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Nausea During Pregnancy

Miki, Nimeela, and Rene



Executive Summary

Experienced by 70-80% of pregnant women, [8] nausea is one of the most common and uncomfortable parts of pregnancy. [19] While it has a significant impact on quality of life, nausea is often accepted as a normal part of pregnancy [17] and treatment options are unreliable in reducing symptoms of nausea. [12]

Our research explores how nausea affects the lifestyle of pregnant women and how pregnant women respond to nausea, to identify ways to help pregnant women adapt to these changes. This report showcases the results uncovered through this study.

Over the past 3 months, we interviewed 11 pregnant women about their experiences, spoke to 5 experts in relevant subject areas, and conducted secondary research. Our research yielded 3 key insights that will inform our design direction:

1. The unpredictability of nausea during pregnancy makes it difficult to prepare for ahead of time
2. Varied patterns of nausea between women cause them to seek solutions through trial-and-error, which can be time-consuming or lead to them giving up
3. The mental toll on pregnant women is heightened by gaps in communication and support during the first trimester

Through technology, we hope to bridge the gaps uncovered in our insights in order to reduce the physical and mental burden of nausea on pregnant women.

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Research Kit

Intro

An Overview of Nausea During Pregnancy

Of the 6 million plus pregnancies per year in the United States, [18] 70-80% of women experience Nausea and Vomiting of Pregnancy (NVP). The timing, symptoms, triggers, and severity of nausea vary from person-to-person, and despite the prevalence of nausea, existing management options are considered to be suboptimal. [25]

Symptoms of NVP usually begin within the first few weeks of pregnancy, peak between 9 and 16 weeks, and subside by 22 weeks. Thus, the majority of nausea occurs throughout the first trimester and in the beginning of the second trimester. About 10% of women experience nausea up until delivery and up to 2% of women experience a particularly severe form of nausea called Hyperemesis gravidarum (HG). [3]

Nausea during pregnancy is likened to seasickness or carsickness [2] and is often referred to as morning sickness, even though the majority of women experience nausea throughout the day. [3] Each woman experiences a unique daily pattern of nausea that is relatively predictable, but often complicated by unexpected stimuli that trigger bouts of nausea. [19] While NVP is not well understood from a biological standpoint, [3] the cause of symptoms is often attributed to increased levels of reproductive hormones and the heightened sense of smell during pregnancy. [20]

The physical and mental burden of nausea has a negative impact on quality of life for pregnant women. In terms of the woman's personal life, nausea has been shown to have adverse effects with one study finding that women with NVP took three times more days off from work compared to women without NVP. [25] In some cases, the experience of nausea leads to depression or termination of the pregnancy. [16]

Despite these effects on quality of life, there is a lack of evidence to support any particular intervention. [12] Both prescription and non-prescription medications can be used to alleviate nausea, but the medical profession recommends non-pharmaceutical treatments to reduce the chance of harm to the fetus. [19] Such non-pharmaceutical treatments include dietary changes, herbal remedies, acupressure or acupuncture, and emotional support. [19] [3] Unfortunately, the effects of these treatments are inconsistent between people and there is no high-quality evidence for a singular treatment for nausea. [12] [21]

To exacerbate the situation, the first trimester—when the majority of women experience nausea—is a well-documented medical and informational gap in the pregnancy process. [21] [19] [14] [6] Since women often do not receive medical care until late in the first trimester, there is a missed opportunity for assistance with managing the pregnancy, and women are forced to seek information about pregnancy on their own. [21] There is even evidence that healthcare providers may have a tendency to trivialize the impact of nausea on pregnant women. [11]

70 - 80%

of pregnant women experience nausea during pregnancy

Despite the prevalence of nausea, existing management options are considered to be suboptimal. [25]



mHealth & Pregnancy

The limitations of traditional care models have led to a growth in mHealth interventions related to pregnancy. Short for mobile health, mHealth is commonly defined as any technology related to personal healthcare, including mobile apps, telehealth, and wearables. [9] The ease of access to technology and its ability to adapt to the diverse needs of pregnancy have the potential to bridge medical and emotional support gaps in pregnancy [9].

The majority of mHealth pregnancy products are mobile apps. While pregnancy apps are widely used and are seen as valuable by many expectant mothers [26], the apps tend to focus on providing superficial tips and general information about the stages of pregnancy [21]. Researchers suggest that these apps should holistically enhance wellness by going beyond just providing information [9], and they should involve the partner rather than solely focusing on the woman. [21] Some of these concerns have been addressed through explorations in academia—including an app to collaboratively track maternal health, [7] a fetal movement simulator, [13] a wearable that informs the partner of fetal movements, [4] and a wristband that records patterns of nausea. [19]

These mHealth interventions will provide us with inspiration in our design process, as we seek to address the shortcomings of the current treatment and support options for pregnant women.

Research Plan

Research Question

How does nausea affect pregnant women and what challenges do they face in responding to it?

Research Sub-Questions

01 How do pregnant women experience nausea and how does it affect their lifestyle?

What are the challenges they face in adapting to it? How do pregnant women respond to nausea? 02

03 How do pregnant women obtain information about nausea and which sources do they trust?

Who are pregnant women comfortable sharing experiences with and seeking advice from? What kind of help do they seek? 04

Research Methods

To better understand nausea and its effects on pregnant women, we conducted 11 participant interviews and 5 expert interviews. In addition, we reviewed academic papers, pregnancy books, pregnancy forums, and pregnancy blogs. We also analyzed the market landscape to explore which products and services are available to pregnant women who experience nausea.

Competitive Assessment

To better understand potential design opportunities and the current market, we conducted a competitive assessment of products and services related to general pregnancy, nutrition, and nausea management.

We evaluated the products based on the following criteria:

1. Degree to which context is incorporated
2. Burden on the user
3. Clarity of the information or advice
4. Flexibility and personalization

We chose to omit medication from this inquiry as our focus was largely on technology-related interventions. Also, medication was a last-resort option for most of our participants.

Expert Profiles



Robin Sheared | Acupuncturist & Herbalist at Blue Ova Health

Practices acupuncture and Chinese herbology for fertility, pregnancy, and post-natal care.



Jennie Capron | Coordinator &

Provides emoti expecting parents from pregnancy



Sean Munson | Associate Professor at UW's HCDE Department

Practices acupuncture and Chinese herbology for fertility, pregnancy, and post-natal care.



Christina Chung | A Indiana University's

Researches how ubiq personal informatics data motivate health behavio



PEPs Community
Former Doula

onal support to
as they transition
to parenthood.



Joey Lee | Adjunct Professor at NYU's Interactive Telecoms Program

Explores novel ways of utilizing data & teaches classes about the quantified self, self-tracking, & designing personal data systems.



Assistant Professor at
Informatics Program

quitous computing and
a can bolster relationships,
, and support clinical care.



