Pregnant women’s use of a consumer-based meditation mobile app: A descriptive study

Jeni Green, Taylor Neher, Megan Puzia, Breanne Laird and Jennifer Huberty

Abstract

Objective: The objectives of this study were to explore the satisfaction of pregnant or recently pregnant women with the existing Calm app content (i.e. non-pregnancy) and preferences and recommendations for the types of pregnancy-specific content that would be helpful to pregnant women.

Methods: This study was a national cross-sectional survey of subscribers to a meditation mobile app (i.e. Calm). Eligible participants were currently pregnant or recently pregnant (within the past 12 months) and used Calm during their pregnancy. Participants were asked about their Calm usage and perceived benefits of Calm during pregnancy, and interest in pregnancy-specific content. Descriptive statistics were used to characterize the sample.

Results: Participants (N = 111) were on average 34 years old (SD = 5.4) and half of the sample was currently pregnant (N = 55). The most common reasons for using the Calm app during pregnancy was for sleep problems (29%; n = 31) or anxiety (27%; n = 29). Women reported Calm was most helpful for improving sleep (32%; n = 32), anxiety (25%; n = 25), and stress (21%; n = 21). Nearly all women wanted pregnancy-specific meditation content within the app (98%; n = 98) and expressed interest in topics including pregnancy-related anxiety (68%; n = 67), postpartum (50%; n = 49), pregnancy-related sleep problems (41%; n = 40), and labor and delivery (38%; n = 37).

Conclusion: Women who used the Calm app during pregnancy found it helpful for improving sleep, anxiety, and stress but desire pregnancy-specific content. Future meditation mobile app studies should utilize pregnancy-specific content and test the feasibility and efficacy of sleep and mental health in pregnant women.

Keywords

Mindfulness, pregnancy, medicine, meditation, mHealth, psychology, apps

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Introduction

In the last decade, there has been an increased interest in prenatal mindfulness-based interventions to improve mental health or pregnancy outcomes. Mindfulness has been defined as observing the present moment, without judgment and can be cultivated through practices such as meditation. Mindfulness-based interventions have been consistently associated with reductions in stress, symptoms of anxiety and depression, and related prenatal mental health outcomes. Pregnant women also report improvements in sleep, reductions in pain and preeclampsia risk, an ability to manage weight gain, and improved recovery following a pregnancy loss. Mindfulness training is recommended for all pregnant women regardless of preexisting concerns. While mindfulness-based interventions show promise, many studies lack methodological rigor and have high

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attrition, no control groups, and are underpowered.\textsuperscript{1} There is a need for more research to explore the utility of mindfulness-based interventions during pregnancy that overcomes previous limitations.

Mobile applications (i.e. apps) have been considered a feasible, effective strategy to deliver mindfulness-based interventions such as meditation.\textsuperscript{6} Using mobile apps to meditate has no known risks or side effects,\textsuperscript{1} may reduce stigma, is cost-effective, and may increase the accessibility for pregnant women.\textsuperscript{7} Over 260 mindfulness meditation apps have been identified in published literature, but many commercially available apps have a low evidence base for their efficacy, particularly among pregnant users.\textsuperscript{7} Few meditation apps exist that are designed specifically for pregnancy and only a few general meditation apps (i.e. not specifically developed with content for pregnant women) have included meditation content for pregnancy.\textsuperscript{1} Although, general meditation apps could also be beneficial to improving mental health during pregnancy, the efficacy of these apps is unknown and there is a poor understanding of how women use these apps or their perceptions/experiences of these apps.

