

MomSafe: Your Maternal Health Companion

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1 ABSTRACT

Maternal health remains a critical challenge worldwide, with disparities in access to quality care impacting millions of women. "MomSafe" addresses these gaps by providing an AI-powered maternal health companion designed to deliver personalized, real-time pregnancy insights and proactive care recommendations. Leveraging large language models (LLMs) and machine learning, the platform synthesizes user inputs and clinical data to identify potential risks, promote informed decision-making, and enhance overall well-being. Grounded in extensive user research, MomSafe offers features tailored to user needs, including daily health check-ins, trend analysis, and secure data options. This paper outlines the development process, user-centered design methodology, and the app's role in improving pregnancy care through affordable, accessible, and evidence-based solutions. By fostering inclusivity and trust, MomSafe empowers women across diverse contexts to navigate their pregnancy journey with confidence and clarity.

2 INTRODUCTION

Pregnancy is a transformative period characterized by significant physiological, psychological, and neurological changes. For women around the world, accessing personalized and instant pregnancy care remains a significant challenge. According to survey research conducted in China [5], only 4.34% of 590,912 pregnant women had access to personalized prenatal education resources. Quality maternity care is often seen as a luxury rather than a universal right, with access varying greatly depending on socioeconomic status and geographic location [2]. These disparities highlight a global issue that remains largely unmet, as emphasized by the World Health Organization and in the UN Sustainable Development Goals, specifically under the good health and well-being target [9].

The challenges in accessing pregnancy care stem from two main issues: limited availability of services and the lack of tailored support. Over 35% of counties in the U.S. are classified as maternity care deserts, leaving more than 2.3

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53 million women of reproductive age without access to adequate maternity healthcare facilities [5]. Furthermore, 49% of
54 US counties lack a single OB / GYN, impacting more than 10 million women, with rural areas particularly affected,
55 as only 7% of OB / GYN practice in these regions [10]. In addition to limited availability, the lack of tailored support
56 makes navigating pregnancy more difficult. Existing solutions, such as forums like The Bump or high-risk pregnancy
57 call centers provide generalized information that often fails to address individual needs in a structured manner. Our
58 conversations with mothers revealed that the volume of unstructured information often overwhelms them as they
59 navigate a vast amount of advice that may not pertain to their situations.
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61 Our app bridges this gap by leveraging large language models (LLMs) to analyze individual inputs, predict pregnancy
62 patterns, and provide tailored recommendations, proactive care alerts, and early warnings. By delivering personalized,
63 data-driven insights, our platform empowers women to make informed decisions, improving their pregnancy experience
64 and addressing disparities in maternity care access.
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67 **3 HEALTH INSIGHTS POWERED BY MACHINE LEARNING**

68 Recent work has demonstrated that machine learning (ML) and specifically a subsection called Large Language Models
69 (LLMs), when integrated with clinical data repositories, has the potential to transform early risk identification and
70 improve patient outcomes. This science forms the backbone of our application, enabling real-time analysis of diverse
71 healthcare data to drive predictive insights and inform timely interventions. Retrospective EHR analysis using the HOPE-
72 CAT algorithm revealed an average lead time of 58.8 days (SD 9.7) between the algorithmic detection of cardiovascular
73 risk factors and the first recorded clinical diagnosis or intervention [7]. This early warning is critical for initiating
74 treatments that can reduce complications and morbidity. Beyond early detection, LLMs offer a range of opportunities,
75 including the rapid synthesis of medical terminology, guidelines, and multi-day patient data to improve provider
76 decision making and reduce health disparities [7].
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78 However, in the context of pregnancy, current solutions like wearable devices and smart implants, while offering
79 valuable real-time health tracking, often fall short of meeting the unique needs of pregnant women. Although beneficial
80 for some conditions, these devices are generally not equipped to capture the complex physiological parameters related
81 to pregnancy disorders and complications [8]. More critically, wear-ables are not a realistic option for many women,
82 particularly those in rural and under-served areas, due to the high costs of technology, maintenance, and the need
83 for consistent usage. To address this, there is a pressing need for a solution that provides personalized and actionable
84 insights tailored to each woman's unique pregnancy[5] journey—without relying on expensive or inaccessible physical
85 devices. Using AI-powered platforms that analyze pregnancy patterns and health data in real-time, our solution offers
86 personalized guidance, ensuring a more inclusive, affordable, and accessible experience that enhances the pregnancy
87 journey for all women.
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93 **4 USER RESEARCH AND DESIGN APPROACH**

