can be said for the information about breastfeeding and dental hygiene; caregivers would need another source of information to get more in-depth advice.

Commitments

During visits to a CRED appointment or a home visit by healthcare staff, caregivers are often given goals related to their infant's development to aim for by the next appointment. These goals are personalised to the infant's needs as well as the caregiver's circumstances.

In Spanish, these are appropriately called "compromisos" or in English, compromises or agreements. The goals are often aligned with getting the infant closer to reaching a recommendation given by MINSA, for example, including more iron-rich foods in the child's diet. However, circumstances may mean access to iron-rich foods daily would not be possible; therefore, a compromise would be agreed to try to give the foods at least twice a week.

In this project, I will call these goals commitments. At present, they can include a wide variety of topics such as complementary and responsive feeding, exclusive breastfeeding, supplementation and developmental play.

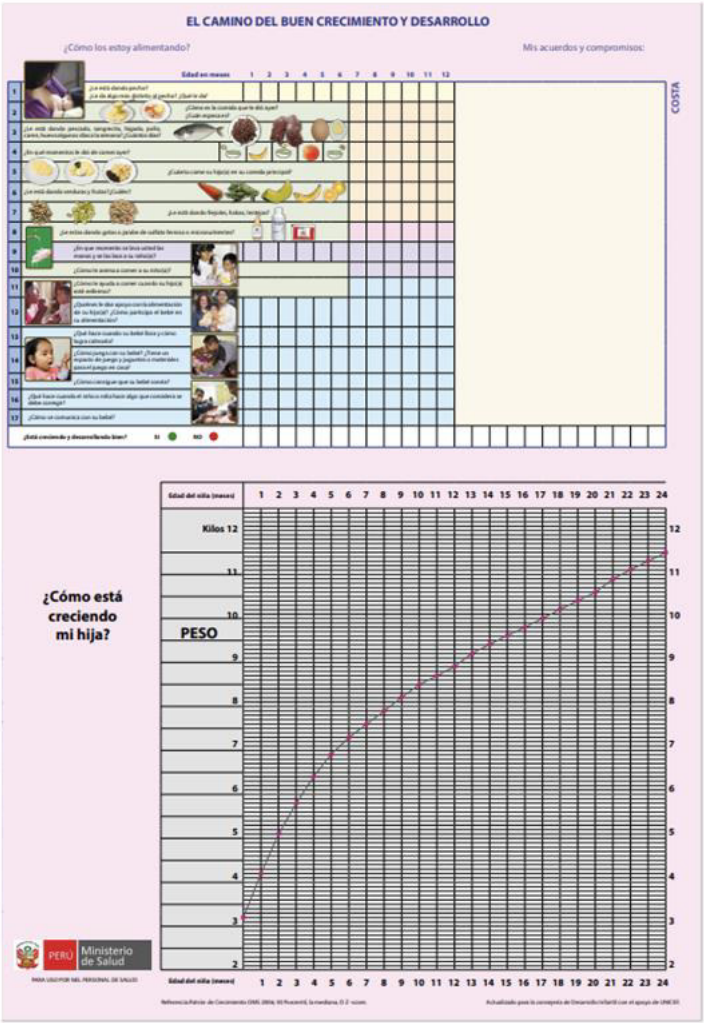


Figure 5: Card for Good Growth and Development (Ministerio de Salud])

The commitments are written on paper and can be given to the caregiver to remind them or stapled to the paper health card to be reviewed at the following appointments. Goals are adjusted depending on achieving the last goal, and a new commitment will be agreed upon.

Community Health Promoters

As well as attending CRED appointments, another strategy in place to increase engagement with infant development and nutrition are the community health promoters. Promoters visit caregivers' homes to advise about breastfeeding, anaemia, nutrition, and other relevant health issues such as COVID-19. After an initial meeting, the follow up can be conducted via phone to ensure caregivers engage with their development and nutrition goals. These sessions ask the caregiver to identify situations in images. The promoter will facilitate a discussion based on the themes in the pictures and then answer any questions the caregiver may have concerning the information (Laminario del actor social. 2020).

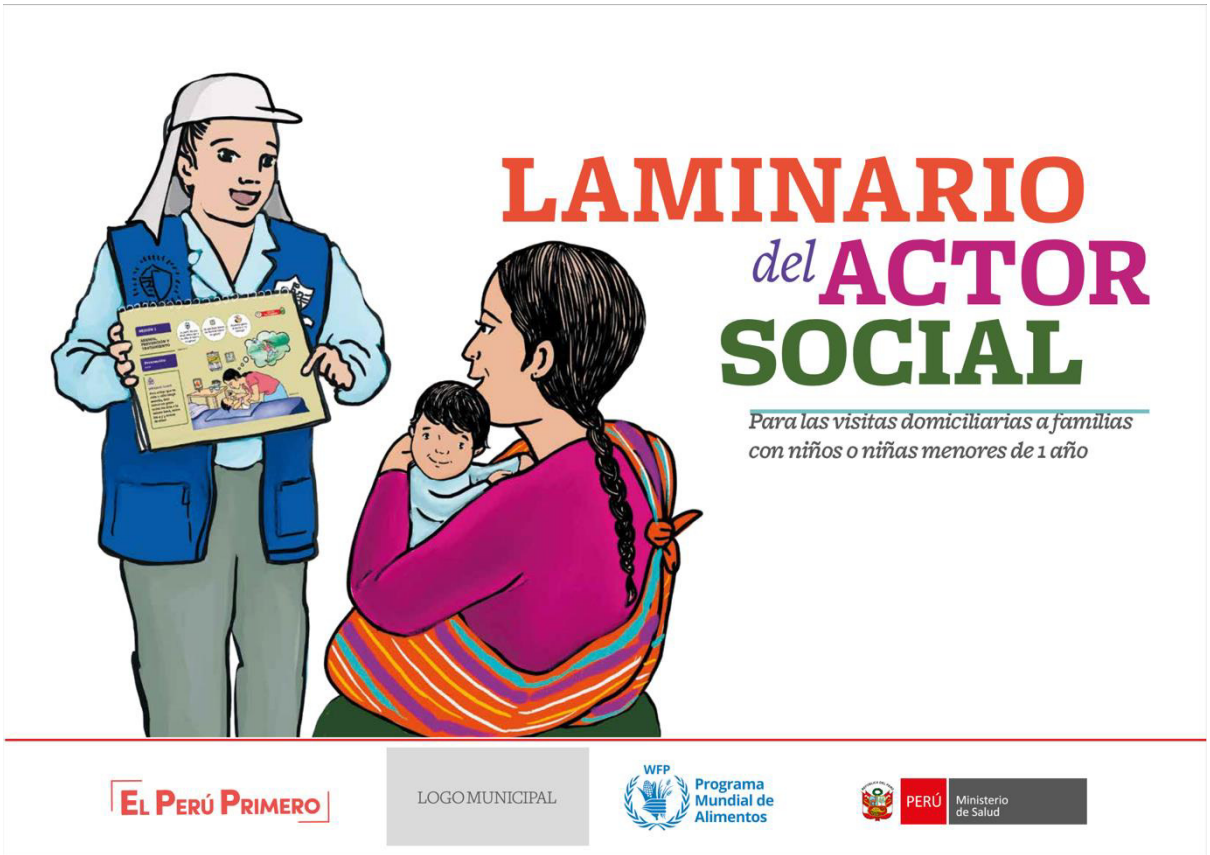


Figure 6: Front cover of Laminario del actor social showing a community health promoter (Laminario del actor social. 2020)

The Laminario del Actor Social (Laminario del actor social. 2020) guides health promoters on what topics to cover and suggested answers to possible questions by caregivers of children under 12 months. There are also images provided to use in their sessions.

There are eight main themes addressed:

- Anaemia and Iron Supplementation
- Breastfeeding
- Complementary Feeding
- Developmental Appointments (CRED)
- Vaccines
- Secure Attachment
- Hand Hygiene
- Coronavirus Information

Covid Related Complications to Infant Health Access

The Covid-19 pandemic created widespread global disruption to healthcare services, including Infant Health Care. It led many countries to reduce in-person health services, resorting to telehealth and video conferencing software to prevent the spread of the virus. In the UK, healthcare professionals' reduction in face-to-face support leads to a reduction in the length of time mother's breastfed compared to non-pandemic years. 79.1% of mothers stated reduced support was a factor in ceasing to breastfeed before they felt ready to (Brown and Shenker 2021)

Infant Health Applications

There are many infant health-related applications available to caregivers. However, of the 4300 apps identified as related to infant health in the Google Play and iOS app stores, only 0.4% (16) had the required MARS quality criteria. The volume of available low-quality apps means selecting reliable infant health apps is difficult for parents. A study showed that half of the sixteen eligible apps contained advertisements and advised healthcare providers to guide caregivers to reliable applications (Virani et al. 2019)

Health authorities such as the NHS provide a list of applications to caregivers (NHS.com). One application includes information about emergency first aid for infants and children. The other is to track appointments plus access information about pregnancy and infants.

The application endorsed by the NHS called Baby Buddy, created by Best Beginnings, has the functionality to access pregnancy and infant health information relating to the gestational period or age of the infant. There is also the functionality to use an NHS login to access appointment information and track goals (Baby Buddy app - NHS.).

A similar application in the United States WebMD baby by WebMD includes tracking features and information about the child; an exciting feature is sharing data with a family member to include other caregivers (WebMD Baby App.). However, unlike Baby Buddy, there is no functionality to connect with the medical centre to access records and appointments.

There are many applications relating to breastfeeding tracking available to caregivers; although they can improve breastfeeding outcomes, many do not address all stages of parenthood and are not inclusive for other caregivers such as fathers (Tang et al. 2019). A study by Dienelt et al. concluded that although breastfeeding tracking apps can be helpful to mothers as they transition to caring for their infant in the early stages, however, mothers expressed concern about being overwhelmed with the data and questioned the credibility of the information the app provided. (Dienelt et al. 2020)

Infant Health Applications in Low to Middle-Income Countries

Road to Health App

In South Africa, a similar project by the South African National Department of Health and Jembi Health Systems to convert their Road to Health booklet given to pregnant mothers into an application. The booklet included infant development charts, vaccination records and information about infant nutrition and medical care at home. (Road To Health – Apps on Google Play.)

Although the country's issues surrounding infant health and population dynamics differ widely from Peru's, there are many similarities in how data should be digitised and the problems surrounding converting to a digital system in both ethical and technical terms.

A CoMaCH Webinar about the Digitisation of the Road to Health Booklet in March 2021 (Webinar: Digitization and the Road to Health Booklet, CoMaCH Network.)

included discussion from healthcare professionals and Jembi Health systems. This webinar concluded that the most frequently used section of the Road to Health booklet was the developmental pages logging the infant's milestones.

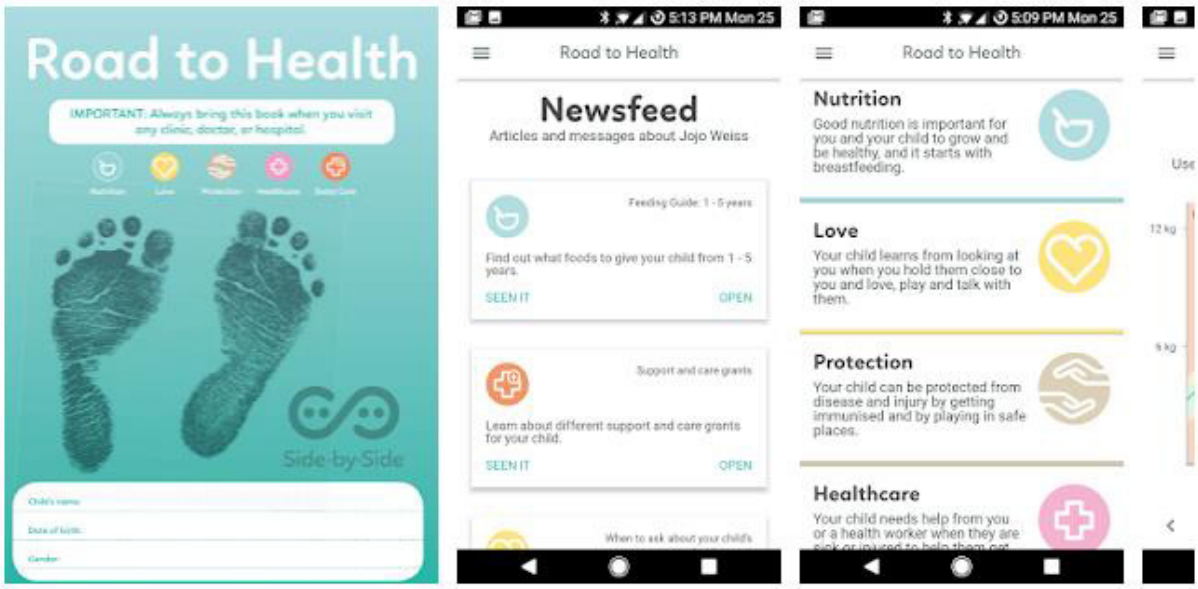


Figure 7 shows the Road to Health app's from the Google Play Store (Road To Health – Apps on Google Play.)

Infant Health Apps in Peru

Yico

In August 2020, in response to the Covid-19 pandemic, Peru's Ministry of Health (Minsa) introduced a mobile application designed by the National Institute of Health (INS) nutritionists to help prevent anaemia and child malnutrition. The app targets caregivers of infants under two years of age; its focus is to offer nutritional advice and recipes. Information includes advice on complementary feeding as well as exclusive

breastfeeding for infants under six months of age. Recipes and advice are grouped according to the infant's age in categories 0-6 months, 6-8 months, 9-11 months, and 12-14 months. The app contains interactive content such as YouTube videos that demonstrate the recipes (INS presenta Aplicativo Móvil ¡Yico!)

While this application offers expert and practical nutritional advice, there is no functionality to record the child's nutritional intake or set reminders to help mothers intake of iron supplementation and breastfeeding. While considering the problems with the current system above, we see that healthcare professionals were keen to implement a reminder system for supplementation, which is not available as part of this application. In addition, the commitments system used currently to promote complementary feeding and exclusive breastfeeding has a solid link to the information in this app. However, there is no functionality to add/log goals to the system to track progress.

Figure 8 shows the Yico Infant Nutrition app introduced by MINSA in 2021 (INS presenta Aplicativo Móvil ¡Yico!)

Technology to promote reflection

The use of apps to track lifestyle and promote reflection is increasingly popular as technology advances and becomes more widely available. Popular uses of tracking applications are food trackers, sleep trackers and mood journals. The focus of many apps is to allow the user to reflect on their behaviour and make informed choices about future actions based on their observations. However, the decisions of food journalers do not appear to be healthier than those of non-journalers, lifestyle, gender and age have more influence on diet than journaling (Achananuparp et al. 2018).

Although many people start to journal their lifestyle, many discontinue after a short period. Cordeiro et al. found that the most common reason for not journaling was forgetting, with 54% of participants citing this reason. (Cordeiro et al. 2015)

Multimodal Tracking

Complex user interfaces discourage journalers as a high User Burden Scale is associated with many tracking applications. The entry of non-standard or homemade food items can be a lengthy process, thus causing users to miss an entry (Cordeiro et al. 2015). The use of voice notes rather than text can reduce the burden to the user while recording meals. However, re-recording of messages meant it could sometimes be less time-efficient (Luo et al. 2021). Photographs are also an effective way to record meal data with less user burden. Instagram food photography has gained popularity has become more acceptable within society. Photos alone don't provide a detailed

enough data entry of a meal as portion size can be challenging to judge, and some ingredients may go unseen (Sun et al. 2020)

Approach

User-centred Design

"Your goal should be for each page or screen to be self-evident, so that just by looking at it, the average user can say 'I get it.'"- Don Norman (Norman 2013)

While designing the application, I followed user-centred design principles to gain a deeper insight into the caregiver's needs through proxy stakeholders as this would give a compelling insight into the design and would highlight similar issues to an evaluation with caregivers. (Novak and Lundberg 2015) . This will allow me to evaluate how an application could promote engagement with infant care. The design was completed in five iterations. Each iteration refined the requirements and user interface according to feedback received by a multidisciplinary team of researchers, nutrition experts, and healthcare professionals.

An expert from the Institute of Nutrition in Peru was regularly consulted for feedback regarding the structure and content of the application. Each design iteration was shown to the expert before presentation to the research group, focus group and user evaluation. This was invaluable as they had current relevant knowledge of the problems relating to infant health in Peru and experience with the Peruvian healthcare system and local customs. They were also responsible for the official translation of the

focus group schema and data from the study and conducting my focus group alongside my supervisor.

Feedback on designs was also received from researchers from the STAMINA project during the later design stages before focus groups were completed with healthcare professionals from two regions in Peru.

System Design

Gather Initial Requirements

Firstly, I gathered requirements from the paper card shown above. The card includes vaccine records, an infant milestone record depicted by a grid of images and descriptions, brief medical records including a height and weight chart, and information about nutrition, breastfeeding and dental health.

Based on the card's content, I concluded that the initial requirements include:

- a dynamic height and weight chart
- access to vaccine records
- an interactive milestone logs
- infant health information

I added additional requirements to the project to facilitate the implementation of daily diary-style reflection logs, iron supplementation and complementary feeding.

- A breastfeeding diary

- An iron supplements diary
- A complementary feeding diary

I created a diagram based on the following use cases. The design assumes that height and weight, medical records, and vaccine information would be acquired from an existing system within the healthcare setting to preserve data integrity.

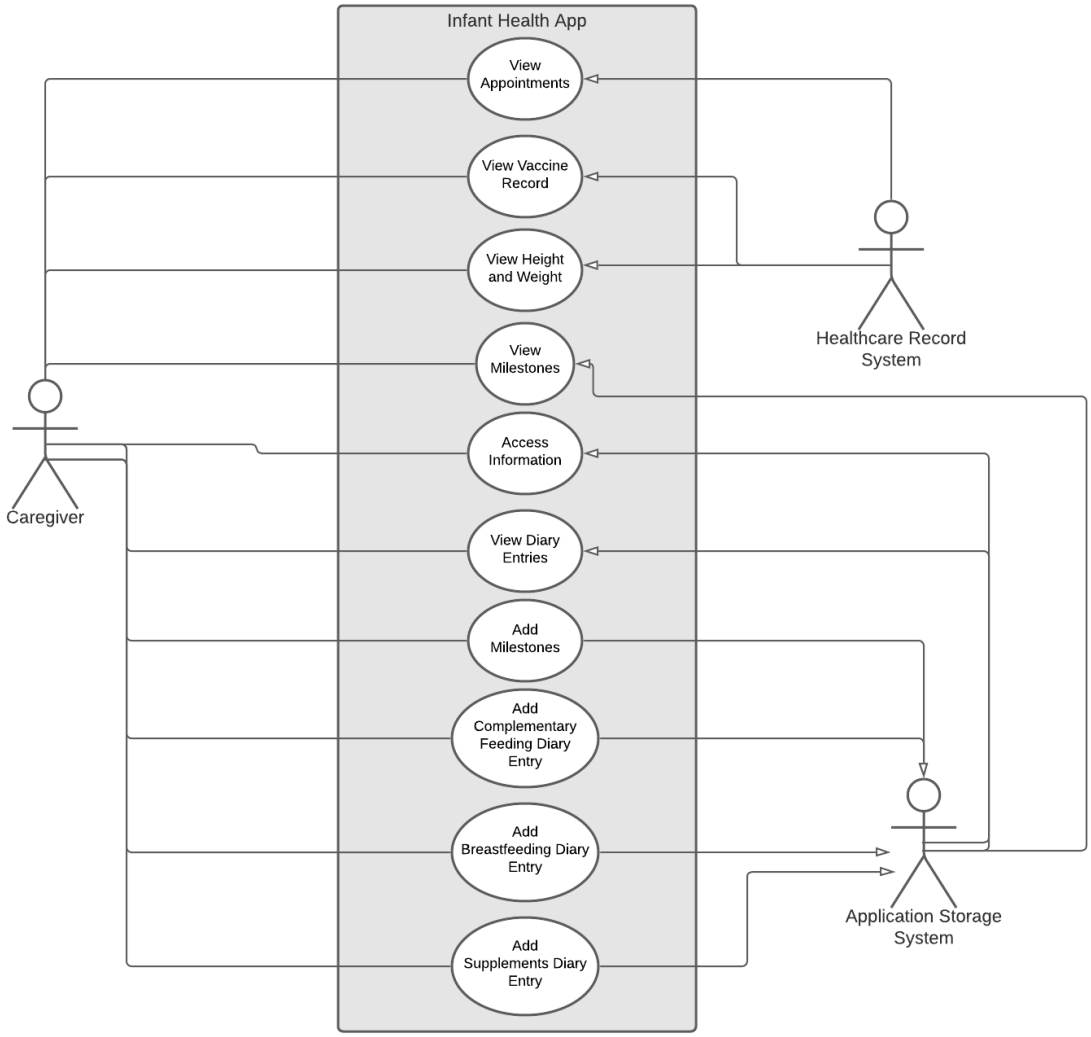


Figure 9: Use Case Diagram for Application

Use Case 1: View vaccine records

Description:

Caregiver requests to view their infant's vaccine records and when the next vaccine is due

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Charts button in the bottom tab bar
2. The app returns a screen with chart options
3. Click on the Vaccines button
4. The app returns a screen showing vaccinations already given and dates when the following vaccines are due if an incomplete record

Use Case 2: View Height and Weight Graph

Description:

Caregiver requests to view their infant's height and weight records

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Charts button in the bottom tab bar
2. The app returns a screen with chart options
3. Click on the Height and Weight button
4. The app produces a screen showing a graph with height and weight data

Use Case 3: Add a Milestone

Description:

Caregiver requests to add an achieved milestone to the milestones log

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Milestones button in the bottom tab bar
2. The app returns a screen with age ranges
3. Click on the appropriate age range
4. The app returns a screen with buttons representing months in the age range
5. Click on the appropriate month
6. The app returns a screen with milestones expected during the month
7. Click on a milestone
8. The app returns a screen with a form with input fields for a date and text note
9. Selects date from field
10. Adds text note
11. Click on Submit button
12. App returns to month view screen; milestone card now shows date and green outline

Use Case 4: Access Infant Health Information

Description:

Caregiver requests to view their infant's health records

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Information button in the bottom tab bar
2. The app returns a screen with information options
3. Click on an information option
4. The app produces a screen showing appropriate information.

In addition to the features of the paper card, caregivers missing CRED appointments or attending a check-up at the wrong age is a problem. To mitigate this issue, I decided to include a feature to remind caregivers of upcoming appointments and when infants are due a vaccine within the application.

Use Case 5: View Appointments

Description:

Caregiver requests to view their infant's upcoming appointments

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Calendar button in the bottom tab bar
2. The app returns a screen with a calendar month view and shows upcoming appointments

Use Case 6: Add Iron Supplements Entry

Description:

Caregiver requests to add an entry to the iron supplements log

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Iron Supplements Log Card
2. The app returns a screen with a form
3. User completes form fields
4. User Submits form
5. The app redirects to the home page

Use Case 7: Add Complementary Feeding Entry

Description:

Caregiver requests to add an entry to the Complementary Feeding log

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Complementary Feeding Card
2. The app returns a screen with options to enter data
3. Click on data selection type
4. The app produces a screen with relevant entry type
5. User completes form fields
6. User Submits form
7. The app redirects to the home page

Use Case 8: Add Breastfeeding Entry

Description:

Caregiver requests to add an entry to the Breastfeeding Log

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Breastfeeding Log Card
2. The app returns a screen with a form
3. User completes form fields
4. User Submits form
5. The app redirects to the home page

Use Case 9: View Diary Entries

Description:

Caregiver requests to view their infant's diary entries

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Calendar button in the bottom tab bar

2. The app returns a screen with a calendar month view and shows marked days when entries were made
3. Click on a select day
4. The app returns all diary entries for that day

Use Case 10: View Milestones

Description:

Caregiver requests to view their infant's milestones

Start Condition:

The caregiver has logged into the application with valid credentials. The caregiver has registered the child with the correct credentials. The caregiver is on the home screen of the application

Basic Flow:

1. Click on the Milestones button in the bottom tab bar
2. The app returns a screen with an overview of milestones
3. Click on the milestone age range
4. The app returns all milestones for the age selected
5. Click on a specific milestone
6. The app displays milestone data

