Team01 Caleb Timmermann (Canada), Kristian Riksheim (Norway) and Rolf Oftedal (Norway)

FRØYA

Imagine you are Lisa, a young woman living in a small town in rural Greenland. You have just bought a pregnancy test and find out that you are pregnant! Whether you feel excited, surprised, or anxious, a number of questions and thoughts start coming to mind: How will this all work? When should you start seeking care? What food and drink should be avoided? You've heard about prenatal screening, but you're unsure whether it's now too late to request. Your family is telling you one thing, your partner and friends something else. You want to be involved in your care and feel empowered, but you don't know where to start!

Now imagine you are Katja. You work in obstetrical care a few hours by boat away from Lisa. You're concerned that your patients who live rurally are not getting optimal prenatal care. You find that your patients, especially first-time moms, feel overwhelmed by the information provided and struggle to follow the care plans that you've set up. You find it challenging to stay up to date on best practices and wish that there was a resource that would help both you and Lisa manage her pregnancy.

Meet FRØYA, an app designed with both patients and practitioners in mind with the goal of facilitating comprehensive prenatal care and improving health outcomes for mother and baby.

THE PROBLEM: WOMEN IN RURAL SETTINGS STRUGGLE TO ACCESS APPROPRIATE PRENATAL CARE

Numerous studies have found that without appropriate prenatal care, maternal and fetal morbidity and mortality increases. (Committee on Health Care for Underserved Women, 2009) The discrepancies in prenatal care between urban and rural settings are well documented; research shows that women in rural communities suffer from a lack of appropriate and timely obstetrical care due to a number of factors including geographical isolation, socioeconomic challenges, and insufficient "know how" to make use of the services that are available. (Mostafaci, 2019) (Kozhimannil, Healthaffairs.org, 2019) (Kozhimannil, 2015) (Sutherns, 2008) Studies from around that world have also shown that there is a lack of healthcare professionals in these communities who are able to provide the prenatal care that is needed. (Lee H. , 2020)

In order to help address this healthcare discrepancy, we are proposing FRØYA, an app named after the norse goddess of fertility. FRØYA will not only be a source of information and guidance for expecting mothers and their healthcare providers, but will also connect them to help ensure that important prenatal investigations are completed and key milestones are met, with the goal of improving health outcomes and streamlining pregnancy management.

We believe that this product will help to address several of the United Nation's Sustainable Development Goals, including:

- **Goal 3: Good Health and Well-Being** - FRØYA will help to foster healthy pregnancies by providing new mothers with important information and by promoting access to and comprehensiveness of prenatal care.
- **Goal 10: Reduce Inequalities** - FRØYA will help reduce inequalities within countries by addressing the discrepancy in prenatal care between rural and urban setting.
- **Goal 11: Sustainable cities and communities** - By streamlining and digitizing certain elements of prenatal care, FRØYA will help reduce the need for women to move out of their communities to get the information and care that they need.

FRØYA's TWO COMPLEMENTARY COMPONENTS

FRØYA would involve two complementary parts: a public facing component that is used by the expecting mother and a practitioner/clinic facing component that is used by the healthcare team.

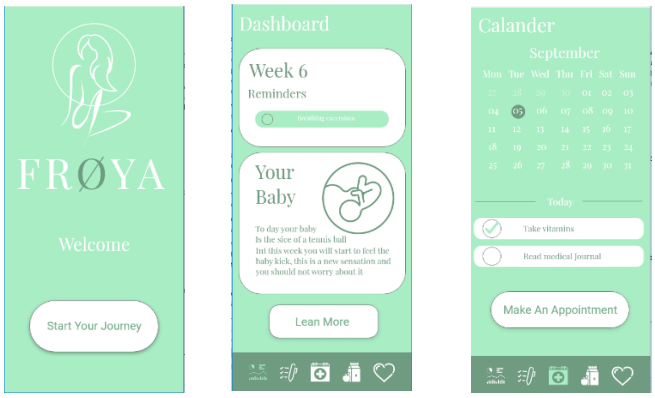
Ideally, for greatest efficacy, the components would be used together, i.e., by both the expecting mother and their health practitioner. However, the public facing component would also be designed to function independently so that the mother can still benefit from FRØYA even if the complementary component is not yet being used by the practitioner.

