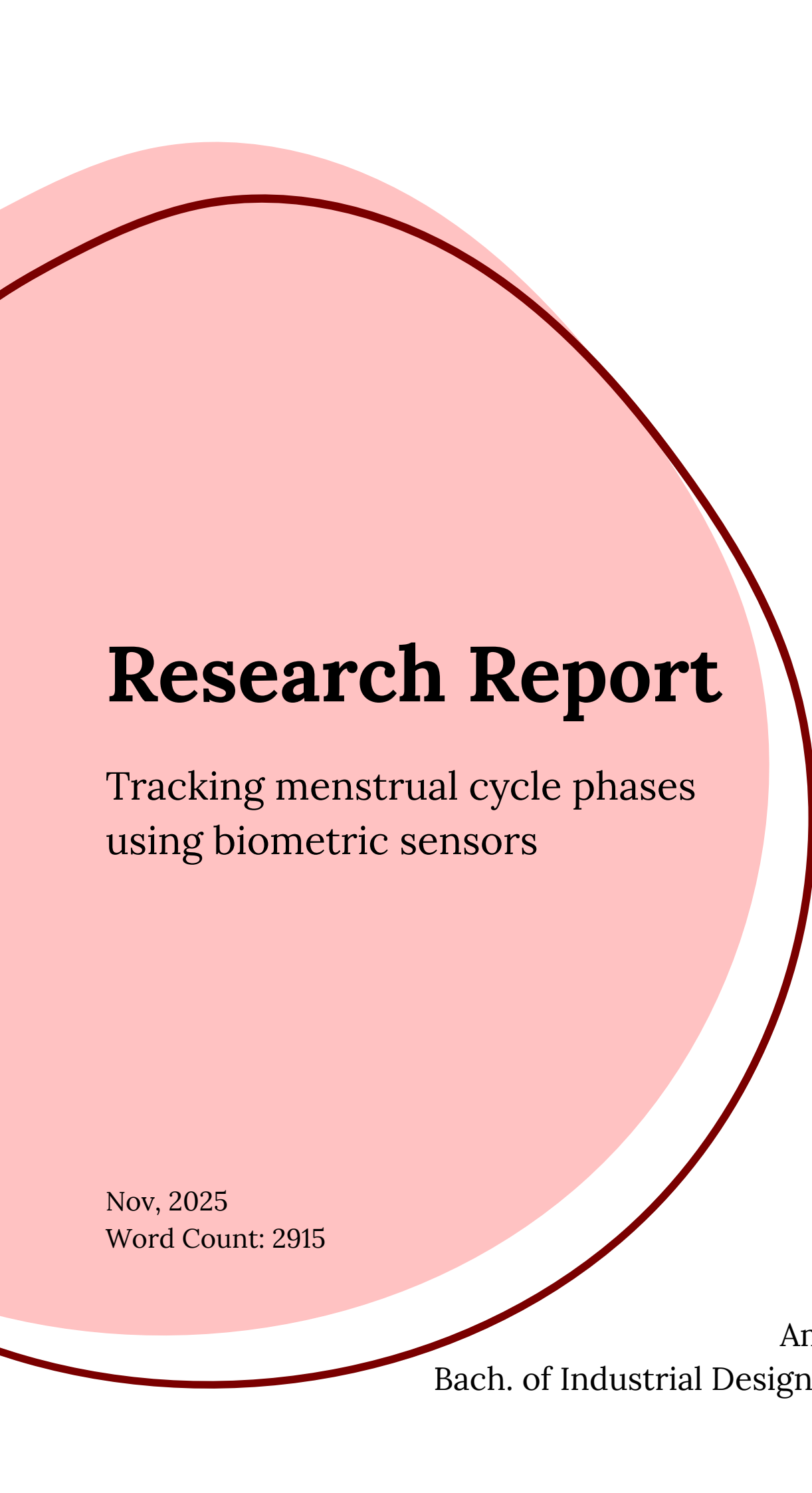




Research Report

Tracking menstrual cycle phases
using biometric sensors

Nov, 2025

Word Count: 2915

Amelia Lush
Bach. of Industrial Design Graduate

Authenticity Statement

This is to certify that to the best of my knowledge, the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

Amelia Lush

n10966072

07/09/25

AI Use Statement

I have utilised Generative AI (ChatGPT, Copilot) in this report to assist in various ways. The way I have used AI includes to assist in reducing word count, to assist in transcribing the audio recordings to remove any filler words (such as 'mhm'), to edit survey and interview questions, to edit the introduction and conclusion for conciseness and clarity. I have edited each answer accordingly before using in this report.

Amelia Lush

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07/09/25

Acknowledgment: Using Inclusive Language

The author of this report acknowledges that not all people who menstruate are women, and not all women menstruate. This report has attempted to use gender-neutral terms where possible, to help include transgender men, non-binary individuals, and other gender minorities in the conversation about menstruation.

“There exists a wide variety of people who experience menstruation, with diverse political qualities, and gender identities, who can be in any phase of the life cycle, including adolescence, adulthood, and peri-menopausal and menopausal. Thus, it is essential to co-develop menstrual health programming, research, and policies based on diverse needs.” (Babbar et al., 2023)

Terminology:

‘People who menstruate’: This term refers to women, adolescent girls, transgender men, non-binary, intersex individuals, and third genders, who menstruate.