Elena Agapie | Assistant Professor at UC Irvine's Informatics Department

Researches how a human-centered approach can inform technology interventions that empower people to make healthy behavioral changes.

Participant Profiles

Recruitment Metrics

For our study, we recruited women who are currently pregnant or have gone through pregnancy in the past year. All but one participant experienced nausea during their pregnancy. Our participants were between ages 21 and 40 to ensure that our data did not focus too heavily on the extreme needs of high-risk pregnancies.

Name
Participant 1
Participant 2
Participant 3
Participant 4
Participant 5
Participant 6
Participant 7
Participant 8
Participant 9
Participant 10
Participant 11

Stage	Age	First Pregnancy
2nd Trimester	31 - 35	Yes
2nd Trimester	21 - 25	Yes
Recently Pregnant	31 - 35	Yes
Recently Pregnant	36 - 40	No
3rd Trimester	31 - 35	Yes
3rd Trimester	31 - 35	Yes
3rd Trimester	31 - 35	Yes
3rd Trimester	31 - 35	Yes
Recently Pregnant	21 - 25	Yes
3rd Trimester	31 - 35	Yes
1st Trimester	21 - 25	Yes

Results & Analysis

Research Insights

01

The unpredictability of nausea during pregnancy makes it difficult to prepare for ahead of time

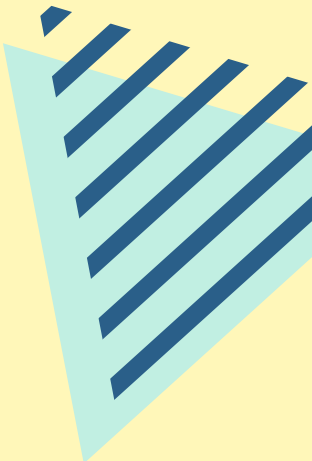
02

Varied patterns of nausea between women cause them to seek solutions through trial & error, which can be time-consuming or lead to them giving up

03

The mental toll on pregnant women is heightened by gaps in communication and support in the first trimester

The unpredictability of nausea during pregnancy makes it difficult to prepare for ahead of time



01

Insight

Observation 1

Expectations are Often Inaccurate

Many pregnant women base their expectations of nausea on anecdotes from pregnant friends, the experiences of their mother, and how pregnancy is portrayed in the media. However, their expectations rarely align with their actual experiences. For example, some women who experienced relatively severe nausea had expected that they would only have mild nausea based on their mother's pregnancy.

Additionally, most women expect nausea to subside by the end of the first trimester. So, when symptoms last longer than expected, some women become anxious at the thought of nausea persisting until delivery.

> **I think I had naive expectations of pregnancy before I got pregnant. - P11**
>
> **[Nausea] kind of knocked me on my butt. - P1**
>
> **To throw up as much as I did was not something I anticipated at all. - P2**

From the Literature

> In the absence of sufficient clinical advice in the first trimester, [22] many women base their understanding of pregnancy on Google searches and their support networks. [24] However, the information gathered through these sources varies in quality, is often contradictory, and can be based on traditional beliefs. [21]

Observation 2

It Doesn't Always Have a Trigger

Tastes and smells, such as that of cooked meat, are common triggers for nausea. While most women consider the process of identifying these triggers to be intuitive, there is not always a trigger for nausea during pregnancy. Many women make lifestyle choices to stave off nausea, such as adjusting eating patterns, but they still often experience nausea throughout the day or have the urge to vomit without warning.

> I remember it would just happen out of the blue. - P10
>
> [Nausea] just ran its course and it was time to get nauseous again. - P10
>
> I felt like there were no options, it was kind of like just deal with it and get through it. - P5
>
> Nothing made it worse and nothing made it better, it was just always there. - P1

From the Literature

> Even though episodes of nausea often occur several times a day, it takes time to identify patterns or triggers in the early stages of pregnancy. [19] [5] To compound this challenge, many pregnant women tend to find tracking burdensome and have difficulty drawing insights from health data to understand pregnancy conditions or fetal health. [7]

Opportunities

01 Help pregnant women anticipate their nausea patterns to empower them to seek solutions.

02 Align pregnant women's expectations of nausea to help them adapt to the changes in their lifestyles.

Varied patterns of nausea between women cause them to seek solutions through trial & error, which can be time-consuming or lead to them giving up

02

Insight

Observation 1

Every Pregnancy is Different

Pregnant women recognize that nausea symptoms are unique to each individual, and thus explore treatment options through trial-and-error. To aid this process, many women refer to personal stories related to their situation in pregnancy forums and through friends, rather than joining formal pregnancy groups. Yet, this can lead to information overload, and filtering through biased stories can be overwhelming. In addition, decision-making is complicated by rigid pregnancy guidelines that leave little room for personalization or interpretation.

> **We're always fine-tuning and trying to figure it out for each person... but if there was a silver bullet [for nausea], oh my God that would be amazing.**
> **- Robin, Blue Ova Health**

> **The advice available for pregnant moms should not be one size fits all. - P10**

> **There are so many things in life that people will just tell you that you cannot do because you are pregnant, and that is not true.**
> **- P1**

From the Literature

> Many pregnant women express frustration at the ineffectiveness of healthcare providers to assess symptoms and recommend treatment for nausea, leading them to seek other avenues of support. [23] [14] [22] In some cases, women reject medical guidelines because they feel that they are not specific enough to their individual pregnancy. [23] [22]

Observation 2

Existing Treatments have Limitations

Even though medication can be effective in relieving nausea, the side effects are often incompatible with lifestyle needs. This leads women to iterate on dietary patterns, try non-pharmaceutical treatment options, and make other lifestyle changes to regain a sense of control. In some cases, the persistence of nausea symptoms can leave pregnant women feeling helpless, leading them to accept nausea as it is and discontinue their search for treatment.

> **I had to revolve my days around it. - P7**
>
> **I felt like there were no options. It was kind of like just deal with it and get through it. - P5**
>
> **The Unisom can make you tired... So taking that before work and trying to work through the night is not really working for me. It's not really an option. - P1**
>
> **I feel it never goes away no matter how many things I've tried. - P11**

From the Literature

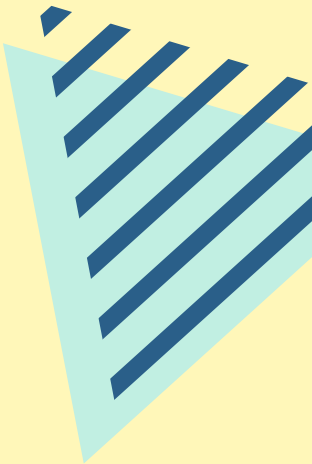
> Even though several medications provide relief from nausea, many pregnant women do not feel comfortable taking them frequently due to the perceived risk of harm to the fetus. [8] [19] While non-pharmaceutical options exist, the effects of these treatments are inconsistent and results vary from person-to-person. [23] [12] [1] [3] [10] Inadequately treated nausea can lead to longer-term negative consequences such as depression, PTSD, and various neurological disorders. [1] [15] [3]

Opportunities

01 Expedite the process of identifying compatible lifestyle adjustments in response to nausea.

02 Provide reassurance to pregnant women when they experience nausea.

The mental toll on pregnant women is heightened by gaps in communication and support in the first trimester



03

Insight

Observation 1

Communicating Needs is Challenging

We observed two main communication challenges that isolate pregnant women from their usual social support systems. First, the risk of miscarriage in the first trimester is high and women have to hide their pregnancy from family, friends, and coworkers. As a result, women may avoid social gatherings and feel the need to cover up any physical discomfort they are feeling at work.