94 Before conducting interviews, we consulted experts to ensure that our research was aligned with best practices and was
95 conducted respectfully. We selected professionals with expertise in maternal health, AI in healthcare, and user-centered
96 design, consulting one obstetrician, one labor nurse, and a user experience researcher. Their feedback helped us refine
97 our interview protocol to prioritize clarity, inclusivity, and sensitivity.
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99 We then conducted qualitative research with women from diverse geographic and socioeconomic backgrounds
100 who had experienced or were undergoing pregnancy. Our study explored their experiences with current pregnancy
101 tools, unmet needs, and preferences for receiving health insights. Participants were recruited through maternal health
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105 organizations and online communities, with five agreeing to take part. We emphasized their right to withdraw at any
106 time, and interviews were semi-structured to address each participant’s unique circumstances.

107 We analyzed the recordings using affinity diagramming and thematic coding to identify key insights, which informed
108 our design requirements. Starting with a low-fidelity prototype tested by five university students familiar with health
109 tech, we focused on usability and functionality. A high-fidelity prototype was then tested by four mothers, who
110 completed specific tasks and provided feedback on usability and relevance. Insights from these rounds guided iterative
111 refinements to ensure the prototype better met user needs.
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114 5 RESEARCH FINDINGS

115 The following sections describe our findings from expert consultations, interviews with healthcare professionals, and
116 survey responses, as well as how these insights influenced our design.

117 **4.1 Expert Consultations** Experts provided key insights that guided the design and ethical foundation of our
118 platform. The obstetrician emphasized the importance of compliance with HIPAA regulations, particularly noting that
119 connecting healthcare providers to patient data must always be an explicit choice by the user. This guidance shaped
120 our designs by incorporating clear opt-in mechanisms for sharing data, ensuring transparency and user control. The
121 labor nurse highlighted the use of pain-rating scales in clinical settings, which informed our decision to integrate a
122 similar feature into the app. This alignment between in-person and digital experiences aims to provide a consistent and
123 familiar approach for expectant mothers.
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126 The user experience researcher reinforced the importance of adhering to user research ethics, such as Nielsen Norman
127 Group’s *Ethical Maturity in User Research*. As they advised, “Standardized consent procedures are critical for trust
128 and participant safety [6].” In response, we established robust consent protocols, ensuring all participants were fully
129 informed about the purpose, benefits, and risks of the research before participating. These expert recommendations not
130 only enhanced the functionality and ethical framework of our app but also ensured that our platform meets the highest
131 standards of usability and trustworthiness.
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134 4.2 Interviews with Pregnant Women