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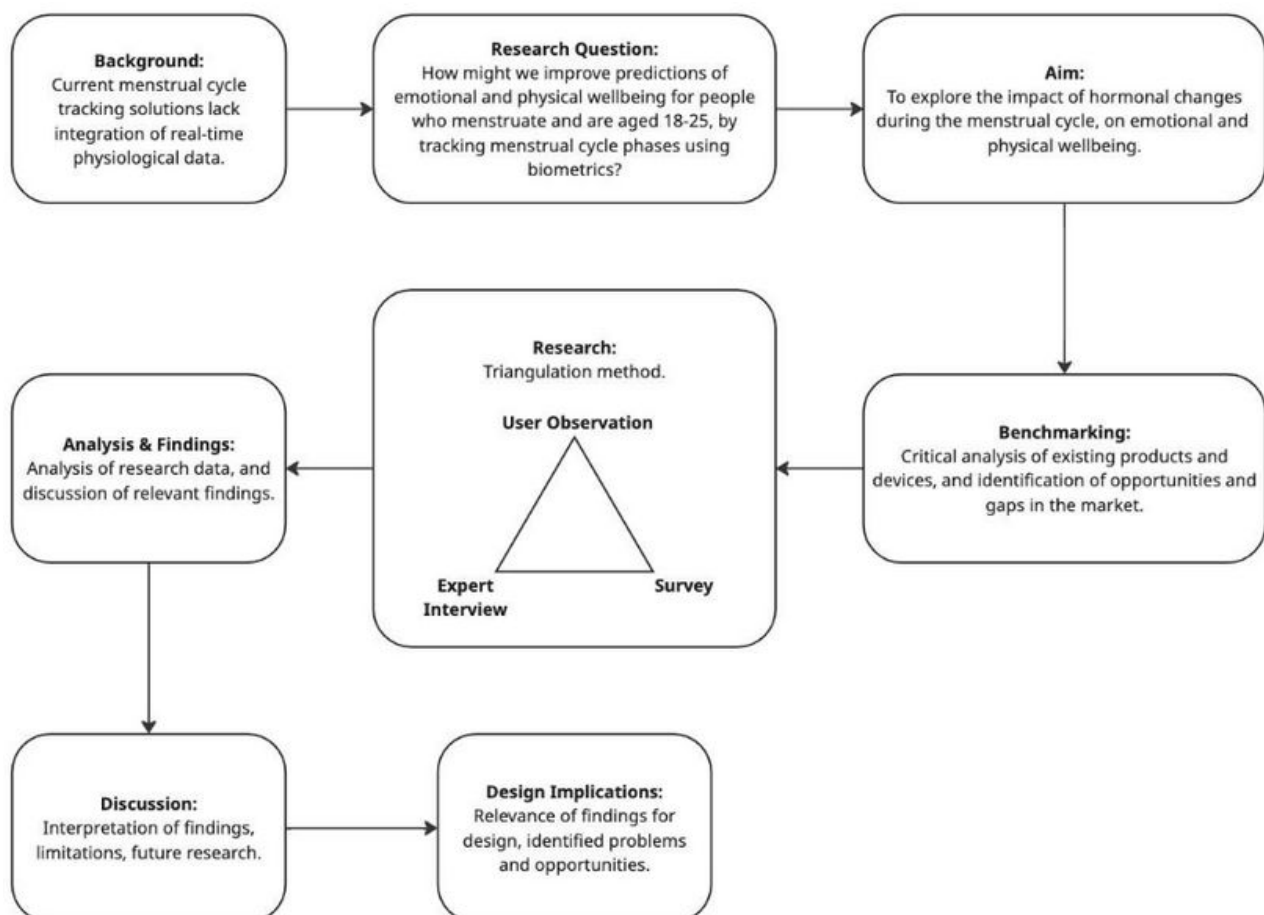
Executive Summary

This report aims to investigate the relationship between hormonal changes and emotional/ physical wellbeing. Implications of this research include improved predictions and accuracy of menstrual cycle tracking, as well as personalised design. Evidence shows the significant need for more research in this area, with “over 50% of all menstrual health literature published after 2015” (Plesons et al., 2023). Furthermore, this report aims to highlight the lack of health monitoring technologies for personal use in a context at home, by benchmarking and analysing existing products. A triangulation of research was conducted through interviews, observations and surveys, as well as secondary research and benchmarking existing products.

Project Structure

Figure 1.

[Project Structure Process]



1.0 Introduction

Many people who menstruate experience significant monthly changes in their emotional and physical wellbeing, which can impact their ability to manage everyday tasks. Emotional wellbeing refers to mood, stress levels and mental acuity, while physical wellbeing refers to sleep, energy levels and physiological symptom management. In recent years, a growing need for personalised health solutions has emerged, and wearable devices, such as smartwatches and rings, now offer advanced tracking capabilities with biometric sensors that track heart rate, skin temperature, physical activity, and sleep patterns. However, many wearables and health tracking apps fail to integrate real-time data into menstrual cycle tracking and women's health monitoring. Despite widespread adoption of these emerging technologies, current solutions often rely heavily on static, calendar-based predictions, resulting in limited ability to support users in anticipating and managing hormonal fluctuations in everyday life.

1.1 Aim

The aim of this project is to explore how hormonal changes that occur during the menstrual cycle, impact emotional and physical wellbeing. This will be conducted by analysing how biometrics and user self-assessment data, within the context of home and personal life. Data will be collected by manual user input and passive data collection via app or wearable technology. The participants include end users who are people who menstruate aged between 18 and 25, residing in Brisbane, QLD. This research seeks to improve predictive models and enhance user autonomy by providing insights into areas of opportunity in menstrual health.

Objectives

To explore how biometric data can be used to identify menstrual cycle phases.

To investigate the relationship between hormonal changes, and emotional/physical wellbeing.

To support in planning activities based on predicted energy levels and emotional states, thus optimising productivity.

Outcomes

Enhanced ability to anticipate and mitigate physical symptoms.

Improved emotional regulation and energy management.

Greater autonomy in managing personal and professional responsibilities.

