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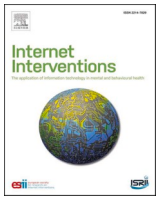

PandaMom – Feasibility and acceptability of an internet- and mobile-based intervention to enhance peripartum mental well-being and to prevent postpartum depression

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ABSTRACT

Background: Mental disorders during pregnancy and the postpartum period can have far-reaching consequences. To enhance peripartum mental well-being and prevent peripartum mental disorders, internet- and mobile-based interventions appear promising. They can overcome help-seeking barriers associated with face-to-face conditions and have proven to be effective. However, previous findings are scarce and mixed. The primary objectives of this study were to assess the feasibility and acceptability of an internet-based program aimed at enhancing peripartum mental well-being and preventing postpartum depression.

Methods: In total, 149 pregnant, German-speaking women were assigned to the internet-based intervention PandaMom. The program comprises a total of 10 basic and supplementary modules related to pregnancy and postpartum, based on cognitive-behavioral principles. Additionally, PandaMom offers professional, individualized guidance and a moderated group-chat. Assessments were conducted at baseline (pre-intervention), as well as two and five weeks postpartum. The primary outcomes included feasibility, user satisfaction, and adherence to the intervention. Secondary outcomes included depressive symptomatology, anxiety and stress.

Results: PandaMom was found to be feasible, and evaluation of module content and length satisfaction indicated that the intervention was well accepted. Nearly half of the participants utilized the guidance service by responding to individual messages from their intervention moderator. Regarding working alliance, participants reported a strong bond with their intervention moderator. Of the 149 participants, 132 logged into the platform at least once. 113 participants accessed at least one module, with an average of 4.7 modules opened per participant. However, only 16 participants completed the basic modules.

Conclusion: The findings of this study support previous evidence that internet-and mobile-based interventions are feasible and acceptable during pregnancy and the postpartum period. Further research is needed to address the challenge of low adherence and to evaluate the efficacy of PandaMom.

1. Introduction

Transition to motherhood is commonly perceived as a joyful time, but is also accompanied by numerous challenges such as sleep deprivation, hormonal fluctuations, disrupted routines, strained relationships, mood swings, and anxiety (O'Hara, 2009). About 50 % of new mothers experience the so-called baby blues within the first days postdelivery, characterized by transient depressed mood (Howard et al., 2014). Experiencing these blues increases the risk of developing postpartum mental illnesses such as postpartum depression (PPD). Other risk factors include a history of depression or anxiety, lacking social support, or a dissatisfying marital relationship (O'Hara and McCabe, 2013).

Maternal PPD is prevalent, affecting up to 20 % of women within the first three months after childbirth (O'Hara and Wisner, 2014). Approximately 10 % of women already exhibit depressive symptoms in early pregnancy, with rates increasing over the course of pregnancy up to 16 % in the third trimester (Wilcox et al., 2021). Symptoms mirror those of depression outside the postpartum period, including depressed mood, decreased interest, sleep disturbances, fatigue, poor concentration, feelings of worthlessness, or suicidal thoughts persisting for at least two

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weeks (American Psychiatric Association, 2013). Additionally, affected mothers may also experience anxiety, irritability, intrusive thoughts, and worries about harming their infant (Stewart and Vigod, 2016).

In addition to causing maternal psychological distress and functional impairment, PPD may adversely impact mother-child bonding and contribute to adverse consequences for the infant, such as impaired cognitive, emotional, and motor development, or behavioral problems (Slomian et al., 2019).

Despite its substantial psychological burden and wide-ranging consequences for the mother, the infant and the whole family, many cases of PPD go undiagnosed and untreated. Detection is challenging due to symptom similarities with typical postpartum-related changes in sleep, appetite, fatigue, concentration, or mood. Moreover, routine screening for postpartum depression is lacking (Boyd et al., 2005) and not mandatory in many countries such as Germany. Further help-seeking barriers include lack of time, childcare responsibilities, perceived stigma, feelings of guilt or shame, fear of losing parental rights or taking medication, limited knowledge about perinatal mental disorders, and insufficient information about available help services (Jones, 2019).

Given the high prevalence and associated burden of PPD, along with its adverse outcomes, raising awareness about peripartum depression and providing early prevention and treatment for peripartum mood disorders are crucial public health priorities.