Calm is a popular, subscription-based, meditation app accessible across web-based and smartphone platforms (iOS and Android) with over 100 million downloads and four million subscribers. The app offers a range of content rooted in mindfulness principles to help users incorporate mindfulness into their lives and generally promote well-being (e.g. a large library of guided meditations including the 10-min Daily Calm, Sleep Stories, educational courses, mindful movement, music, and nature scenes and sounds).\textsuperscript{8,9} Calm also teaches users the basics of mindfulness, includes components to remind users to meditate, track user activity, and allow users to share their status with others. The feasibility of the app and its efficacy for improving mental health outcomes (i.e. stress, anxiety, and depressive symptoms), mindfulness, and sleep have been previously tested in various populations providing evidence that using Calm may improve well-being.\textsuperscript{5,6,10,11} Currently, Calm has no content specific to pregnancy, has a limited understanding of how its pregnant users are using the app, and only a small study has studied its efficacy in pregnant women.\textsuperscript{12}

The purpose of this study was to conduct a cross-sectional survey of Calm subscribers who are pregnant or were recently pregnant. We explored satisfaction in pregnant or recently pregnant women with the existing Calm content (i.e. non-pregnancy), and preferences and recommendations for the types of pregnancy-specific content that would be helpful to pregnant women. Findings from this study will inform pregnancy-specific content for meditation mobile apps and the design of future research using mobile apps in pregnant women.

**Methods**

**Study design and recruitment**

This was a national cross-sectional study. Participants were paying subscribers to Calm who were currently using the app during pregnancy or who had used the app during a recent pregnancy. Participants were recruited via email and on social media platforms (e.g. Calm’s Instagram account and Calm’s Daily Calm Community group on Facebook) in July 2021. Participants were eligible if they (1) were at least 18 years old, (2) US residents, (3) were able to read and answer questions in English, and (4) were either currently pregnant and using the Calm app or within 12 months of pregnancy and used the Calm app during pregnancy.

**Survey**

The investigator-developed survey included a total of 37 questions and took participants \( \sim 10.3 \) min to complete (median = 6.7, SD = 14.4). The survey asked questions about demographics, pregnancy-related questions (e.g. weeks’ gestation and months since last pregnancy), and mental and physical health during pregnancy. Additionally, the survey asked about their Calm usage during pregnancy, perceived benefits of Calm during pregnancy, and interest in pregnancy-specific content or communities. The survey was administered using an online data capturing software (Qualtrics, Provo, UT, USA) and those who were interested in participating accessed the survey through a link or QR code provided in recruitment materials. Participants were able to skip questions or stop taking the survey at any time.

**Statistical analysis**

Data were analyzed using SPSS Statistics version 26.0 (IBM Corp.). Descriptive statistics were used to characterize the sample regarding demographics, pregnancy-related characteristics, Calm usage during pregnancy and perceived benefits, motivation to use Calm, and proposed content areas to incorporate for pregnancy.

**Results**

**Demographic and health characteristics**

In total, 440 individuals completed the eligibility questions, 155 were eligible, and 151 consented to the study. Of those who were eligible, 111 completed the survey. Most participants were ineligible because they did not reside in the US. All participants identified as female. The sample was mostly White (79%; \( n = 86 \)) and non-Hispanic (87%; \( n = 95 \)), and the average age was 34 years (SD = 5.4;
Most participants had completed college (87%; \( n = 95 \)), and the majority had been employed and working during their pregnancies (73%; \( n = 80 \)) with an average household income of over $100,000 (62%; \( n = 59 \)). Approximately half of the sample were currently pregnant and using Calm (Table 2). About 74% (\( n = 80 \)) of participants reported that during their pregnancies, their physical health was Good or Very good and 78% (\( n = 84 \)) reported their mental health was Moderate or Good. Slightly over half reported having a health diagnosis during pregnancy (55%; \( n = 45 \)), and 42% (\( n = 45 \)) reported that they experienced adverse events, pregnancy complications, or otherwise had a “high-risk” pregnancy.