1.2 Target User

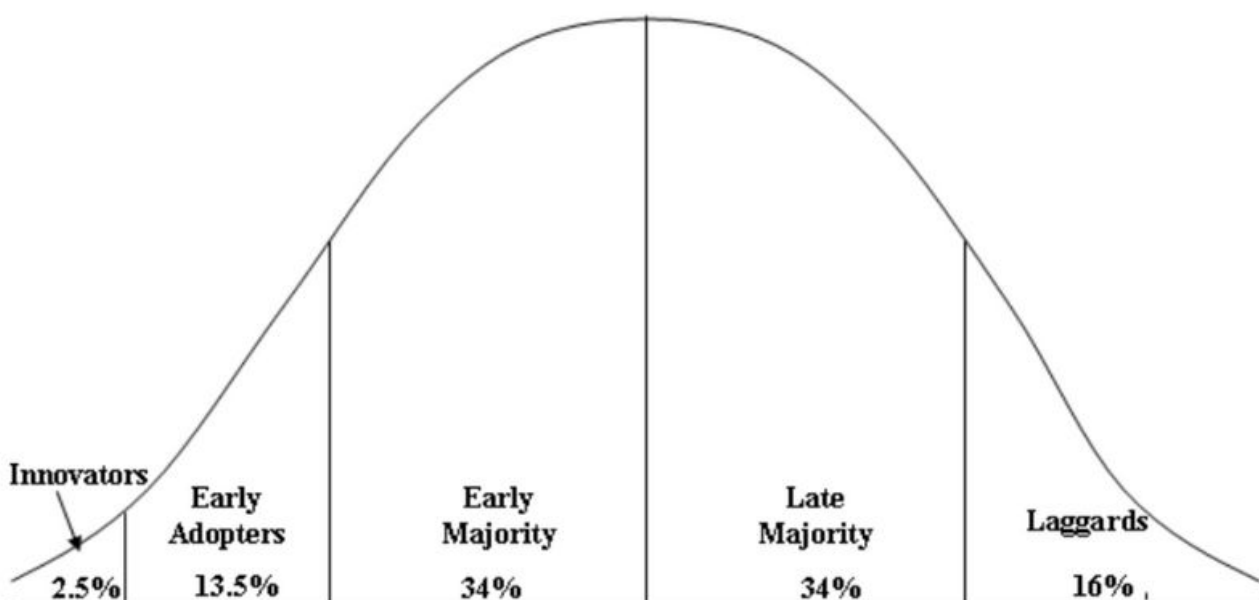
People who menstruate aged 18-25 years old were identified to be significantly impacted by the identified gap in research, as they are in the significant transition from adolescence to adulthood. These users are aware of the impact their menstrual cycle can have on their emotional and physical wellbeing; however, many are uninformed about the long-term effects of hormonal changes and how to successfully prepare for future life stages (i.e. having or postponing children, perimenopause and menopause). Young people who menstruate face unique challenges in managing a demanding lifestyle, balancing work, study and socialisation.

1.2.1 'Early Adopters' Group

This age group can be classed as 'early adopters' of technology based on the Innovation adoption model by Rogers (2003). 'Early adopters' play a central role in the innovation process, as they are regarded as leaders in the social system, whose attitudes towards the innovation are highly important. This can be translated into the design consideration of testing prototypes with end users. Their lived experience is necessary in order to create a design that meets their needs and preferences.

Figure 2.

Innovation adoption model



Note. From "Adopter Categorization on the Basis of Innovativeness" by E. M. Rogers, 2003, Diffusion of Innovations, fifth edition.

1.2.2 Target User

Attribute	Description
Age	18–25
Location	Brisbane, QLD
Lifestyle	Students or early-career professionals.
Needs	Emotional stability, energy prediction, wellbeing planning.
Technology Use	Regular use of cycle tracking apps (e.g., 'Clue', 'Flo', 'Natural Cycles') and wearable technologies.
Innovation Adoption Role	'Early Adopters' (13.5%) (Refer to Figure 2) • More likely to hold leadership roles in the social system. • Role models – influence others by providing advice or information about the innovation through interpersonal networks. • 'Stamp of approval' on a new idea by adopting it. • Decrease uncertainty in the diffusion process. Rogers (2003)

1.3 Background

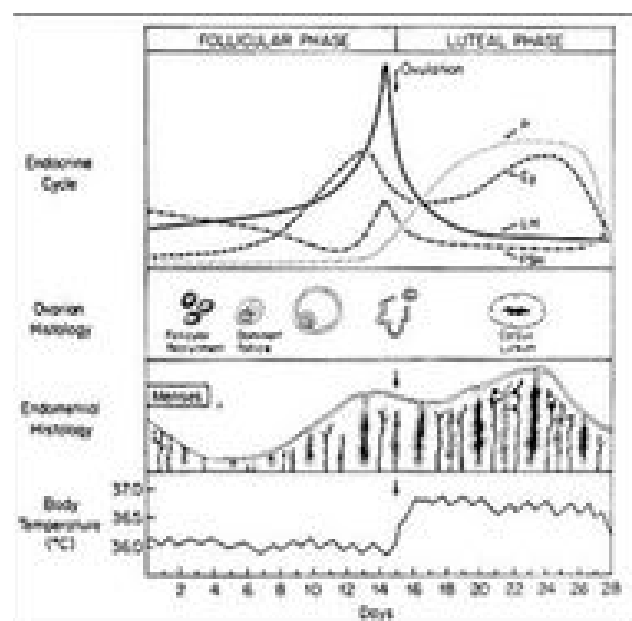
The menstrual cycle involves three phases, the follicular phase, ovulation and the luteal phase, each characterised by changes in hormone levels. “The median duration of a menstrual cycle is 28 days with most cycle lengths between 25 to 30 days” (Reed et al., 2000). This study’s reference to the ‘typical’ length of the menstrual cycle, as with many other studies, does not take into account the use of contraception, disorders related to hormonal differences, or irregular cycles due to contextual factors like stress. Historical lack of consideration of these factors directly leads to gaps in current predictive models and monitoring systems of menstrual cycle tracking. Design can help to reduce these gaps, and improve the end user’s overall satisfaction and enjoyment of products. Furthermore, many studies show a clear link between mental being and physical state, pushing the need for more research and innovation in menstrual health.

However, barriers exist that limit women’s ability to live a full and healthy life, due to systemic inequality (Almeida et al., 2020). Even though over half of the global population are women, in cultures across the world, they continue to be subject to systemic disadvantage, and are greatly impacted by this, “particularly in terms of access to health and education” (Almeida et al., 2020). The design of technology is a clear example of a long history of being centred around males and male activities. Therefore, innovations that design for the needs of women are critical to improving women’s overall quality of life.