Public facing component:

- Once a woman learns that she is pregnant, she would open the app and it would guide her through each stage of her pregnancy journey:
    - It would first help her to schedule an initial prenatal appointment with her doctor or midwife.
    - The woman would then add in basic biographical and health information which would allow the app to provide more relevant and personalized information and guidance.
    - At FRØYA's core would be an interactive checklist organized by trimester which would guide the woman through each stage of her pregnancy. This checklist would not only provide her with information as to what to expect as her pregnancy progresses, but would also help to ensure that important investigations are completed and important milestones are met, ex:
        - Reminders, and direct connectivity with the practitioner/clinic facing component, to schedule prenatal visits.
        - Information about and daily reminder to take prenatal vitamins and supplements.
        - As more information becomes available (ex. her due date, blood pressure, ultrasound imaging etc.) the app would adjust and update accordingly.

Other features:

- Daily vitamin/supplement reminder.
- A pregnancy journal where she can record her thoughts and feelings.
- Postpartum and miscarriage supports.
- Articles and forums where she can connect with other expecting mothers.



Practitioner/clinic facing component:

- A dashboard which would allow the practitioner/clinic to see, at a glance, the status of their patients who are pregnant and the progression of their pregnancy.
- Plug in to the clinic's appointment scheduling software so that patients can easily request and schedule prenatal appointments.

- Practitioner-focused checklists for each patient organized by trimester/each visit to ensure that investigations are completed and milestones are met, ex:
    - First Trimester:
        - Perform dating ultrasound.
        - Discuss prenatal screening options with the patient.
        - Prescribe prenatal vitamins and folic acid.
    - Each visit:
        - Update antenatal records.
        - Record fetal heart rate.

All checklists, recommendations, and scheduling prompts in FRØYA would align with the World Health Organization's recommendations on antenatal care for a positive pregnancy experience. (WHO, 2016)

MARKET POTENTIAL

In 2019, there were 49,863 live births in Scotland (Scotland, 2020), 54,495 in Norway (Norway, 2021), 372,038 in Canada (Canada, 2020) and 3,745,540 in the United States. As such, our target audience - pregnant women living in the North Atlantic region – is thought to be in the millions.

Smartphone apps have emerged as a mode for provision of information to women during pregnancy. For example, in one study on the utilization of pregnancy apps published in the Journal of Healtcare Informatics Research, researchers found that of the 193 pregnant women who participated in the study, 55% were using mobile apps related to pregnancy, birth, and/or childcare. On average, users downloaded 2.4 free and 0.69 paid apps and used them for 31.2 minutes per day. (Lee Y. , 2016)

Similarly, a 2016 survey of 410 women who were pregnant or who had given birth in the past 3 years found that almost three quarters had used at least one pregnancy app. (Lupton, 2016), while researches who conducted a survey of pregnant women at an Irish maternity hospital showed that 59% had used a pregnancy app (O'Higgins, 2017). These apps were viewed as particularly important for disadvantaged women who may lack access to other educational resources (Thomas, 2015). Large scale survey of American women who had recently given birth found that 56% of first-time mothers rated pregnancy apps as providing valuable information, as did 47% of experienced mothers. (Declerq, 2013) Accordingly, there is a significant demand for and use of pregnancy apps.

However, despite the large number of pregnancy apps available, recent studies have also found that few of the pregnancy apps freely available are of high quality. (Brown, 2020) Healthcare and public health professionals have begun to suggest that women's use of apps will influence maternity care and that they should be considered in the future planning of care. They stress, however, that while apps may empower and inform women so that they take more responsibility for their health, the quality of information offered is often dubious and may supplant professional advice. (Robinson, 2014) Further, of the pregnancy apps reviewed by our team, none incorporate functionality for medical practitioners. As such, FRØYA will differentiate itself from the competition by being the first pregnancy app to bridge the gap between patient and health care provider.