### Table 1. Demographic characteristics of the sample (\( N = 111 \)).

| Variable                                      | \( n \)/M | Percentage/SD |
|-----------------------------------------------|-----------|---------------|
| Age \( (N = 105) \)                           | 34.0      | 5.4           |
| Race \( (N = 109) \)                          |           |               |
| White, European American, or Caucasian        | 86        | 78.9          |
| Black, African American, or Native African    | 9         | 8.3           |
| Asian or Asian American                       | 7         | 6.4           |
| American Indian or Alaskan Native             | 2         | 1.8           |
| Arab or Non-Arab North African/Middle-Eastern | 2         | 1.8           |
| Native Caribbean or Afro-Caribbean Islander   | 2         | 1.8           |
| Bi-racial or Multi-racial                     | 5         | 4.6           |
| Other                                         | 3         | 2.8           |
| Hispanic or Latinx \( (N = 109) \)            | 14        | 12.8          |
| Highest level of education                    |           |               |
| High school                                   | 1         | 0.9           |
| Some college                                  | 13        | 11.9          |
| Associate degree                              | 9         | 8.3           |
| Bachelor’s degree                             | 41        | 37.6          |
| Graduate degree                               | 45        | 41.3          |
| Employment status during pregnancy \( (N = 109) \) |           |               |
| Employed and working                          | 80        | 73.4          |
| Employed but not working, related to pregnancy| 3         | 2.8           |
| Employed but not working, not related to pregnancy | 2     | 1.8           |
| Unemployed                                    | 5         | 4.6           |
| Unable to work for reasons related to pregnancy| 2         | 1.8           |

(continued)
with the most common reasons being to improve pregnancy-related sleep problems (29%; n = 31) or reduce pregnancy-related anxiety (27%; n = 29; Table 4). Participants reported that Calm was most helpful for improving sleep (32%; n = 32), anxiety (25%; n = 25), and stress (21%; n = 21) with ~10% (n = 10) reporting Calm not being helpful for pregnancy (Table 5).

Overwhelmingly, participants felt that there was a need for pregnancy-specific meditation content within the app (98%; n = 98), such as meditations for pregnancy-related anxiety (68%; n = 67), postpartum (50%; n = 49), pregnancy-related sleep problems (41%; n = 40), and preparation for labor and delivery (38%; n = 37; Table 6). Additionally, 90% of participants believed that they would benefit from trimester-specific meditations. Beyond meditation, 43% (n = 41) of participants felt that other pregnancy-related features could be included in the app. Slightly over half reported that they would be interested in connecting with other pregnant or recently pregnant users or becoming a member of a Calm pregnancy community (58%; n = 58). Of those, participants were specifically interested in connecting through group meditations with other pregnant or recently pregnant users (69% n = 40) and discussion boards within the app (57% n = 33).

**Discussion**

We conducted a cross-sectional survey of Calm subscribers who are pregnant or were recently pregnant. We explored satisfaction in pregnant or recently pregnant women (within 12 months postpartum) with the existing Calm content (i.e. non-pregnancy), and preferences and recommendations for the types of pregnancy-specific content.

### Table 2. Pregnancy-related characteristics of the sample.

| Variable                                                                 | n  | Percentage |
|--------------------------------------------------------------------------|----|------------|
| Pregnancy status (N = 111)                                               |    |            |
| Currently pregnant                                                      | 55 | 49.5       |
| Pregnant in the last year                                               | 56 | 50.5       |
| Self-rated physical health during pregnancy (N = 107)                    |    |            |
| Very bad                                                                | 3  | 2.8        |
| Bad                                                                     | 3  | 2.8        |
| Moderate                                                                | 21 | 19.6       |
| Good                                                                    | 54 | 50.5       |
| Very good                                                               | 26 | 24.3       |
| Self-rated mental health during pregnancy (N = 107)                      |    |            |
| Very bad                                                                | 4  | 3.7        |
| Bad                                                                     | 9  | 8.4        |
| Moderate                                                                | 42 | 39.3       |
| Good                                                                    | 42 | 39.3       |
| Very good                                                               | 10 | 9.3        |
| Experienced adverse events, pregnancy complications, or had a “high-risk” pregnancy (N = 109) | 45 | 41.7 |
| Health diagnoses during pregnancy (N = 99)                               |    |            |
| Anxiety                                                                 | 28 | 28.3       |
| Depression                                                              | 16 | 16.2       |
| Hypertension                                                            | 13 | 13.1       |
| Pain                                                                    | 7  | 7.1        |
| Insomnia                                                                | 7  | 7.1        |
| Diabetes                                                                | 7  | 7.1        |
| PTSD                                                                    | 6  | 6.1        |
| Asthma                                                                  | 5  | 5.1        |