135 **4.2.1 On Demand, Personalized Care** Pregnant Women expressed a strong need for personalized, proactive guidance
136 that caters to their specific health and emotional needs, especially during moments of vulnerability. One participant
137 shared, “I would love to have an app that offered a chat feature with professionals or therapists to help when I am
138 struggling at 2am feedings with lack of sleep and just need to talk to someone about all my fears (rational and irrational)”
139 (P2). Participants noted the overwhelming amount of conflicting advice available on social media and the internet,
140 which often leaves them feeling more stressed and discouraged. As one participant stated, “There is almost too much
141 information available via social media and the internet that contradicts itself and usually leaves me feeling worse
142 and discouraged and stressed” (P2). This feedback highlighted the need for an app that not only delivers relevant,
143 user-specific content but also provides access to trusted professional support when it’s needed most.
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146 **4.2.2 Flexible Data Options** Our research data highlighted the importance of having control over their data. One
147 participant shared, “I am less likely to use an app if it requires too much personal info” (P4), emphasizing the need for
148 privacy and minimal data entry. Additionally, in some regions, women’s lack of decision-making power can restrict
149 their access to vital resources, making it crucial to offer flexible options for care [2]. Several participants noted that they
150 would prefer a way to ask questions without having their data saved. By offering flexibility, users can feel ensured that
151 their data isn’t being compromised.
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Feature	Description	Rationale
Survey Check-in	The platform encourages pregnant women to log physical (e.g., fatigue, nausea), emotional (e.g., stress, happiness), and cognitive (e.g., memory, focus) experiences. This simple tool helps them track their health and well-being, offering a holistic view of their pregnancy journey.	Pregnant women expressed a strong need for care that fosters awareness of their physical, emotional, and cognitive well-being. The Survey Check-In supports this by helping them monitor their feelings and experiences in real time.
Insights & Trends/ Pattern Recognition/ Predictive Modeling	The platform's AI analyzes user data to identify patterns (e.g., low energy linked to mood shifts) and provides personalized suggestions. Machine learning builds dynamic user profiles, predicting trends and offering proactive tips based on past data and pregnancy patterns.	By predicting and addressing potential challenges, the platform delivers tailored insights to support each user's unique pregnancy journey.
Quick Access to Health Professionals and Practices	The platform connects users with healthcare professionals through a user-friendly interface. When the AI detects concerning patterns, it prompts users to schedule virtual consultations or seek expert guidance.	Research shows pregnant women often feel overwhelmed by conflicting advice and limited support. This feature ensures timely access to trusted care during critical moments.
AI Chatbot	A built-in chat feature enables real-time communication with AI for quick on demand advice	The AI chatbot offers instant, on-demand support, providing guidance whenever users need it. This feature addresses the emotional and practical challenges of pregnancy, delivering reassurance and help during moments of uncertainty and stress—key concerns highlighted in the research.

Fig. 1. Table 1

4.2.3 *Accessing Reliable, Medically-Backed Information* We noticed expressed frustration with the overwhelming and often contradictory information available online, particularly from social media, which can leave them feeling more confused and stressed. One participant shared, “There is almost too much information available via social media and the internet that contradicts itself and usually leaves me feeling worse and discouraged and stressed” (P3). This underscores the need for a platform that offers clear, medically-backed information without the clutter of unreliable sources to empower mothers to find the answers they need with confidence and clarity.

6 DESIGN REQUIREMENTS

Our interviews and research provided valuable insights, allowing us to define detailed design requirements that align with our project’s objectives, as outlined in Table 1. These findings helped us tailor our design to effectively address the specific needs of our users.

7 DESIGN OF MOMSAFE

6.1 Overview MomSafe is a web-based tool designed to provide expectant mothers with personalized guidance and support throughout their pregnancy journey. We chose a web-based approach for its universal accessibility on any internet-enabled device and to eliminate the need for app downloads or updates, ensuring a frictionless experience for users. The platform offers flexibility through two modes of use: a single-session option for those seeking immediate assistance without data retention, and a personalized experience for users who sign in, enabling machine learning to analyze their data and provide tailored insights, both shown in Figure 2. Additionally, the platform connects users to healthcare providers when necessary, ensuring timely and professional support. The design is optimized for both mobile and desktop, ensuring accessibility and functionality across devices.

6.2 Key Product Features

6.2.1 Daily Well-Being Overview Early in our ideation phase, we sketched various layouts and ultimately converged on a design that places daily emotional and physical status cards front and center. We believed that displaying personalized