Activity Diagrams

Figure 10: Activity Diagram – Add Breastfeeding Diary Entry

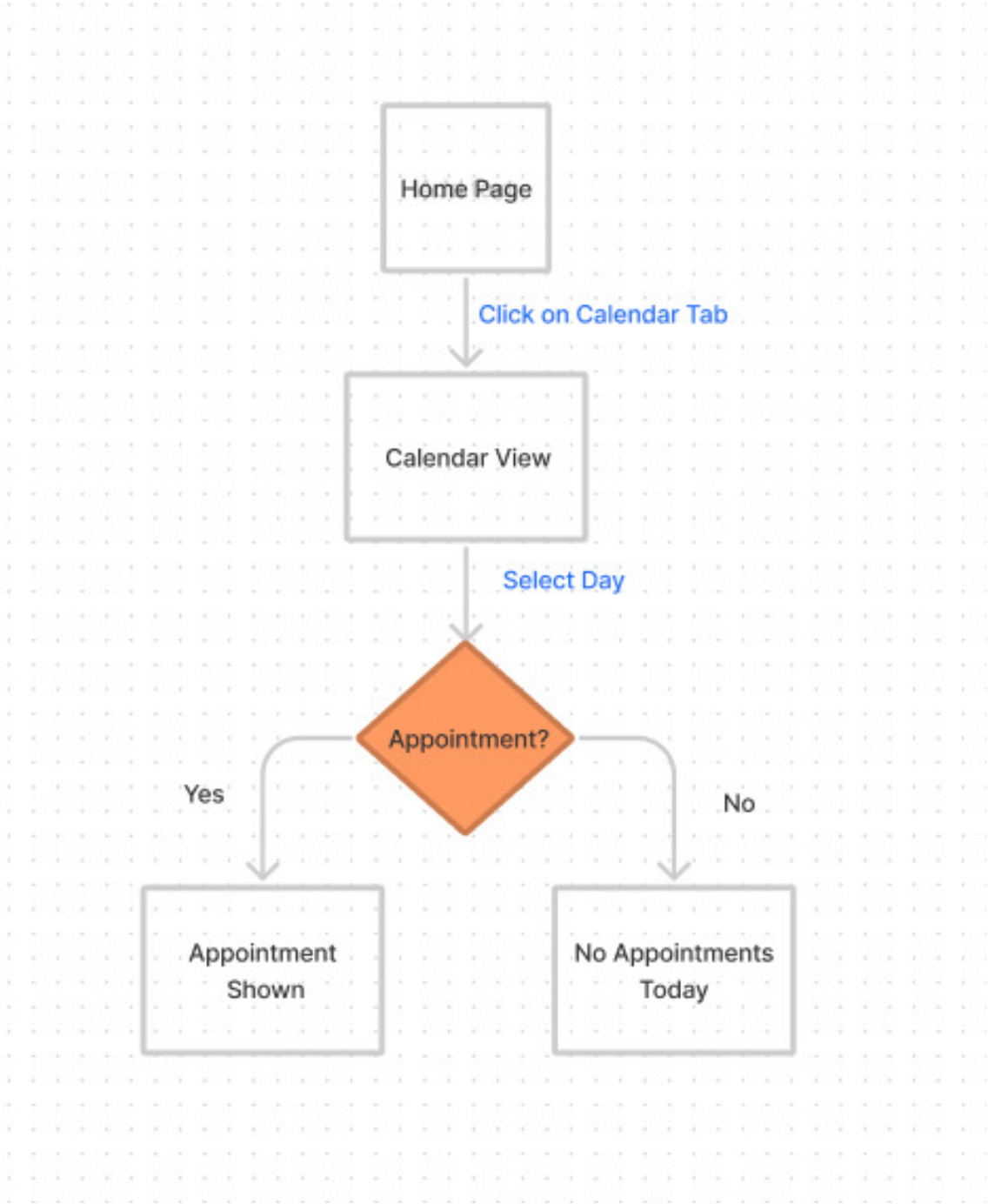


Figure 11: Acitvity Diagram – View Appointments

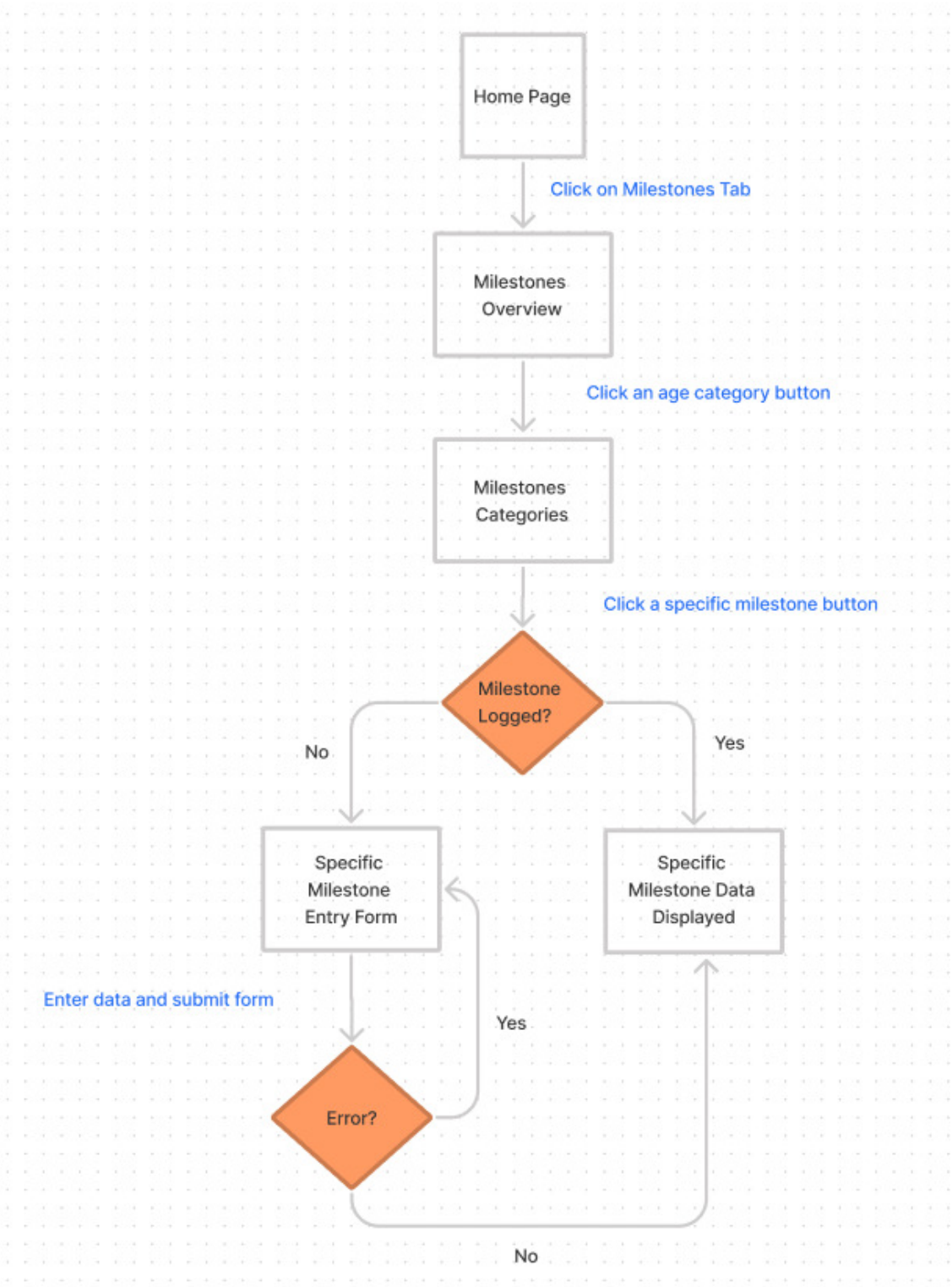


Figure 12: Activity Diagram – Add a Milestone

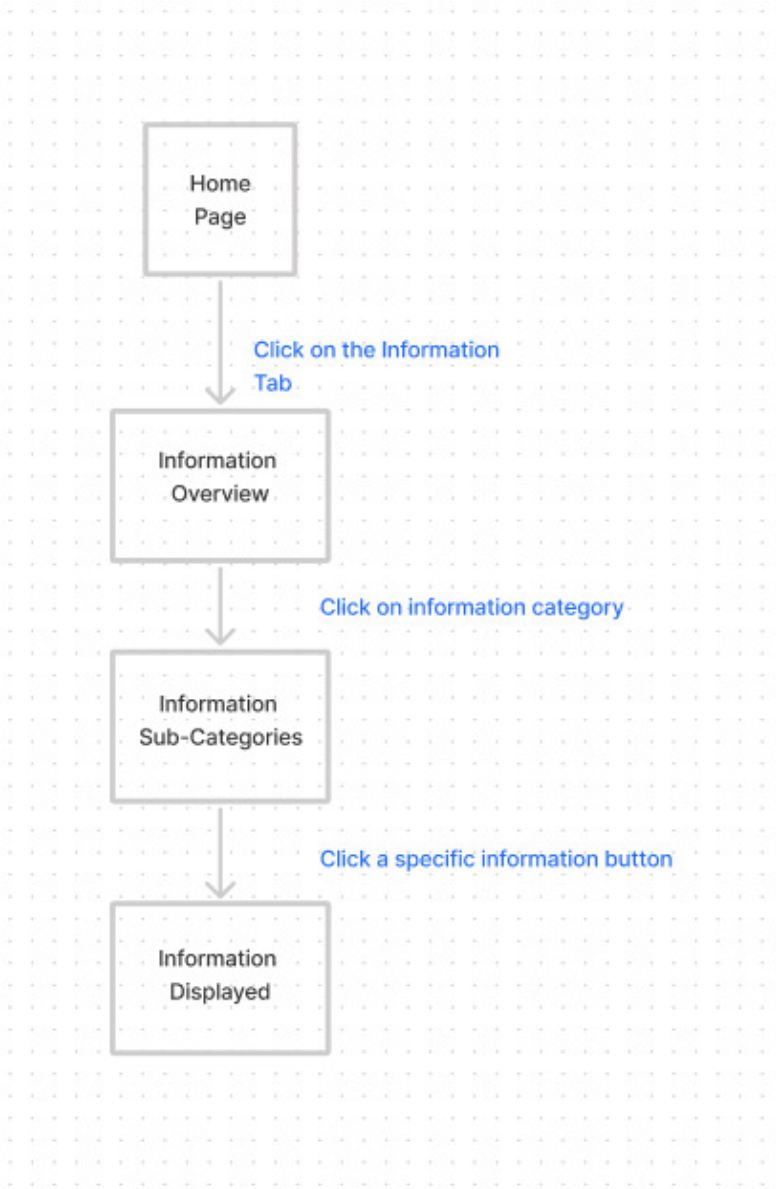


Figure 13: Activity Diagram – Access Information

User Interface Design

From these requirements, I made an initial low-fidelity design using InVision Design Software.

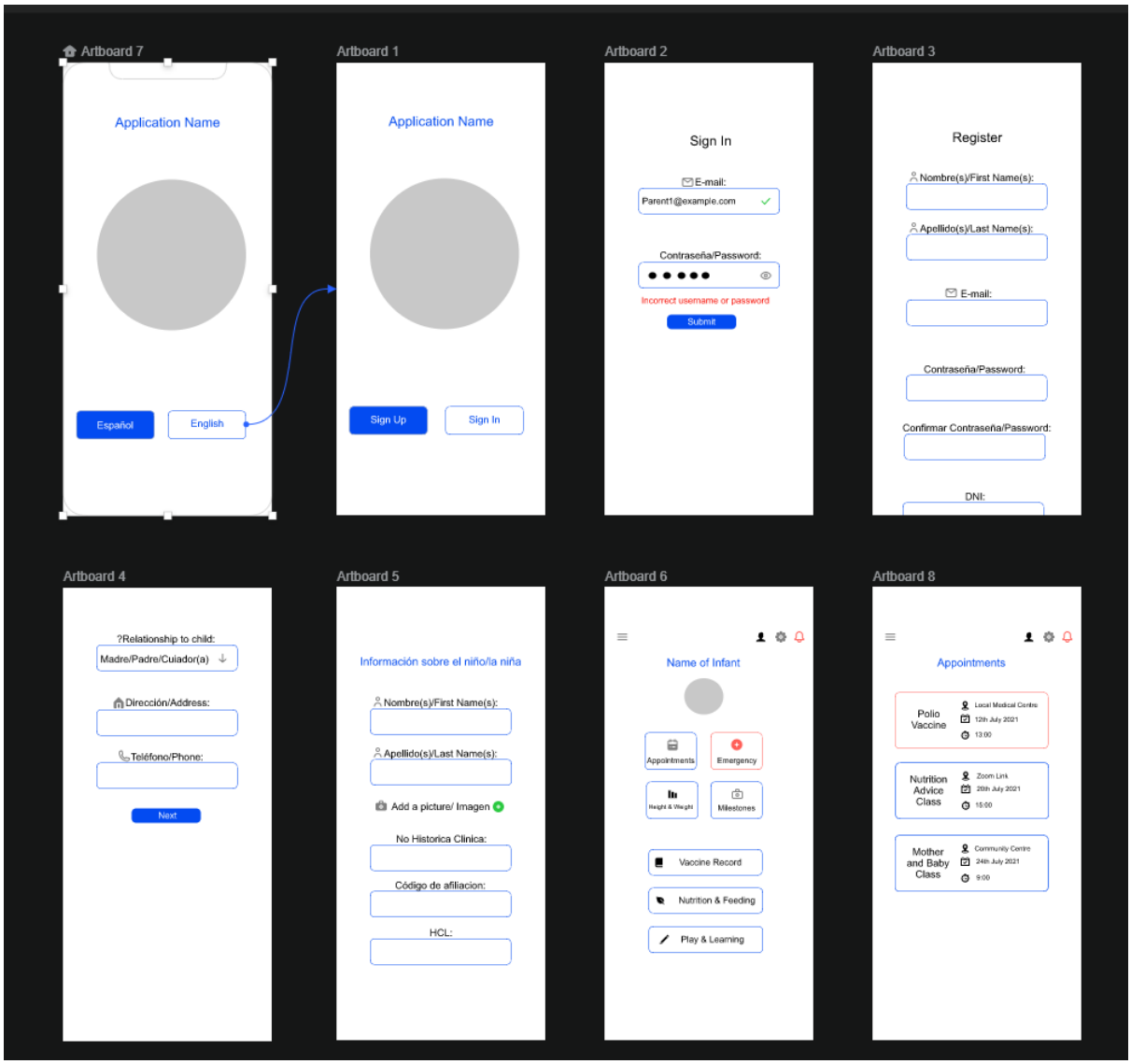


Figure 14: Design 1 Onboarding pages, home page and Appointments

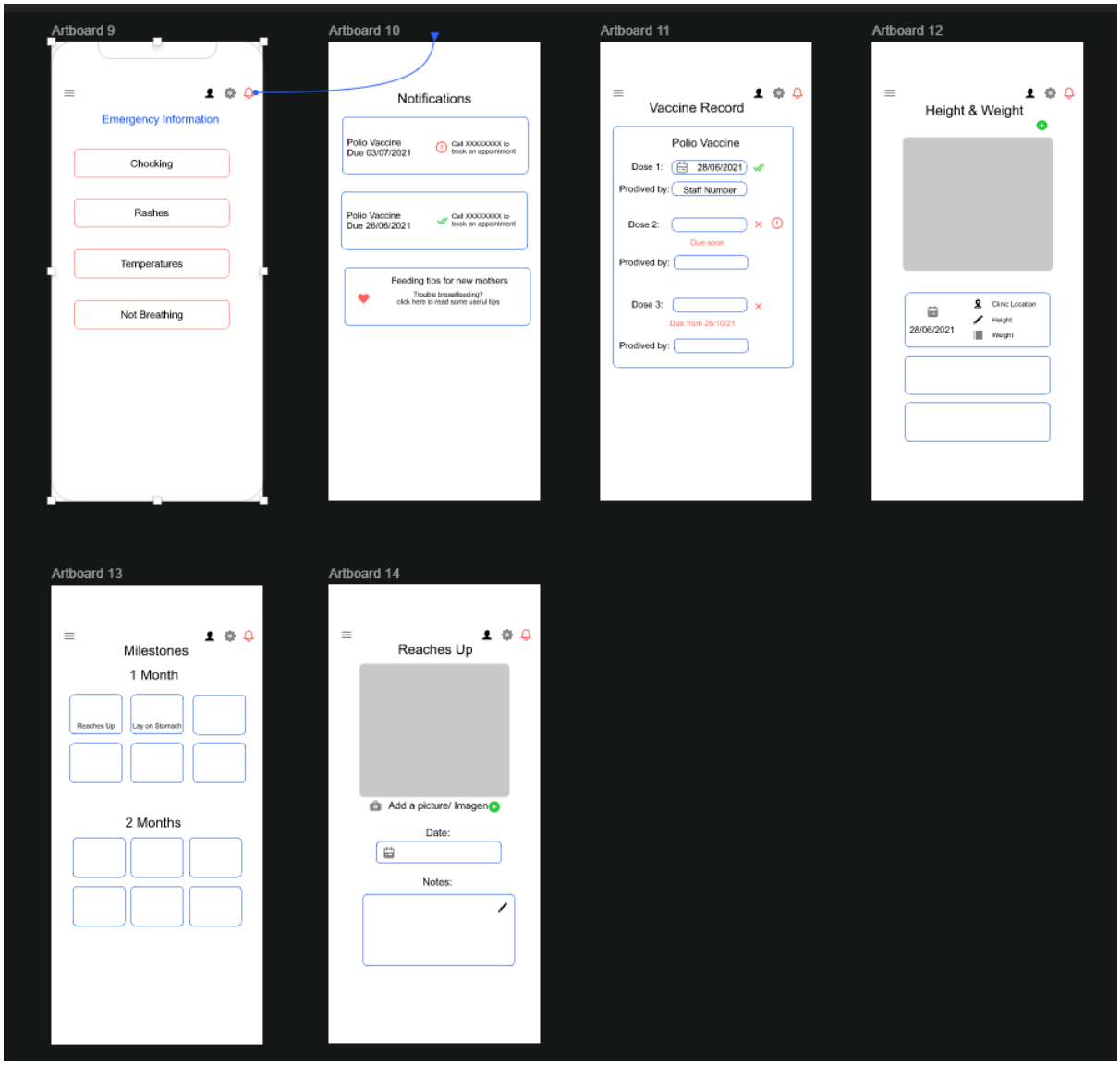


Figure 15: Design 1 Information , Notifications, Milestones, Height and Weight and Vaccine Screens

From the initial sketch, I then refined the design while considering CRAP and Gestalt's principles. As humans perceive objects as organised patterns, I decided to retain the box structure and align the buttons to create a hierarchy of importance within the designs. The updated screens also featured a colour schema showing a higher fidelity design.

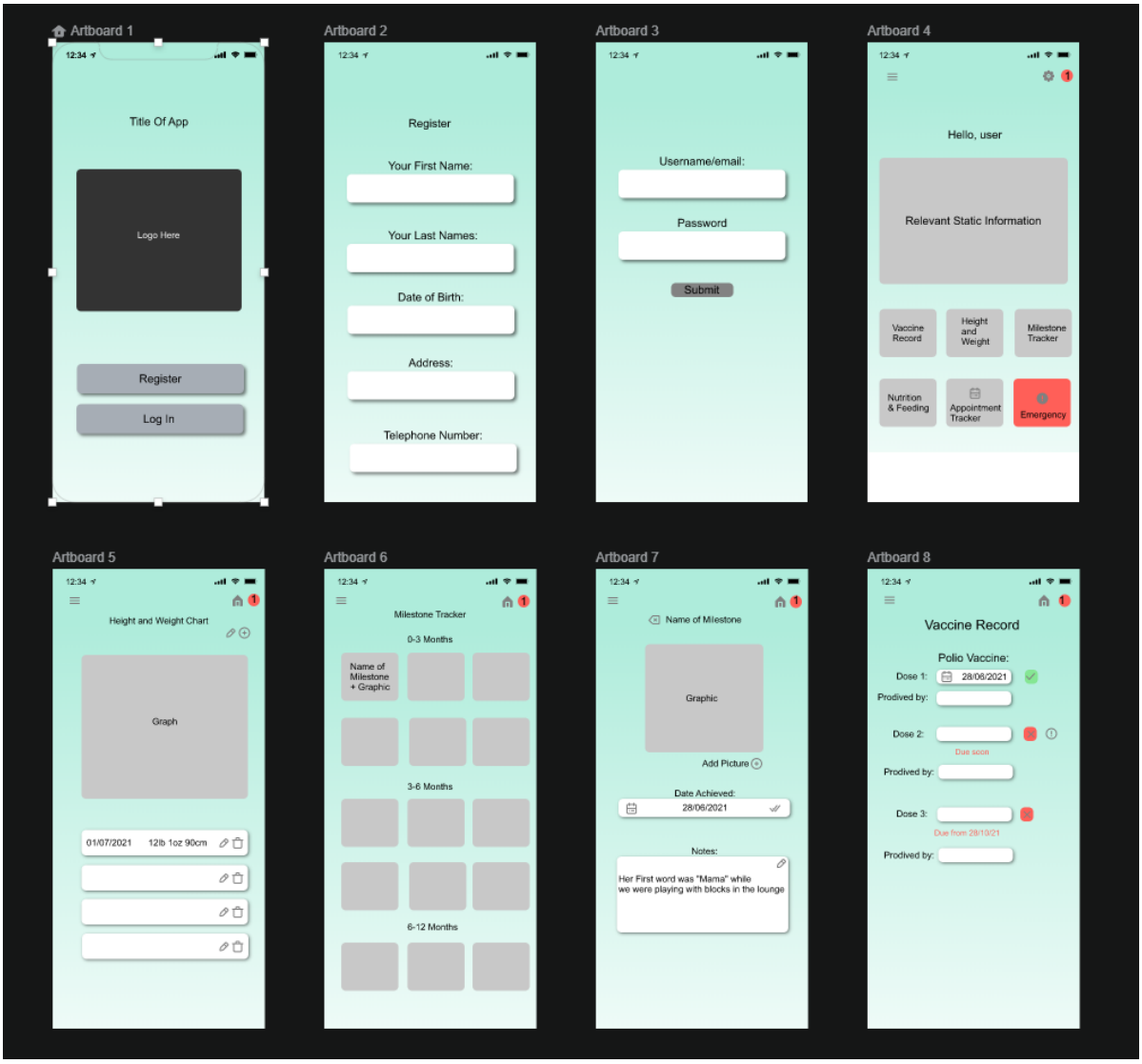


Figure 16: Design 2 Onboarding, home page, milestones and vaccines

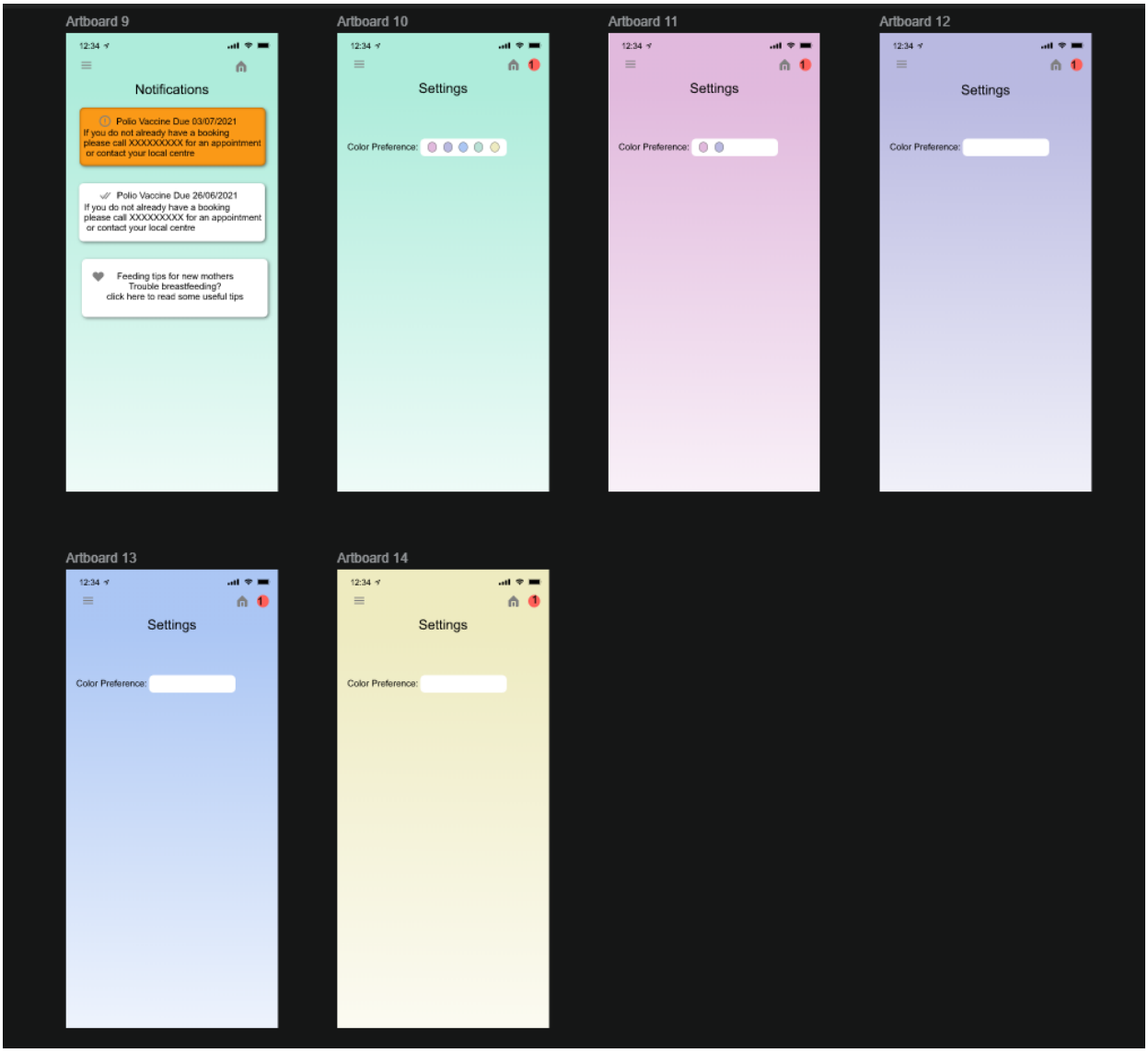


Figure 17: Design 2 Notifications and Color options

Review Design with Nutrition Expert

The initial design created was shown to a nutrition expert for evaluation. The idea of adding reminders for commitments given to caregivers during appointments was well received. We discussed adding a reflection style diary for each commitment into the application interface. The inclusion of a log for iron supplementation, breastfeeding and complementary feeding with notifications to remind caregivers and help with recall of issues or successes during CRED appointments.

The possibility of allowing health professionals to view these logs was considered. However, concerns surrounding the risk of the caregiver feeling judged were expressed by the expert. A study by (Luo et al. 2019) found that nutritionists feared data sharing personal reflections from food trackers might not be well received by patients due to fear of judgement from professionals. (Luo et al. 2019) Therefore, I decided the logs would be private to the user who could show their record in an appointment if they felt comfortable doing so. Allowing health professionals access to the data later would be considered. The expert also felt the colour scheme was too bold and should be reviewed.

During the third design phase, I reviewed the design to be more muted, focusing on contrast as suggested in the previous feedback session. Expanding on the requirements, I added designs for a complementary feeding log, an iron supplement log and a breastfeeding log. While designing these reflection logs, I was acutely aware of the data entry burden engaging with the logs would place on already increasingly busy caregivers. Influenced by Foodscrap's paper (Luo et al. 2021), where multimodal proved successful in reducing user input burden, I included the option to record iron supplement and breastfeeding data as a voice note and text answers. Additionally, data by (Sun et al. 2020) showed that using images to promote reflection was a way to capture data with less burden on the user. Therefore, I added the feature to add entries as images in the complementary feeding log.

Instead of the text entry for food items, I decided to trial an icon-based selection to reduce the amount of input for the user. Here are some of the screens included in design three; all screens can be found in Appendix 1.