(continued)
that would be helpful to pregnant women. Our findings demonstrated that the most common reasons for using the Calm app during pregnancy were to improve pregnancy-related sleep problems and anxiety. Women also reported that the app was most helpful during pregnancy for specifically improving sleep, anxiety, and stress. Despite that Calm was perceived as helpful for women, most felt there was a need for pregnancy-specific meditation particularly related to anxiety, postpartum, sleep problems, and preparation for labor and delivery. Many women also wanted other pregnancy-related features, besides meditations, to be included in the app. Finally, most women also expressed interest in connecting with other pregnant women via a pregnancy community, group meditations, or discussion boards.

Women in our study reported using the Calm app during pregnancy for sleep problems and anxiety and report the app being most helpful for improving sleep, anxiety, and stress. It is not surprising that pregnant women seek resources to improve sleep during pregnancy as many report alternations in sleep duration, quality, and pattern of sleep across their pregnancy. Data from a sleep survey from the National Sleep Foundation reported up to 78% of pregnant women complain about sleep disturbance during their third trimester. Cognitive behavioral therapy-insomnia (CBT-I) is often the first-line treatment for insomnia and while CBT-I

| Variable                                      | n   | Percentage |
|-----------------------------------------------|-----|------------|
| Time when started to use Calm (N = 105)       |     |            |
| Regularly used prior to pregnancy             | 56  | 53.3       |
| Previously used, but not immediately prior to | 30  | 28.6       |
| pregnancy                                      |     |            |
| Began using it during pregnancy               | 17  | 16.2       |
| Began using after finding out they were       | 2   | 1.9        |
| pregnant                                      |     |            |
| Of regular users, the way they used Calm     | 26  | 46.4       |
| changed during pregnancy (N = 56)             |     |            |
| Of new users, trimester started using Calm    |     |            |
| (N = 17)                                      |     |            |
| First trimester                               | 5   | 29.4       |
| Second trimester                              | 8   | 47.1       |
| Third trimester                               | 4   | 23.5       |
| Trimester with most usage (N = 101)           |     |            |
| First                                         | 18  | 17.8       |
| Second                                        | 14  | 13.9       |
| Third                                         | 24  | 23.8       |
| Equally across all trimesters                 | 45  | 44.6       |
| Length of time using Calm during pregnancy    |     |            |
| (N = 97)                                      |     |            |
| Less than a week                              | 3   | 3.1        |
| More than one week, but less than a month     | 7   | 7.2        |
| More than a month, but not the through        | 9   | 9.3        |
| entire pregnancy                              |     |            |
| Throughout the rest of my pregnancy, until    | 34  | 35.1       |
| delivery                                      |     |            |
| Continued using after delivery                | 44  | 45.4       |
| Frequency of use (N = 103)                    |     |            |
| Less than 1 time per week                     | 17  | 16.5       |
| 1 to 2 times per week                         | 33  | 32         |

Table 3. Continued.

| Variable                                      | n   | Percentage |
|-----------------------------------------------|-----|------------|
| 3 to 4 times per week                         | 24  | 23.3       |
| 5 or more times per week                      | 29  | 28.2       |
| Component used the most (N = 102)             |     |            |
| Meditations (not sleep-specific)              | 39  | 38.2       |
| Sleep stories                                 | 29  | 28.4       |
| Sleep meditations                             | 12  | 11.8       |
| Soundscapes                                   | 8   | 7.8        |
| Music                                         | 7   | 6.9        |
| Breathing exercises                           | 2   | 2.0        |
| Mood check-ins                                | 2   | 2.0        |
| Gratitude check-ins                           | 1   | 1.0        |
| Walking meditations                           | 1   | 1.0        |
| Calm body                                     | 1   | 1.0        |