1.3.1 Physical and Emotional Changes during the Menstrual Cycle

75% of people who menstruate experience changes in their emotions and body during the premenstrual week (refer to the luteal phase in figure 3.), including symptoms like appetite changes, fatigue, mood swings and depression (Doornweerd & Gerritsen, 2025). These changes occur in response to natural fluctuations in hormones.

Figure 3.
Menstrual Cycle Diagram with Annotated Hormones



Note. From *The Normal Menstrual Cycle and the Control of Ovulation* by B. Reed, B. Carr, 2000.

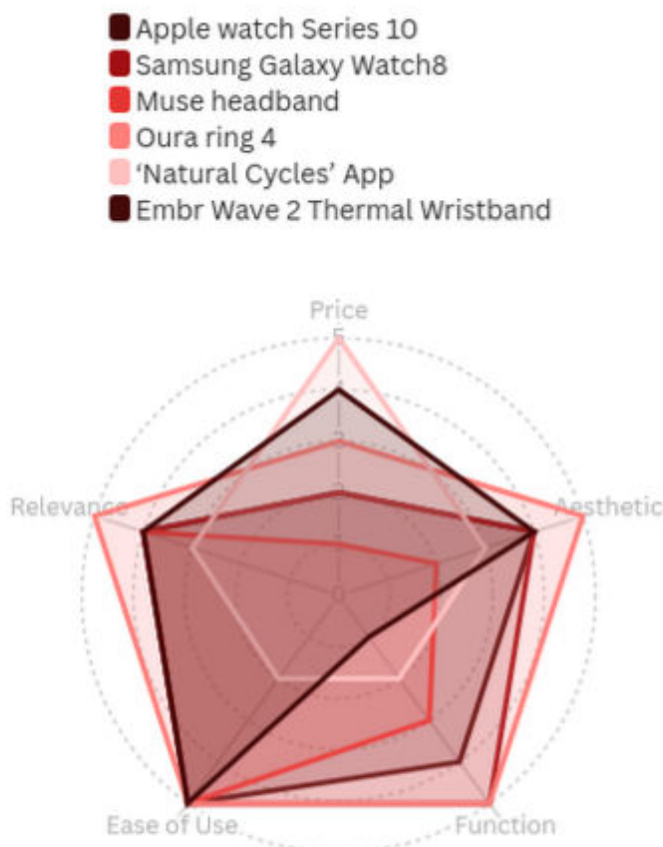
1.4 Product Benchmarking

Wearable devices take form in many shapes as rings, earrings, forehead bands and different clothing. Each product, capable of collecting physiological data from sensors and sending to an interface (to view on a digital screen). Products that monitor health and wellbeing have continued to grow for more than a decade, with new wearable devices used for multiple purposes such as the extraction of health related characteristics, or the classification of emotions and moods (Asiain et al., 2022). Wearable technology can apply collection of physiological signals for “disease diagnosis, remote healthcare, human-machine interaction (e.g., to increase the autonomy of people with disabilities), rehabilitation processes, stress detection, monitoring of daily activity and emotion detection” (Asiain et al., 2022). This is corroborated by Alhejaili, (2023), who found that by analysing indicators of stress, like heart rate, pupil dilation, skin temperature and electrodermal activity, anxiety could be reduced and self-control enhanced. Alhejaili’s study provides evidence that wearable technology can assist in health and emotional wellbeing solutions.

Product benchmarking revealed the trend of health and activity monitoring, with newer models using emerging technologies, such as AI models to provide health insights and track biological trends.

Figure 4.

[Comparison of benchmarked products that assist in health monitoring]



Therefore, the products selected for benchmarking in the following section were selected upon a criteria.

The criteria of products benchmarked include:

- **Price:** Affordability of the product for target user, and if features create value.
- **Aesthetic:** How effective use of colour, material, finish (CMF) is, and if it fits the context of use in menstrual health.
- **Functionality:** How well functions meet user needs and expectations.
- **Ease of Use:** How intuitive the design is, and level of complexity from the user's perspective.
- **Relevance:** How relevant the features are for the user and their future.

1.4.1 Product Benchmarking

Apple watch Series 10

\$699AUD

Primary Feature:
Health Monitoring



Samsung Galaxy watch 8

\$649AUD

Primary Feature:
Health Monitoring



Muse S Athena headband

\$728AUD

Primary Feature:
Sleep Tracking



Oura ring 4

\$569AUD

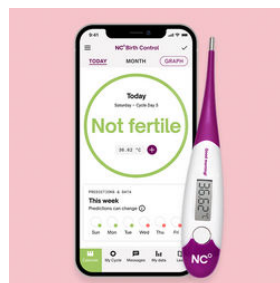
Primary Feature:
Health Monitoring



'Natural Cycles' App

\$14.99AUD/month

Primary Feature:
Fertility status



Embr Wave 2 Thermal Wristband

\$463AUD

Primary Feature:
Regulates temperature



2.0 Research

The type of research conducted was the triangular method of interviews, observations and surveys. Participants were recruited through social media platforms (Facebook and Instagram) and by word-of-mouth. Ethics was explored before commencing any primary research, and participant consent forms were created. Before any research was conducted, it was ensured that consent was gained from each participant. User observations and interviews were transcribed using Microsoft word.

2.1 Methodology

The 'Discover' phase consisted of conversations with people with lived experience and explored potential areas of interest. The 'Define' phase included the primary research conducted, consisting of:

- 1x 10 min survey.
- 3x 15 min user observations.
- 1x 1.5 hr expert interview.

Finally, the 'Develop' and 'Deliver' phases include the future phase after this report. Refining the design through prototyping, user testing and iterating.

Timeline of Research based on Double Diamond Framework from Kochanowska et al. (2022)

NOW: DISCOVER

Broad research using empathy and openness to explore user needs and motivations. Full immersion into context of research.

NOW: DEFINE

Define research question, aims and objectives. Gaining insight through primary research, connecting ideas and themes, looking for patterns.

FUTURE: DEVELOP

Inventing and experimentation through prototyping, iterating and testing. Highly creative stage. Create potential solutions.