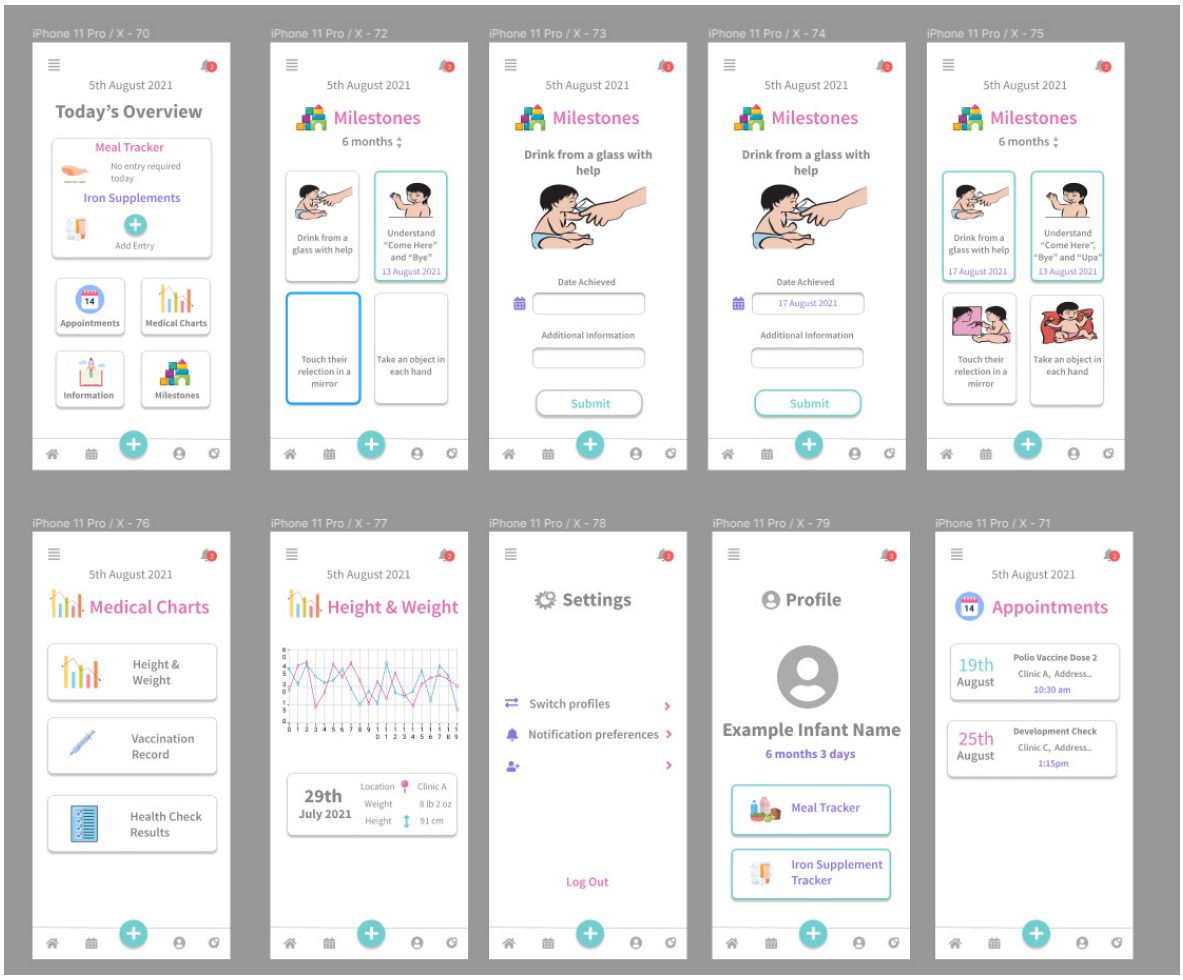


Figure 18: Design 3 Screens for Home page, milestones, height and weight and appointments

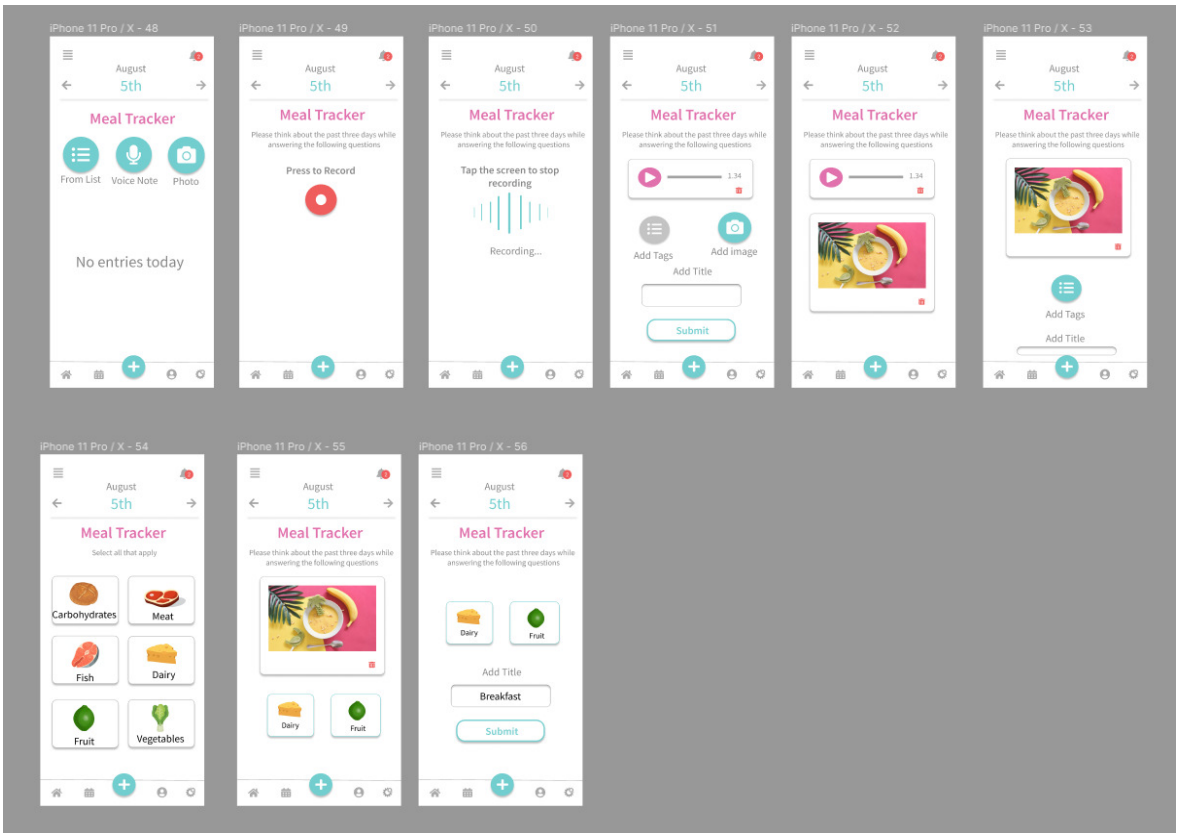


Figure 19: Design 3 Screens for a Meal Diary

The third design iteration was presented to the STAMINA research group of nutrition and public health experts. Although the concept was well-received, no specific comments were noted. An agreement to provide feedback on a future design was suggested.

Upon receiving feedback from the nutrition expert, they felt the colour scheme was too feminine and needed to be more gender-neutral. The change would make the app more inclusive to male caregivers. The design was also perceived as too cluttered, although the additional functionalities such as the photo and voice entry were well received. The icon-based complementary feeding log received criticism as icons were

not representative of foods commonly found in Peru. A change to the included food items and icons was suggested in the subsequent design iteration. We also discussed a concern that the user input burden associated with daily reflection would be high. Subsequently, the decision to change the focus from daily to weekly or fortnightly reflection entries was made. However, the app will still facilitate daily reflection if the caregiver chooses to do so.

As I entered the fourth design phase, I made the user interface clearer while retaining all functionalities. The colour scheme was changed to a more neutral and focused on pastel tones. The inclusion of the user being able to choose a colour scheme was re-introduced. When designing the reflection logs, it became clear there needed to be a way for caregivers to review previous entries. Therefore, I included a calendar view that would replace the list of appointments shown in previous designs and show reflection entries for a specific day. Reflection logs for iron supplements and breastfeeding were re-worded and designed to facilitate fortnightly and weekly reflection, respectively. All screens are shown in Appendix 2.

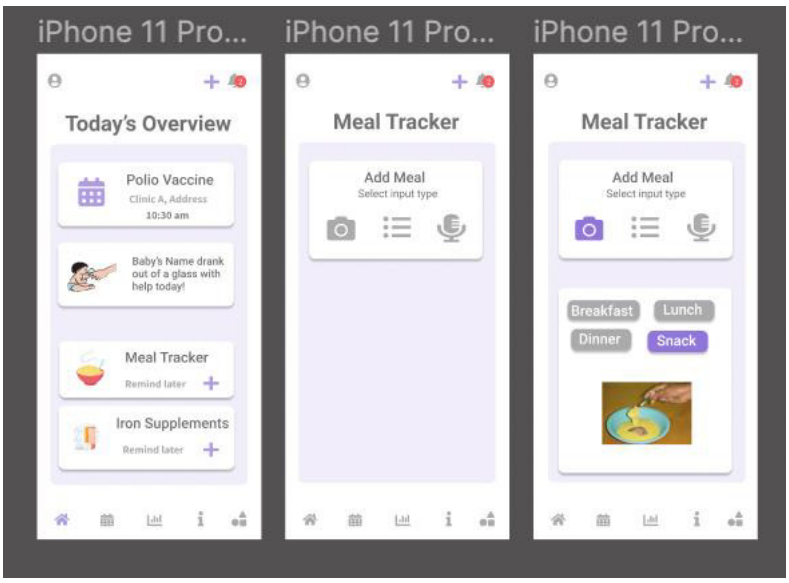


Figure 20: Screens from Design 4's meal diary

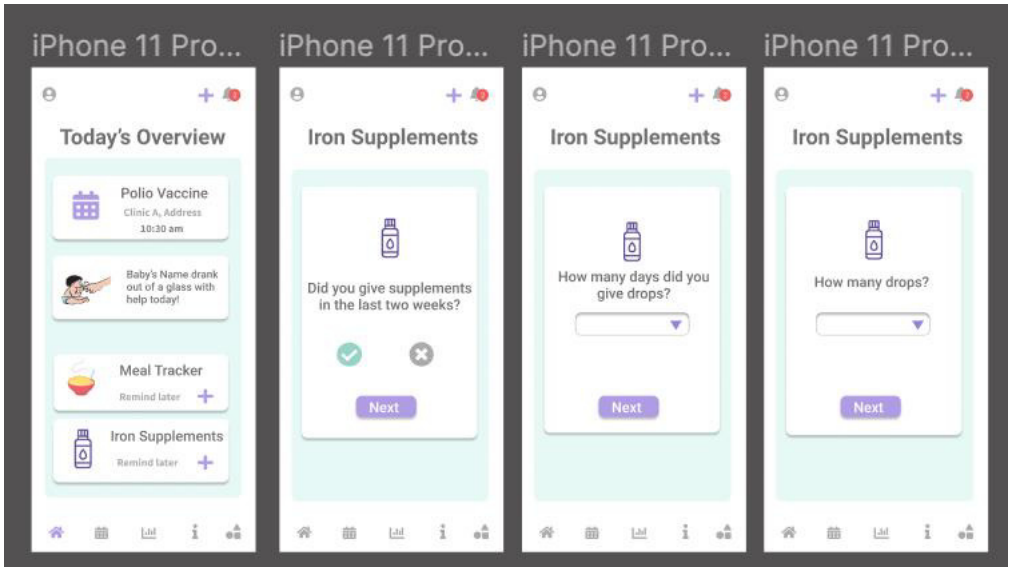


Figure 21: Screens from Design4's iron supplement diary

STAMINA and Focus Group Feedback on Design 4

The next step was to design and conduct formal focus groups with healthcare professionals in Peru, introducing the project and collecting feedback about the current system to get a health professional's perspective of the present paper card system.

The main goal of the workshops was to

- Understand how the current system is being used and explore what challenges exist.
- Design and evaluate an interactive prototype that will allow the caregiver to be more engaged with their infant's development, track appointments, receive recommendations given by healthcare professionals and promote self-reflection by self-tracking goals.

The workshops included three phases, including the evaluation of the paper card, self-tracking data evaluation and an opportunity to give feedback on a design of the application. The questions are shown below:

Phase 1: Paper Card Evaluation

- What works well with the current system?
- What does not work so well with the current system?
- Is there anything that could be added or changed about the card?

Phase 2: Self-tracking Data Collection Evaluation

The same questions were asked for the three categories: Breastfeeding, Iron Supplementation and Complementary Feeding.

- Would data on complementary feeding be a priority?
- Which commitments are most important? i.e. iron-rich foods, vegetable intake, sugary foods
- How often would data collection be needed?
- Which information is most important to collect? Portion size, animal produce included, frequency of meals

Phase 3: Prototype 4 Evaluation

- Any feedback on screens shown?

- Possible benefits of implementing an application?
- Possible problems of implementing an application?

As the healthcare staff in Peru's primary language is Spanish, the workshop was conducted by a local expert in nutrition and my Spanish speaking supervisor. When designing the focus group structure, I took this into account, created explicit instructions, and briefed the researchers before the session. A local researcher completed the translation of my research questions and designs. I was present during the workshops and took limited notes.

I decided to use a Miro board, an online real-time collaboration board. The design included a section containing images of the paper card and areas containing questions about the current system with space for responses collected by the researcher on post-it notes.

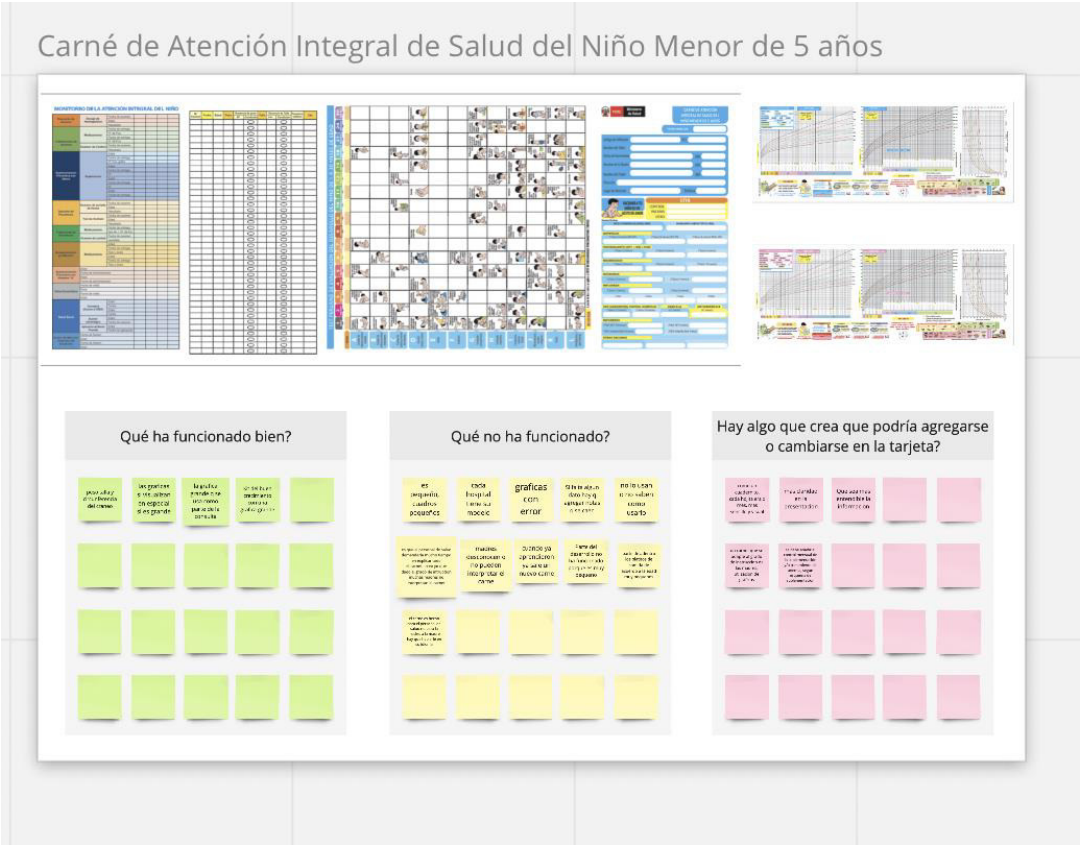


Figure 22: Miro Board from Focus Group 1

Another section included several questions relating to collecting data in the iron supplement, breastfeeding, and complementary feeding logs.

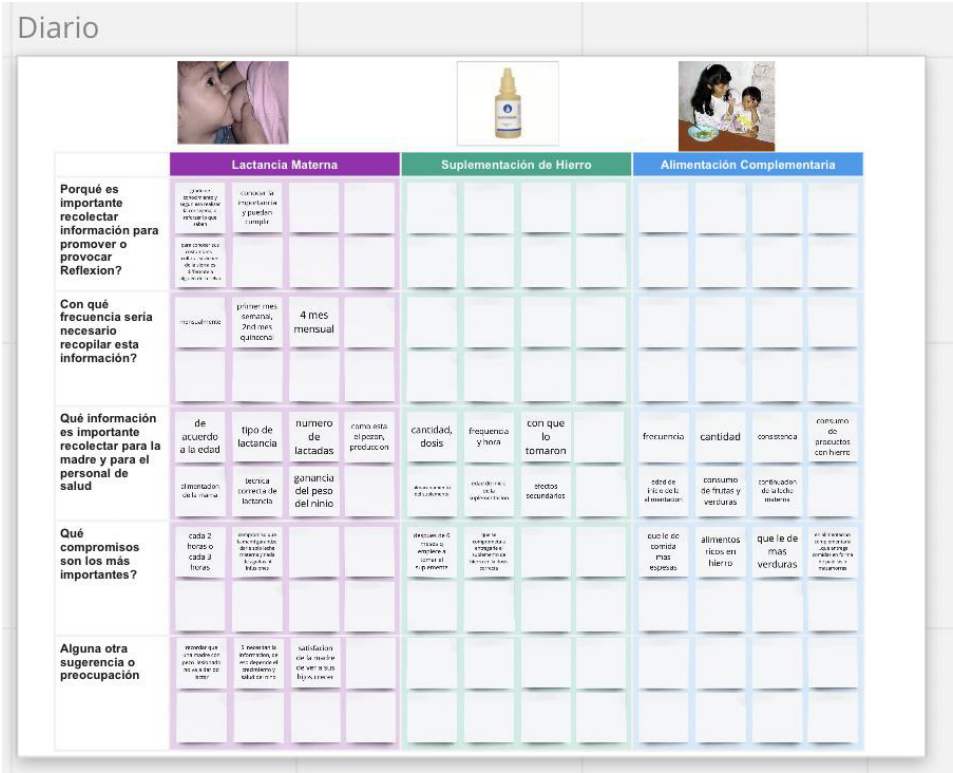


Figure 23: Miro board layout for diary entry discussion from Group 1

A similar design using virtual post-its was used to collect responses.

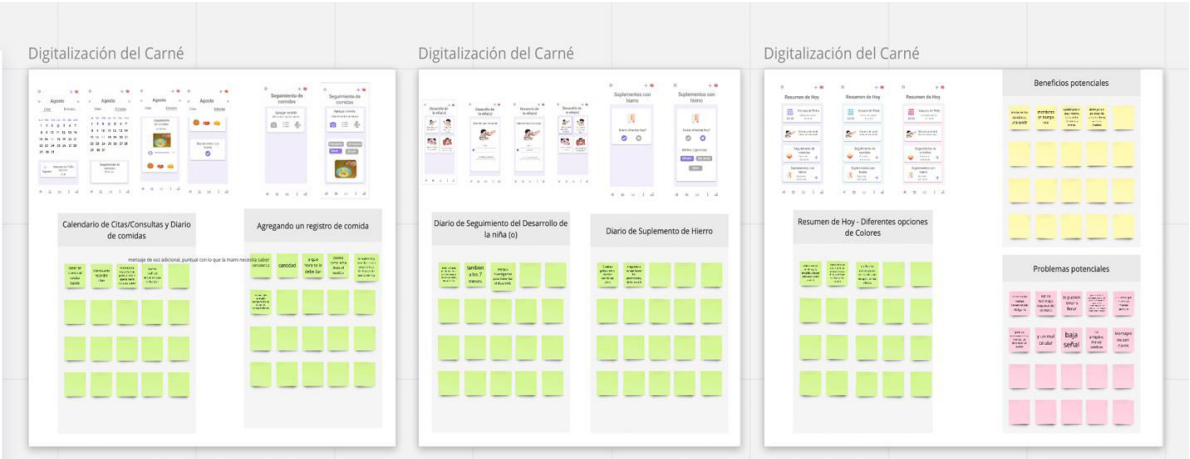


Figure 24: Miro board layout for design evaluation from Focus Group 1

Qualitative Analysis of Data

The first workshop (G1) included six participants in various infant healthcare roles from Pomares. The second (G2) included six participants who were nurses from the Las Moras region.

Roles of Participants

G1	G2
Head of the Health Centre	Chief of Nurses
Coordinator of Immunisations	Nurse: Children Area Coordinator
CRED Program Nurse	Nurse: Immunisation Strategy Coordinator
Coordinator of PROMSA (Promotion of Health)	Nurse: Health Promotion
Nutritionist	Nurse: CRED Coordinator
Childcare Coordinator/Head of Nurses	Nurse: Children

Figure 25: Table of G1 and G2 Participants

Note that quotes in this section are translations of the Spanish quotes. Original comments can be seen in Appendix X

Phase 1: Paper Health Card

I conducted a thematic analysis of the data collected, starting with the coding of data from the ground up to identify the main themes of the phase. I chose a ground-up analysis as this would allow me to understand better the participants' priorities and concerns without the influence of pre-defined codes. Usability was the central theme of this phase, with usability for caregivers and health professionals as sub-themes identified by G1 and G2 when evaluating the paper card.

Theme: Usability for Caregivers

Participants in both G1 and G2 noted few positive features regarding the usability of the paper card. The only positive aspect mentioned by G1 was the graph, as this was a tool they could use in consultations to visualise data for caregivers.

Negative comments surrounding usability for caregivers were similarly themed in both G1 and G2. A common theme was that the card is designed for health professionals rather than the caregiver, this resulting in caregivers not being able to use the card effectively – “They don’t know how to use it” (G1 participant)

The card's layout was mentioned as a problem in both groups. The graphics were unclear and too small, which was the primary concern. As well as design, the negative aspects of a physical paper card were commented on. Paper cards are easily damaged.

Problems mentioned regarding the card's layout support the creation of a multi-page application with a simplified design. The comments also aligned with the app's focus on language and functionality to support the caregiver's engagement rather than healthcare professionals. A digital solution would mitigate the issues surrounding the fragility of a paper system and allow for flexibility and updates to the system to be carried out without a steep learning curve for the caregiver.

When asked to provide suggestions of improvements to the paper card G1 suggested improvements to the presentation, making the information more understandable and better use of graphics to mitigate varying literacy levels of caregivers. Referring to cards in other countries, the idea of creating a notebook rather than a card was suggested where information was separated into pages to simplify the design. Another suggestion was to add a section about the monthly control of anaemia and iron supplementation to the card. The sole comment in G2 was to design a digital version – "design a digital card that you can have on the phone so that you can monitor the child's growth and development".

Suggestions for improvement included implementing a digital system that supports the idea that an app could be an option. The inclusion of information about anaemia and controls for anaemia was mentioned; this also aligned with my current design iteration that they were yet to see.

Theme: Usability for Healthcare Professionals

G1 mentioned the lack of personalisation of the paper version; cards are standardised. There is little flexibility for infants that may need additional controls - "designed for normal, not underweight children because they have established numbers of check-ups, and underweight children need more frequent check-ups".

Thus making the cards impractical for outlier cases that need different protocols; in this case, the ease of use for both health professionals and caregivers was negatively impacted.

In contrast, G2 focused on the card facilitating professionals to follow a child's development. These comments support the inclusion of medical charts within the app.

Analysis of Phase 2: Breastfeeding, Iron Supplement and Complementary Feeding Diary

As phase two was designed to have three main sections, I conducted a top-down analysis of the themes Breastfeeding, Iron Supplementation and Complementary feeding.

Due to time constraints, this activity was only completed by G1.

Theme: Breastfeeding

Participants engaged enthusiastically within this theme of the focus group in comparison to the other themes. This could be due to several factors such as job title and participants' areas of interest.

Sub-theme: Importance of collecting data

When asked about the importance of collecting data on breastfeeding, participants suggested that it could reinforce the matter to the mothers and allow healthcare professionals to learn about the customs of the caregivers.

Sub-theme: Data Collection

Details about the type of breastfeeding, number of feeds per day, and correct technique were mentioned. The mother's nipple health and milk production were stated as critical to collect.

Sub-theme: Frequency

The frequency of data collection should change depending on the infant's age, reducing from weekly to monthly over the first four months of the infant's life.

Sub-theme: Recommendations

The commitments suggested to be prioritised were to offer breastmilk every 2-3 hours and guarantee exclusive breastfeeding for the first six months. However, caution was stated when using standardised questions in the diaries. Mothers who cannot breastfeed may be utilising the log - "Remember, a mother with an injured breast will not breastfeed".

Theme: Iron Supplementation

As participants moved to the iron supplement section, no comments were observed regarding the importance of collecting data or the frequency of diary entries.

Sub-theme: Data Collection

The most critical data to collect was the age of starting supplements, frequency and time given, dosage, accompanying food/drinks and side effects.

Sub-theme: Recommendations

Commitments prioritised were starting supplements after six months and providing the correct dosage of supplements.

Theme: Complementary Feeding

There were again no comments observed regarding complementary feeding during the importance of collecting data and frequency sections.

Sub-theme: Data Collection

Prioritised data to collect was noted as the age food started to be included in the infant's diet, the continuation of breastmilk, texture and portion size. Food groups prioritised were iron-rich foods and vegetables.

Sub-theme: Recommendations

Recommended commitments were increasing the thickness of food given, prioritising the above food groups, and continuing breastfeeding.

Conclusion

Following feedback received in this section, the questions in all three reflection logs were changed to prioritise the information perceived as most important by G1. This included using information from Laminario del Actor (Laminario del actor social. 2020)

to improve the continuity of the application with exiting facilitators, such as information given by community health promoters.

Phase 3: Prototype 4 Evaluation

The feedback analysis was coded top down to identify the main themes discussed during the evaluation.

Both G1 and G2 participated in this section.

Theme: Notifications

Both groups responded that notifications to remind caregivers of appointments and vaccinations would be a valuable addition to the app as it could help with the follow-up of patients. G2 mentioned that adding alerts as warnings could be implemented within the diaries.

“Reminders to attend infant check-ups” (G2 participant)
“Red alerts when they are not eating well or have forgotten to take the vaccine” (G1 participant)

Theme: Technological Barriers to Accessing the App

Accessing the internet was a barrier mentioned by G1 and G2 as the signal can be poor in Peru. Also, it was noted in both groups that not all caregivers have access to

a smartphone which would be a barrier to some caregivers accessing an application such as this prototype.

“They argued they didn’t always have internet” (G1 participant).

“No data connectivity” (G2 participant)

Theme: Engaging Caregivers

Although generally, the app was complimented as a solution, the need to better engage caregivers and provide encouragement was a common theme. Solutions such as creating media such as videos/audio rather than text and adding messages of encouragement throughout the app were suggested by both groups of participants.

“Educate the mother and improve her knowledge so it could improve infant and maternal nutrition” (G2 participant)

“If additional voice messages provided, timely clear and punctual with what mommy needs to know” (G1 participant)

Screen by screen evaluation of feedback and required changes

Calendar

When shown the calendar view screen, participants in both groups responded positively and commented on the exciting idea.