Additionally, once women are able to talk about their pregnancy, people are often more interested in giving advice and discussing the joys of pregnancy, rather than hearing about physical and mental discomfort. Consequently, women may have an increased reliance on their partners for emotional support, but at the same may feel uncomfortable placing that burden on them.

> That's the worst part of it, I hated lying to people. - P5

> I didn't want my co-workers to know [that I was feeling nauseous] because I didn't want them to feel bad or feel like they had to change their routine or the food they brought in. - P7

> It's a unique situation because you feel really sick and you can't tell anyone why. - P1

> People don't like to hear about that [negative] stuff, they just want to hear that you're loving pregnancy. - P7

From the Literature

> Women describe many points during the first trimester as particularly anxiety-inducing. The most pronounced of these periods is the time leading up to the first medical appointment when feelings of anxiety are exacerbated by factors such as lack of support and symptoms of nausea. [6] Moreover, many pregnant women feel guilty about asking for help and fear judgment from others, which makes them reluctant to seek support. [24]

Observation 2

Partners are Unsure How to Provide Support

When the partner wants to be supportive, there are often no clear options for what to do. There are very few resources directed toward the partner and the woman may not even know how the partner can help, which effectively blocks much-needed support. Moreover, many women feel that their partner cannot fully understand what they are going through, especially because nausea is often present even when there are no visible symptoms.

> **To him, if I wasn't throwing up then I was not feeling nauseous. - P1**

> **When I have someone who's supportive, and they're by my side, [but] nothing's getting geared towards him... it's like a waste of a resource. -P10**

> **I wish [my husband] could kind of experience it for a day or two... You can't really understand something that you haven't experienced. -P1**

From the Literature

> Pregnant women often rely on their partner as a primary source of emotional support and they can even be considered as "key drivers to healthy sane pregnancies." [23] [24] However, since partners have difficulty relating to the physical demands of pregnancy, women turn to their birth mother or friends who have experienced pregnancy for support with physical issues. [21] Additionally, most apps and websites are directed solely toward the woman, from the content to the visual design. [21]

Opportunities

01 Facilitate lightweight communication between pregnant women and their support circles to reduce the burden caused by nausea.

02 Help partners better support pregnant women's life and work struggles caused by nausea.

Market Landscape

We conducted a competitive assessment as we were narrowing down the scope of our problem space to nausea. As such, we analyzed five categories of products related to nutrition in pregnancy. Out of these categories, two of them are still relevant to this report:

1. **Comprehensive Pregnancy Apps**
2. **Nausea Management**
3. Food and Weight Tracking
4. Nutrition Advice
5. Recipes and Meal Kits

Comprehensive Pregnancy Apps

There are a number of iOS and Android apps that have features addressing multiple aspects of pregnancy. The most popular pregnancy app on iOS, What to Expect, includes features such as pregnancy tips, milestone tracking, and a community forum. Other apps such as Pregnancy +, Ovia Pregnancy Tracker, BabyCenter, The Bump, and Sprout Pregnancy contain a similar spread of features. While these apps are feature-rich, they offer little in terms of personalization or meaningful interactions beyond tracking and information delivery. Moreover, they are largely focused on the pregnant woman and do not foster a connection with the partner, family, or medical staff.

Nausea Management

Technology-based nausea interventions are few and far between, but more diverse in nature than comprehensive pregnancy apps. WellMom is an app that is used by pregnant women in tandem with her medical practitioner to create a treatment plan for nausea. Nevasic is an app that provides nausea relief by playing soothing sounds. The Relief Band and Sense Relief are high-tech versions of acupressure sea-bands—the first is a standalone wearable and the latter is an Apple Watch app. While Well Mom has a collaborative approach, it is focused primarily on pharmaceutical treatment options and is thus limited in its audience. The other three products are based on interventions that tend to be hit-or-miss and are likely unreliable.

Takeaways

There is a clear market opportunity for products that holistically address the needs of pregnant women experiencing nausea. Pregnancy apps tend to provide superficial tips related to nausea, while nausea-specific products are narrow and hit-or-miss. A holistic approach would incorporate the physical and emotional needs of pregnant women and their social support systems to form a personalized, context-based intervention.

Comprehensive Pregnancy Apps



What to Expect

★★★★★

242.1K Ratings



BabyCenter

★★★★★

70.6K Ratings



Pregnancy +

★★★★★

38.1K Ratings



Ovia

★★★★★

30.7K Ratings



The Bump

★★★★★

19.3K Ratings



Glow Nurture

★★★★½

9K Ratings



PregLife

★★★★★

7.7K Ratings



HiMommy

★★★★★

5.9K Ratings



Baby Bump

★★★★½

2.6K Ratings



Sprout Pregnancy +

★★★★★

1.3K Ratings



Hello Baby

★★★★☆

1.5K Ratings



Pregnancy Calendar

★★★★½

986 Ratings



WebMD Pregnancy

★★★★½

783 Ratings

Nausea Management



WellMom

★★★★★

1 Rating



Nevasic

★★★★☆

10 Ratings



Sense Relief

★★★★★

7 Ratings



Relief Band

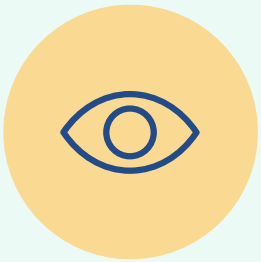
Discussion

Design Principles



Personalized

Every pregnancy is different and each woman has diverse fluctuating needs. Adapting to these needs in a meaningful way will be central to the design.



Context-Aware

Women can experience nausea at any time, anywhere. The design will be considerate of these contexts—from the home to the grocery store to the office.



Comforting

Experiencing nausea persistently for weeks on end is both physically and mentally taxing. The design will be sensitive to these challenges in the support it provides.



Collaborative

Pregnancy is a shared experience between the woman, partner, and other loved ones. Involving these people in the design will decrease isolation and result in more holistic support.