EMR Connectivity and Investor Exit

Electronic medical records systems (EMRs) are office-based software systems that allow health care providers to, among other things, record the information gathered during the patient's visit and to access information from other practitioners relating to the patient. In many cases, the doctor/clinic's appointment scheduling system is integrated into the EMR software. In the last decade, the majority of primary care providers and clinics in Ontario, Canada, have transitioned from paper records to electronic medical records systems (EMRs). As of 2019, roughly 86% of general practitioners were using

EMRs. (Commonwealth Fund survey, 2019). Norway was an early adopter of EMRs and started transitioning in the 1980s. Over 95% of Norwegian general practitioners have been using EMRs for the past 10 years. (Accenture, 2015)

In Ontario, Canada, EMRs are developed and sold by a handful of certified vendors. For example, one of Ontario's most widely used EMRs, PS Suite, is a product of Telus Health, which is a division of Telus (one of Canada's largest telecom companies). Companies like Telus Health are actively seeking to expand the scope and functionality of their products. In April 2020, Telus Health accelerated the development of virtual video functionality into its PS Suite software in response to the pandemic. This has enabled over 26,00 Canadian family doctors to conduct virtual visits with their patients through their existing EMR systems. (Telus Health, 2019)

As a potential exit strategy for investors, our product could be marketed to EMR software developers as a plug in/complement to their existing platforms.

BARRIERS TO ENTRY

We conducted a series of interviews to identify potential challenges for taking FRØYA to market. These include:

- Taboo associated with using technology as a medical service in rural areas, which we hope to address through software design. That is why we believe user testing is essential for our idea to succeed. We need to know our audience, and what makes them tick.
- Reimagining the system: Changing systems is hard, and if we do want to use this application in cooperation with practitioners or clinics - it can be a long way to market. We will address this by promoting FRØYA at medical conferences and by emphasizing how it can be used to improve patient management and reduce missed opportunities for timely prenatal care.
- Just another app syndrome: We only have space in our phones and minds for a few apps at the time. This is a potential barrier and would need to be overcome by smart outreach and novel features.
- Security/privacy: depending on the nature of in-app services, it could be transmitting personal health care information. Strong security features would need to be implemented and legal compliance would need to be considered.

FUNDING

Initial/startup funding

Before FRØYA's launch, we would need to acquire funding for three different areas:

- Working prototype/MVP: To understand how and if we can meet the demands of our target persona, we would need to develop a small-scale version of the app to test. Estimated cost: $8,000 USD
- Product testing: Before launch we would need a product testing phase to figure out what parts of the app that works in practice, and what doesn't. For example, we can do a pilot program with practitioners in a certain region to work out kinks before expanding. Estimated cost: $6,000 USD
- Design work: In what way can we design this app so that we can make the appeal greater? Designing for the people requires a lot of empathy work and depth interviews. Estimated cost: $4,000 USD

In sum, to bring this product to market, we will need a seed-fund of approximately $18,000 USD. This is a viable first goal as we can combine the resources of Innovation Norway and Nora to fund this first experimentation phase.

Innovation Norway Market-test grant	11,706 USD
Winning the NORA hackathon	6,403 USD

Recurring revenue

If the app shows promise in the test phase, there could be several solutions for creating recurring revenue from the application:

- Lisa funds it: The public facing app could be free to use, or it could carry a 9-month subscription model for pregnant women.
- Katja funds it: Primary care practitioners/clinics would pay an initial startup fee, then an annual subscription fee (similar to how they currently pay for EMRs.
- Government funds it: In some North Atlantic countries, FRØYA could be government-funded
- Insurer funded: In other North Atlantic countries, FRØYA may be a service that is covered by insurance providers