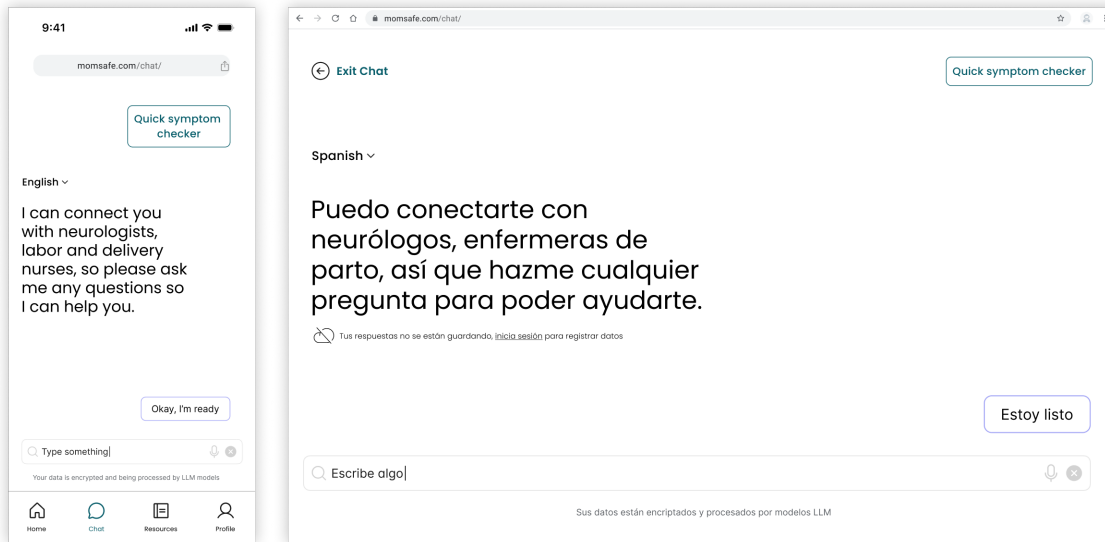


Fig. 2. MomSafe Chat Interface: Positioned at the left is the mobile version of a personalized experience, and at the right is the desktop version of the single-session experience, both allowing users change language and press the question icon to learn about how data is being processed.

insights in simple, jargon-free language would make it easier for users to quickly log how they feel and take immediate action. To further enhance clarity, we utilize distinct icons and concise labels for each check-in (e.g., “How are you feeling today?”, “Track Your Patterns”), to track any significant changes as seen in Figure 3. In addition, resource cards are generated based on user’s unique trends determined by our machine learning model, making them highly personalized. These resource cards include quick links to help users instantly refine their searches and find more specific information. By tapping any card, users can dive deeper—updating their mood or sleep patterns, adjusting dietary habits, or even initiating a chat with a mental health professional.

6.2.2 Appointment & Trends Display On the profile screen, we focus on giving users an at-a-glance view of their upcoming medical appointments and weekly health patterns. Much like labeling different water sources with unique icons, we represent each health metric (e.g., sleep duration, heart rate) in color-coded bar charts to help users quickly discern patterns over time. During our design discussions, we decided to highlight the next health appointment prominently (as shown in Fig. 4) so users can easily see important details—such as the doctor’s name, date, and time—right away. Clicking on these charts or the appointment panel expands a detailed view with notes, enabling users to delve deeper into their data and manage future appointments with greater clarity.

6.2.3 Guided Survey Check-In When designing the survey screen, we drew inspiration from the simple and direct pain-rating scales used by labor nurses, aiming to create a similarly straightforward approach for assessing emotional and physical well-being. Instead of rating pain, our survey prompts users to gauge their current mood, stress levels, and motivation using emoji-based options (e.g., “Happy,” “Neutral,” “Sad,” “Angry”), as illustrated in Figure 5. These easily recognizable emojis provide an intuitive and universal shorthand, enabling users to quickly interpret and select their emotional state. Each section—covering sleep quality, stress, and motivation—adheres to our accessibility-first philosophy, featuring clear labels, simple icons, and descriptive text. Once users submit their responses, the system