Next Steps

Opportunities

We will further narrow down our scope by using the following criteria:

1. Is the opportunity most suitable for technological interventions?
2. Can it be addressed using tangible interactions (i.e., ones more diverse than just a mobile application)?
3. What kind of technological constraints might this space pose?

Co-Design Session

We will also be designing a virtual co-design session with some of our participants who have expressed further interest in participating in our activities. The aim of this session would be to co-create design explorations that address the needs and interests of pregnant women who have experienced nausea.

Speculative Technologies

Moving forward, we will explore the speculative course our project can take by understanding technological and design trends that are emerging. We will conduct further research through a literature review as well as interviews with expert technologists around specific technologies that could support our design interventions.

Citations

1. Attard, C. L., Kohli, M. A., Coleman, S., Bradley, C., Hux, M., Atanackovic, G., & Torrance, G. W. (2002). The burden of illness of severe nausea and vomiting of pregnancy in the United States. American Journal of Obstetrics and Gynecology, 186(5). doi: 10.1067/mob.2002.122605

2. Bellefonds, C. de. (2020, January 21). Morning Sickness and Nausea During Pregnancy. Retrieved from https://www.whattoexpect.com/pregnancy/morning-sickness/

3. Bustos, M., Venkataramanan, R., & Caritis, S. (2017). Nausea and vomiting of pregnancy - Whats new? Autonomic Neuroscience, 202, 62–72. doi: 10.1016/j.autneu.2016.05.002

4. Carpenter, V. J., & Overholt, D. (2017). Designing For Meaningfulness. Proceedings of the 2016 ACM Conference Companion Publication on Designing Interactive Systems - DIS 17 Companion. doi: 10.1145/3064857.3079126

5. Davis, M. (2004). Nausea and Vomiting of Pregnancy. The Journal of Perinatal & Neonatal Nursing, 18(4), 312–328. doi: 10.1097/00005237-200410000-00002

6. Doherty, K., Barry, M., Marcano-Belisario, J., Arnaud, B., Morrison, C., Car, J., & Doherty, G. (2018). A Mobile App for the Self-Report of Psychological Well-Being During Pregnancy (BrightSelf): Qualitative Design Study. JMIR Mental Health, 5(4). doi: 10.2196/10007

7. Gao, Y., Li, X., Lin, Y.-H., Liu, X., & Pang, L. (2014). Nuwa. Proceedings of the Extended Abstracts of the 32nd Annual ACM Conference on Human Factors in Computing Systems - CHI EA 14. doi: 10.1145/2559206.2580928

8. Gordon, A., & Love, A. (2018). Nausea and Vomiting in Pregnancy. Integrative Medicine. doi: 10.1016/b978-0-323-35868-2.00054-2

9. Günay, A., & Erbuğ, Ç. (2018). Mobile Health Integration in Pregnancy. Current and Emerging MHealth Technologies, 57–83. doi: 10.1007/978-3-319-73135-3_5

10. Gürkan, Ö. C., & Arslan, H. (2008). Effect of acupressure on nausea and vomiting during pregnancy. Complementary Therapies in Clinical Practice, 14(1), 46–52. doi: 10.1016/j.ctcp.2007.07.002

11. Heitmann, K., Nordeng, H., Havnen, G. C., Solheimsnes, A., & Holst, L. (2017). The burden of nausea and vomiting during pregnancy: severe impacts on quality of life, daily life functioning and willingness to become pregnant again – results from a cross-sectional study. BMC Pregnancy and Childbirth, 17(1). doi: 10.1186/s12884-017-1249-0

12. Jewell, D., & Young, G. (2010). Interventions for nausea and vomiting in early pregnancy. Cochrane Database of Systematic Reviews. doi: 10.1002/14651858.cd000145.pub2

13. Kosaka, T., Misumi, H., Iwamoto, T., Songer, R., & Akita, J. (2011). "Mommy Tummy" a pregnancy experience system simulating fetal movement. ACM SIGGRAPH 2011 Emerging Technologies on - SIGGRAPH 11. doi: 10.1145/2048259.2048269

14. Kraschnewski, J. L., Chuang, C. H., Poole, E. S., Peyton, T., Blubaugh, I., Pauli, J., … Reddy, M. (2014). Paging "Dr. Google": Does Technology Fill the Gap Created by the Prenatal Care Visit Structure? Qualitative Focus Group Study With Pregnant Women. Journal of Medical Internet Research, 16(6). doi: 10.2196/jmir.3385

15. Köken, G., Yilmazer, M., Cosar, E., Sahi¨n, F. K., Cevri¨oglu, S., & Geci¨ci¨, Ö. (2008). Nausea and vomiting in early pregnancy: Relationship with anxiety and depression. Journal of Psychosomatic Obstetrics & Gynecology, 29(2), 91–95. doi: 10.1080/01674820701733697

16. Lacasse, A., Rey, E., Ferreira, E., Morin, C., & Bérard, A. (2008). Nausea and vomiting of pregnancy: what about quality of life? BJOG: An International Journal of Obstetrics & Gynaecology, 115(12), 1484–1493. doi: 10.1111/j.1471-0528.2008.01891.x

17. Lacroix, R., Eason, E., & Melzack, R. (2000). Nausea and vomiting during pregnancy: A prospective study of its frequency, intensity, and patterns of change. American Journal of Obstetrics and Gynecology, 182(4), 931–937. doi: 10.1016/s0002-9378(00)70349-8

18. Laporte, J. (n.d.). Topic: Pregnancy. Retrieved from

19. Lee, T.-I., Chiang, Y.-H., Guo, J., Chen, M.-T., & Chen, Y. (2016). Dot-it. Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA 16. doi: 10.1145/2851581.2890631

20. Morning sickness: Treatments, prevention, and when it starts. (n.d.). Retrieved from https://www.medicalnewstoday.com/articles/179633

21. Oster, E. (2019). Expecting better: why the conventional pregnancy wisdom is wrong--and what you really need to know. New York: Penguin Books.