Home Page

The overview screen/home page also received positive comments on its simplicity and received some suggestions such as having notifications on the home page from G1 – "red alerts when you/they are not eating well or have forgotten to take the vaccine rate the action, either with colour or an image, in alerts". The colour scheme received a mixed review, with G1 favouring a neutral colour such as yellow or green. At the same time, G2 thought the colour scheme was appropriate.

Acting on this feedback, I decided to change the colour scheme similar to the colours included in the Lamainario (Laminario del actor social. 2020). This would allow for continuity with the existing paper systems and include a more neutral palette. Notifications will be explored as an inclusion that could be implemented in further studies.

Milestones

The milestones screen was complimented in both groups, and G2 stated that it was a practical solution. A suggestion made by G2 was to include videos to demonstrate the milestones more effectively than using images.

Due to the positive comments received, the structure of the milestones section will remain unchanged; content such as the inclusion of videos could be explored further in future studies by using existing videos or creating new media.

Complementary Feeding Diary

While discussing the Add, a Meal screen G2 suggested that more focus should be given to informing the caregiver of suitable food choices for their infant's age, and G1

suggested promoting healthy options within the screens. G2 suggested that adding audio or video information may be easier for caregivers to engage with than adding text information. Concern was raised by G1 about mothers not wanting to add photos as they fear judgement if they produce simple recipes. To mitigate this, a list view was suggested as an alternative. G2 suggested that adding audio or video information may be easier for caregivers to engage with than adding text information.

While concern for mothers choosing not to use the photo option is noted, as the app proposes to give a list option, voice and photo entry for the meal log, the suggestion to add a list has already been implemented. No change would be needed to this section. However, a more profound study into how caregivers feel about using photos and voice notes could be conducted in the future to gain better insight into their data entry preferences.

Iron supplement Diary

Both groups received the screens showing an iron supplementation diary, and G1 suggested aligning the questions with those asked by the community health promoters.

Questions in the iron supplement log will be changed to align with the priorities mentioned in phase 2.

General Observations

When asked about the possible benefits of implementing this system, both G1 and G2 commented that it could help with patients' follow-up, remind caregivers of appointments, and promote engagement.

However, when asked about the possible problems, both groups stated that access to appropriate technology and the internet was an issue. G1 suggested that less text would need to be used to make it more accessible to caregivers with lower literacy levels. The use of graphics could influence nutrition choices.

Overall, the possible positive aspects support implementing an application system, and the features are shown could facilitate follow up and promote engagement with caregivers. Concerns regarding access to technology is an issue that cannot be ignored. However, creating an application to complement the paper card system could benefit those using the app. While internet/cellular data connectivity can be poor in Peru, I have attempted to mitigate this. All graphics and static information is stored locally within the app to allow for access at any time regardless of internet availability. Data that requires updating, such as appointments, would need internet access. Implementing a delay in downloading content or the option to turn off the automatic fetch algorithms within the app could help minimise data usage for families (Chetty et al. 2012).

Final Design Evaluation: Design 5

Following feedback from the focus groups, I created a new iteration of the design. As alignment with PRISMA's goal four was necessary, I based the latest content on

Laminario's information and images. The colour scheme was changed to a more muted version of the colours used in the document, and I isolated images to use in the prototype. Participants stated the importance of educating the caregiver many times in both G1 and G2; therefore, I created screens based on the information in Laminario. As I wanted the information to appear more friendly, I styled the information section as an FAQ-style with questions and answers similar to those the community health promoters asked. These screens covered Breastfeeding, Anaemia, Complementary Feeding, Development, Vaccines, Hand Washing and Covid-19. Thus making the app relevant to the current health situation in Peru and worldwide. The questions in the diaries were updated to reflect the data deemed essential to collect by both focus groups.

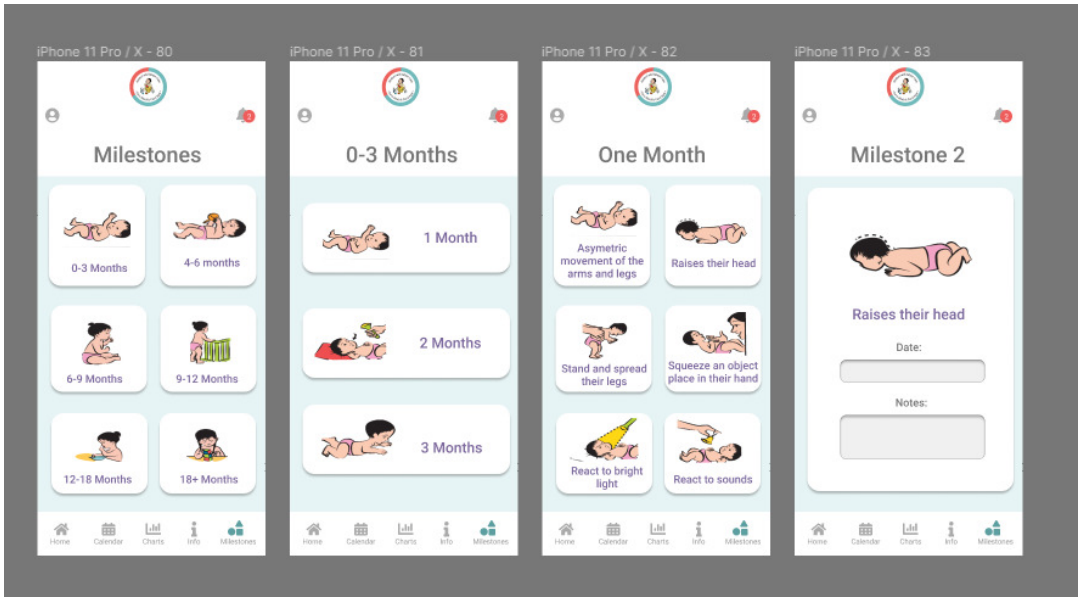


Figure 26: Design 5 Milestones Screens

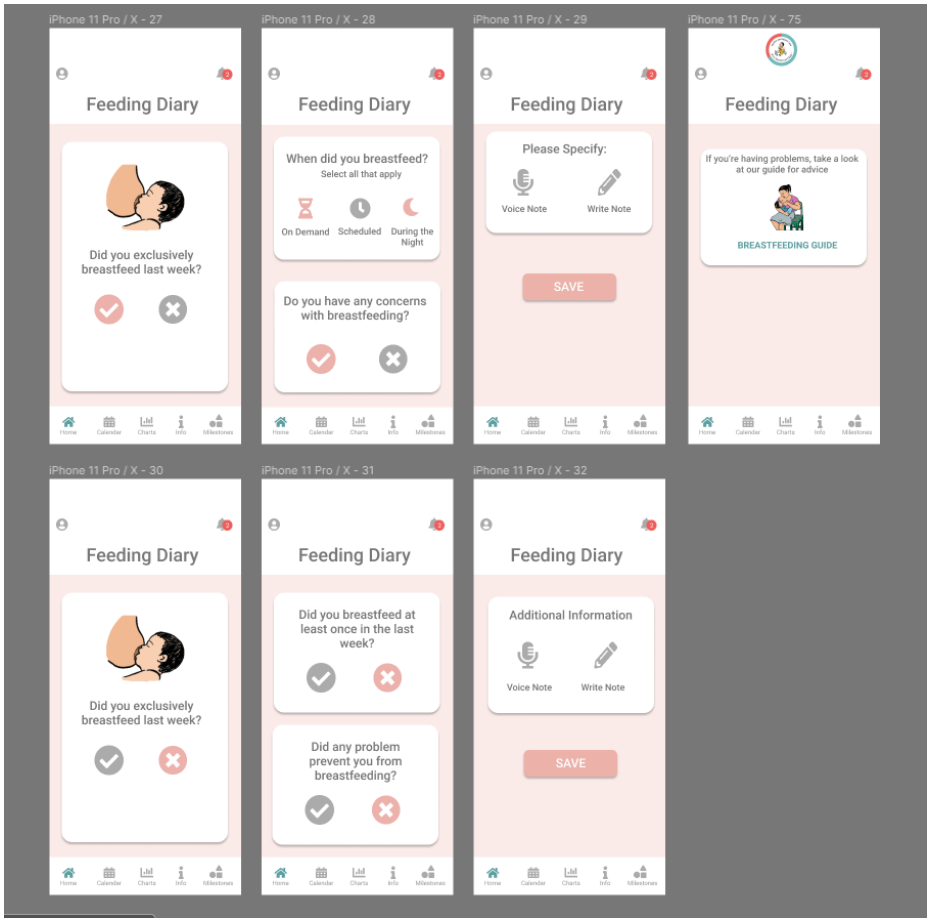


Figure 27: Design 5 Breastfeeding Diary

The STAMINA group suggested changes to the images to include more family members as the graphics focused on mothers interacting with the infant. Additional suggestions were made about adding more information topics within the app, such as more in-depth nutritional information, increasing the amount of information on latching/unlatching techniques in breastfeeding, and making the language more inclusive to other caregivers such as fathers.

Implementation

To allow the app to be used by a broad audience of caregivers, I created a cross-platform application that would function on iOS and Android mobile devices. As I had previous experience with JavaScript during my MSc, I chose to build my app with the framework React Native and use Expo for on-device testing.

Each screen displayed in the app is a functional component comprised of React Native's core components, JSX and a style function with CSS like code. These screens are imported into the main App.js file to be compiled into a multi-page application. React Navigation was used to handle the routing within the application to allow for nested Navigation and unique route history depending on the tab selected; this also ensured there were no back buttons within the user management screens.

As the primary language of Peru is Spanish, the application needed to be implemented in both English for assessment purposes and Spanish for evaluations with healthcare professionals in Peru. I utilised Expo's Localisation package to automatically detect the mobile device's language on launching the app to achieve this goal. Complementing Localisation, I used the i18n package to allow conditional rendering of text according to the language set by Localization. I created two separate JSON files, 'en' and 'es'; this allowed me to use the same key for both languages but add different values depending on the device's language. The codes were called within the screens, and i18n managed the rendering of the appropriate values.

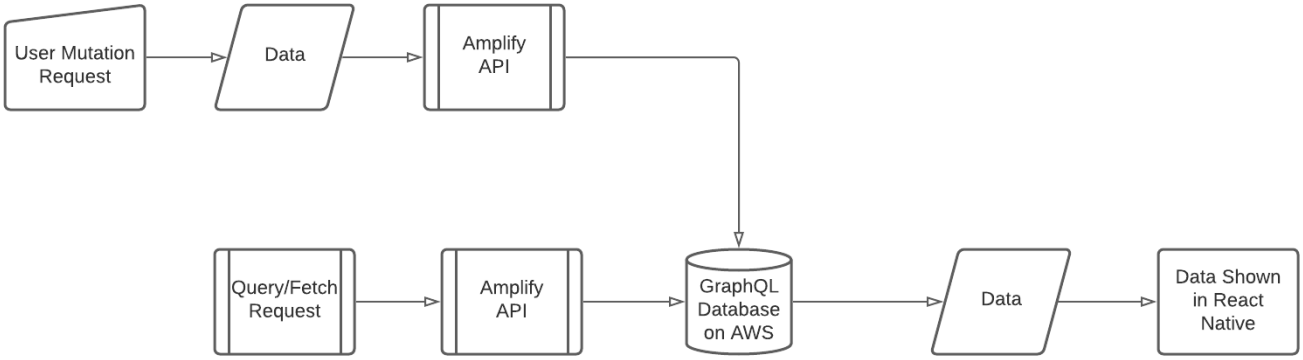


Figure 28: Software Architecture Diagram of Infant and Child Care Application

Backend

The backend of the application was created using AWS's Amplify framework, which facilitates the use of Dynamo DB for data storage, Cognito for user management and App Sync for queries and mutations. The database used a GraphQL API to access the database and Amplify's Auth class methods to manage users. I chose to implement the backend in this way as Amplify allowed me to expedite the login process while maintaining security by using the built-in Auth class while giving me the freedom to customise the UI fully. Amazon's API and GraphQL made creating and accessing the database entries simple. The Amplify codegen auto-generated standard CRUD mutations and queries to access data and restrict permissions.

Database Design

The database was designed such that a caregiver could log in using Cognito, and owner-based authentication was enabled. This allowed database entries to be restricted such that CRUD access was limited to the user that created the entry.

Although the design was initially to include multiple children per account, the decision was made for the prototype to limit to one child per caregiver login.

The database tables were created to store infant data, appointments, vaccines, milestones, breastfeeding logs, complementary feeding logs and iron supplement logs. Below is the schema used to create the database.

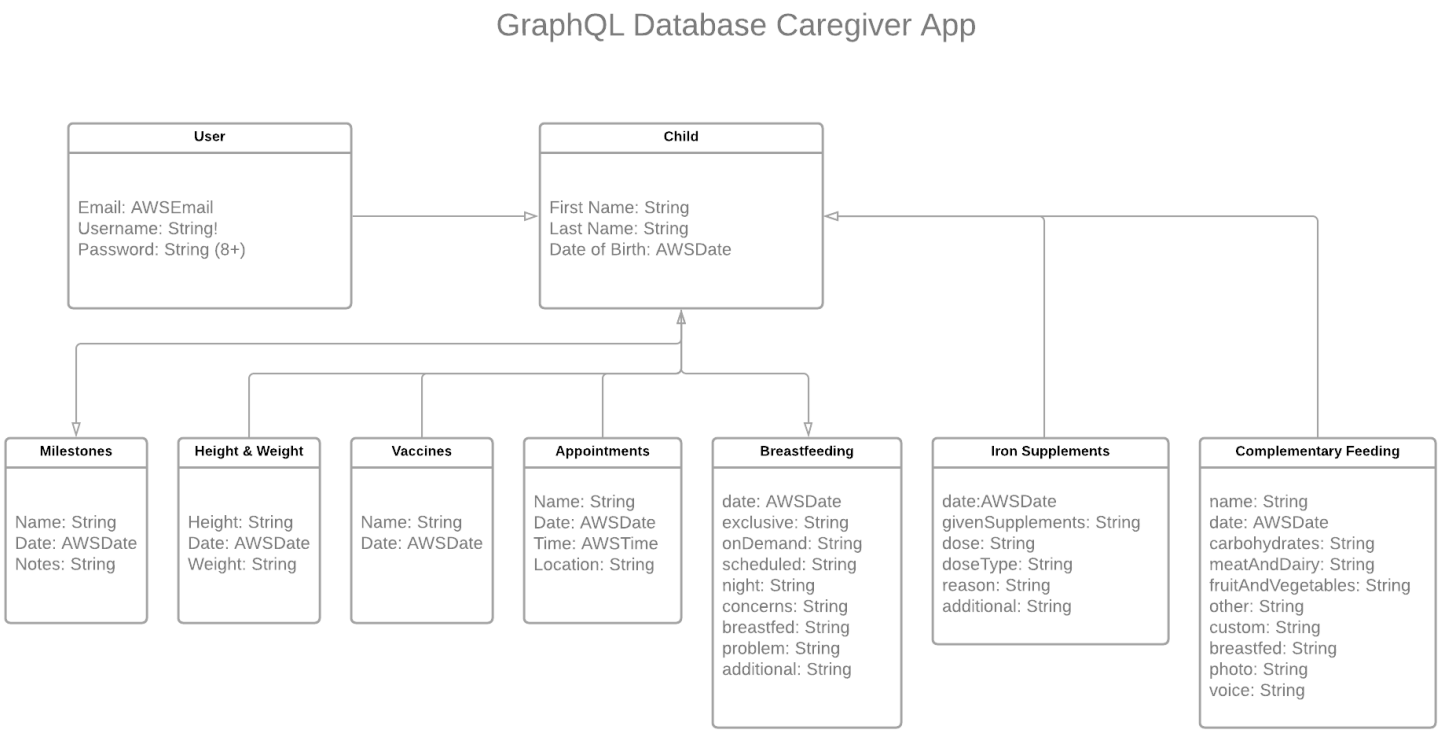


Figure 29: Database Schema for Infant and Child Care Application

The system design includes future functionalities such as access to appointments, vaccines, and medical records such as height and weight from an existing system; this prototype will replicate this behaviour by setting dummy data in the tables to demonstrate the expected result.

```
type Breastfeeding @model @auth(rules: [{allow: owner}]) @key(name: "byChild", fields: ["childID"]) {
  id: ID!
  exclusive: String
  onDemand: String
  scheduled: String
  night: String
  concern: String
  breastfed: String
  problem: String
  additional: String
  date: AWSDate
  childID: ID
}
```

Figure 30: Example of a database table and permissions

Functionalities of Implementation

Registration and Login

As mentioned above, user management was handled by Amplify's Auth class. This included security options such as requiring an email confirmation code to access the account for the first time and secure storage of login credentials within the AWS Cognito service.

```
function onSubmit(values){
    var username = values.username;
    var password = values.password;
    var confirmPassword = values.confirmPassword;
    var email = values.email;




    if (password != confirmPassword) {
        alert( "Passwords do not match")
    }

    try { Auth.signUp({username, password, attributes: {email}})
       console.log("Success!")

    }
    catch (err) { console.log("Error occurred:", err)

     }
```

Figure 31: Register Code from application

```
function LoginScreen({navigation}) {



    async function onSubmit(values){
        var username = values.username;
        var password = values.password;



        try {
            const user = await Auth.signIn(username, password);
            navigation.navigate('HomeTabs', {screen:i18n.t('home')});
        } catch (error) {
            console.log(error)

                return(
                    <View style={styles.error}>
                        <Text>Incorrect Password or Username</Text>
                    </View>
                )
            }
```

Figure 32: Login Code from application

Home Page

The home page design was completed; however, functionality is limited, the proposal to show the day's appointments hasn't yet been implemented. Diary links are not functional from this route. React Navigation was an issue as the diary screens are deeply nested in stacks. The routing of the application could be changed to allow for this in future.

Calendar

The calendar view was created with the react-native-calendars package. Code based on their documentation examples was used to create a calendar view that changes locale based on device settings and marks dates based on fetch requests to the database. Marked dates are entries from the database tables for appointments, milestones, breastfeeding diary, iron supplementation diary and complementary feeding diary.

The second set of filtered fetch requests is made once a caregiver clicks on a specific day to display the appointments or entries of that day. Thus, allowing the user to reflect on previous entries or check upcoming events.

```
 async function fetchAppointments() {
  try {
    const appointmentData = await API.graphql(graphqlOperation(listAppointments))
    const appointments = appointmentData.data.listAppointments.items
     setAppointments(appointments)
   } catch (err) { console.log('error fetching appointments', err) }


}

async function fetchMilestones() {
 try {
   const milestoneData = await API.graphql(graphqlOperation(listMilestones))
   const milestones = milestoneData.data.listMilestones.items
    setMilestones(milestones)
  } catch (err) { console.log('error fetching milestones', err) }
```

Figure 33: Fetch Requests for appointments and milestones in the calendar screen

Charts

In both vaccines and height and weight, dummy data is retrieved via fetch request and displayed for the caregiver in these screens. The initial idea was to include a chart for height and weight, but this will be included in the future due to time constraints.

Commitments

The breastfeeding diary has a conditional rendering of questions based on the answer to the first question; these answers are sent to the database and can be retrieved in the calendar screen. Iron supplements diary was implemented in a similar way

```
//function to show different questions depending on the user's answer
 function viewSelector(){
     if (choice == "Yes"){

         return (
           <><View style={styles.longContainer}>

                 <Text style={styles.buttonText}>{i18n.t('whenBreastfeed')}</Text>
                 <View style={styles.iconButtonsView2}>
                     <TouchableOpacity onPress= {() => setInput('onDemand', i18n.t('yes')) }>
                         <Ionicons style={styles.iconButton2} name='hourglass' color='grey'></Ionicons>
                         <Text style={styles.numbers}> {i18n.t('onDemand')}</Text>
                     </TouchableOpacity>
                     <TouchableOpacity onPress= {() => setInput('scheduled', i18n.t('yes')) }>
                         <Ionicons style={styles.iconButton2} name='time' color='grey'></Ionicons>
                         <Text style={styles.numbers}>{'\n'}{i18n.t('scheduled')}</Text>
                     </TouchableOpacity>
                     <TouchableOpacity onPress= {() => setInput('night', i18n.t('yes')) }>
                         <Ionicons style={styles.iconButton2} name='moon' color='grey'></Ionicons>
                         <Text style={styles.numbers}> {i18n.t('night')}</Text>
                     </TouchableOpacity>


                 </View>
```

Figure 34: Function to conditionally render questions in breastfeeding diary

The complementary feeding diary was different. Here there is an option to add items from a list view, take a photo or record a voice note. While the functionality to add from a list is connected to the database. Photo and voice entry were only partly implemented due to time restrictions. Pictures can be taken, and URI sent to the database however, displaying the image was not possible due to issues with conditional rendering of images. A similar problem occurred with voice notes. This could be implemented by changing the database structure to store URI's of photos separately in future iterations.

```
 async function addEntry(){
     setInput('carbohydrates', carbs);
     setInput('meatAndDairy', meats);
     setInput('fruitAndVegetables', fruits);
     setInput('other', fruits);
     try{
         const meal = { ...formState }
         setMeal([...meals, meal])
         setFormState(initialState)
         await API.graphql(graphqlOperation(createComplementary, {input: meal}))
       } catch (err) {
         console.log('error creating meal:', err)
       }
```

Figure 35: Function to add a meal to Complementary Feeding Diary

Information

Here information is nested into screens per topic then sub-topic to follow a progressive declaration style. As mentioned above, all images and data are stored locally due to concerns regarding internet connectivity in Peru.

Milestones

I used conditional rendering in the milestones screens to show a form if the specific milestone had not yet been achieved and the milestone data if an entry was already in the database. A fetch request queried if a named milestone was already in the infant's records and, if so, displayed the information. If no record is found, the form is displayed. There were over 50 milestones on the paper card; due to time constraints, a demo set of 11 milestones have been implemented for this prototype.

```
async function addMilestone() {
  try {
    const milestone = { ...formState }
    setMilestones([...milestones, milestone])
    setFormState(initialState)
    await API.graphql(graphqlOperation(createMilestones, {input: milestone}))
  } catch (err) {
    console.log('error creating milestone:', err)
  }
}
```

Figure 36: Function to add a milestone to the database

Focus Group 3: Demonstration of App

After implementing design five into a React Native Application, a focus group was conducted with 3 participants who were healthcare professionals. In the focus group,

I gave a demonstration of the app's functionalities. At the same time, a Nutrition expert and my supervisor led a discussion with the participants in Spanish following a protocol of questions I had created. The protocol is included in Appendix 6.

Welcome Screen

Participants responded positively to the welcome screen, stating it was clear and concise. The majority wanted to change the image of the infant in the logo to an image that is more life-like and tender.

Login

The login process was well-received, although participants suggested an evaluation with mothers would give more insight into the screen's usability. There was confusion about why a login would be necessary as caregivers could add the infant's data to the app. It was explained that although the prototype uses dummy data, the idea is that in full implementation, the information would come from existing records on hospital systems; therefore, a login was necessary for security purposes.

Home Page

Participants stated that the design was clear and straightforward. The images were representative of the meaning, regardless of the mothers' socio-economic status using the app.

Calendar Screen

When shown the calendar screen, there was again confusion over where the appointment data would come from. It was explained that data would come from hospital servers in full implementation. However, for this prototype, dummy data from an AWS server was used. Participants suggested that healthcare staff could add appointments to a caregiver's app if it were not possible to access a central system. Again, they felt it needed to be further evaluated with mothers.

Milestones Screen

This screen was felt to be too cluttered as all milestone age options are shown initially. Participants suggested only showing the milestones close to the infant's age while maintaining to show previously recorded milestones so that nurses could check. A message to reassure caregivers that each child develops at their own rate may encourage engagement with developmental commitments. The language used from the health card is aimed at health professionals; this would need to be changed to be more accessible to caregivers.

Generally, if it featured all the images/milestones from the card, participants felt the screens visualised the milestones better than the card. An evaluation with mothers would be essential to see if they have the capacity to mark every milestone.

Information Screen

Suggestions for additional information included more in-depth nutritional information and an explanation of anaemia. The icon representing complementary feeding needed changing to a more appealing image, maybe having vegetables and the icon used for

Anaemia Screen to be replaced with a picture of a tired child rather than iron supplements.

The idea of including a chatbot as part of the information section was not well received.

Vaccines Screen

Participants felt the screen needed an image of a vaccine to make the design more appealing. Change the wording of the vaccine due and remove the administered by as only the date is required. When asked if reminders about vaccine appointments would be helpful to caregivers, the response was positive, suggesting adding alerts 20 mins before the appointment.

Commitments Screen

Participants felt a disconnect between commitments and the diaries. It is not clear that the diaries are intended to track commitment progress.

Breastfeeding Diary

Information from paper card commitments should be used here to align with the existing system.

Supplements Diary

Asking caregivers if supplements were given in the last week was perceived as too long. Suggestions were to decrease the amount of time over the previous three days or yesterday. In the section where caregivers are asked how many days, the number selecting the days could be used for simplicity. Translation needed changing on the empty bottle reason for not offering supplements. Participants stated that supplements

could be given in half and ¾ spoons or 1-5 drops; therefore, a text entry would be appropriate as dosages can vary.

Complementary Diary

Adding a title text entry was suggested to replace it with buttons representing meal type such as breakfast, dinner, etc. Some icons needed changes to the translation, more food options required to be included, and a custom entry for food that was not represented by a button. Participants felt there needed to be a motivational message included on submission to motivate caregivers and reinforce positive choices. The frequency of data collection was suggested as once weekly but not on Sundays. Photo entry received positive feedback, and they felt this feature would be valuable as they could better evaluate portion size and types of food included in a meal.

General Comments

Participants felt the app could be valuable if it were explained to the mothers how useful it could be for them and healthcare professionals.

Problems with the existing card system were stated as the information is too small, and mothers can leave places to avoid engaging with it. As the app is on the phone, this would mitigate this problem.

Evaluation of changes needed in response to focus group 3 (G3)

During the session, numerous non-technical changes were mentioned, including changing graphics to be more representative and making the language more inclusive to caregivers. These changes could be made in future iterations by researching and

sourcing new pictures that could replace the existing images within the application; this was out of this project's scope as there was no funding to acquire new graphics to be made. Changing the language style of the card could be implemented in future. However, it would require more focus groups with healthcare professionals and caregivers to balance being informative and accessible to caregivers with varying literacy levels. Exploring alternate styles of presenting information such as audio or videos could provide a more engaging experience for the caregivers.

Other comments centred around increasing the amount of information provided within the application align with comments made by the STAMINA group. Due to this project's time constraints, only a small amount of information was added to the design to demonstrate the concept. In future iterations, more in-depth information could be provided on the topics covered.