With the increasing digitization in recent years, internet- and mobile-based interventions (IMIs) aimed at promoting, maintaining, or restoring mental health have become an essential part of mental health-care. IMIs are typically offered as self-help interventions and can be delivered with (guided) or without professional support (unguided). Generally, guided IMIs have been found to be more effective in reducing symptoms of depression and lead to larger effect sizes compared to unguided interventions (Spek et al., 2007; Titov, 2011). Furthermore, guided interventions have demonstrated similar effects as face-to-face treatments for various mental health conditions (Andersson et al., 2014). IMIs have the potential to overcome barriers to help-seeking by offering anonymous, flexible, and easily accessible support whenever and wherever needed, thereby reducing feelings of shame and stigmatization (Ebert et al., 2018). This is particularly relevant for pregnant women and new mothers, who already face significant demands such as round-the-clock infant care, additional responsibilities for older children, and household responsibilities. To reduce psychological symptoms during the peripartum period, IMIs can deliver content based on established psychological approaches, such as Cognitive Behavioral Therapy (CBT) to address unhelpful thoughts, mindfulness techniques to focus on automatic reactions, or problem-solving strategies (Lau et al., 2021). Additionally, they can incorporate effective behavior change techniques (Abraham and Michie, 2008). IMIs have also shown efficacy in significantly improving depressive symptoms in peripartum women (e.g., Duffecy et al., 2022; Hanach et al., 2021; Lau et al., 2021; Loughnan et al., 2019; Mu et al., 2021). Larger effects were observed in trials providing interventions with professional support compared to unguided trials, when targeting women at high-risk compared to women at low-risk (Mu et al., 2021) and among postpartum women compared to antepartum women (Lau et al., 2021). However, some studies failed to show efficacy and/or long-term effectiveness of self-help interventions treating PPD (Hanach et al., 2021; Lin et al., 2018). In terms of PPD prevention, small effect sizes were found in studies conducted during pregnancy (Silang et al., 2022), and the effects observed in prevention studies are smaller compared to those seen in treatment conditions (Lin et al., 2018). Regarding the risk status of the target group, prevention studies yield varied findings. Studies on indicated prevention have shown efficacy (Duffecy et al., 2019; Fonseca et al., 2020), while studies on universal prevention of peripartum depression have produced both no effects and significant effects (Barrera et al., 2015; Haga et al., 2019; Nishi et al., 2022).

In conclusion, peripartum specific IMIs have demonstrated effectiveness in improving depressive symptomatology and show promise in preventing PPD among women at risk. Additionally, these interventions have proven to be feasible and acceptable (Fonseca et al., 2020; Forsell et al., 2017; Hanach et al., 2021; Loughnan et al., 2019) with high user satisfaction rates reported (Milgrom et al., 2016). However, some studies have noted high attrition rates (Fonseca et al., 2020), which is a common challenge in e-mental health research (Eysenbach, 2005). Factors contributing to dissatisfaction include overlong modules, irrelevant content, lack of customization, and non-responsive or mobile-unfriendly visualization (Ashford et al., 2018). Studies have indicated that interventions offering guidance by professionals, employing regular reminders, e.g. via telephone (Mu et al., 2021), featuring fewer modules (Westerhoff et al., 2019), providing content tailored to individual needs and circumstances tend to have higher completion rates (O'Mahen et al., 2015). Additionally, women prefer tailored content that is perceived as helpful and relevant to PPD symptomatology and treatment, a user-friendly layout with highlighted key information, and information on support groups (Siddhpuria et al., 2022).

To develop effective preventive interventions and promote their use, it is crucial to address target group-specific factors and involve relevant stakeholder groups, such as future users. During planning and conducting the present study, we found no studies on German-language interventions, and research from other countries reported only limited and mixed findings. Therefore, as a preliminary step, we conducted a qualitative study to examine attitudes and needs of relevant stakeholder groups concerning peripartum-specific IMIs: health care professionals, pregnant women, mothers and women who had previously experienced a postpartum mood disorder. Stakeholders identified various topics to be included in the intervention, such as pregnancy and puerperium, peripartum mood swings and disorders, self-care, and partnership. Regarding preferences for program features, stakeholders noted, for example, the importance of professional guidance, responsive design for device flexibility, and interactive content (Schmidt-Hantke and Jacobi, 2023). Based on the results of this study, previous research on user experiences with peripartum-specific interventions, and findings on risk and protective factors for PPD, we developed the internet- and mobile-based self-help program PandaMom. The program equips pregnant women with tools to manage peripartum challenges, as indicated in other preventive interventions (e.g., Barrera et al., 2015; Duffecy et al., 2019; Haga et al., 2019; Nishi et al., 2022). This pilot trial primarily aims to examine the feasibility and acceptability of PandaMom. Given the nature of a pilot study, we will not evaluate effectiveness and efficacy but will conduct and report exploratory analyses (Leon et al., 2011). At the time we planned the study, PandaMom was, to the best of our knowledge, the first German guided self-help IMI to improve peripartum maternal well-being and prevent PPD.