Peyton, T., Poole, E., Reddy, M., Kraschnewski, J., & Chuang, C. (2014). Information, sharing and support in pregnancy. Proceedings of the Companion Publication of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW Companion 14. doi: 10.1145/2556420.2556489

22. Peyton, T., Poole, E., Reddy, M., Kraschnewski, J., & Chuang, C. (2014). "Every pregnancy is different". Proceedings of the 2014 Conference on Designing Interactive Systems - DIS 14. doi: 10.1145/2598510.2598572

23. Peyton, T. (2014). Pregnancy Ecologies As Teachable Moments For The Lifecourse. Proceedings of the 18th International Conference on Supporting Group Work - GROUP 14. doi: 10.1145/2660398.2660438

24. Prabhakar, A. S., Siek, K. A., Guerra-Reyes, L., Effron, A., Kleinschmidt, V. M., Driscoll, M., … Ongwere, T. (2017). "let me know if you need anything". Proceedings of the 11th EAI International Conference on Pervasive Computing Technologies for Healthcare - PervasiveHealth 17. doi: 10.1145/3154862.3154863

25. Tan, A., Lowe, S., & Henry, A. (2017, September 26). OBGYN. Retrieved from https://obgyn.onlinelibrary.wiley.com/doi/abs/10.1111/ajo.12714

26. Thomas, G. M., & Lupton, D. (2015). Threats and thrills: pregnancy apps, risk and consumption. Health, Risk & Society, 17(7-8), 495–509. doi: 10.1080/13698575.2015.1127333
Wood, H., McKellar, L. V., & Lightbody, M. (2013, June). Nausea and vomiting in pregnancy: blooming or bloomin' awful? A review of the literature. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23200815

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Other References

27. Arriaga, R. I., Miller, A. D., Mynatt, E. D., Pagliari, C., & Poole, E. S. (2013). Theory vs. design-driven approaches for behavior change research. CHI 13 Extended Abstracts on Human Factors in Computing Systems on - CHI EA 13. doi: 10.1145/2468356.2468801

28. Bussone, A., Stumpf, S., & Buchanan, G. (2016). It Feels Like Im Managing Myself. Proceedings of the 9th Nordic Conference on Human-Computer Interaction - NordiCHI 16. doi: 10.1145/2971485.2971542

29. Cena, F., & Matassa, A. (2015). Adopting a user modeling approach to quantify the city. Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2015 ACM International Symposium on Wearable Computers - UbiComp 15. doi: 10.1145/2800835.2800955

30. Chi, P.-Y., Chen, J.-H., Chu, H.-H., & Chen, B.-Y. (2007). Enabling nutrition-aware cooking in a smart kitchen. CHI 07 Extended Abstracts on Human Factors in Computing Systems - CHI 07. doi: 10.1145/1240866.1241003

31. Choe, E. K., & Lee, B. (2019). Toward supporting personalized tracking experiences in healthcare. Interactions, 27(1), 84–87. doi: 10.1145/3371287

32. Chung, C.-F., Agapie, E., Schroeder, J., Mishra, S., Fogarty, J., & Munson, S. A. (2017). When Personal Tracking Becomes Social. Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. doi: 10.1145/3025453.3025747

33. Dimitrov, D. V. (2016). Medical Internet of Things and Big Data in Healthcare. Healthcare Informatics Research, 22(3), 156. doi: 10.4258/hir.2016.22.3.156

34. Elsden, C., Kirk, D., Selby, M., & Speed, C. (2015). Beyond Personal Informatics. Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA 15. doi: 10.1145/2702613.2702632

35. Epstein, D. A., Ping, A., Fogarty, J., & Munson, S. A. (2015). A lived informatics model of personal informatics. Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing - UbiComp 15. doi: 10.1145/2750858.2804250

36. Etzel, B., & Thomas, P. (1996). Personal information management. Personal Information Management, 8–17. doi: 10.1007/978-1-349-24869-8_2

37. Franco, R. Z. (2017). Online Recommender System for Personalized Nutrition Advice. Proceedings of the Eleventh ACM Conference on Recommender Systems. doi: 10.1145/3109859.3109862

Gulotta, R., Forlizzi, J., Yang, R., & Newman, M. W. (2016). Fostering Engagement with Personal Informatics Systems. Proceedings of the 2016 ACM Conference on Designing Interactive Systems - DIS 16. doi: 10.1145/2901790.2901803

38. Jeff. (2017, October 11). #12 # When Quantified Self Meet Smart Cities. Retrieved from https://datadrivendiary.com/2017/10/11/13/

Luo, Y., Liu, P., & Choe, E. K. (2019). Co-Designing Food Trackers with Dietitians. Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI 19. doi: 10.1145/3290605.3300822

39. Mamykina, L., Miller, A. D., Grevet, C., Medynskiy, Y., Terry, M. A., Mynatt, E. D., & Davidson, P. R. (2011). Examining the impact of collaborative tagging on sensemaking in nutrition management. Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems - CHI 11. doi: 10.1145/1978942.1979037

40. Managing Nausea and Vomiting at Home. (n.d.). Retrieved from https://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/nausea-and-vomiting/nausea-and-vomiting.html

41. Marinchev, I., & Agre, G. (2016). An Expert System for Healthful and Dietary Nutrition. Proceedings of the 17th International Conference on Computer Systems and Technologies 2016 - CompSysTech 16. doi: 10.1145/2983468.2983485

42. Meyer, J., Heuten, W., & Boll, S. (2016). No effects but useful? long term use of smart health devices. Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct. doi: 10.1145/2968219.2968314

43. Munson, S. A. (2017). Rethinking assumptions in the design of health and wellness tracking tools. Interactions, 25(1), 62–65. doi: 10.1145/3168738

44. Muralikumar, M. D., & Nardi, B. (2018). Addressing limits through tracking food. Proceedings of the 2018 Workshop on Computing within Limits. doi: 10.1145/3232617.3232620

45. Mynatt, E. D. (2011). IT in healthcare. Interactions, 18(3), 22. doi: 10.1145/1962438.1962446

46. Nair, S. (2016). QS x NUI. Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct. doi: 10.1145/2968219.2968316

47. "Nausea Transformer". (n.d.). Retrieved from https://doi-org.offcampus.lib.washington.edu/10.1145/1280720.1280772

48. Pina, L. R., Sien, S.-W., Ward, T., Yip, J. C., Munson, S. A., Fogarty, J., & Kientz, J. A. (2017). From Personal Informatics to Family Informatics. Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing. doi: 10.1145/2998181.2998362

49. Prost, S., Vlachokyriakos, V., Midgley, J., Heron, G., Meziant, K., & Crivellaro, C. (2019). Infrastructuring Food Democracy. Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), 1–27. doi: 10.1145/3359159

50. Rapp, A., Cena, F., Kay, J., Kummerfeld, B., Hopfgartner, F., Plumbaum, T., … Gouveia, R. (2017). New frontiers of quantified self 3. Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers. doi: 10.1145/3123024.3124456

51. Jones, D., See, Z. S., Billinghurst, M., Goodman, L., & Fealy, S. (2019). Extended Reality for Midwifery Learning: MR VR Demonstration. The 17th International Conference on Virtual-Reality Continuum and Its Applications in Industry. doi: 10.1145/3359997.3365739 https://dl.acm.org/doi/pdf/10.1145/3359997.3365739

52. Kamal, N., Fels, S., & Ho, K. (2010). Online social networks for personal informatics to promote positive health behavior. Proceedings of Second ACM SIGMM Workshop on Social Media - WSM 10. doi: 10.1145/1878151.1878167