Adding alerts within the app was well-received; this would be a feature that could be implemented in the next iteration. The addition of motivating messages was suggested in multiple screens to encourage caregivers to engage; the inclusion of statements could be trialled in the next iteration but would need to be evaluated by mothers.

Commitments and the diaries were felt to be disconnected; therefore, a review of their presentation will be needed. Changing the questions in the journals to those used by healthcare professionals during appointments would provide continuity of the messages being promoted in the app with CRED appointment goals. Participants were happy to share a document that would include questions in the diaries for future iterations.

Changes to the user interface were suggested for the complementary feeding diary, vaccine screen, anaemia information and iron supplementation diary. These changes would need to be introduced in future work.

The addition of a photo option to record meals was considered valuable. Therefore, it would need to be fully implemented in the subsequent design phase. Voice notes received no comments; their inclusion in future iterations would need to be considered by mothers.

Overall feedback was generally positive regarding implementing an app; it was suggested it was more straightforward to understand than the card and would mitigate some issues that come with a paper version, such as forgetting the card at appointments.

Discussion

This project aimed to design an interactive application that resembled the paper health card to engage caregivers with infant development and nutrition in Peru. Over the course of the project, I have used background information to create an initial design, evaluate designs iteratively with a multidisciplinary team of experts and local healthcare professionals. I will discuss my findings in this chapter.

Principal findings

Analysis of the paper card system concluded that the design was unfavourable by G1 and G2. Usability for both caregivers and healthcare staff is poor. Caregivers struggle to use the cards as the layout is complex, and the language is aimed at health professionals.

The concept of implementing an application was generally well-received by all three groups G1, G2, G3. User interfaces were perceived as straightforward in general. However, some comments suggested that conditional rendering of information relating to the infant's age may make the app easier for caregivers.

Participants showed interest in increasing the scope of the information section to include more in-depth explanations. Videos and audio were frequently mentioned as solutions to creating a more approachable solution for varying literacy levels of caregivers that may use the app.

Features considered most valuable by the participants were the ability to remind caregivers of infant care appointments and promote engagement with commitments, which could improve the follow-up of infants.

Promotion of reflection in the diaries needed improvement to align the questions and messages with the current commitment system. Participants felt data from these diaries would be helpful to evaluate progress with commitments once changes were implemented.

The photo-based diary entry was perceived as valuable by G3. In contrast, G1 expressed concern whether mothers from lower socioeconomic backgrounds would want to show images of simple meals as they may feel judged.

Factors that could cause barriers to the use of the app, such as internet access and the requirement to own a mobile device, were considered the main potential issues of digitising the card.

Limitations of the Study

As the focus groups were conducted by proxy, there may be some contradictions in the perceived utility and usability of the application when evaluated by caregivers. Although the evaluation by the proxy stakeholders, healthcare professionals should give representative opinions as they work closely with caregivers (Novak and Lundberg 2015). Due to limitations with the ethics protocol of this project, an evaluation was not possible with mothers.

Healthcare professionals conducted no usability evaluation on the device; they demonstrated the application's functions on a simulator. On-device, testing would need to be undertaken, and a system usability survey conducted to gain insight into problems when users are navigating the app independently.

Issues regarding the protection of medical data such as GDPR (UK) and HIPPA (US and Peru) could pose a problem with the implementation of the application during later phases of testing. The proposal to integrate with an existing medical record system in

Peru would depend on permissions and ethical approval by MINSA and other appropriate stakeholders.

Future work

As a result of the focus groups, a further investigation into the type of information to include within the application would need to be conducted with healthcare professionals. Features such as notifications and positive reinforcement messages should be explored further. The suggested changes to the user interface would need to be evaluated before revising the implementation for usability testing by healthcare professionals.

Feedback and testing by caregivers would be invaluable to gain a deeper insight into creating a user experience that is easy to use and contains appropriate content for a range of literacy levels. Focus groups that evaluate the user interface as well as a thematic analysis of the proposed features.

A future version would include additional features such as implementing the photo and voice input types within the complementary feeding diary. Caregiver testing of these features could give insight into the utility of the features.

Although this project was conducted with Peru's infant health priorities, there is scope for the idea to be explored in other countries as an application system was implemented in South Africa (Webinar: Digitization and the Road to Health Booklet, CoMaCH Network.). Future researchers should take into account concerns and possible benefits raised by this study when researching the field of infant mHealth.

Reflection

This project has taught me more than any module throughout my academic study. It has allowed me to be creative, learn many new skills, collaborate with a multidisciplinary team, and learn a lot about myself. I have experienced both failures and success throughout the weeks, but my passion for continuing my research never wavered. At the start of the project, one of my first tasks was participating in a workshop with academics from other institutions worldwide. That day, I was extremely nervous. Since then, I have participated in many meetings with the same academics from the STAMINA group and grew confident presenting my ideas. I enhanced my communication skills by explaining technical concepts to other non-technical researchers, which is crucial when working on a multidisciplinary research project. This will stand me in good stead as I advance my career. In addition to this, at the beginning of the project, I found taking criticism of my designs difficult. Throughout the design iterations, I reflected on how I felt and saw all feedback positively contributing to the app's development. After each feedback session, I would write down both positive and negative feedback, turning the negative feedback into actionable changes I could make to the design. This is a transferable skill that will aid me in future endeavours.

My time management skills were challenged many times as design changes were sometimes needed rapidly to present for feedback to others. However, this increased my flexibility and taught me to allow for buffer time when working with code, as bugs are inevitable when learning a new framework.

I decided to use React Native as I had no experience with the framework, although I knew JavaScript and Node. As the weeks passed, my framework knowledge increased rapidly as I was learning while implementing a prototype. Learning independently certainly seemed overwhelming in phases of the programming. However, it allowed me to develop my problem-solving skills and appreciate the framework's documentation.

The most challenging phase of the project was learning AWS's services and implementing the back end of the application. I found the documentation challenging to read and the volume of available services overwhelming. AWS's online conference AWSome day was happening during that time; I attended the introduction day where an instructor explained all the different services and their utility, allowing me to decide on Amplify. The knowledge I gained from this session was invaluable to my progress with the implementation; this taught me that being proactive in researching resources can make a big difference in a project.

During the design and research phases, I expanded my knowledge of user-centred design and human-computer interaction principles. Conducting qualitative research taught me how to create a protocol, conduct a focus group and analyse the data. Seeing the process from start to finish meant I could appreciate the skill required to conduct qualitative research well and give insight on how I could improve my protocols in the future.

I completed a crash course with Languages for All in Spanish at A2 level; I had pre-emted some translation and focus groups challenges. What I did not expect was how my Spanish language skills would improve over the project; I required translation services less and could roughly read comments or the context documents about infant health without aid.

Overall, this project taught me much more than I anticipated when I started and enhanced my passion for research within HCI. Coming from a mathematics background, I was in a realm where there was usually a correct answer to a question. I think I finally learnt that there is no correct answer in designing a system. Feedback and research are the most valuable tools to reach your user's perception of right.

Conclusion

By iteratively evaluating designs and the final implementation of Infant and Child Care and conducting a qualitative analysis of focus group findings, it can be concluded that the implementation of an application system has the potential to benefit caregivers and healthcare professionals in Peru. Results suggest, though there exist some barriers to implementing a system, the idea was well-received as an alternative to the existing paper system if explored in further studies. The research clearly illustrates that healthcare professionals would value automated reminders for appointments and vaccination; over the course of the project, many extra functionalities such as notifications, creation of new media to support a digital solution and to increase the

breadth and depth of information. Further studies are needed to establish if the concept and design would be welcomed by caregivers and explore the suggested improvements to the design and user experience.

References

Achananuparp, P., Lim, E.-P. and Abhishek, V. 2018. Does Journaling Encourage Healthier Choices?: Analyzing Healthy Eating Behaviors of Food Journalers. In: *Proceedings of the 2018 International Conference on Digital Health*. Lyon France: ACM, pp. 35–44. Available at: https://dl.acm.org/doi/10.1145/3194658.3194663 [Accessed: 2 October 2021].

Baby Buddy app - NHS. [no date]. Available at: https://www.nhs.uk/apps-library/baby-buddy/ [Accessed: 1 November 2021].

Brown, A. and Shenker, N. 2021. Experiences of breastfeeding during COVID-19: Lessons for future practical and emotional support. *Maternal & Child Nutrition* 17(1). Available at: https://onlinelibrary.wiley.com/doi/10.1111/mcn.13088 [Accessed: 3 November 2021].

Chetty, M., Banks, R., Brush, A.J., Donner, J. and Grinter, R. 2012. You're capped: understanding the effects of bandwidth caps on broadband use in the home. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Austin Texas USA: ACM, pp. 3021–3030. Available at: https://dl.acm.org/doi/10.1145/2207676.2208714 [Accessed: 3 November 2021].

Cordeiro, F., Bales, E., Cherry, E. and Fogarty, J. 2015. Rethinking the Mobile Food Journal: Exploring Opportunities for Lightweight Photo-Based Capture. In: *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. Seoul Republic of Korea: ACM, pp. 3207–3216. Available at: https://dl.acm.org/doi/10.1145/2702123.2702154 [Accessed: 3 November 2021].

Dienelt, K., Moores, C.J., Miller, J. and Mehta, K. 2020. An investigation into the use of infant feeding tracker apps by breastfeeding mothers. *Health Informatics Journal* 26(3), pp. 1672–1683. Available at: http://journals.sagepub.com/doi/10.1177/1460458219888402 [Accessed: 2 October 2021].

Fewtrell, M.S., Morgan, J.B., Duggan, C., Gunnlaugsson, G., Hibberd, P.L., Lucas, A. and Kleinman, R.E. 2007. Optimal duration of exclusive breastfeeding: what is the evidence to support current recommendations? *The American Journal of Clinical Nutrition* 85(2), pp. 635S-638S. Available at: https://academic.oup.com/ajcn/article/85/2/635S/4649679 [Accessed: 3 November 2021].

INEI - Perú: Encuesta Demográfica y de Salud Familiar-ENDES 2020. [no date]. Available at: https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1795/ [Accessed: 3 November 2021].

INS presenta Aplicativo Móvil ¡Yico! que brinda consejos para la alimentación de los niños en sus 2 primeros años de vida. [no date]. Available at: http://web.ins.gob.pe/index.php/es/prensa/noticia/ins-presenta-aplicativo-movil-yico-que-brinda-consejos-para-la-alimentacion-de-los [Accessed: 2 October 2021].

Laminario del actor social. Para las visitas domiciliarias a familias con niños o niñas menores de 1 año. 2020. Available at: https://www.gob.pe/institucion/minsa/informes-

publicaciones/1091071-laminario-del-actor-social-para-las-visitas-domiciliarias-a-familias-con-ninos-o-ninas-menores-de-1-ano [Accessed: 2 October 2021].

Luo, Y., Kim, Y.-H., Lee, B., Hassan, N. and Choe, E.K. 2021. FoodScrap: Promoting Rich Data Capture and Reflective Food Journaling Through Speech Input. In: *Designing Interactive Systems Conference 2021*. Virtual Event USA: ACM, pp. 606–618. Available at: https://dl.acm.org/doi/10.1145/3461778.3462074 [Accessed: 2 October 2021].

Luo, Y., Liu, P. and Choe, E.K. 2019. Co-Designing Food Trackers with Dietitians: Identifying Design Opportunities for Food Tracker Customization. In: *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. Glasgow Scotland Uk: ACM, pp. 1–13. Available at: https://dl.acm.org/doi/10.1145/3290605.3300822 [Accessed: 2 October 2021].

Ministerio de Salud 2017. Norma Técnica de Salud para el Control del Crecimiento y Desarrollo de la Niña y el Niño menor de cinco años.

Ministerio de Salud [no date]. KIT DEL BUEN CRECIMIENTO Y DESARROLLO INFANTIL, EN EL MARCO DE LA CONSEJERÍA CRED Y ATENCIÓN INFANTIL.

Norman, D.A. 2013. *The design of everyday things*. Rev. and expanded ed. Cambridge, Mass.: MIT Press.

Novak, G. and Lundberg, L. 2015. Usability Evaluation of an M-Commerce System Using Proxy Users. SPRINGER-VERLAG BERLIN, pp. 164–169. Available at: http://urn.kb.se/resolve?urn=urn:nbn:se:bth-14576 [Accessed: 4 November 2021].

Penny, M.E., Creed-Kanashiro, H.M., Robert, R.C., Narro, M.R., Caulfield, L.E. and Black, R.E. 2005. Effectiveness of an educational intervention delivered through the health services to improve nutrition in young children: a cluster-randomised controlled trial. *The Lancet* 365(9474), pp. 1863–1872. Available at: https://linkinghub.elsevier.com/retrieve/pii/S0140673605664264 [Accessed: 3 November 2021].

Penny, M.E., Meza, K.S., Creed-Kanashiro, H.M., Marin, R.M. and Donovan, J. 2017. Fruits and vegetables are incorporated into home cuisine in different ways that are relevant to promoting increased consumption: Home cuisine determines fruit and vegetable intake. *Maternal & Child Nutrition* 13(3), p. e12356. Available at: https://onlinelibrary.wiley.com/doi/10.1111/mcn.12356 [Accessed: 2 October 2021].

Peru - Place Explorer - Data Commons. [no date]. Available at: https://datacommons.org/place/country/PER?utm_medium=explore&mprop=count&popt=Person&hl=en [Accessed: 1 November 2021].

Road To Health – Apps on Google Play. [no date]. Available at: https://play.google.com/store/apps/details?id=com.roadtohealthv2&hl=en_GB&gl=US [Accessed: 2 October 2021].

Santos, M.P., Turner, B. and Chaparro, M.P. 2021. The double burden of malnutrition in Peru: An update with a focus on social inequities. *The American Journal of Clinical Nutrition*

113(4), pp. 865–873. Available at: https://doi.org/10.1093/ajcn/nqaa387 [Accessed: 11 March 2021].

Sun, Z., Wang, S., Yang, W., Yürüten, O., Shi, C. and Ma, X. 2020. 'A Postcard from Your Food Journey in the Past': Promoting Self-Reflection on Social Food Posting. In: *Proceedings of the 2020 ACM Designing Interactive Systems Conference*. Eindhoven Netherlands: ACM, pp. 1819–1832. Available at: https://dl.acm.org/doi/10.1145/3357236.3395475 [Accessed: 2 October 2021].

Tang, K., Gerling, K., Chen, W. and Geurts, L. 2019. Information and Communication Systems to Tackle Barriers to Breastfeeding: Systematic Search and Review. *Journal of Medical Internet Research* 21(9), p. e13947. Available at: https://www.jmir.org/2019/9/e13947 [Accessed: 4 November 2021].

Vazir, S. et al. 2013. Cluster-randomized trial on complementary and responsive feeding education to caregivers found improved dietary intake, growth and development among rural Indian toddlers: Responsive feeding, infant growth and development. *Maternal & Child Nutrition* 9(1), pp. 99–117. Available at: https://onlinelibrary.wiley.com/doi/10.1111/j.1740-8709.2012.00413.x [Accessed: 3 November 2021].

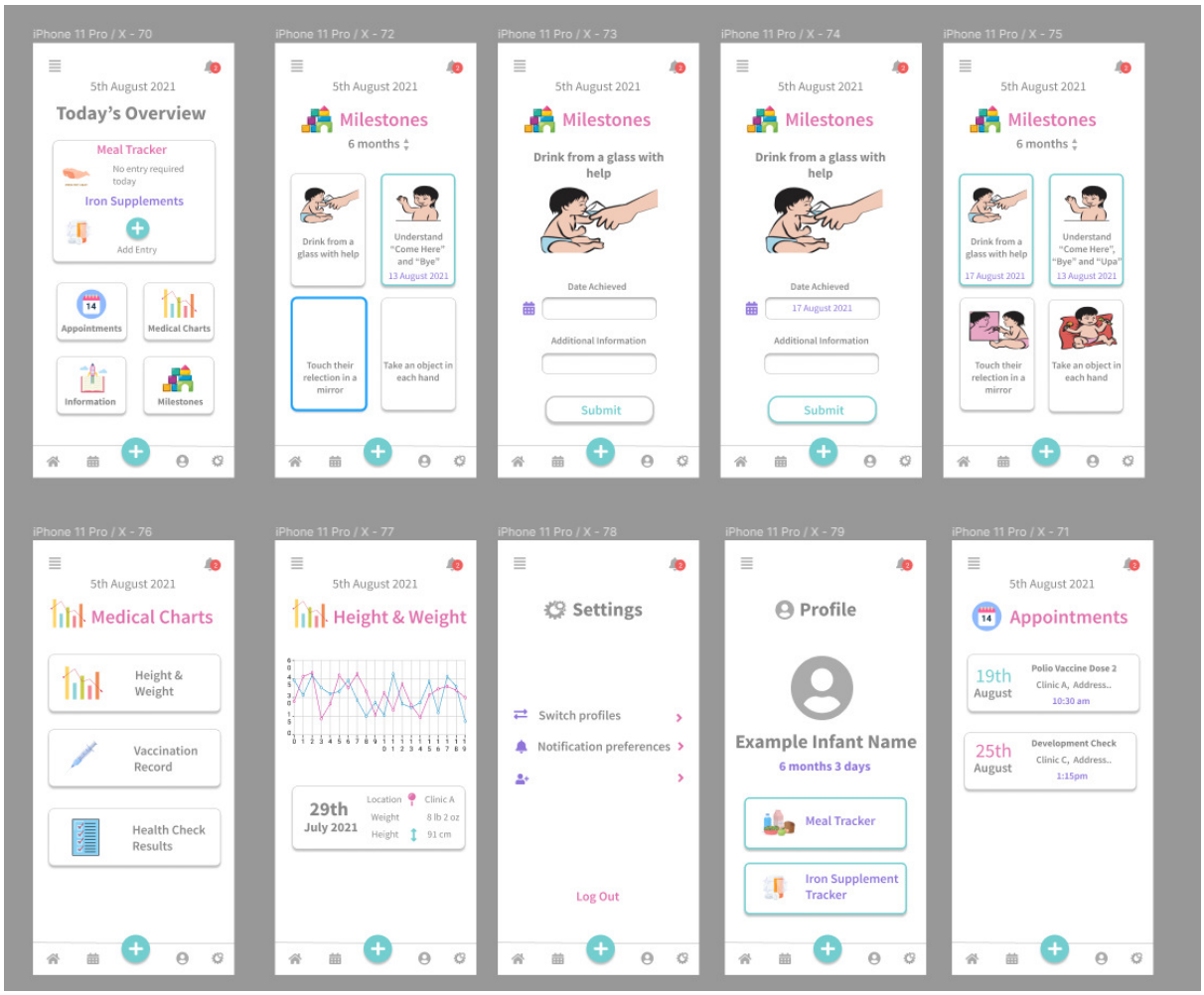
Virani, A., Duffett-Leger, L. and Letourneau, N. 2019. Parenting apps review: in search of good quality apps. *mHealth* 5, pp. 44–44. Available at: http://mhealth.amegroups.com/article/view/29870/html [Accessed: 3 November 2021].

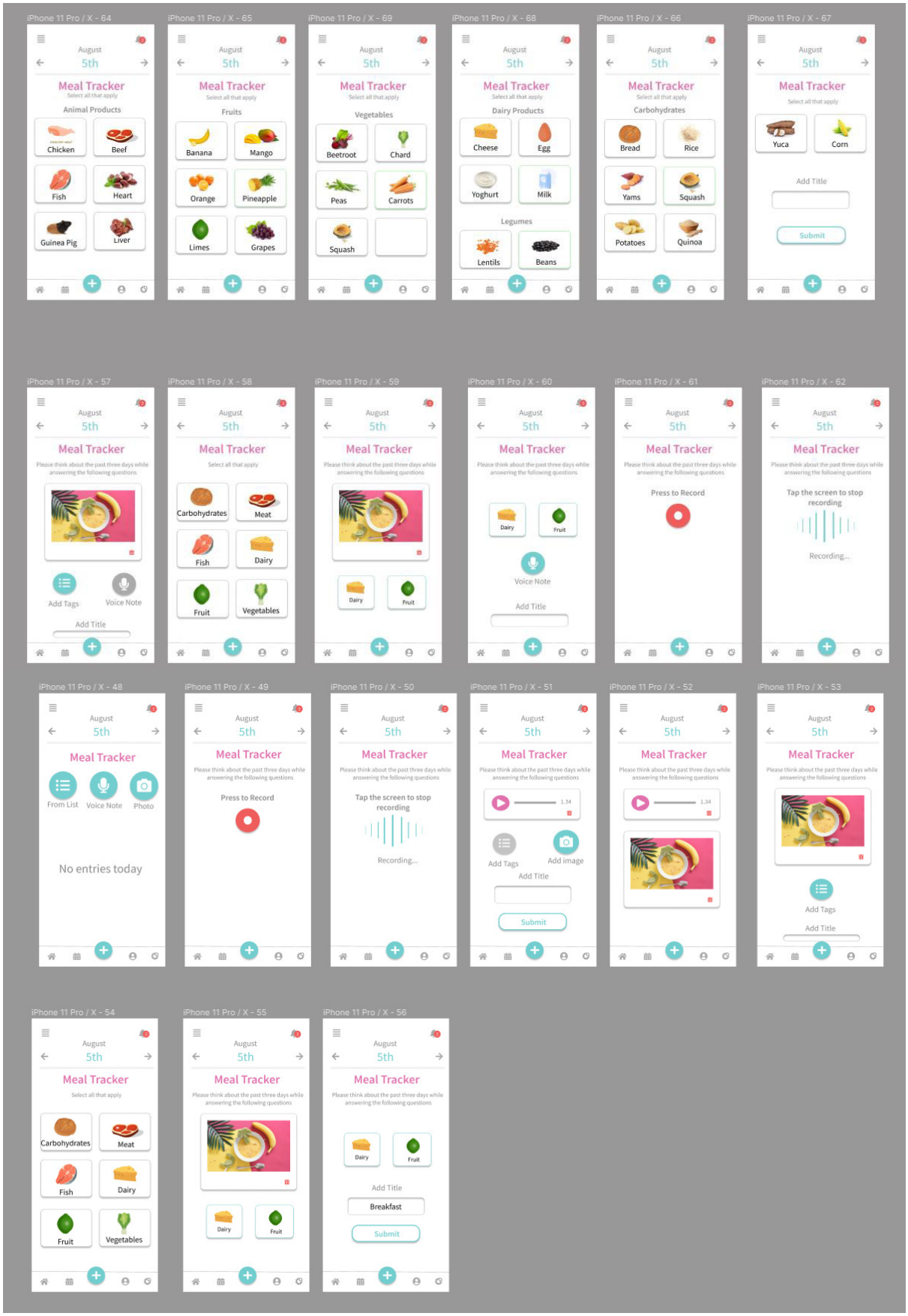
Webinar: Digitization and the Road to Health Booklet, CoMaCH Network. [no date]. *CoMaCH Network* . Available at: https://comach.melissadensmore.com/webinar-digitization-and-the-road-to-health-booklet/ [Accessed: 2 October 2021].

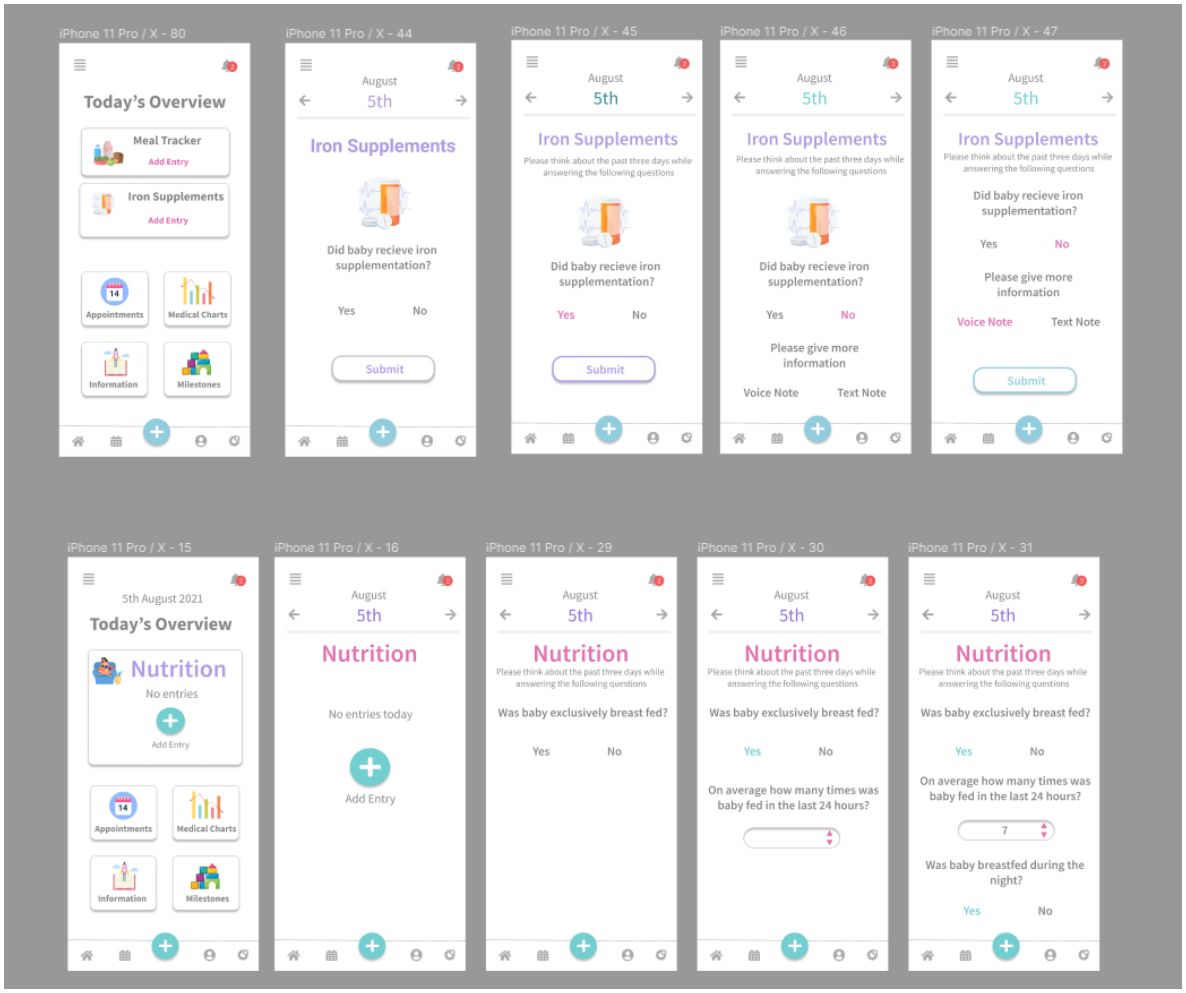
WebMD Baby App. [no date]. Available at: https://www.webmd.com/baby-app [Accessed: 1 November 2021].