FUTURE: DELIVER

Refining the solution by further testing and iterating.

DISCOVER METHOD

Collecting inspiration, mind maps, desktop research, creating bibliography, reading current studies, product analysis. Using divergent thinking to explore area of interest and gain knowledge.

DEFINE METHOD

Tools used to organise data included: Microsoft Excel, 'Notion' workspace, OneDrive. Survey was created on Qualtrics. Interview was transcribed using Microsoft word and Copilot AI.

DEVELOP METHOD

Utilise previous research and inspiration to design as many solutions as possible that meet user needs. Prototyping, sketching, testing. Returning to 'Discover' and 'Define' phases to explore and diverge.

DELIVER METHOD

Testing with end users. Developing high fidelity prototype, resulting in a physical product.

2.2 Method

Method	Purpose
1. Planning Ethics, consent forms, recruitment.	Prepare for research and data collection.
2. Recruitment Social media, word of mouth	Find women aged 18-25 to complete my survey (10-12 participants), and experts in women's healthcare.
3. Survey 20 questions for people who menstruate	Gain insight into end user's lived experiences. Questions are framed based on exploring the research question and objectives.
4. Interviews Semi-structured (60-90 mins)	Explore lived experiences. Gain expert knowledge and recommendations. Support findings in background research. Justify research question and objectives.
5. Observations Think aloud (10-15 min)	Regular use of cycle tracking apps (e.g., 'Clue', 'Flo', 'Natural Cycles') and wearable technologies.
6. Analysis Thematic coding	Identify trends, patterns and insights in the data using codes and sub-codes.
7. Reporting Research report	State research findings, background, methodology and design implications.

2.3 Stages of Primary Research

Stage One: Survey

The first set of data was collected using an online survey created and administered via Qualtrics (Brisbane, QLD). A mix of quantitative and qualitative questions were included in the survey, that aimed to gain a better understanding of user needs and to identify value and meaning in existing knowledge.

Stage Two: Interview

The aim of interviewing an expert was to explore how physiological symptoms affect the way people feel during their menstrual cycle, and how it impacts their life. As well as gaining expert knowledge and professional opinion, questions explored how users managed their physical and emotional symptoms. For the expert interview, one camera was used to record body language and facial expressions, and one device for voice recording.

Stage Three: Observations

Conducting observations were critical in gaining the user's perspective and identifying opportunities and limitations. Participant observations were conducted using the 'think aloud' method, in a studio space at QUT. The aim of this method was to observe how end user's track their menstrual cycle using an app or wearable device. Variables to observe included features used, frequency of use, duration of use, personal preferences, awareness of emotional and physical changes across their menstrual cycle, and if they felt supported in understanding their health and anticipating change. Two cameras were used to record, with one camera to capture body language, facial expressions and gestures, and another to capture user's hand positioning and their interaction with the interface.

2.4 Analysis and Findings

Data collected was analysed by reading through and coding into main themes and sub-themes using Microsoft excel spreadsheets and by writing notes on physical sticky notes and paper, then grouping by theme. This can be broken into six steps (Braun & Clarke, 2014).

Qualitative Data Coding Process



2.4.1 Analysis and Findings

Stage One: Survey

The first set of data was collected using a survey created via Qualtrics (Brisbane, QLD). A mix of quantitative and qualitative questions were included, that aimed to better understand user needs, to identify value in existing knowledge, and to explore behaviours related to menstrual cycle tracking. This survey collected nineteen responses from people who are aged between 18–25, live in Brisbane, QLD.

Figure 5.

[Top physical symptoms experienced]

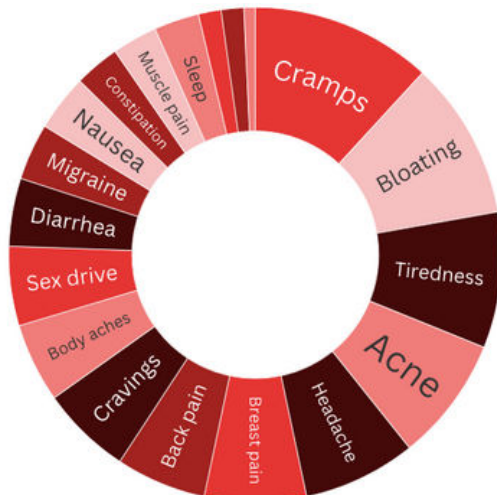


Figure 6.

[Top emotional symptoms experienced]



Cramps (89%), bloating (78%) and tiredness (67%) were the top three physical symptoms experienced by survey participants during the menstrual cycle. The top emotional symptoms were mood swings (89%), irritability (72%) and changes in energy levels (72%). Survey participants reported managing emotional changes through mindfulness activities (61%), talking to someone trusted (56%) and physical exercise (50%). Top motivations for menstrual cycle tracking included predicting period date (83%), understanding their body better (67%), and tracking physical symptoms (50%).

Figure 7.

[Frequency of feature use in menstrual cycle tracking apps]

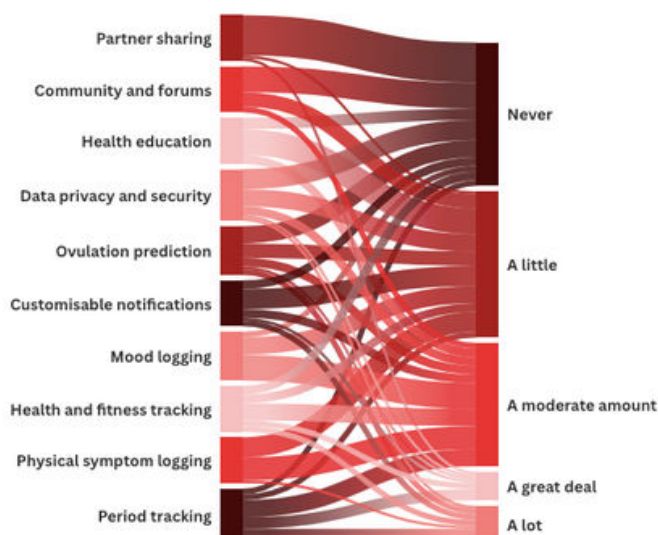
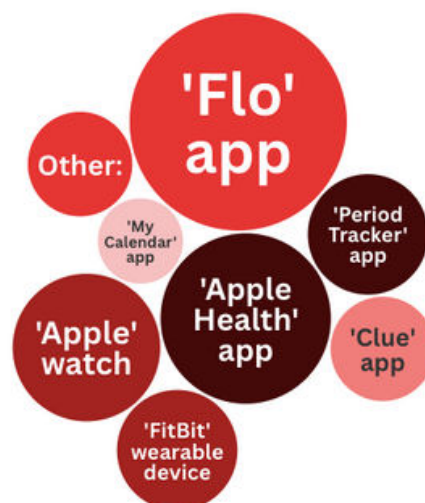