53. Karanam, Y., Alotaibi, H., Filko, L., Makhsoom, E., Kaser, L., & Voida, S. (2014). Motivational affordances and personality types in personal informatics. Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing Adjunct Publication - UbiComp 14 Adjunct. doi: 10.1145/2638728.2638800

54. Katule, N., Densmore, M., & Rivett, U. (2016). Leveraging Intermediated Interactions to Support Utilization of Persuasive Personal Health Informatics. Proceedings of the Eighth International Conference on Information and Communication Technologies and Development - ICTD 16. doi: 10.1145/2909609.2909664

55. Kay, M. (2014). Challenges in personal health tracking. XRDS: Crossroads, The ACM Magazine for Students, 21(2), 32–37. doi: 10.1145/2678024

56. Li, I., Medynskiy, Y., Froehlich, J., & Larsen, J. (2012). Personal informatics in practice. Proceedings of the 2012 ACM Annual Conference Extended Abstracts on Human Factors in Computing Systems Extended Abstracts - CHI EA 12. doi: 10.1145/2212776.2212724

57. Li, I., Froehlich, J., Larsen, J. E., Grevet, C., & Ramirez, E. (2013). Personal informatics in the wild. CHI 13 Extended Abstracts on Human Factors in Computing Systems on - CHI EA 13. doi: 10.1145/2468356.2479641

58. Li, Y., & Guo, Y. (2016). Wiki-Health: From Quantified Self to Self-Understanding. Future Generation Computer Systems, 56, 333–359. doi: 10.1016/j.future.2015.08.008

59. Luhanga, E. T., Hippocrate, A. A. E., Suwa, H., Arakawa, Y., & Yasumoto, K. (2016). Towards proactive food diaries. Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct. doi: 10.1145/2968219.2968441

60. Ruffle, J. K., Patel, A., Giampietro, V., Howard, M. A., Sanger, G. J., Andrews, P. L. R., … Farmer, A. D. (2019). Functional brain networks and neuroanatomy underpinning nausea severity can predict nausea susceptibility using machine learning. The Journal of Physiology, 597(6), 1517–1529. doi: 10.1113/jp277474
https://physoc.onlinelibrary.wiley.com/doi/full/10.1113/JP277474

61. Samuel, H. W., Zaïane, O. R., & Sobsey, D. (2010). Towards a definition of health informatics ethics. Proceedings of the ACM International Conference on Health Informatics - IHI 10. doi: 10.1145/1882992.1883029

62. Schäfer, H., & Willemsen, M. C. (2019). Rasch-based tailored goals for nutrition assistance systems. Proceedings of the 24th International Conference on Intelligent User Interfaces. doi: 10.1145/3301275.3302298

63. Smart health communities and the future of health. (n.d.). Retrieved from https://www2.deloitte.com/us/en/insights/industry/health-care/smart-health-communities.html

64. Thapa-Chhetry, B., & Keck, T. (2019). A Chrome App for Improving Reading Comprehension of Health Information Online for Individuals with Low Health Literacy. 2019 IEEE/ACM 1st International Workshop on Software Engineering for Healthcare (SEH). doi: 10.1109/seh.2019.00018

65. Theodoridis, T., Solachidis, V., Dimitropoulos, K., Gymnopoulos, L., & Daras, P. (2019). A survey on AI nutrition recommender systems. Proceedings of the 12th ACM International Conference on PErvasive Technologies Related to Assistive Environments. doi: 10.1145/3316782.3322760

66. Thomaz, E. (2013). Practical food journaling. Proceedings of the 2013 ACM Conference on Pervasive and Ubiquitous Computing Adjunct Publication - UbiComp 13 Adjunct. doi: 10.1145/2494091.2501089

67. Wei, Z., Chen, J., Ming, Z., Ngo, C.-W., Chua, T.-S., & Zhou, F. (2019). DietLens-Eout. Proceedings of the 2019 on International Conference on Multimedia Retrieval. doi: 10.1145/3323873.3326923

Appendix

Research Kit

Questions for Pregnancy Experts

Warm-Up

1. How did you decide to focus your practice on pregnancy?

Pregnancy Process

1. What are the common health issues that people come to you with related to pregnancy? What is your role at different stages of pregnancy? How does it change?
2. How do you create treatment plans for patients? How do you personalize treatment from person to person?
3. What is the role of Chinese medicine and western medicine in treating health issues related to pregnancy? How do you work with other specialists involved in the pregnancy process?
4. What role does nutrition play in Chinese medicine related to pregnancy? What kind of advice do you give related to nutrition?
5. What effects can a good diet compare to a poor diet have on someone's pregnancy?
6. Do you encourage women to track anything health or nutrition-related during pregnancy?
7. What are some common challenges related to nutrition that your patients have?
8. What are a pregnant woman's health and wellness needs throughout the different phases of pregnancy?
9. What are some common concerns or stigmas that women have related to pregnancy? How do you provide emotional support to them?

Wrap Up

1. If you could invent any kind of service or product related to health and wellness during pregnancy, what would it be?
2. Do you have any questions for us?

Questions for Pregnancy Experts

Warm-Up

1. How long were you a doula for? What first got you interested in being a doula?
2. What's your role with PEPS and how long have you been involved?

Pregnancy Process

1. What's the role of a doula in a woman's pregnancy? How does a doula's role change during and after pregnancy?
2. How common is it for someone to involve a doula in their pregnancy?
3. What are a pregnant woman's health and wellness needs throughout the different phases of pregnancy?
4. What are some common concerns that you would hear from women related to health and wellness during pregnancy?
5. From your experience, what are some common informal sources of information about wellness for pregnant women?
6. How does a doula interact with other specialists involved in the pregnancy process, such as doctors?

Wrap Up

1. If you could snap your fingers and invent any kind of service or product related to wellness during pregnancy, what would that be?

Questions for Health Informatics Experts

Warm-Up

1. Can you give us a brief summary of your current research interests?

Pregnancy Process

1. What types of personal health data are people tracking?
2. What are the major trends in personal health informatics right now?
3. What are some major challenges in this field?
4. What challenges do people face when interpreting data related to personal health?
5. Are you aware of any examples where personal health informatics is being used in a community context, such as to promote altruistic behavior? What opportunities or challenges do you see in this area?
6. Are you aware of any examples of personal health data being combined with public city data?
7. What other types of non-personal health data are relevant to personal health informatics? In what ways could personal health data be integrated with other data streams?

Wrap Up

1. How do you see the field of personal health informatics changing in the next 5-10 years?
2. What other types of personal health data have the potential for individuals to track in the near future? What technologies do you see being widely used in personal health informatics in the next 5-10 years?
3. If you could wave a magic wand to make any project related to personal health informatics possible, what would it be?