Appendices

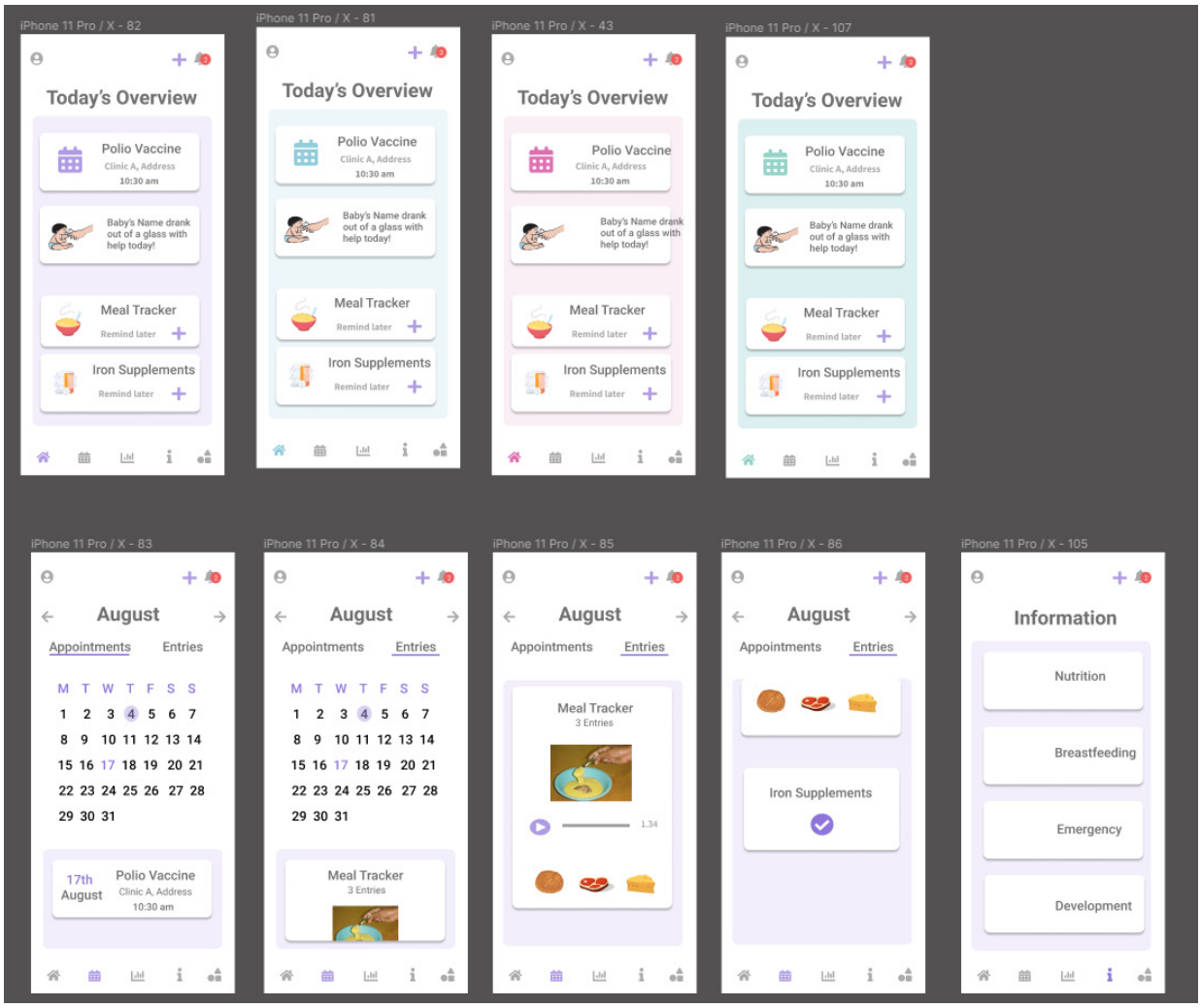
Appendix 1: Design 3

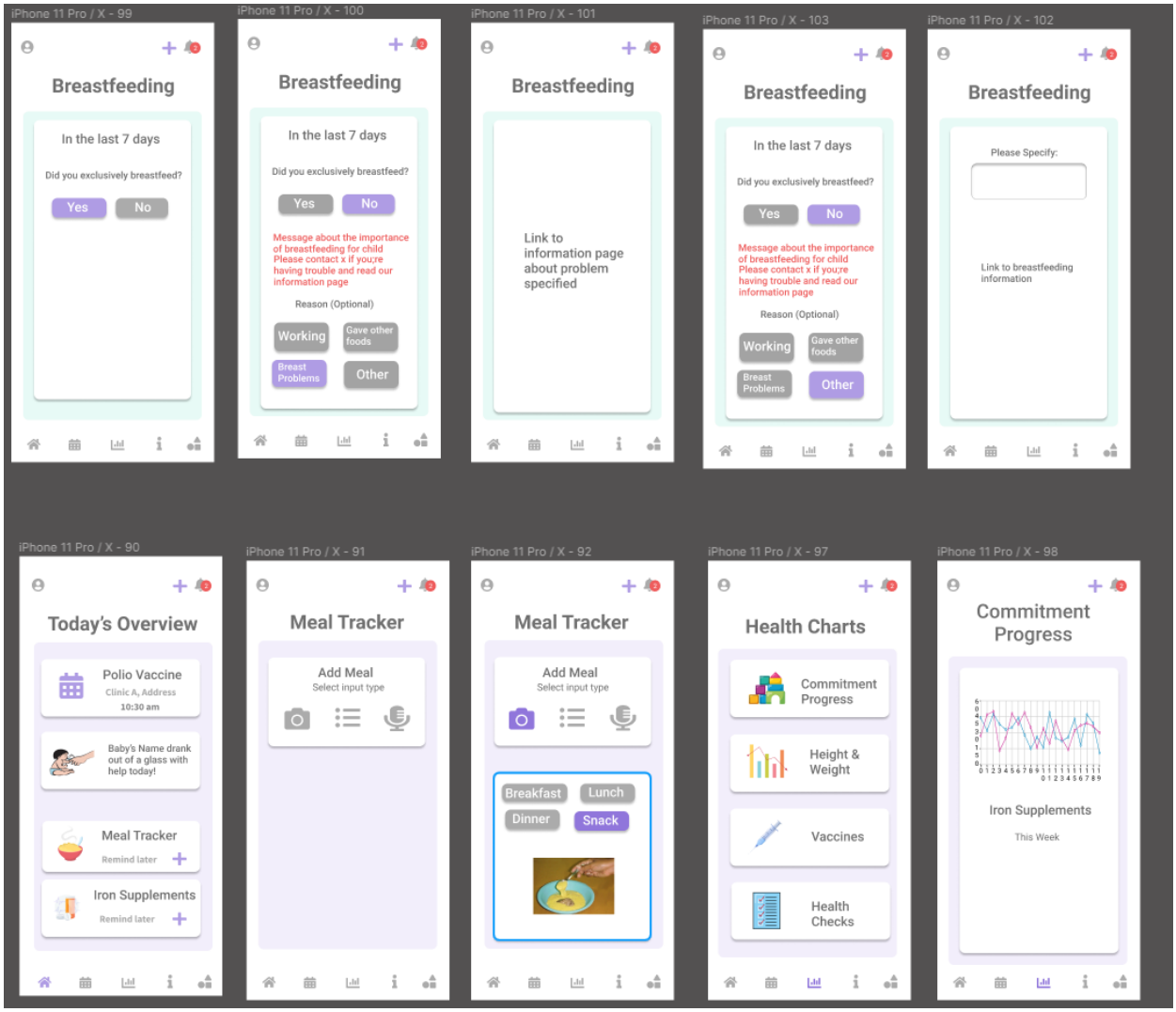


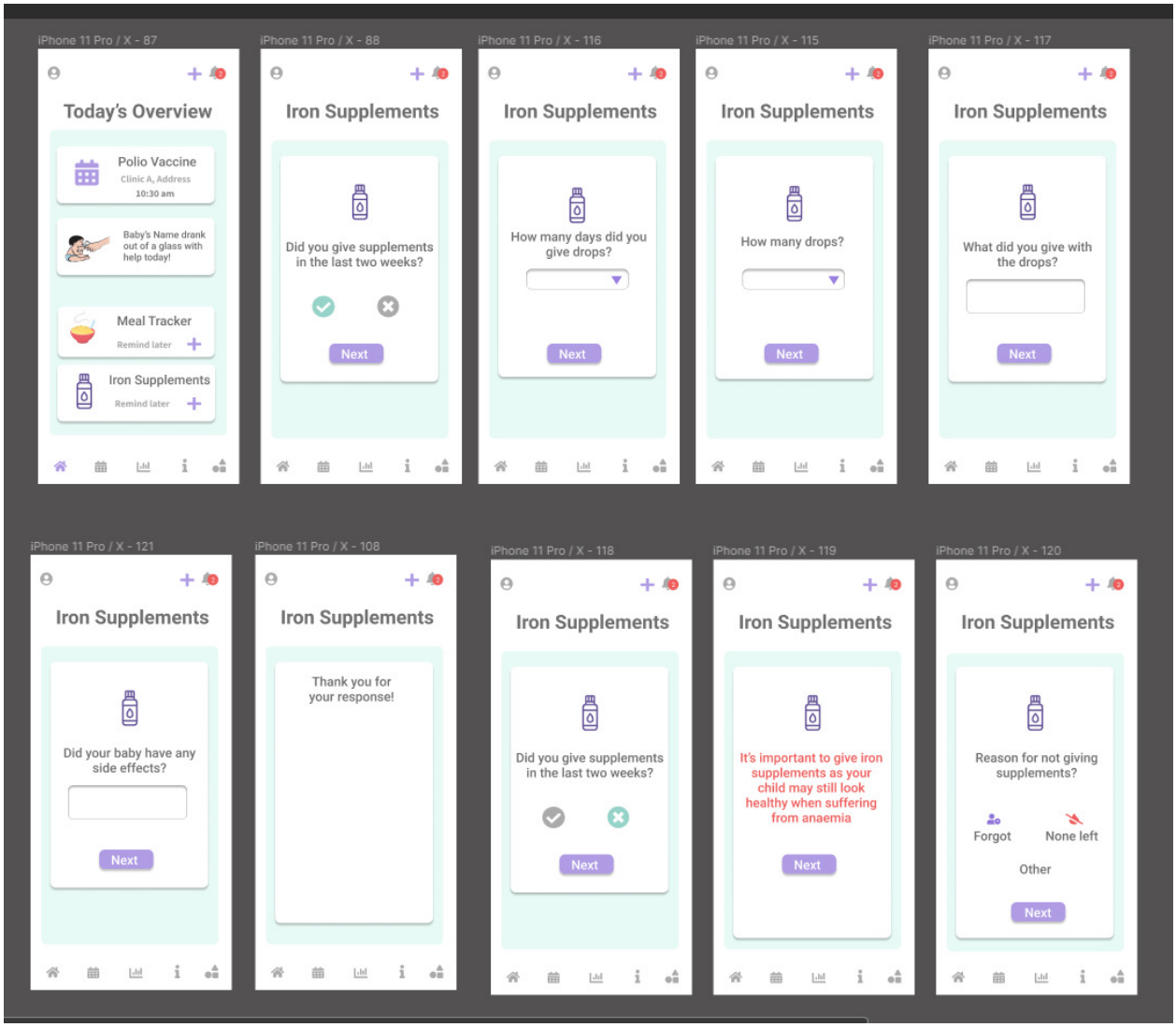

iPhone 11 Pro / X - 64
August
5th
Meal Tracker
Select all that apply
Animal Products
Chicken
Beef
Fish
Heart
Guinea Pig
Liver
iPhone 11 Pro / X - 65
Fruits
Banana
Mango
Orange
Pineapple
Limes
Grapes
iPhone 11 Pro / X - 69
Vegetables
Beetroot
Chard
Peas
Carrots
Squash
iPhone 11 Pro / X - 68
Dairy Products
Cheese
Egg
Yoghurt
Milk
Legumes
Lentils
Beans
iPhone 11 Pro / X - 66
Carbohydrates
Bread
Rice
Yams
Squash
Potatoes
Quinoa
iPhone 11 Pro / X - 67
Yuca
Corn
Add Title
Submit
iPhone 11 Pro / X - 57
Please think about the past three days while answering the following questions
Add Tags
Voice Note
Add Title
iPhone 11 Pro / X - 58
Carbohydrates
Meat
Fish
Dairy
Fruit
Vegetables
iPhone 11 Pro / X - 59
iPhone 11 Pro / X - 60
Voice Note
iPhone 11 Pro / X - 61
Press to Record
iPhone 11 Pro / X - 62
Tap the screen to stop recording
Recording...
iPhone 11 Pro / X - 48
From List
Photo
No entries today
iPhone 11 Pro / X - 49
iPhone 11 Pro / X - 50
iPhone 11 Pro / X - 51
Add image
iPhone 11 Pro / X - 52
iPhone 11 Pro / X - 53
iPhone 11 Pro / X - 54
iPhone 11 Pro / X - 55
iPhone 11 Pro / X - 56
Breakfast

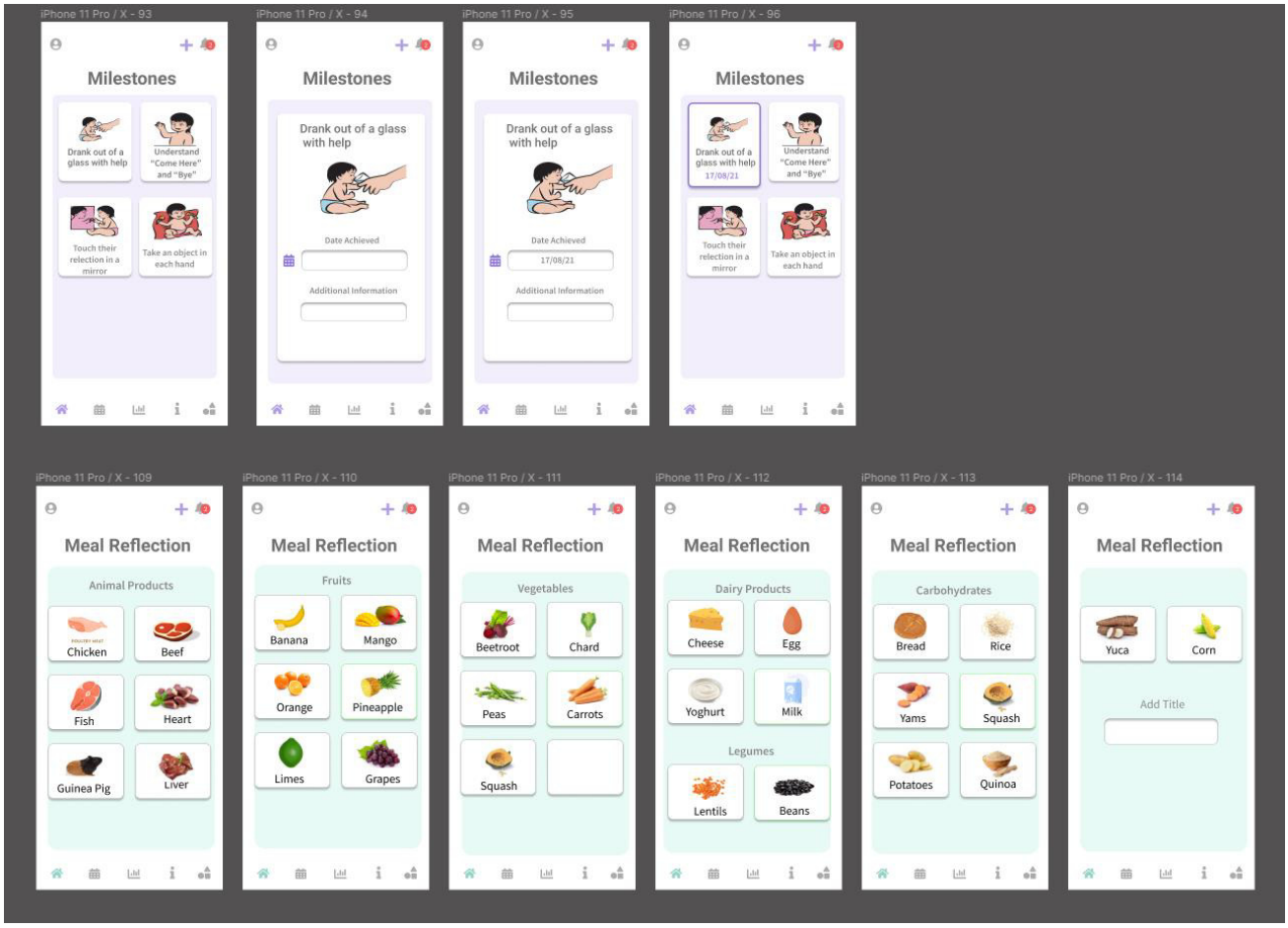

iPhone 11 Pro / X - 80
Today's Overview
Meal Tracker
Add Entry
Iron Supplements
Add Entry
Appointments
Medical Charts
Information
Milestones
iPhone 11 Pro / X - 44
August
5th
Iron Supplements
Did baby recieve iron supplementation?
Yes
No
Submit
iPhone 11 Pro / X - 45
August
5th
Iron Supplements
Please think about the past three days while answering the following questions
Did baby recieve iron supplementation?
Yes
No
Submit
iPhone 11 Pro / X - 46
August
5th
Iron Supplements
Please think about the past three days while answering the following questions
Did baby recieve iron supplementation?
Yes
No
Please give more information
Voice Note
Text Note
iPhone 11 Pro / X - 47
August
5th
Iron Supplements
Please think about the past three days while answering the following questions
Did baby recieve iron supplementation?
Yes
No
Please give more information
Voice Note
Text Note
Submit
iPhone 11 Pro / X - 15
5th August 2021
Today's Overview
Nutrition
No entries
Add Entry
Appointments
Medical Charts
Information
Milestones
iPhone 11 Pro / X - 16
August
5th
Nutrition
No entries today
Add Entry
iPhone 11 Pro / X - 29
August
5th
Nutrition
Please think about the past three days while answering the following questions
Was baby exclusively breast fed?
Yes
No
iPhone 11 Pro / X - 30
August
5th
Nutrition
Please think about the past three days while answering the following questions
Was baby exclusively breast fed?
Yes
No
On average how many times was baby fed in the last 24 hours?
iPhone 11 Pro / X - 31
August
5th
Nutrition
Please think about the past three days while answering the following questions
Was baby exclusively breast fed?
Yes
No
On average how many times was baby fed in the last 24 hours?
7
Was baby breastfed during the night?
Yes
No

Appendix 2: Design 4

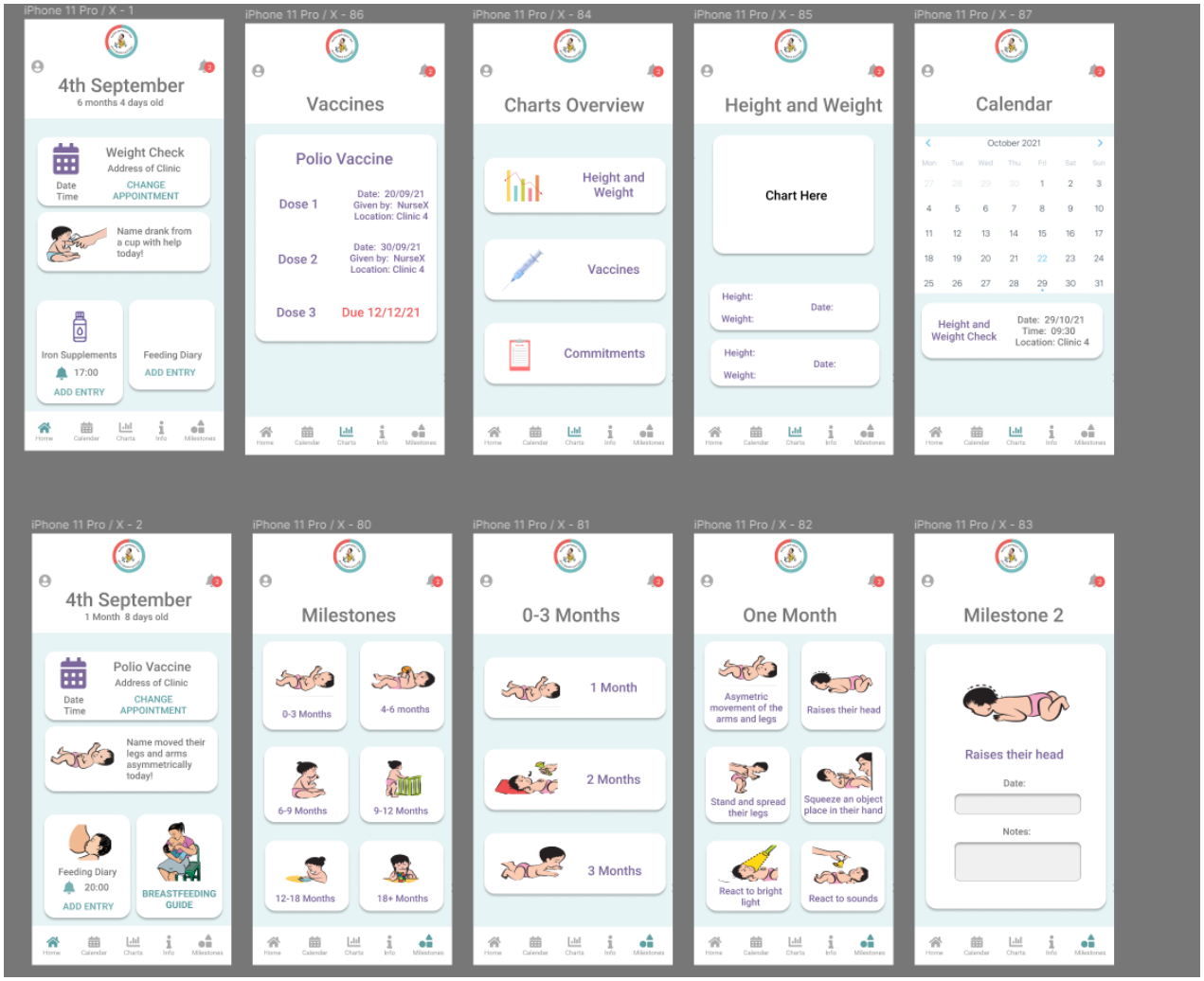


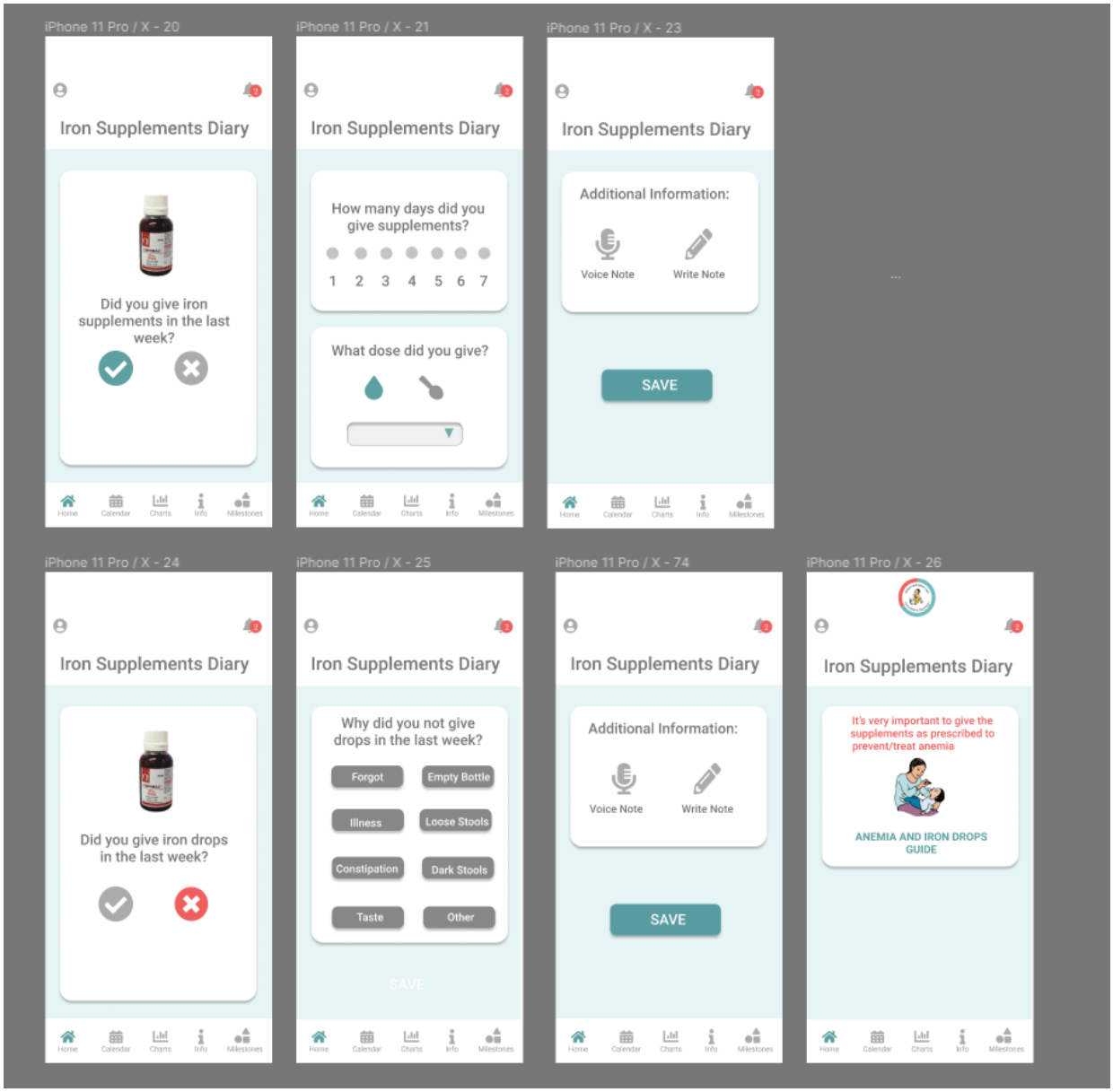

iPhone 11 Pro / X - 99
Breastfeeding
In the last 7 days
Did you exclusively breastfeed?
Yes
No
iPhone 11 Pro / X - 100
Breastfeeding
In the last 7 days
Did you exclusively breastfeed?
Yes
No
Message about the importance of breastfeeding for child Please contact x if you;re having trouble and read our information page
Reason (Optional)
Working
Gave other foods
Breast Problems
Other
iPhone 11 Pro / X - 101
Breastfeeding
Link to information page about problem specified
iPhone 11 Pro / X - 103
Breastfeeding
In the last 7 days
Did you exclusively breastfeed?
Yes
No
Message about the importance of breastfeeding for child Please contact x if you;re having trouble and read our information page
Reason (Optional)
Working
Gave other foods
Breast Problems
Other
iPhone 11 Pro / X - 102
Breastfeeding
Please Specify:
Link to breastfeeding information
iPhone 11 Pro / X - 90
Today's Overview
Polio Vaccine
Clinic A, Address
10:30 am
Baby's Name drank out of a glass with help today!
Meal Tracker
Remind later
Iron Supplements
Remind later
iPhone 11 Pro / X - 91
Meal Tracker
Add Meal
Select input type
iPhone 11 Pro / X - 92
Meal Tracker
Add Meal
Select input type
Breakfast
Lunch
Dinner
Snack
iPhone 11 Pro / X - 97
Health Charts
Commitment Progress
Height & Weight
Vaccines
Health Checks
iPhone 11 Pro / X - 98
Commitment Progress
Iron Supplements
This Week