(continued)
has been shown to be effective in improving sleep outcomes in pregnant women, these programs can be burdensome and costly. While mindfulness-based interventions may be a good alternative or adjunctive approach, studies testing their efficacy on sleep outcomes in pregnant women are lacking. In fact, one review on mindfulness studies during pregnancy reported that none of the randomized controlled trials reviewed (N = 13) included sleep outcomes and none were app based. Other mindfulness-based interventions such as yoga have been shown to be efficacious for sleep in pregnant women. One study testing a mindfulness-based program (not app based) to reduce excessive gestational weight gain, stress, and depression in overweight and obese pregnant women reported that mindfulness training attenuated the influence of poor sleep on perceived stress. Additionally, several reviews specifically suggest delivering mindfulness meditation interventions via mobile apps to encourage adherence and overcome other treatment barriers such as cost and transportation. To our knowledge, only one study testing a mindfulness meditation app in pregnant women assessed sleep. Findings from a recent pilot feasibility study testing a mindfulness meditation app in pregnant women with moderate to moderately severe depressive symptoms (N = 27) reported significant

### Table 4. Motivations for using Calm during pregnancy.

| Variable | n  | Percentage |
|----------|----|------------|
| Improve pregnancy-related sleep problems | 31 | 29.2 |
| Reduce pregnancy-related worries/anxiety | 29 | 27.4 |
| Lower pregnancy-related stress | 10 | 9.4 |
| Manage a pregnancy-related health condition | 5 | 4.7 |
| Become a more mindful parent | 5 | 4.7 |
| Manage physical discomfort or pain related to pregnancy | 4 | 3.8 |
| Prepare for labor/delivery | 4 | 3.8 |
| Other reasons related to pregnancy | 5 | 4.7 |
| Reasons not specifically related to pregnancy | 13 | 12.3 |

### Table 5. Perceived benefits of Calm during pregnancy.

| Variable | n  | Percentage |
|----------|----|------------|
| Improving pregnancy-related sleep problems | 32 | 31.7 |
| Reducing pregnancy-related worry/anxiety | 25 | 24.8 |
| Lowering pregnancy-related stress | 21 | 20.8 |
| Becoming a more mindful parent | 6 | 5.9 |
| Managing a pregnancy-related health condition | 2 | 2.0 |
| Managing pain or physical discomfort related to pregnancy | 2 | 2.0 |
| Preparing for labor/delivery | 2 | 2.0 |
| Other things related to pregnancy | 1 | 1.0 |
| Calm was not specifically helpful for pregnancy | 10 | 9.9 |

Table 4. Motivations for using Calm during pregnancy.

Table 5. Perceived benefits of Calm during pregnancy.
improvements in sleep disturbance.\textsuperscript{25} Women also indicated, in interviews, appreciating the convenience of the intervention. Considering the high rates of sleep problems during pregnancy and the potential of mindfulness interventions (i.e. meditation mobile apps) to improve sleep, research in this area is highly warranted. Additionally, mobile app developers and future studies should consider incorporating multi-component (e.g. mindfulness and CBT-I strategies) as well as hybrid approaches (e.g. in-clinic and/or remote) and testing these strategies to improve the experience of pregnancy and postpartum.

Women in our study also reported using the Calm app during pregnancy for anxiety and found it most helpful for anxiety and stress (in addition to sleep). Interestingly poor sleep has been implicated in the development of prenatal mood disorders including anxiety and has been linked to increased stress in pregnant women.\textsuperscript{26–28} It is likely that pregnant women with sleep problems experience mental health problems (or vice versa) and are seeking out resources to help manage these issues. Several reviews on mindfulness-based interventions in pregnancy have reported significant reductions in anxiety and stress.\textsuperscript{1–5} However, there is limited data on the effects of mindfulness-based apps on mental health in pregnant women. One recent study conducted during the COVID-19 pandemic in both obstetric (pregnant between 14 and 34 weeks) and gynecology (surgical procedures) patients (\(N = 50\)) reported significant reductions in stress, anxiety, and depression compared to a treatment as a usual control group (\(N = 51\)) after using a meditation mobile app for 30 days.\textsuperscript{12} Women using the app also reported high satisfaction and that mindfulness meditation helped to improve their stress. In the aforementioned pilot feasibility study by Kubo,\textsuperscript{25} the findings also showed significant improvements in stress (in addition to sleep disturbance) after using the app for six weeks. While meditation apps may show promise for improving sleep, anxiety, and stress, women express a desire for pregnancy-specific meditation content. It is unknown whether tailoring meditations for pregnant women would have a greater impact on sleep and/or prenatal mental health. However, research suggests tailoring interventions to increase engagement and efficacy in digital health interventions such as mobile apps.\textsuperscript{29} Given the unique, temporal stressors that pregnancy confers, pregnant women may benefit and better optimize health outcomes from content that is specifically tailored to their needs during pregnancy.\textsuperscript{1,30,31} Social support is also another strategy shown to increase engagement and efficacy in digital health interventions.\textsuperscript{29} Not surprisingly women in our study expressed interest in a social support component (e.g. pregnancy community, group meditations, and discussion boards), which could easily be integrated into mobile apps. Tailored apps for pregnant women and digital social