Figure 8.

[Most commonly used technologies for menstrual cycle tracking]



2.4.2 Analysis and Findings

Stage Two: Interview

The concept that ‘physical symptoms affect emotional wellbeing’ was identified as part of the interview with a nurse (participant: Expert 01). Sleep was evidenced as a contributing factor to emotional wellbeing in both the survey and interview. The interview revealed that sleep disturbances negatively impact wellbeing, being “quite difficult... physically”. Expert 01 discussed their lived experience of shift work and how it significantly disrupted their sleep routine, being “mentally draining as well as physically... if you are not feeling physically well, you’re going to feel pretty bad emotionally”. This links to the discussion of how workplaces can be limiting and debilitating for women. Workplace structure creates a barrier in trusting one’s own intuition and mind-body connection, due to frequently ignoring own needs. The interview also explored how emotional state is critical in the decision making process as it impacts focus, concentration and energy.

Figure 9.

[Interview with nurse]

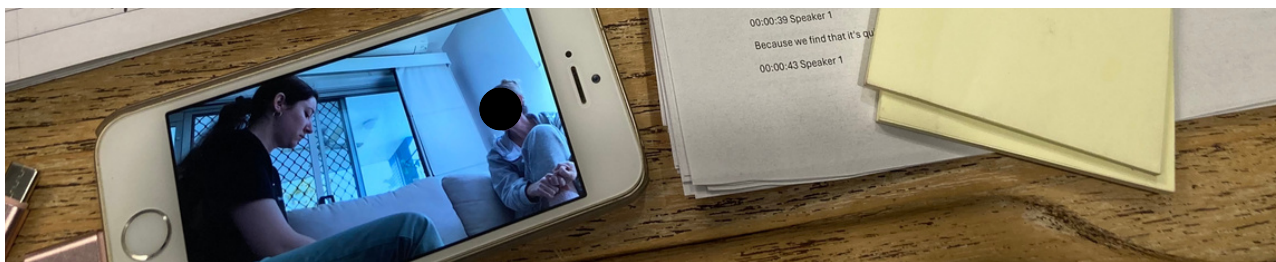
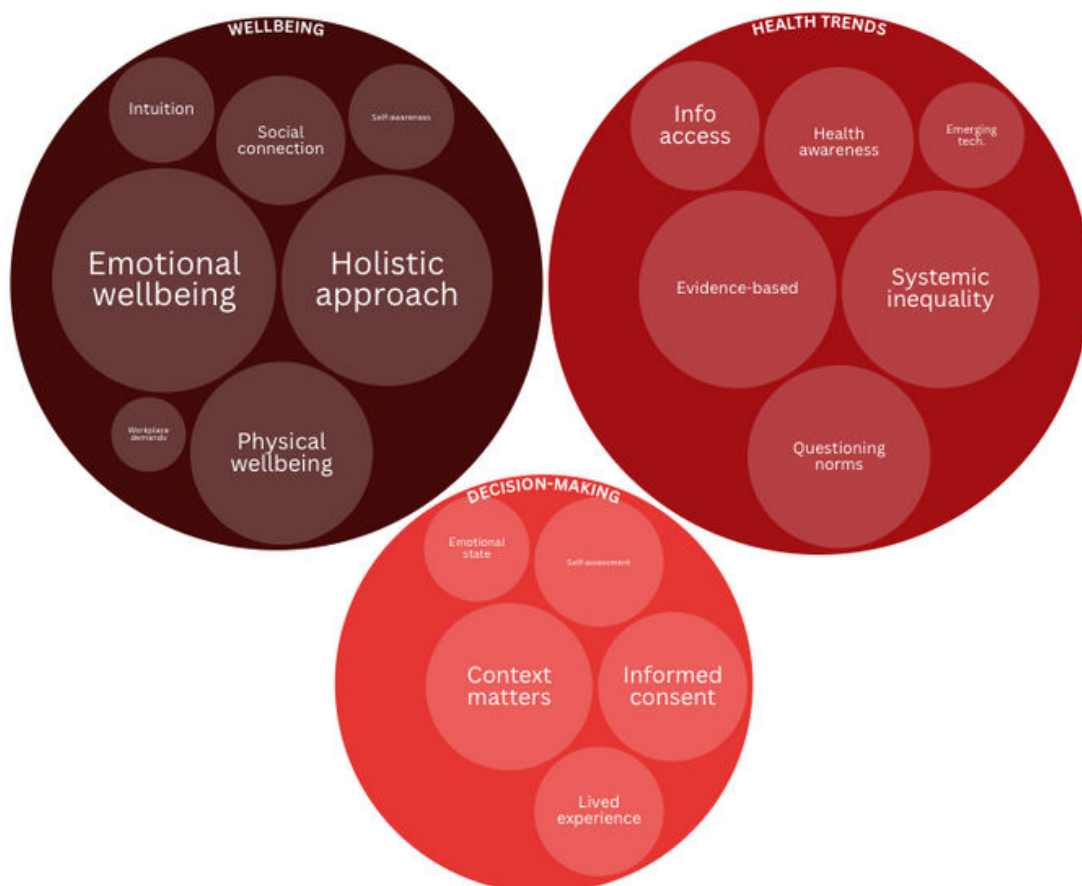


Figure 10.