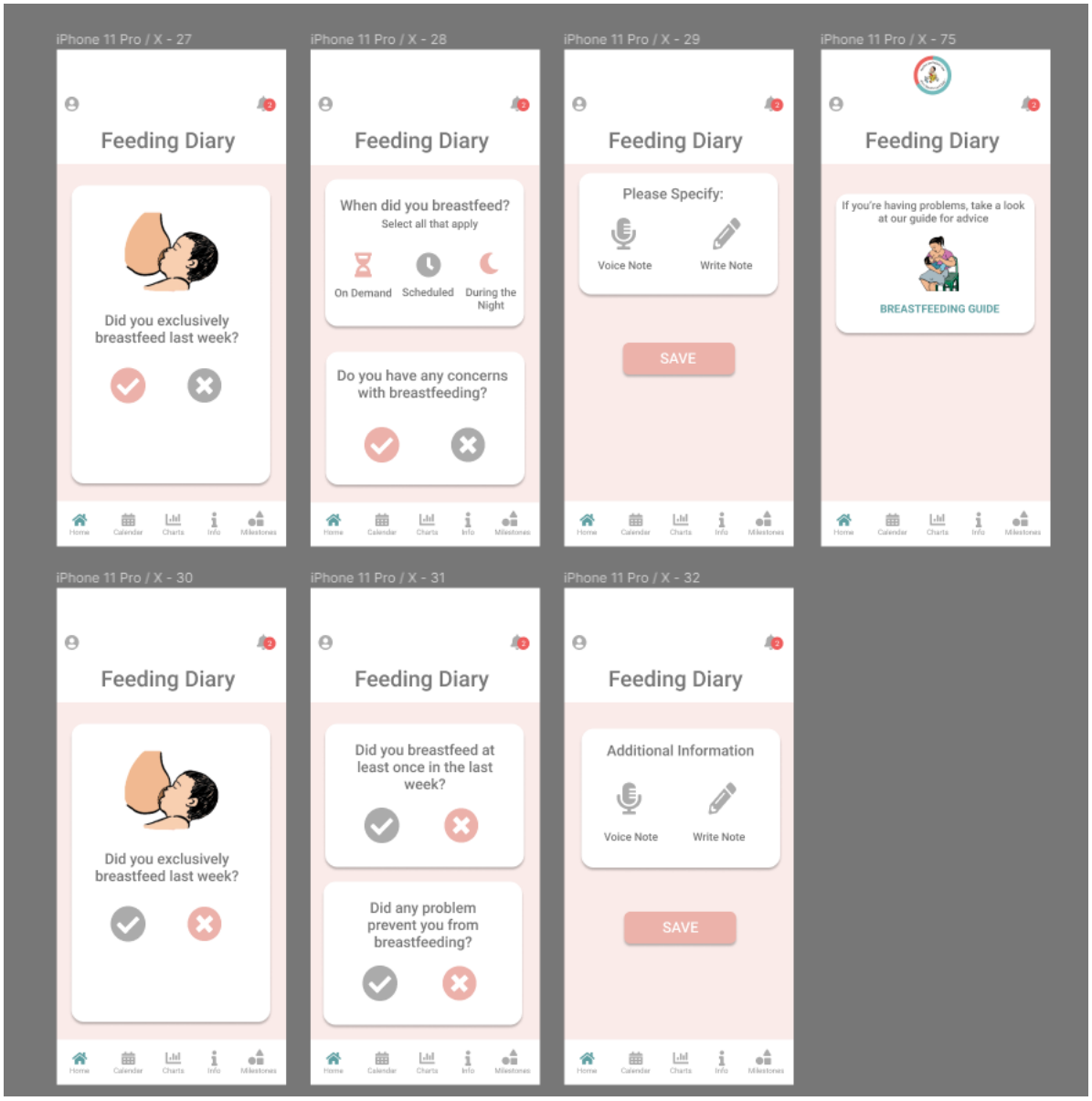

iPhone 11 Pro / X - 87
Today's Overview
Polio Vaccine
Clinic A, Address
10:30 am
Baby's Name drank out of a glass with help today!
Meal Tracker
Remind later
Iron Supplements
Remind later
iPhone 11 Pro / X - 88
Iron Supplements
Did you give supplements in the last two weeks?
Next
iPhone 11 Pro / X - 116
Iron Supplements
How many days did you give drops?
Next
iPhone 11 Pro / X - 115
Iron Supplements
How many drops?
Next
iPhone 11 Pro / X - 117
Iron Supplements
What did you give with the drops?
Next
iPhone 11 Pro / X - 121
Iron Supplements
Did your baby have any side effects?
Next
iPhone 11 Pro / X - 108
Iron Supplements
Thank you for your response!
iPhone 11 Pro / X - 118
Iron Supplements
Did you give supplements in the last two weeks?
Next
iPhone 11 Pro / X - 119
Iron Supplements
It's important to give iron supplements as your child may still look healthy when suffering from anaemia
Next
iPhone 11 Pro / X - 120
Iron Supplements
Reason for not giving supplements?
Forgot
None left
Other
Next

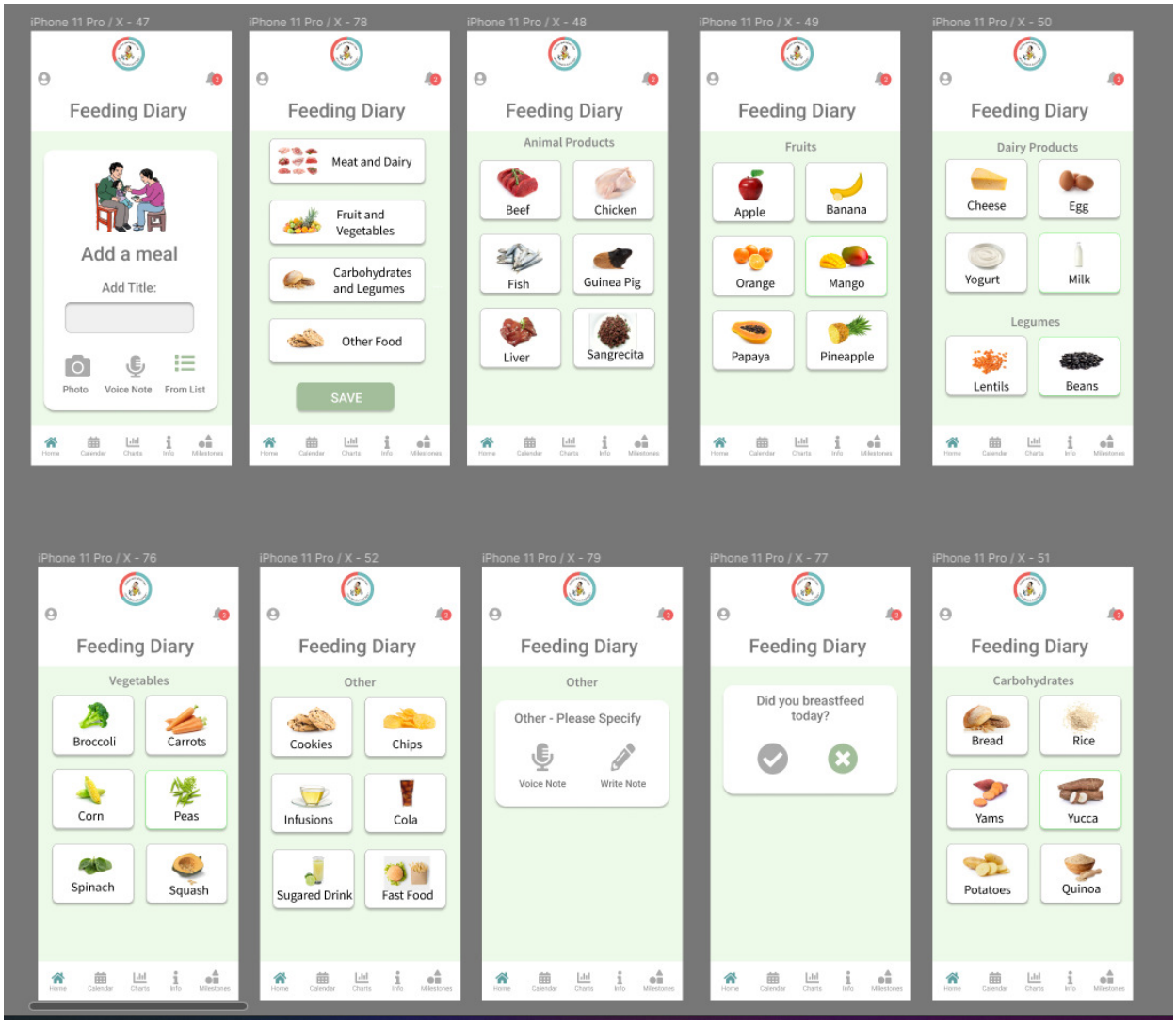

iPhone 11 Pro / X - 93
Milestones
Drank out of a glass with help
Understand "Come Here" and "Bye"
Touch their relection in a mirror
Take an object in each hand
iPhone 11 Pro / X - 94
Milestones
Drank out of a glass with help
Date Achieved
Additional Information
iPhone 11 Pro / X - 95
Milestones
Drank out of a glass with help
Date Achieved
17/08/21
Additional Information
iPhone 11 Pro / X - 96
Milestones
Drank out of a glass with help
17/08/21
Understand "Come Here" and "Bye"
Touch their relection in a mirror
Take an object in each hand
iPhone 11 Pro / X - 109
Meal Reflection
Animal Products
Chicken
Beef
Fish
Heart
Guinea Pig
Liver
iPhone 11 Pro / X - 110
Meal Reflection
Fruits
Banana
Mango
Orange
Pineapple
Limes
Grapes
iPhone 11 Pro / X - 111
Meal Reflection
Vegetables
Beetroot
Chard
Peas
Carrots
Squash
iPhone 11 Pro / X - 112
Meal Reflection
Dairy Products
Cheese
Egg
Yoghurt
Milk
Legumes
Lentils
Beans
iPhone 11 Pro / X - 113
Meal Reflection
Carbohydrates
Bread
Rice
Yams
Squash
Potatoes
Quinoa
iPhone 11 Pro / X - 114
Meal Reflection
Yuca
Corn
Add Title

Appendix 3: Design 5

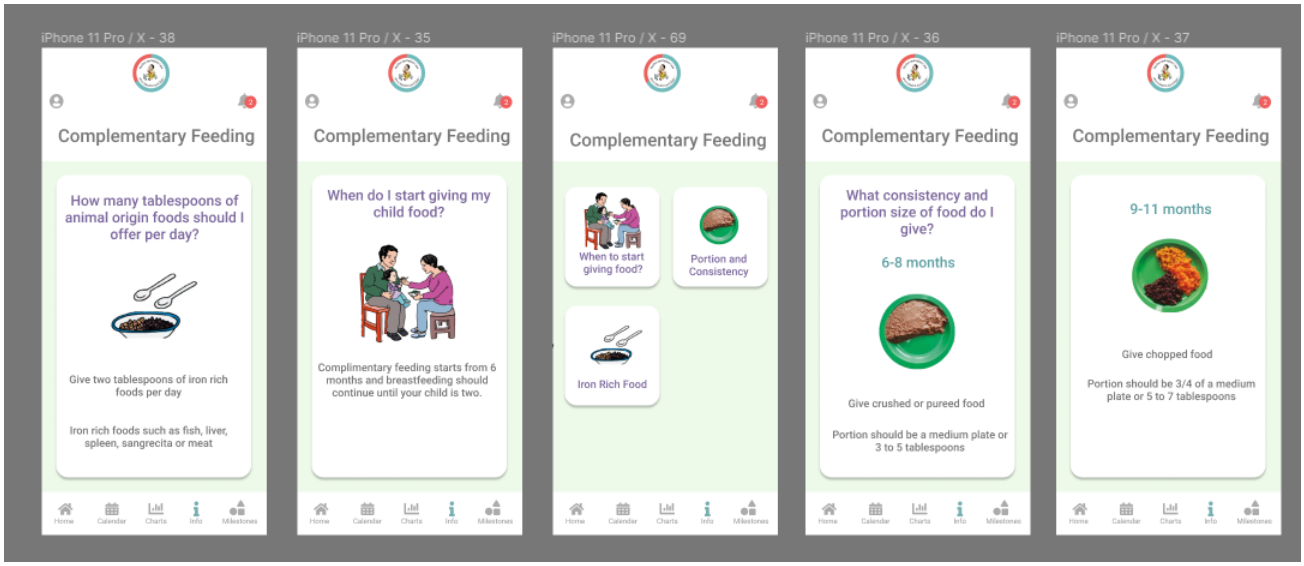



iPhone 11 Pro / X - 20
Iron Supplements Diary
Did you give iron supplements in the last week?
iPhone 11 Pro / X - 21
Iron Supplements Diary
How many days did you give supplements?
1 2 3 4 5 6 7
What dose did you give?
iPhone 11 Pro / X - 23
Iron Supplements Diary
Additional Information:
Voice Note
Write Note
SAVE
iPhone 11 Pro / X - 24
Iron Supplements Diary
Did you give iron drops in the last week?
iPhone 11 Pro / X - 25
Iron Supplements Diary
Why did you not give drops in the last week?
Forgot
Empty Bottle
Illness
Loose Stools
Constipation
Dark Stools
Taste
Other
SAVE
iPhone 11 Pro / X - 74
Iron Supplements Diary
Additional Information:
Voice Note
Write Note
SAVE
iPhone 11 Pro / X - 26
Iron Supplements Diary
It's very important to give the supplements as prescribed to prevent/treat anemia
ANEMIA AND IRON DROPS GUIDE
Home
Calendar
Charts
Info
Milestones

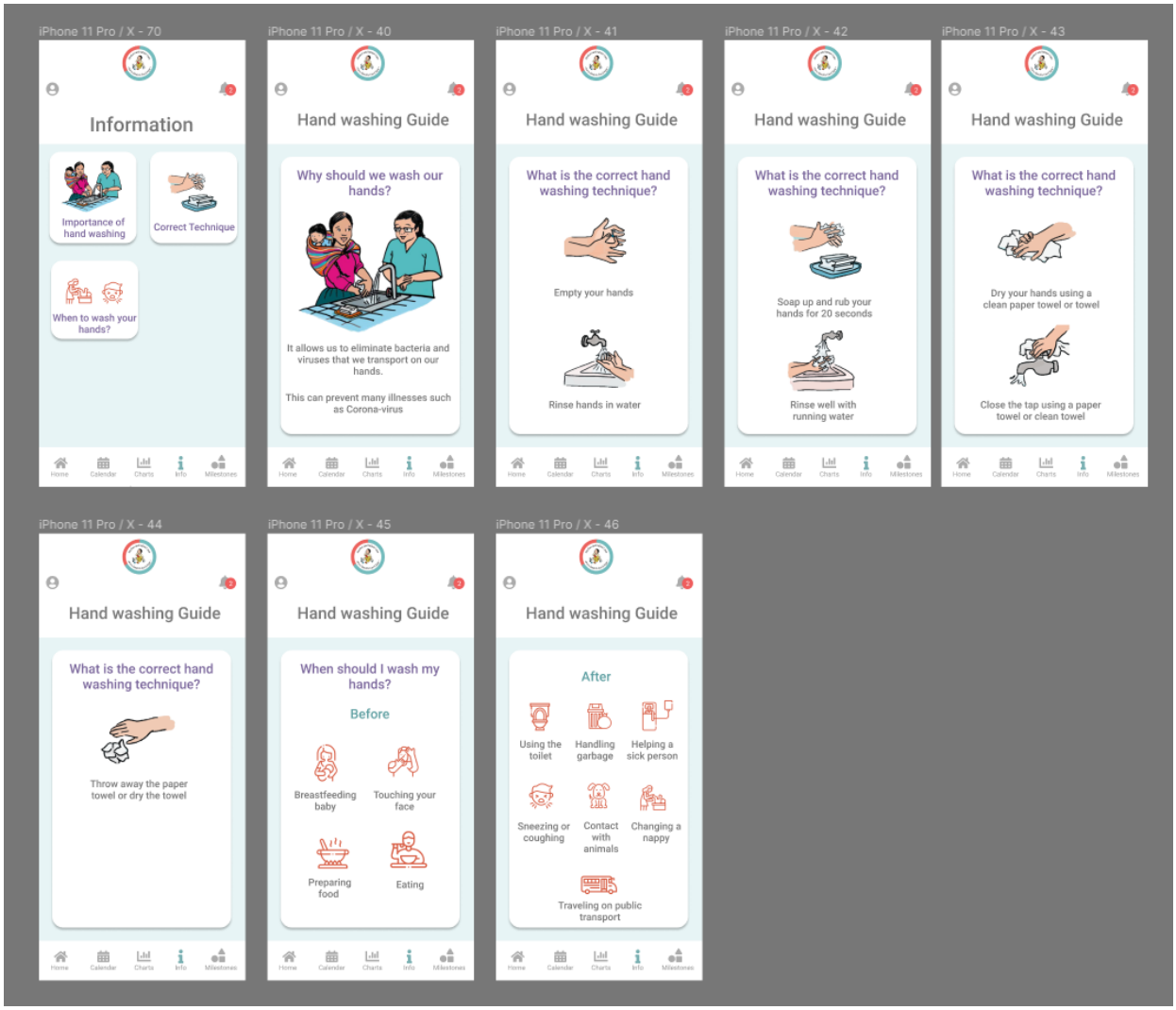

iPhone 11 Pro / X - 27
Feeding Diary
Did you exclusively breastfeed last week?
iPhone 11 Pro / X - 28
Feeding Diary
When did you breastfeed?
Select all that apply
On Demand
Scheduled
During the Night
Do you have any concerns with breastfeeding?
iPhone 11 Pro / X - 29
Feeding Diary
Please Specify:
Voice Note
Write Note
SAVE
iPhone 11 Pro / X - 75
Feeding Diary
If you're having problems, take a look at our guide for advice
BREASTFEEDING GUIDE
iPhone 11 Pro / X - 30
Feeding Diary
Did you exclusively breastfeed last week?
iPhone 11 Pro / X - 31
Feeding Diary
Did you breastfeed at least once in the last week?
Did any problem prevent you from breastfeeding?
iPhone 11 Pro / X - 32
Feeding Diary
Additional Information
Voice Note
Write Note
SAVE

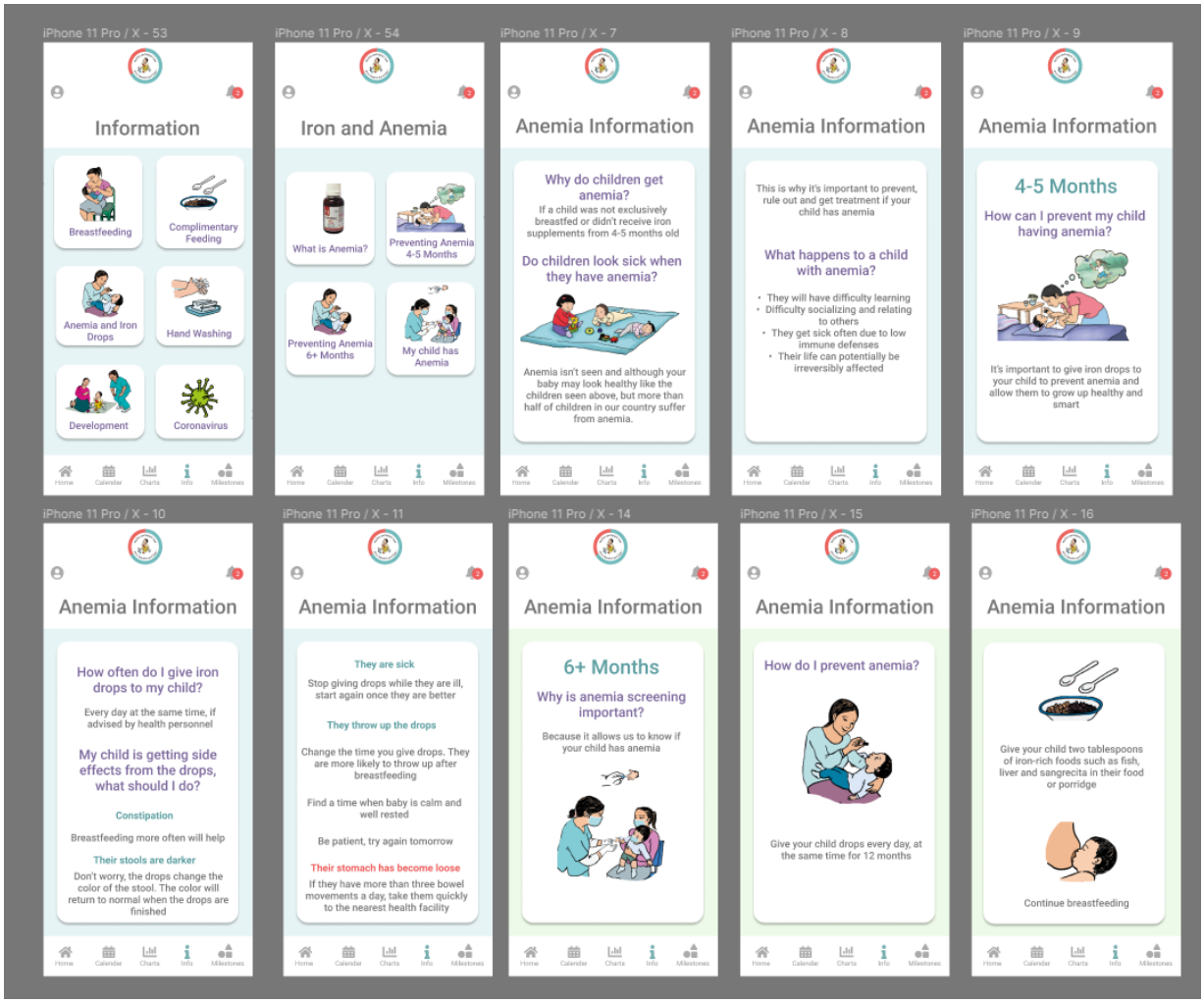

iPhone 11 Pro / X - 47
Feeding Diary
Add a meal
Add Title:
Photo
Voice Note
From List
iPhone 11 Pro / X - 78
Feeding Diary
Meat and Dairy
Fruit and Vegetables
Carbohydrates and Legumes
Other Food
SAVE
iPhone 11 Pro / X - 48
Feeding Diary
Animal Products
Beef
Chicken
Fish
Guinea Pig
Liver
Sangrecita
iPhone 11 Pro / X - 49
Feeding Diary
Fruits
Apple
Banana
Orange
Mango
Papaya
Pineapple
iPhone 11 Pro / X - 50
Feeding Diary
Dairy Products
Cheese
Egg
Yogurt
Milk
Legumes
Lentils
Beans
iPhone 11 Pro / X - 76
Feeding Diary
Vegetables
Broccoli
Carrots
Corn
Peas
Spinach
Squash
iPhone 11 Pro / X - 52
Feeding Diary
Other
Cookies
Chips
Infusions
Cola
Sugared Drink
Fast Food
iPhone 11 Pro / X - 79
Feeding Diary
Other
Other - Please Specify
Voice Note
Write Note
iPhone 11 Pro / X - 77
Feeding Diary
Did you breastfeed today?
iPhone 11 Pro / X - 51
Feeding Diary
Carbohydrates
Bread
Rice
Yams
Yucca
Potatoes
Quinoa

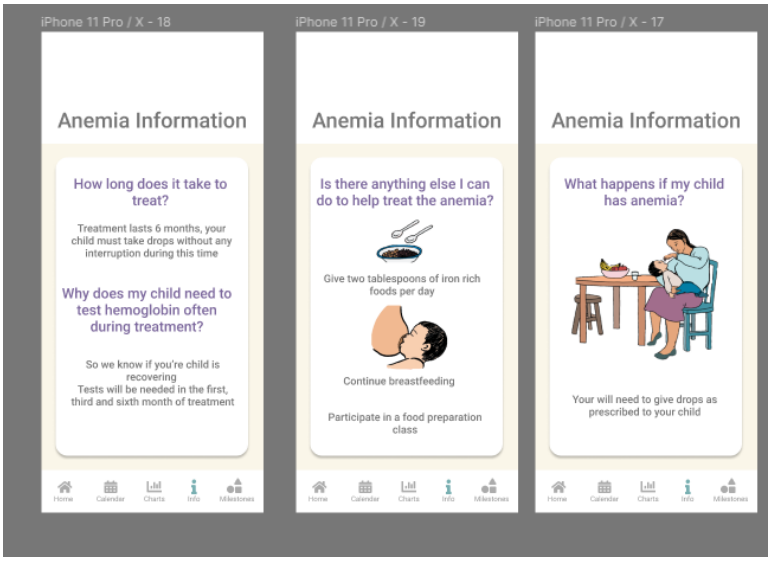
iPhone 11 Pro / X - 3
Breastfeeding Guide
Why is exclusive breastfeeding important for the first 6 months?
It will provide your baby with all the nutrients and defenses they need
iPhone 11 Pro / X - 67
Iron and Anemia
Exclusive Breastfeeding Importance
How to hold baby while feeding
Latching Technique
iPhone 11 Pro / X - 68
Breastfeeding Guide
How do I hold baby while breastfeeding?
There are many different ways, the most common is shown here:
iPhone 11 Pro / X - 4
Breastfeeding Guide
We see that:
• Baby's head and body are aligned
• Baby's body is close to the mother's body
• The baby's head and shoulders are supported
• If baby is newborn the whole body should be supported
iPhone 11 Pro / X - 5
Breastfeeding Guide
How do I latch baby to get a good supply of milk?
Good Technique
We can see that:
• The mouth is always wide open
• Lower lip is turned outward
• Baby's chin and nose touch the chest
• There is more areola (dark part) above the child's upper lip than below their bottom lip
iPhone 11 Pro / X - 6
Breastfeeding Guide
Bad Technique
We can see that:
• The mouth is almost closed
• Baby's chin is away from mom's chest
• There is more areola (dark part) uncovered