Questions for Quantified-Self Experts

Warm Up

1. Can you give us a brief summary of your current research interests?

Data

1. What are the major challenges people face when tracking their personal data? How does this differ between different types of data?
2. Can you give us an example of a popular self-tracking application? What are the gaps that exist in this in terms of people tracking or making sense of their data?
3. What are some nuanced approaches to self-tracking that are emerging? What new opportunities or understanding can they bring?
4. I know this is an ambiguous question, who is the general audience for self-tracking, and what is their data literacy?
5. What are the major challenges people face when making sense of their personal data?
6. What types of goals is data tracking most useful for helping people achieve?
7. What difference do you see in people's relationship to personal data compared to public data, such as data collected by a city?
8. Do you know of any examples where public data is combined with personal tracking data effectively to deliver a service? What makes these examples effective?
9. What are some examples of communities built around self-tracking /quantified-self?

Wrap Up

1. What will be the future trend of self-tracking in the next 5-10 years?
2. If you could wave a magic wand to make any project related to self-tracking data possible, what would it be?

Participant Protocol

Introduction

Hi we are Miki, Nimeela, and Rene. We're students in the Masters of Human Computer Interaction and Design program at UW. We are working on our capstone project and are currently in the research phase. We are interested in how nausea affects pregnant women and what challenges they face in responding to it. The purpose of this interview will be to inform the research and design of this project. Today, _____ will be facilitating our session and _____ will be taking notes.

Consent Forms

Before we begin we want to inform you about the privacy aspects of this study and ask for your consent. (facilitator goes over the consent form) Do you have any questions about what we covered? Do you consent to being recorded during this meeting?

Questions

Warm-Up

1. How far along are you in your pregnancy?
2. How many people do you live with in your household? Were there frequent visitors to support your pregnancy?

Food

1. What are some of the food cravings and aversions you have developed in your pregnancy?
2. How did your experiences with food during pregnancy compare to what you expected before you got pregnant?

Nausea Overview

1. Did you experience any kind of nausea during your pregnancy? How long has nausea lasted during your pregnancy? How has it affected you?
2. What are the different symptoms you are experiencing with nausea?
3. Have you noticed a pattern of when you experience nausea?
4. How does the nausea you experienced compare to what you expected before you got pregnant?
5. Can you tell me about a time when your nausea was pretty bad? What did you do?
6. How do you decide what to eat when you're feeling nauseous?
7. Are there any specific triggers that you have identified related to your nausea? How did you identify these triggers?

Relief & Needs

1. What relieves your nausea? How did you learn about these solutions?
2. Have you ever been in a situation when you didn't have _____ on you to help you with your nausea? What did you do? How did it make you feel?
3. Have you heard of any solutions that you decided not to try? If so, why?
4. What comforts you when you have nausea?
5. What's something you wish you had to help with your nausea?

Lifestyle

1. What is an example of an aspect of your life that has changed due to experiencing nausea? What changes in your daily routine have you developed because of nausea? How do you feel about these changes?
2. What's one thing that nausea prevented you from doing that you wish you could have done during that time?
3. How has nausea affected your social life? How did you feel about that?
4. How has nausea affected your work life? What did you do about it?

Advice/Support

1. Who do you feel comfortable talking about nausea with?
2. Who do you go to for advice related to nausea? What kind of advice or response are you seeking from them?
3. Are you involved in any pregnancy groups or communities? Why or why not?
4. When you're feeling nauseous, do you ask anybody for support in the moment? If so, who? How do they help you out with your nausea?
5. Why do you go to _____ for support related to nausea instead of _____ (mom/friend/sibling)? How do you decide who to reach out to?
6. Can you tell me about a time when you really appreciated the empathy and support you received from your _____ (partner/mom/friend) during pregnancy?
7. What do you wish your partner knew about your nausea or could do for you?

General Pregnancy

1. What are some products or services you've used related to pregnancy? Have you used any pregnancy apps?
2. How did you hear about these products or services related to pregnancy?
3. Which people or other sources of information do you trust related to pregnancy?
4. What sources of information does your _____ (partner/friend/mom) look into to support your pregnancy?

Cooldown Questions

1. Do you have any questions for us?

Conclusion

Thank you for taking the time to meet with us. We learned a lot from our interview. If you have any other questions or concerns you can always reach out to us via the contact information we have provided you with.

To show our appreciation we would like to give you a $10 gift card from either Amazon or Target. Do you have a preference between the two? We will email you the gift card shortly after this call.

Consent Form - Page 1

Consent Form

Focus of this Study

Miki, Nimeela & Rene are graduate students in the MHCI+D program at the University of Washington, Seattle. We are conducting research for our 6-month-long graduate school capstone project. We are researching how nausea affects the lifestyles of pregnant women and what challenges they face in responding to it, to identify ways to help them adapt to these changes.

What We Will Ask You to Do

This is an interview about your experiences. We have a list of questions, but we see it more like a conversation. You don't have to answer any question you're not comfortable answering and you are free to end the interview at any time.

Privacy & Consent

You may find some of the questions about nausea during your pregnancy to be sensitive. Please only show or speak about the information you are comfortable with sharing with us. We ask that you permit us to make a recording of this meeting. You are not required to consent to be recorded. The records associated with this study will be kept private and will be used to inform research for our capstone project. Do you consent to being recorded?

- ☐ Yes, I consent to being recorded
- ☐ No, I do not consent to being recorded

Consent Form - Page 2

Our Commitment to You

- **Confidentiality:** The records associated with this study will be kept private and will only be accessed by this research team. We will not release your name or any other identifying details of this interview. Your participation in this study will remain anonymous. We will store the recordings in a private Google Drive folder and will delete them by December 31st, 2020.
- **Compensation:** As a token of our appreciation, you will receive a $10 Amazon or Target gift card.
- **Voluntary:** Your participation in this study is completely voluntary. You may refuse to answer any question that is asked or end the interview at any time. If you agree to be recorded, you may ask that we stop recording at any time.

Our Contact Details

You may bring up any questions or concerns you have to the researchers. If you have any questions or concerns after this interview, you may contact us at any of the following email addresses: Nimeela Daripineni (nimeela@uw.edu), Xue (Miki) Bin (xb285@uw.edu), or Rene Goldfarb-Ilyashov (renegi@uw.edu).

Participation

Please sign below if you confirm you agree and understand the information on this form, and agree to participate in this research study.

Print Your Name

Signature & Date

Screener - Page 1



UW Graduate Research Study Participation Form

Welcome!

We are graduate students in the MHCI+D program at the University of Washington conducting research for our capstone project. If you are pregnant or were recently pregnant, we would like to learn about your experience related to nausea during your pregnancy.

We are looking to conduct an hour-long interview via a Zoom call with eligible participants. To show our appreciation, we will provide a $10 Target or Amazon gift card for participating in the interview.