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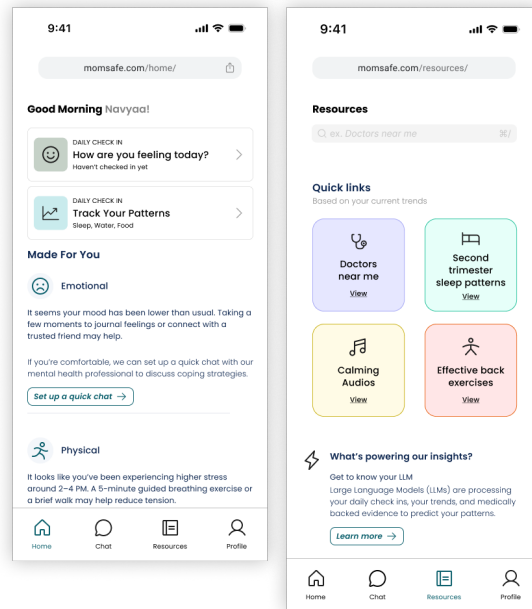


Fig. 3. Home page (on the left) displaying daily check ins for user to complete along with insights for the day, resources page (on the right) with LLM generated quick links and for user to learn about the technology behind their information.

processes the data to refine and personalize the recommendations displayed on both the home and profile screens, echoing the responsive approach labor nurses use to adapt care based on patient feedback.

6.2.4 *Privacy and Permissions* To ensure users always feel in control of their data, we implemented robust opt-out permissions, accessible through the profile settings and represented by a universal settings icon. Committed to prioritizing user comfort, we provide the option to disable data collection during chatbot interactions and within other key app features. By making these permissions straightforward and easily toggleable—similar to adjusting notifications or location services—we empower users to share only what they’re comfortable with at any given time. This approach not only aligns with our broader design philosophy of transparency and accessibility but also fosters trust, allowing users to engage with the app’s insights and recommendations on their own terms.

8 CONCLUSION AND FUTURE WORK

We developed an AI-driven, web-based platform to support expectant mothers by addressing the unique challenges they face during pregnancy. Insights from in-depth interviews shaped our approach, highlighting the need for personalized guidance, reliable medical information, and flexible privacy options. These findings informed our design, ensuring the platform meets the diverse needs of mothers and empowers them throughout their journey.

By combining self-reported data, predictive AI insights, and access to professional healthcare, the platform provides tailored support, fostering confidence and reducing stress for users. Features such as real-time chat, data-driven insights, and seamless healthcare connections have been refined through continuous testing and user feedback. Participants have expressed appreciation for the platform’s personalized and accessible care.

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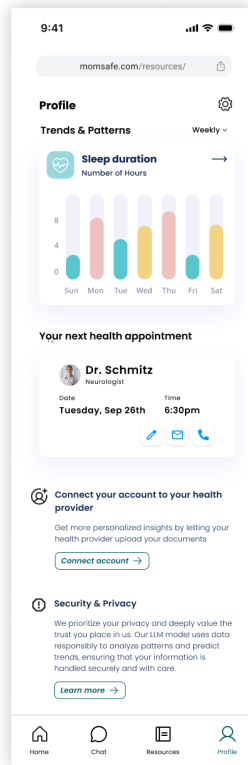


Fig. 4. Mobile - Profile page gives user a snapshot of their trends, allows them to sort trends based on time frame, view any upcoming appointments, and edit personal settings.

We aim to expand this platform to a broader audience by conducting additional usability testing in global communities, striving to create the most inclusive platform possible. Our vision is to make maternal care more accessible and equitable worldwide, ensuring that every mother has the tools and support needed to navigate pregnancy with confidence and ease.

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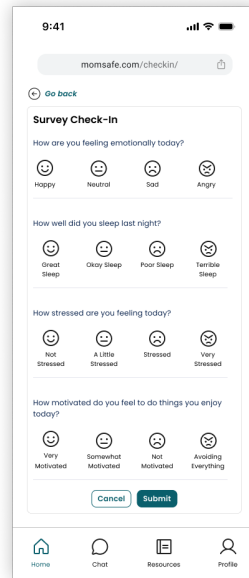


Fig. 5. The check ins have consistent iconography to maintain user understanding and allow user to exit/cancel at any time.

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