[Themes and sub-codes recount represented by size of circles]



2.4.3 Analysis and Findings

Stage Three: Observations

Conducting observations were critical in gaining the user's perspective and identifying opportunities and limitations. Participant observations were conducted using the 'think aloud' method, in a studio space at QUT. The main researcher was actively involved by asking semi-structured questions and observing the user during a typical interaction with the product, to gain a deeper, more authentic understanding. The aim of this method was to observe how end user's track their menstrual cycle using an app or wearable device. Variables to observe included features used, frequency of use, duration of use, personal preferences, awareness of emotional and physical changes across their menstrual cycle, and if they felt supported in understanding their health and anticipating change. For user observations, two cameras were used to record, with one camera to capture body language, facial expressions and gestures, and another to capture user's hand positioning and their interaction with the interface.

Images of User Observations

Figure 11.

[Observation 1: Wearable device only]



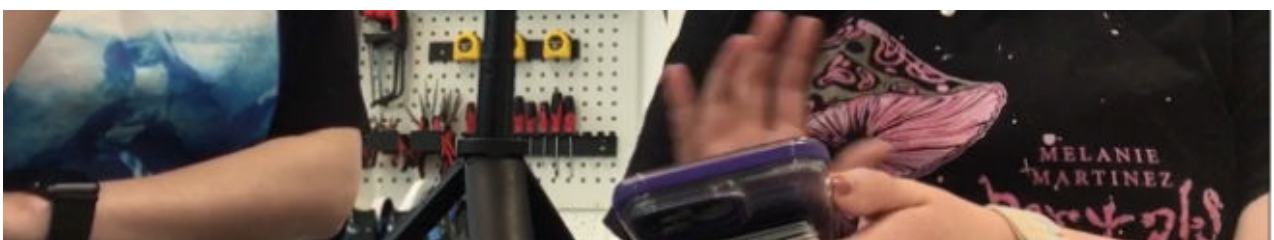
Figure 12.

[Observation 2: Wearable device and mobile phone app]



Figure 13.

[Observation 3: Mobile phone app only]



3.0 Discussion

Within the context of home use, this section discusses the findings of the research conducted. Areas of opportunity were identified based on the data collected during the triangulation of research (survey, interview and observations). Data can be translated into the following themes.

Theme One: Wellbeing

Sub-codes: physical wellbeing, emotional wellbeing, social connection, shared experience, community, intuition, workplace demands, varied experiences, holistic approach, self-awareness.

Throughout the research, the link between physical and mental was clearly evident. The survey explored common symptoms experienced during the menstrual cycle and how these are managed, with mood swings, fatigue and sleep disturbances frequently reported. Wellbeing can be seen as a connection between body and mind, rather than as separate, with unique experiences in health due to differences in physiology. Observations evidenced this, by indicating an awareness of the cyclical nature of wellbeing, through tracking emotional states as well as physical. Personalised information can empower users to better understand and manage their health, as shown in the trend of educational tools incorporated into health apps and devices. It was also evidenced that participants manage challenges through relating to other people through shared experiences and storytelling. The sub-code of social connection was seen across the research, with the importance of community to support wellbeing.

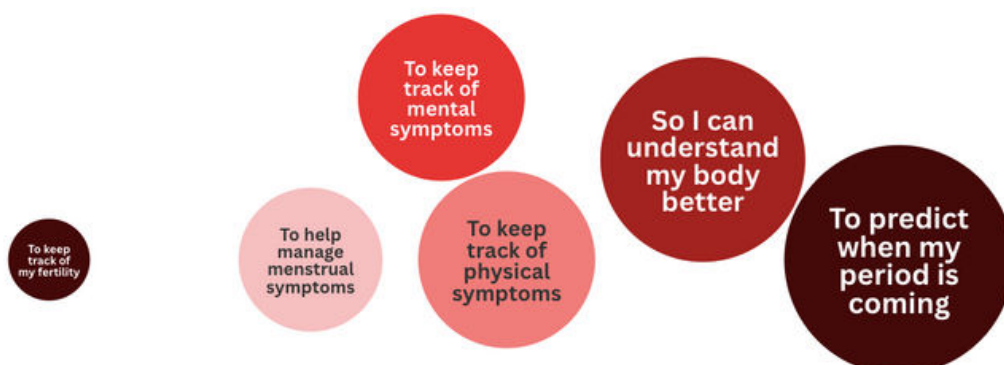
Figure 14.

[Participant demand for insights that improve planning based on menstrual cycle]



Figure 15.

[Motivations for tracking menstrual cycle]



3.0 Discussion



Theme Two: Decision-making

Sub-codes: *emotional state, context matters, lived experience, self-assessment, informed consent.*

‘Decision making’ was a theme that emerged late in the analysis of qualitative data, revealing that emotions significantly impact decision making. Affected by focus, concentration and energy levels, context is critical in effective decision-making. Almost all respondents led busy lives with multiple daily activities (refer to figure 16), and reacted to immediate demands rather than long-term planning. Observations revealed the insight that stress can be seasonal, with higher stress at different times of year when daily energy demands increase. The theme that lived experience justifies user preferences is shown throughout the research, with a need for tools that reflect daily routines and constraints. Expert 01 supported this, by stating that “people are time-poor”, so users prefer intuitive, low-effort solutions that adapt to user’s context.

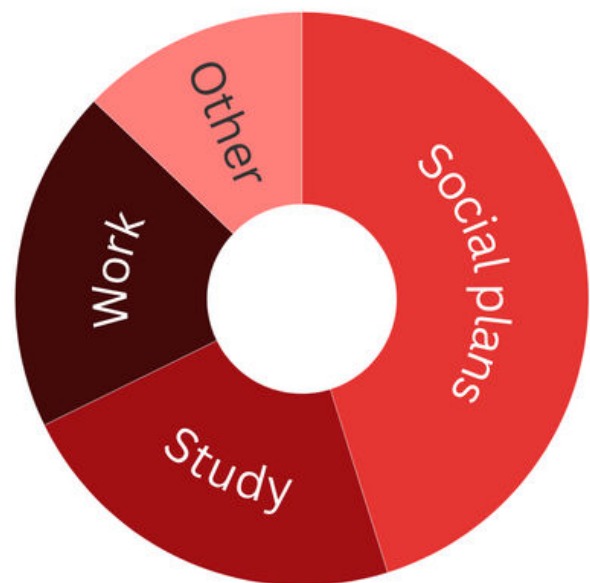
Figure 16.