CONCLUSION/SUMMARY

FRØYA: the app for planning and managing pregnancy in rural areas is very relevant for the hackathon concept. Firstly, there is a demonstrated need for improved prenatal care in rural areas where access to services and patient engagement is lacking. Second, through desk research and user interviews, we have discovered that there is a large market potential for apps such as FRØYA. While pregnancy apps are not a new idea, FRØYA would present a novel approach by bringing together patients and health care providers in one simplified platform. FRØYA's public facing component would provide pregnant women with information to help guide them throughout their pregnancy while improving "know how" to access prenatal services. The practitioner/clinic facing component of FRØYA would help practitioners manage their patients' needs and would help to ensure that key investigations are undertaken and milestones are met, all with the goal of facilitating comprehensive care and improving health outcomes for mother and baby.

Sources

Accenture. (2015). *Accenture.com.* Hentet fra https://www.accenture.com/t00010101t000000__w__/au-en/_acnmedia/pdf-4/accenture-norway-early-electronic-medical-record-adoption-helped-then-but-hurts-now.pdf

Brown, H. M. (2020, September 31). *pubmed.ncbu.nih.gov*. Hentet fra https://pubmed.ncbi.nlm.nih.gov/31225924/

Canada, S. (2020, September 29). Hentet fra https://www150.statcan.gc.ca/n1/daily-quotidien/200929/dq200929e-eng.htm

Committee on Health Care for Underserved Women. (2009, March). *acog.org*. Hentet fra https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2014/02/health-disparities-in-rural-women

Commonwealth Fund survey. (2019, Janurary 30). *cihi.ca*. Hentet fra https://www.cihi.ca/en/commonwealth-fund-survey-2019

Declerq, R. E. (2013, May). *Nationalpartnership.com*. Hentet fra https://www.nationalpartnership.org/our-work/resources/health-care/maternity/listening-to-mothers-iii-pregnancy-and-birth-2013.pdf

Kozhimannil. (2015, January 1). Hentet fra https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4130377/

Kozhimannil. (2019, December). *Healthaffairs.org*. Hentet fra https://www.healthaffairs.org/doi/abs/10.1377/hlthaff.2019.00805

Lee, H. (2020, December 10). *Journals.plos.org*. Hentet fra https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0240700

Lee, Y. (2016, April 30). *ncbi.nlm.nih.gov*. Hentet fra https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4871848/#).

Lupton, D. (2016, August). *Sciencedirect.com*. Hentet fra https://www.sciencedirect.com/science/article/abs/pii/S1871519216000329?via%3Dihub

Mostafaci, B. (2019, December 3). *lablog.uofmhealth.org*. Hentet fra https://labblog.uofmhealth.org/rounds/rural-women-at-higher-risk-of-life-threatening-pregnancy-complications

Norway, S. (2021, March 11). Hentet fra https://www.ssb.no/en/fodte

O'Higgins, A. (2017, August). *Researchrepository.ucd.ie*. Hentet fra https://researchrepository.ucd.ie/handle/10197/8742

Origo. (2021). *https://www.origo.is*. Hentet fra https://www.origo.is/english/solutions/healthcare

Robinson, F. (2014, January 1). *europepmc.org*. Hentet fra https://europepmc.org/article/med/24520591

Scotland, N. R. (2020). Hentet fra https://www.nrscotland.gov.uk/statistics-and-data/statistics/scotlands-facts/births-in-scotland

Sutherns. (2008, September 3). Hentet fra https://pubmed.ncbi.nlm.nih.gov/18726796/

Telus Health. (2019). *appsruntheworld.com*. Hentet fra https://www.appsruntheworld.com/cloud-top-500-applications-vendors/telus-health/

Thomas, G. M. (2015, December 2015). *tandfonline.com*. Hentet fra https://www.tandfonline.com/doi/abs/10.1080/13698575.2015.1127333

WHO. (2016). Hentet fra https://www.who.int/publications/i/item/9789241549912