**Table 6. Proposed pregnancy-specific content to incorporate.**

| Variable                                             | n     | Percentage |
|-------------------------------------------------------|-------|------------|
| Reported the need for pregnancy-specific content (\(N = 100\)) | 98    | 98.0       |
| Desired topics in pregnancy-related content (\(N = 98\))  |       |            |
| Managing pregnancy-related worry/ anxiety              | 67    | 68.4       |
| Life after delivery/postpartum                         | 49    | 50.0       |
| Pregnancy-related sleep problems                        | 40    | 40.8       |
| Preparing for labor/delivery                           | 37    | 37.8       |
| Being a parent to other children while pregnant         | 31    | 31.6       |
| Managing pregnancy-related stress                       | 26    | 26.5       |
| Managing physical discomfort/pain related to pregnancy  | 15    | 15.3       |
| Managing pregnancy-related depression                   | 8     | 8.2        |
| Managing health conditions diagnosed during pregnancy   | 6     | 6.1        |
| Other pregnancy content                                 | 1     | 1.0        |
| Reported that they would benefit from trimester-specific meditations (\(N = 98\)) | 90 | 91.8 |
| Reported that non-meditation features/components related to pregnancy could be incorporated into the app (\(N = 95\)) | 41 | 43.2 |
| Interested in connecting with other pregnant users or joining a pregnancy community with other users (\(N = 100\)) | 58 | 58.0 |
| Desired type of community (\(N = 58\))                 |       |            |
| Group meditations with other pregnant users             | 40    | 69.0       |
| Discussion boards within the app                        | 33    | 56.9       |
| Social media communities with other pregnant users      | 24    | 41.4       |
| Direct messaging through the app                        | 8     | 13.8       |
| Other type of community                                 | 2     | 3.4        |
support strategies should be tested for their impact, particularly on sleep and prenatal mental health.

**Limitations**

Though the information provided here may help inform future studies, there are several limitations to this research. First, the data may be biased to participant self-selection and the sample is not representative of all pregnant women. There is a need to explore perceptions of meditation apps in those who do not already use them as well as across a range of demographic characteristics and in more diverse samples (e.g. racial/ethnic minorities and trans/non-binary individuals). Second, for participants completing the survey who were in the postpartum period may be subject to recall errors related to how they used Calm when they were pregnant. Future studies exploring the needs and preferences for mobile apps in the postpartum period would also be useful as well as incorporating objective usage data for more accurate reporting of app use. Third, we did not assess the reasons for discontinued app use during pregnancy. Future studies should investigate why pregnant women stop using meditation apps and strategies to encourage adherence. Finally, this survey did not evaluate mental health outcomes. Future studies testing the feasibility and efficacy of mobile apps both specific for and not specific for prenatal mental health and sleep are needed.

**Conclusion**

Pregnant women using the Calm app find the app most helpful for improving sleep, anxiety, and stress but feel the app needs more tailoring related to pregnancy content. Mobile apps, even if not developed specifically for pregnancy, could benefit by adding pregnancy-specific content in their app including topics related to anxiety, postpartum, sleep problems, and preparation for labor and delivery. Strategies for social support between pregnant women are also a desired feature within the app. Future research testing the feasibility and efficacy of tailored meditation mobile apps for pregnant women to improve sleep and mental health are needed.

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