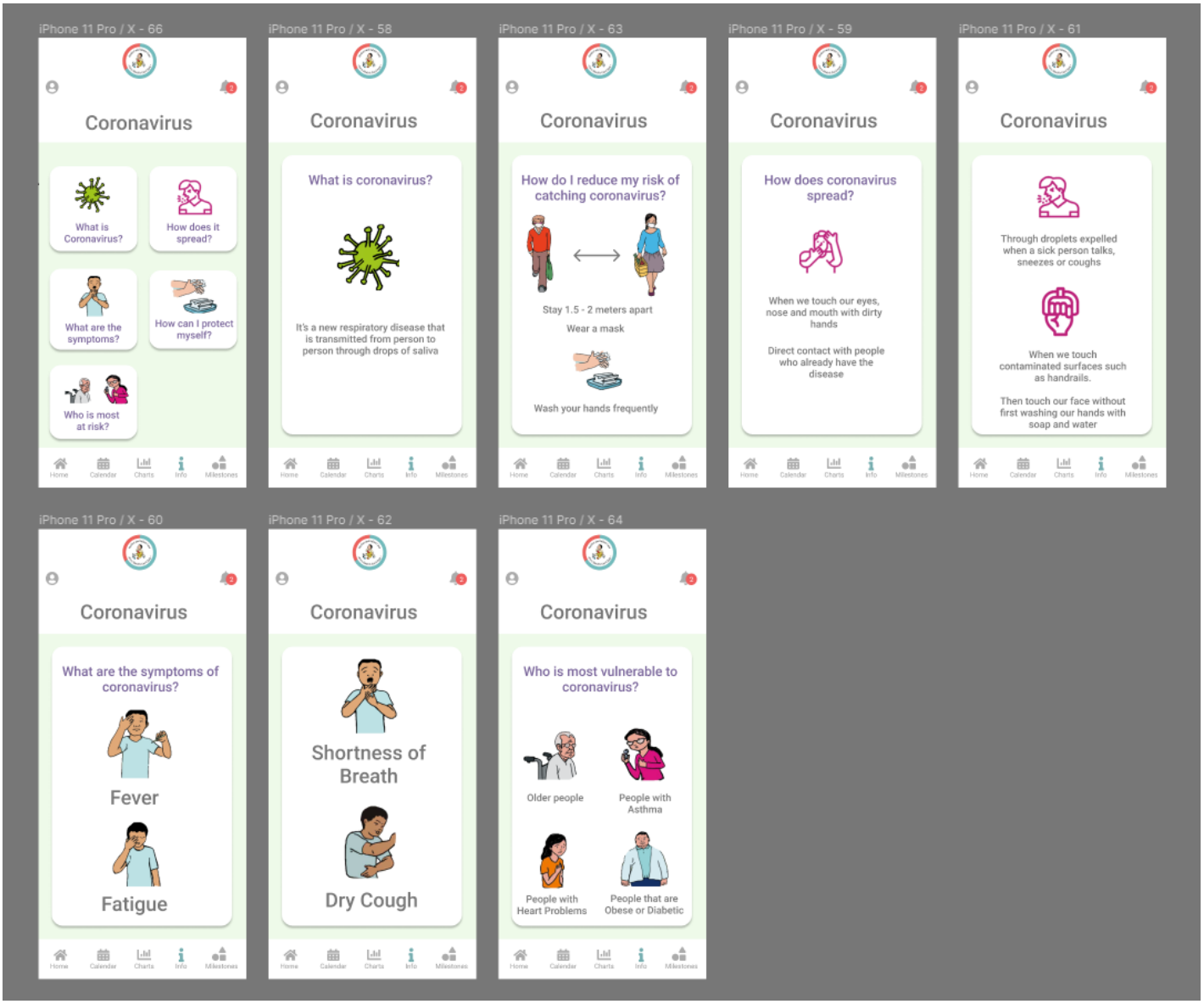

iPhone 11 Pro / X - 38
Complementary Feeding
How many tablespoons of animal origin foods should I offer per day?
Give two tablespoons of iron rich foods per day
Iron rich foods such as fish, liver, spleen, sangrecita or meat
iPhone 11 Pro / X - 35
Complementary Feeding
When do I start giving my child food?
Complimentary feeding starts from 6 months and breastfeeding should continue until your child is two.
iPhone 11 Pro / X - 69
Complementary Feeding
When to start giving food?
Portion and Consistency
Iron Rich Food
iPhone 11 Pro / X - 36
Complementary Feeding
What consistency and portion size of food do I give?
6-8 months
Give crushed or pureed food
Portion should be a medium plate or 3 to 5 tablespoons
iPhone 11 Pro / X - 37
Complementary Feeding
9-11 months
Give chopped food
Portion should be 3/4 of a medium plate or 5 to 7 tablespoons

iPhone 11 Pro / X - 55
Development
Why is it important to evaluate the development of my child?
To see if they are making progress with their skills and abilities such as listening, speaking, distinguishing colors and social skills
iPhone 11 Pro / X - 57
Development
Why do we evaluate development?
Why do I need to attend CRED appointments?
Why should I vaccinate my child?
What is secure attachment?
iPhone 11 Pro / X - 56
Development
Why is it important to attend CRED appointments?
To allow us to see if they are growing well.
We can detect problems with organs and the brain early and take action
iPhone 11 Pro / X - 71
Development
Why should I vaccinate my child?
Vaccines will protect your child from many diseases such as Polio, Tetanus, Measles and more.
These illnesses have serious consequences and can cause death
iPhone 11 Pro / X - 72
Development
What is secure attachment?
Secure attachment is the strong bond between you and your child.
This bond is so strong and important it allows your child to improve their self-esteem, feel safe and manage their emotions.
This sets them up well for the future and adulthood.
iPhone 11 Pro / X - 73
Development
Who should establish this attachment to your child?
It is usually set by the person who they spend the most time with. They feel safe and protected.
When breastfeeding, singing or talking to your child this helps strengthen the bond
But the whole family can participate by giving them love and attention


iPhone 11 Pro / X - 70
Information
Importance of hand washing
Correct Technique
When to wash your hands?
iPhone 11 Pro / X - 40
Hand washing Guide
Why should we wash our hands?
It allows us to eliminate bacteria and viruses that we transport on our hands.
This can prevent many illnesses such as Corona-virus
iPhone 11 Pro / X - 41
Hand washing Guide
What is the correct hand washing technique?
Empty your hands
Rinse hands in water
iPhone 11 Pro / X - 42
Hand washing Guide
What is the correct hand washing technique?
Soap up and rub your hands for 20 seconds
Rinse well with running water
iPhone 11 Pro / X - 43
Hand washing Guide
What is the correct hand washing technique?
Dry your hands using a clean paper towel or towel
Close the tap using a paper towel or clean towel
iPhone 11 Pro / X - 44
Hand washing Guide
What is the correct hand washing technique?
Throw away the paper towel or dry the towel
iPhone 11 Pro / X - 45
Hand washing Guide
When should I wash my hands?
Before
Breastfeeding baby
Touching your face
Preparing food
Eating
iPhone 11 Pro / X - 46
Hand washing Guide
After
Using the toilet
Handling garbage
Helping a sick person
Sneezing or coughing
Contact with animals
Changing a nappy
Traveling on public transport


iPhone 11 Pro / X - 53
Information
Breastfeeding
Complimentary Feeding
Anemia and Iron Drops
Hand Washing
Development
Coronavirus
iPhone 11 Pro / X - 54
Iron and Anemia
What is Anemia?
Preventing Anemia 4-5 Months
Preventing Anemia 6+ Months
My child has Anemia
iPhone 11 Pro / X - 7
Anemia Information
Why do children get anemia?
If a child was not exclusively breastfed or didn't receive iron supplements from 4-5 months old
Do children look sick when they have anemia?
Anemia isn't seen and although your baby may look healthy like the children seen above, but more than half of children in our country suffer from anemia.
iPhone 11 Pro / X - 8
Anemia Information
This is why it's important to prevent, rule out and get treatment if your child has anemia
What happens to a child with anemia?
• They will have difficulty learning
• Difficulty socializing and relating to others
• They get sick often due to low immune defenses
• Their life can potentially be irreversibly affected
iPhone 11 Pro / X - 9
Anemia Information
4-5 Months
How can I prevent my child having anemia?
It's important to give iron drops to your child to prevent anemia and allow them to grow up healthy and smart
iPhone 11 Pro / X - 10
Anemia Information
How often do I give iron drops to my child?
Every day at the same time, if advised by health personnel
My child is getting side effects from the drops, what should I do?
Constipation
Breastfeeding more often will help
Their stools are darker
Don't worry, the drops change the color of the stool. The color will return to normal when the drops are finished
iPhone 11 Pro / X - 11
Anemia Information
They are sick
Stop giving drops while they are ill, start again once they are better
They throw up the drops
Change the time you give drops. They are more likely to throw up after breastfeeding
Find a time when baby is calm and well rested
Be patient, try again tomorrow
Their stomach has become loose
If they have more than three bowel movements a day, take them quickly to the nearest health facility
iPhone 11 Pro / X - 14
Anemia Information
6+ Months
Why is anemia screening important?
Because it allows us to know if your child has anemia
iPhone 11 Pro / X - 15
Anemia Information
How do I prevent anemia?
Give your child drops every day, at the same time for 12 months
iPhone 11 Pro / X - 16
Anemia Information
Give your child two tablespoons of iron-rich foods such as fish, liver and sangrecita in their food or porridge
Continue breastfeeding


iPhone 11 Pro / X - 18
Anemia Information
How long does it take to treat?
Treatment lasts 6 months, your child must take drops without any interruption during this time
Why does my child need to test hemoglobin often during treatment?
So we know if you're child is recovering
Tests will be needed in the first, third and sixth month of treatment
iPhone 11 Pro / X - 19
Anemia Information
Is there anything else I can do to help treat the anemia?
Give two tablespoons of iron rich foods per day
Continue breastfeeding
Participate in a food preparation class
iPhone 11 Pro / X - 17
Anemia Information
What happens if my child has anemia?
Your will need to give drops as prescribed to your child


iPhone 11 Pro / X - 66
Coronavirus
What is Coronavirus?
How does it spread?
What are the symptoms?
How can I protect myself?
Who is most at risk?
iPhone 11 Pro / X - 58
Coronavirus
What is coronavirus?
It's a new respiratory disease that is transmitted from person to person through drops of saliva
iPhone 11 Pro / X - 63
Coronavirus
How do I reduce my risk of catching coronavirus?
Stay 1.5 - 2 meters apart
Wear a mask
Wash your hands frequently
iPhone 11 Pro / X - 59
Coronavirus
How does coronavirus spread?
When we touch our eyes, nose and mouth with dirty hands
Direct contact with people who already have the disease
iPhone 11 Pro / X - 61
Coronavirus
Through droplets expelled when a sick person talks, sneezes or coughs
When we touch contaminated surfaces such as handrails.
Then touch our face without first washing our hands with soap and water
iPhone 11 Pro / X - 60
Coronavirus
What are the symptoms of coronavirus?
Fever
Fatigue
iPhone 11 Pro / X - 62
Coronavirus
Shortness of Breath
Dry Cough
iPhone 11 Pro / X - 64
Coronavirus
Who is most vulnerable to coronavirus?
Older people
People with Asthma
People with Heart Problems
People that are Obese or Diabetic

Appendix 4: Focus Group Response Translations G1

Paper Health Card

What works well?

peso talla y circunferencia del craneo

Weight Height and head circumference

las graficas si visualizan en especial si es grande

the graphs if they visualise especially if it is the large/big version

la grafica grande q se usa como parte de la consulta

the large graph that is used as part of the consultation

Kit del buen crecimiento con una grafica grande

Kit for the Good development with a large graph

What doesn't work well?

es pequeño, cuadros pequeños

It's small, small squares

cada hospital tiene su modelo

Each hospital has it's own model

graficas con error

Graphs with errors

Si falta algun dato hay q agregar notas q se caen

If any data is missing you have to add notes that fall off

no lo usan o no saben como usarlo

they don't use it or they don't know how to use it

es que el personal de salud demandaria mucho tiempo en explicar todo el.carnet...creo yo que dado el.grado de intruccion muchas madres no interpretan el carnet

is that the health personnel would take a long time to explain the entire card ... I think that given the degree of literacy, many mothers do not interpret the card

madres desconocen o no pueden interpretar el carne

Mothers unaware or can’t interpret the card?

cuando ya aprendieron ya sale un nuevo carne

When they already learned a new card comes out

Parte del desarrollo del nino no ha funcionado porque es muy pequeno

Part of the child development has not worked because it is too small

parte de adentro los platitos de comida de acuerdo a la edad muy pequenos

The part containing the food dishes according to age is very small

el carne es hecho para el personal de salud no para la madre, a la madre hay que hablarle en su idioma

the card is made for health personnel not for the mother, the mother must be spoken to in her language

Any changes or recommendations?

como un cuadernito, cada hojita era x mes, mas sencillo y visual [she refered here to cards that she has seen from other countries I think]

like a notebook, each sheet was x month, simpler and more visual

mas claridad en la presentacion

More clarity in the presentation

Que sea mas entendible la informacion

Make the information more understandable

un carnet que se adapte al grado de instruccion de las madres, utlizacion de gráficos

a card that adapts to the degree of literacy of mothers, use of graphics

se debe añadir el control mensual de la suplementación y/o tratamiento de anemia, según esquema de suplementación

should be added the monthly control of iron supplementation and / or treatment for anemia , according to the supplementation scheme

Exclusive Breastfeeding

Why it's important to collect data?

grado de conocimiento y segun eso realizar la consejeria, o reforzar lo que saben

degree of knowledge and according to that, carry out the counselling, or reinforce what they know

conocer la importancia y puedan cumplir

Know the importance and can comply

para conocer sus costumbres - cultura, si vienen de la sierra es differente a alguien de la selva

To get to know their customs - culture, if they come from the mountains it is different from someone who come from the jungle

Frequency?

Mensualmente

Monthly

primer mes semanal, 2nd mes quincenal

First month weekly, second month bi-weekly

After 4 month, it should be monthly

Most important data to collect for mothers and health professionals?

De acuerdo a la edad

According to age

Tipo de lactancia

Kind of breastfeeding

Numero de lactadas

Number of breastfeds

como esta el pezon, produccion

How is the nipple, production

Alimentaćion de la mama

feeding of the mother

tecnica correcta de lactancia

Correct breastfeeding technique

ganancia del peso del ninio

Child's weight gain

Most important commitments?

cada 2 horas o cada 3 horas

Every two or three hours

compromiso que la mami garantize darle solo leche materna y nada de aguitas ni infusiones

Commitment that the mother guarantees to give her only breast milk and no water or infusions

Other suggestions?

recordar que una madre con pezon lesionado no va a dar de lactar

remember that a mother with an injured breast will not breastfeed

Si necesitan la informacion, de eso depende el crecimiento y salud del nino

If they need the information, from that it depends the growth/development and health of the child

satisfacion de la madre de ver a sus hijos crecer

mother's satisfaction to see their children growing

Iron supplementation

Why it's important to collect data?

Frequency?

Most important data to collect for mothers and health professionals?

Cantidad, dosis

Amount, dose

Frequencia y hora

Frequency and time

Con que lo tomaron

what did they take it with

almacenamiento del suplemento

Supplementation storage

edad de inicio de la suplementacion

Age of starting supplementation

efectos secundarios

Side Effects

despues de 6 meses q empiece a tomar el suplementoAfter six months start taking the supplements

que se comprometa a entregarle el suplemento de hierro en la dosis correcta

To commit to giving iron supplements in the correct dose

Most important commitments?

Other suggestions?

Complimentary feeding

Why it's important to collect data?

Frequency?

Most important data to collect for mothers and health professionals?

Frequencia

Frequency

Cantidad

Amount/Quantity

Consistencia

Consistency

Consumo de productos con hierro

Consumption of products with iron

Edad de inicio de la alimentacion

When they started giving food

Consumo de frutas y verduras

Consumption of fruits and vegetables

Continuacion de la leche maternal

Continuation of breast milk

que le de comida mas espesas

Give them thicker food

Alimentos ricos en hierro

Food rich in iron

que de la mas verduras

That they give them more vegetables

en alimentacion complementaria ...que entrega comidas en forma de papillas o mazamorras

in complementary feeding ... to givemeals in the form of porridges or "mazamorras" [this is a typical type of dish]

Most important commitments?

Other suggestions?

Prototype Evaluation

Comments on the Calendar View

tener en cuenta el celular basico

Take into account basic cell phones

interesante recordar citas

Interesting to remember appointments

mensaje de voz adicional, puntual con lo que la mami necesita saber

If additional voice messages provided, clear and punctual with what mommy needs to know

iconos podrian influir en que se les dan

Icons could influence what they are giving

Comments on the add a meal view

Consistencia

Constistency

Cantidad

Quantity/Amount

a que hora se le debe dar

What time it should be given

acorde como le ha dado el medico

according to how the doctorprescribed

la madre muy sencilla no va a tomar la foto. Un listado de que le dio hoy

the very simple mother is not going to take the photo because they don't want to feel judged when they might share their food. A simple list where they can choose what she gave today

los mensajes puntuales acompañados de imagenes correspondientes

specific messages accompanied by corresponding images

Comments on iron supplement view

Cuantas gotitas tomo, cuantas cucharitas tomo

How many drops do I take, how many teaspoons do I take?

preguntas a las que hacen las promotoras, de la meta 4

questions asked by promoters, from goal 4 [Rossina will try to get the information from the health promoters to use the same language] -> probably this needs to be tested later with mothers to see if the language is clear if possible

Comments on milestones

titulo, 6 meses, que tiene q hacer a los 6 meses, q tiene que hacer, video cortito

title, 6 months, what they are supposed to be doing at 6 months, short video

tambien a los 7 meses

Also at seven months

PRISMA investigacion para fomentar el desarrollo

PRISMA research to promote development

Comments on overview and colour options

color neutral, verde agua, amarillo, colores primarios, color pastel

neutral color, aqua green, yellow, primary colors, pastel color

alertas de color rojo cuando no este comiendo bien, o se haya olvidado de la vacuna

red alerts when they are not eating well, or have forgotten to take the vaccine

calificar la accion, ya sea con color o un imagen, en las alertas

rate the action, either with color or an image, in alerts

Overall possible benefits

onda de los celulares, una ayuda

cellphones seen as trends, a help

monitoreo en tiempo real

real time monitoring

ayudar para el seguimiento, para poder llamar a la mama

help with follow-up, to be able to call the mother

alerta para el personal de salud tambien, y de las madres

alerts for health personnel as well, and mothers

Overall possible cons

no todas las mamas tienen celular inteligente

Not all moms have a smart phone

uso de tecnologia depende del contexto

Use of technology depends on context

lo pueden llenar x llenar

They can fill it just by the fact of doing it – [the self-reporting issues that we talked before]

para nosotroa es excelente pero para la paciente es dificil por experiencia en manchay cuando digitalizamos el seguro no tuvo mucha acogida

for us it is excellent but for the patient it is difficult due to a previous experience in manchay when we digitized the insurance it did not have much adoption

aducieron que no tenian internet siempre

They argued they didn't always have internet

grado de intruccion de las madres....se debe tener en cuenta

degree of education/literacy of mothers ... should be taken into account

y un mal celular

and a bad cellphone

baja señal

Bad Signal

no amigable, menos palabras

Not friendly, less text

Mensajes no son claros

Messages are not clear

Appendix 5: Focus Group Responses and Translation G2

Paper Card Evaluation

Positives

ayuda para el seguimiento de los controles, esquema de crecimiento y desarollo, alimentacion, etapa a etapa

help for the follow-up of controls, growth and development scheme, feeding, stage by stage

permitir a los agentes comunitarios que puedan identificar si los niños ganan peso o talla

enable community agents to identify whether children are gaining weight or height

identificar si tiene anemia o no, o si esta superando

identify if they have anemia or not, or if they are overcoming anemia

los profesionales si el ninio esta con los controles

the professionals can see if the child is with the controls

visualiza todas las vacunas segun la edad, provee informacion a la madre

view all vaccines according to age, provide information to the mother

ayuda a evaluar al ninio en sus vacunas y controles de cred y valores antropometricos

helps to evaluate the child in their vaccines and checks of cred and anthropometric values

Negatives

son perecibles, porque se rompen, o esta sucio

They are perishable, because they break, or it is dirty

no se visualiza bien la evaluacion psicomotriz y no se les puede mostrar claramente

The psychomotor evaluation is not well visualised and cannot be clearly shown to them

disenado para normales no con bajo peso porque tienen numeros establecidos de controles, y los de bajo peso necesitan mas

designed for normal not underweight because they have established numbers of controls, and underweight need more

no hacen buen llenado del carne, entonces las mamas no lo entienden porque no conocen tanto

they do not fill the card well, so the mothers do not understand it because they do not know so much

Other Comments or Ideas

disenar un carne digital, tener en el telefono, y controlar como esta yendo su ninio

design a digital card, have on the phone, and monitor how your child is doing

Phase 3

Not completed due to time restrictions

Phase 4

Overview

colores estan bien de acuerdo a la nines

colors are good according to the children

sencillo y rapido

simple and fast

facilitar mas rapido al ninio y a la madre

facilitate the child and the mother faster

practico como una receta para aprender rapidamente

I practice as a recipe to learn quickly

Complimentary Feeding Diary

que sepa q va a comer de acuerdo a la edad

that you know what you are going to eat according to age

educar a la mama y conoceria mejor, y podria mejorar la nutricion del ninio y de la madre

educate the mother and get to know better, and could improve the nutrition of the child and the mother

escucha y sale, mejor es algo q se vea para evitar anemia

Easier to listen to something than read about preventing anaemia

Iron Supplement Diary

No Comments

Calendar View

No Comments

Milestones Tracker

mas vistoso, corto, pueda entender la madre, mejorado bastante

more colorful, short, mothers can understand, improved a lot

rapido que no quite mucho tiempo

fast that does not take much time

mas practico

more practical

Possible Benefits

rapidez, dinamica de entendimiento

speed, dynamics of understanding

recordatorio del control de niño

record cred controls

Importante que facilite la participacion de la madre

Important to facilitate the mother's participation

compartir con los vecinos y familiares

share with neighbors and family

Possible Problems

necesitar de Internet

need internet

caida del sistema

system failure

no hay conectividad

no connectivity

deben de coodinarse con el Sistema

must be coordinated with the system

antecedentes del niño

Accessing the child's medical background

Appendix 6: Final Prototype Demonstration to Healthcare Professionals

Introduction

Infant and Child Care – Peru Infant Health Card App is designed to provide a digital version of the paper health card and allow additional features such as diary entries concerning breastfeeding, supplements, and complementary feeding.

Appointment, Vaccine and Height & Weight data would be obtained from the infant's record on an existing healthcare system. The app would allow the caregiver to read the data and implement reminders for CRED appointments and vaccines.

Milestone data is collected by the caregiver, who may log the date and notes on when the infant achieves a particular milestone. The milestones shown in the app were taken from the paper health card.

Diaries have also been included in this prototype version; these are forms with pre-set questions surrounding breastfeeding, iron supplementation and complementary feeding. The questions shown are based on previous focus group data on which information was helpful to healthcare professionals.

This is an unfinished prototype; therefore, styling may not be complete, and some functionalities are not yet implemented. At present, data on appointments, vaccines and height and weight are coming from demo data on a server.

Images shown in this application are taken from the Laminario del Actor, Normativa CRED and Adobe Stock.

Welcome Screen

- What do you think about the welcome screen?
- Is it clearly related to infant health? If not, why not?

- Does this clearly show the app is infant health-related?
- What do you think of the login functionality?

Login

- Any suggestions about the login process?

Home Screen

- Do you think the layout of this screen is clear? If not, why not?Are the contents of the navigation bar (bottom bar) easy to understand?
- Any other suggestions or feedback on this screen?

Calendar Screen

This calendar shows upcoming appointments and diary/ milestone entries by the caregiver. On pressing a day, it will show all entries for the specific day.

- Would this calendar be helpful to caregivers?
- Suppose caregivers could receive automatic notifications about upcoming appointments. Could this reduce the amount of follow up calls to remind caregivers of appointments?
- Any suggestions or questions?

Milestones Screen

Here caregivers can add a milestone when their infant achieves a specific goal. Oncedata is entered, the screen will show the milestone information rather than the form to input a milestone.

- What do you think of the design? Is it understandable?
- Would notifying a caregiver of an overdue milestone to prompt engagement cause anxiety for the caregiver? Could this be mitigated by including a reassuring message that each child develops at their own pace?
- Suppose the healthcare professionals could receive alerts when a child is substantially overdue a milestone; would that be helpful?
- Any suggestions that could improve this interface?

Information Screen

Here we can see information screens on all topics covered by the laminario del actor document. However, information has been restructured to an FAQ style to appear more conversational.

- Do you think thetopics covered appropriate for the application?
- Could you mention any additional topic that you would consider helpful to add to the application?Any suggestions for improvements for the design?
-
- Would a chatbot with information be a valuable feature to include?

Vaccines Screen

Here we see vaccine information for the infant.

- What do you think of the overview in this screen?
- Would alerts for overdue vaccines be helpful to caregivers to promote engagement with the vaccination programme?
- Any suggestions for improvement on this screen?

Commitments Screen

Here we see the diaries available to the caregiver

- What do you think of the overview of this screen?
- Are there any other topics you feel should be included?
- Any suggestions for improvement?

Breastfeeding Diary

Here we see the breastfeeding diary form. This form has set questions that change according to tparticular situation if the infant was exclusively breastfed or not in the last seven days.

- Are the questions helpful to healthcare professionals?
- Do you believe this would promote reflection for the caregiver?
- Any concerns/feedback on this diary?
- Any suggestions to improve on this diary?

Supplements Diary

Here we see the breastfeeding diary form. This form has set questions that change according to the particular situation: if the infant was given iron supplements in the last seven days?

- Are the questions asked helpful to healthcare professionals?
- Do you believe this would promote reflection for the caregiver?
- Any concerns/feedback on this diary?
- Any suggestions to improve on this diary?

Complementary Feeding Diary

Here we can see the complementary feeding diary. There is an option to make an entry by photo, voice note or from a list of items and text entry.

- Do you believe this would be useful in promoting reflection for caregivers?
- Would this information be useful to healthcare professionals?
- Could this improve the recall of an infant's diet in appointments?
- What is your opinion on the photo and voice entry?
- Any other comments or suggestions for improvement?

General Closing Questions

- Could data from this app be useful to healthcare professionals before or during consultations?
- Would using this app be helpful to caregivers, in your opinion?
- Any additional comments or suggestions to improve the app?

Thank you to all participants for their time and feedback!