Before we reach out to you for an interview, we would like to learn a little more about you to see if you qualify for this study.

* Required

Which of the following best applies to you? *

- ○ I'm in my 1st trimester
- ○ I'm in my 2nd trimester
- ○ I'm in my 3rd trimester
- ○ I had a baby in the past year
- ○ It's been over a year since I had my baby

Is this your first pregnancy? *

- ○ Yes
- ○ No

Next

Page 1 of 4

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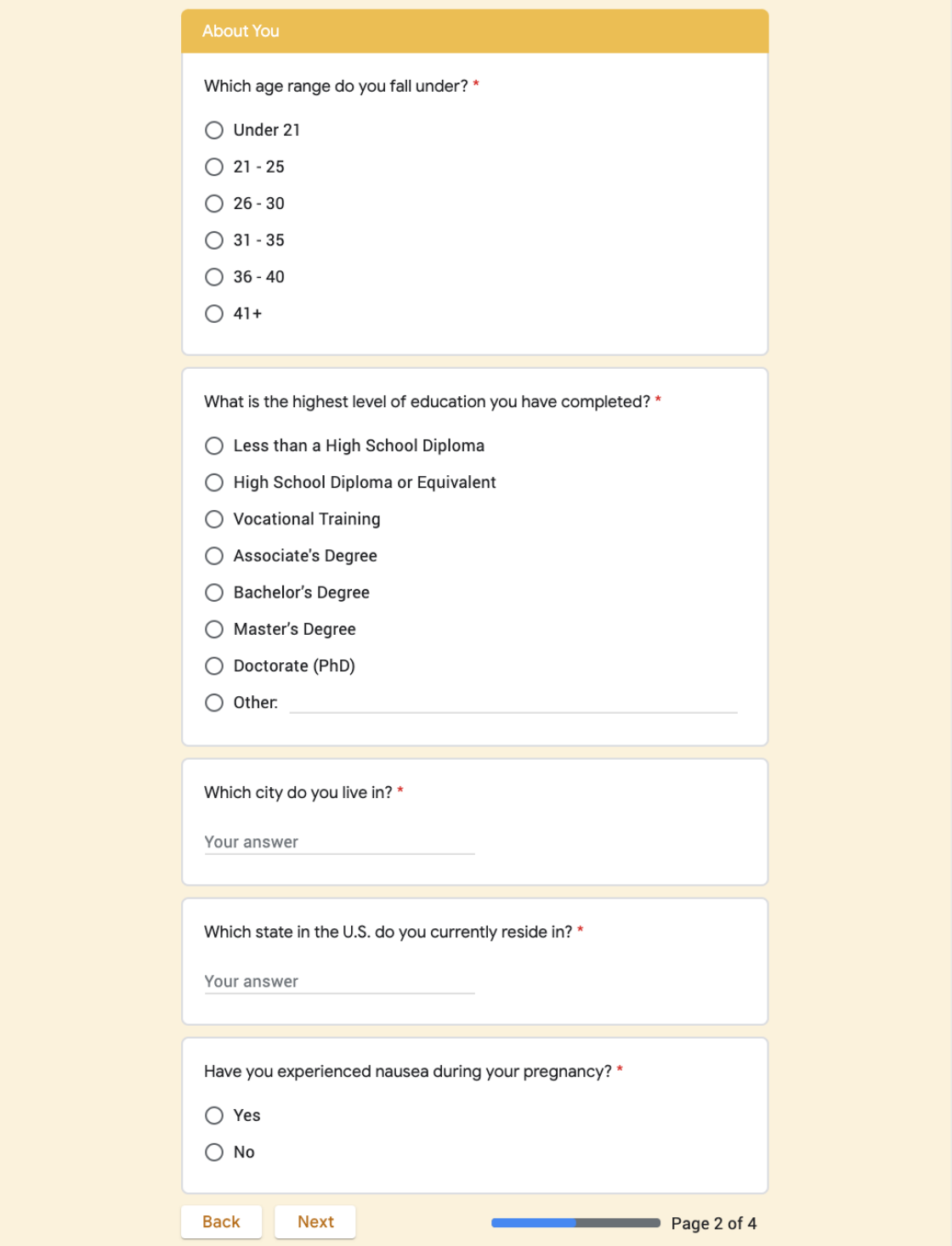
This form was created inside of UW. Report Abuse

Google Forms

Screener - Page 2



About You

Which age range do you fall under? *

- Under 21
- 21 - 25
- 26 - 30
- 31 - 35
- 36 - 40
- 41+

What is the highest level of education you have completed? *

- Less than a High School Diploma
- High School Diploma or Equivalent
- Vocational Training
- Associate's Degree
- Bachelor's Degree
- Master's Degree
- Doctorate (PhD)
- Other:

Which city do you live in? *

Your answer

Which state in the U.S. do you currently reside in? *

Your answer

Have you experienced nausea during your pregnancy? *

- Yes
- No

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Screener - Page 3



UW Graduate Research Study Participation Form

* Required

Nausea During Pregnancy

During which trimester(s) have you experienced nausea? Check all that apply. *

- [ ] I haven't experienced nausea during my pregnancy
- [ ] I've experienced nausea during all or part of my first trimester
- [ ] I've experienced nausea during all or part of my second trimester
- [ ] I've experienced nausea during all or part of my third trimester

How severe was your nausea when it was at its worst during your pregnancy? *

	1	2	3	4	5	
Not severe	○	○	○	○	○	Very severe

Which of the following methods have you used to alleviate nausea?

- [ ] I haven't tried anything
- [ ] Rest
- [ ] Aromatherapy
- [ ] Prescription medication
- [ ] Changing eating patterns
- [ ] Taking supplements
- [ ] Identifying & avoiding triggers
- [ ] Acupuncture/acupressure
- [ ] Other: _____

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Screener - Page 4



UW Graduate Research Study Participation Form

* Required

Contact Details

Please let us know if you would be interested in participating in either of the activities below and how we might be able to contact you.

What is your name? *

This can be your first name or a nickname we can use to address you.

Your answer

What would be the best email we can reach you at? *

Your email will only be used to contact you and will not be shared with anyone.

Your answer

Would you be willing to participate in a 1-hour interview via a Zoom call about your experience? *

You will receive a $10 gift card for participating in the interview.

- ◯ Yes
- ◯ No

Would you be willing to participate in a remote design workshop in the future? *

You will receive an additional gift card for participating in the design workshop.

- ◯ Yes
- ◯ No
- ◯ I am interested in learning more

Back Submit Page 4 of 4

Screener - Page 5



UW Graduate Research Study Participation Form

Thank you for your interest in this research study. We will be reaching out to eligible participants soon!

Edit your response

This form was created inside of UW. Report Abuse

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intentionally left blank