[Survey participant’s daily activities]



Figure 17.

[Activities impacted by menstrual cycle symptoms]



3.0 Discussion



Theme Three: Health Trends

Sub-codes: *health awareness, information access, emerging technology, evidence-based practice, questioning norms, systemic inequality.*

The main theme ‘health trends’ emerged during secondary research into innovations in menstrual cycle tracking and health management tools, and later appeared in the survey and interview. A shift towards person-centred and evidence-based practice was shown, through new research and emerging technologies. Younger people who menstruate demonstrate a high health awareness, due to increased access to information via the internet. This has led to changed perspectives and greater expectations of digital tools to support informed consent, personalisation and holistic health tracking. The interview described how clinical practice has changed, questioning norms and ensuring all care is evidence-based. This is a direct reflection of broad changes in society, regarding an increasing demand of transparency and inclusivity in healthcare.

***“You wouldn’t question years ago when I started...
There’s been a huge change in health over that period
of time”. (Expert 01, interview)***

Despite significant progress, systemic inequality continues to disadvantage and sideline people who menstruate. Braun (2001) critiques the term “femtech” for reinforcing the stigmatisation of the female anatomy, and that women’s health is directly influenced by the socio-cultural representations of genitals and gender identity. While, Almeida et al. (2020) emphasises that systemic inequality significantly impacts women’s ability to live a full and healthy life, resulting in disadvantaged access to health and education.

3.1 Design Implications

The main themes identified in the analysis of research data can be translated into the following design implications. Each implication was analysed through the perspective of the user's future, including major life markers and transitions in a woman's life.

Improving Quality of Life by Focussing on Wellbeing

Emerged from Theme One: Wellbeing

Integrating biometric sensors into health products is an identified opportunity area. Utilising emerging technologies can be seen as beneficial in improving quality of life, through applications like predictive models using AI technologies, or using Blockchain technologies to protect data and confidentiality. Evidence of varied experiences of the menstrual cycle due to different physiologies, creates the opportunity of using social connection to relate to other people through storytelling and shared lived experiences. This provides users with real, relatable context when experiencing physical and mental symptoms and changes during the menstrual cycle.

Enhanced Decision-Making through a Holistic Approach to Health

Emerged from Theme Two: Decision-making

The research revealed that emotional state significantly affects decision-making. Self-assessment of health through a holistic perspective was evidenced as beneficial, with data showing that users make decisions based on immediate reactions. Engagement with health tools was evidenced as fluctuating stress and energy levels influenced level and duration of interaction. Young people want simple, quick solutions. This creates the opportunity to focus on design elements that are intuitive and enhance longevity through emotionally durable design. Creating a product that provides context-aware insights that meet user needs now and, in the future, ensures a long product life, enhancing sustainability.

Health Promotion as a Trend

Emerged from Theme Three: Health Trends

Regardless of advancement in women's health, their wellbeing cannot be improved unless we address the limitations that women experience across the world. This report's findings reinforce the need for inclusive, accessible designs that challenge stereotypes across social and cultural contexts. Users seek holistic tools that consider their situation and provide insights into emotional and physical wellbeing, promoting empowerment. Creating designs that reflect the diversity of individual experiences, including different life stages and identity, will benefit users through a more personalised experience. The opportunity arises of integrating emerging technologies, like Artificial Intelligence (AI), into designs, through improving predictive models and providing relevant insights based on the user's context.

3.2 Conclusion

The relationship between hormonal changes in the menstrual cycle and emotional/physical wellbeing was explored in this report. Through a triangulation of research (survey, interview and observation), the connection between wellbeing, decision-making and health trends emerged. This was translated into the need for personalised designs that consider the user's context, as well as supporting emotional regulation, intuitive interactions and a holistic approach to health tracking. Wearable devices and menstrual cycle tracking apps must reflect user's lived experiences, promote health through educational tools and personalised insights, as well as challenge the systemic inequality that disadvantages women. Through design, we can enhance inclusivity and empower users to better understand and manage menstrual health.

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Appendix

Figure 1.

[Project Structure Process]

Created by Amelia Lush using Miro. <https://miro.com>

Figure 2.

Innovation adoption model

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Figure 3.

Menstrual Cycle Diagram with Annotated Hormones

Reed, B. G., & Carr, B. R. (2000). *The Normal Menstrual Cycle and the Control of Ovulation*.

Figure 4.

[Comparison of benchmarked products that assist in health monitoring]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Figure 5.

[Top physical symptoms experienced]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Figure 6.

[Top emotional symptoms experienced]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Figure 7.

[Frequency of feature use in menstrual cycle tracking apps]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Figure 8.

[Most commonly used technologies for menstrual cycle tracking]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Appendix

Figure 9.

[Interview with nurse]

Image by Amelia Lush (25/08/25).

Figure 10.

[Themes and sub-codes recount represented by size of circles]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Figure 11.

[Observation 1: Wearable device only]

Image by Amelia Lush (22/08/25).

Figure 12.

[Observation 2: Wearable device and mobile phone app]

Image by Amelia Lush (22/08/25).

Figure 13.

[Observation 3: Mobile phone app only]

Image by Amelia Lush (22/08/25).

Figure 14.

[Participant demand for insights that improve planning based on menstrual cycle]

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Figure 15.

[Motivations for tracking menstrual cycle]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Figure 16.

[Survey participant's daily activities]

Created by Amelia Lush using 'Flourish'. <https://flourish.studio/>

Figure 17.

[Impact of menstrual cycle symptoms on daily activities]

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