2. Material and methods

2.1. Participants

Pregnant women were recruited through leaflets distributed in German gynecological and midwifery practices, antenatal classes, counseling centers, as well as via advertisements in local print media, online forums, blogs, and websites. Recruitment occurred between April 2019 and December 2019. Interested women accessed the study website through a QR code or link included in the recruitment material and obtained information about the study.

The inclusion criteria were (1) pregnancy with gestational age of $\geq$27 weeks, (2) maternal age of 18 years or older, (3) proficiency in German, and (4) access to an internet-enabled device (smartphone, computer, tablet). Exclusion criteria were: (1) a current psychotic or substance use disorder, or (2) current suicidal or self-harm thoughts (indicated by answering “sometimes” or “quite often” to Edinburgh Postnatal Depression Scale (EPDS) item 10) (Bergant et al., 2008; Cox et al., 1987). As this pilot trial aims to examine the feasibility and acceptability of a universal prevention program, we did not establish a

symptom-specific cutoff as an inclusion criterion.

2.2. Study design and procedure

We conducted a longitudinal uncontrolled feasibility pilot trial. After providing informed consent, pregnant women interested in participating in the study were directed to LimeSurvey, an online survey tool where the screening and baseline questionnaires were administered. After completing the screening and baseline questionnaires, all eligible participants were granted access to the intervention provided via the Minddistrict eHealth platform (Minddistrict, Amsterdam, The Netherlands).

Online assessments occurred at baseline (T0) during late pregnancy, as well as two (T2, mid-assessment) and five weeks (T3, post-assessment) after the calculated delivery due date. A short interim survey (T1) following the completion of the first three modules was utilized to evaluate working alliance (Fig. 1). To enhance participation in the post-assessment, vouchers valued at €30 each were raffled off at three different time points among participants who completed the post-assessment. The study received approval from the ethics committee of the medical faculty at the TU Dresden (EK23012019) and was retrospectively registered at the German Clinical Trials Register (DRKS00029125).

2.3. Intervention

PandaMom is a guided self-help online program aimed at the universal prevention of perinatal depression. It is based on interpersonal and CBT-principles, as well as behavior change techniques (e.g., information about behavior-health link, consequences, intention formation, barrier identification, general encouragement, and goal setting) (Abraham and Michie, 2008). The program was developed following several stakeholder interviews for assessing attitudes and needs regarding peripartum IMIs (Schmidt-Hantke and Jacobi, 2023). The program consists of two phases with a total of six basic and four supplementary modules (see Appendix A). The first phase focuses on the prepartum period, while the second phase begins two weeks after giving birth and addresses postpartum-related topics. To meet the demand for customization and tailoring, PandaMom is designed in modular fashion, with access to the first module provided upon registration on the platform. Once participants start the first module, they gain access to the other basic and supplementary modules for pregnancy and the postpartum period. This allows participants to engage with modules based on their individual needs and preferences. Users are recommended to complete one module per week, depending on their circumstances. Each module includes audio-visual content, psychoeducational materials, exercises, and self-report questionnaires. Modules consist of both fixed and customizable components through implemented conditional content. Additionally, participants can set individual goals, and after completing a module, can download the module content as a workbook. Participants were able to track their current progress on their dashboard as well as via the progress bar within each module.

PandaMom is a guided intervention, meaning that each participant after completing a module received weekly feedback via the platform's messaging service from the study team, consisting of psychologists with a bachelor's or diploma degree. This feedback was personalized and tailored to user's responses within the modules. The participants also had the opportunity to reply to these feedback messages and receive additional feedback if required. Participants who had been inactive for a week or more received up to three adherence-focused messages to enhance motivation and engagement. An adherence message was also sent to participants two weeks after childbirth to inquire about their current well-being and to remind them about the program. Additionally, participants were given access to a moderated group chat-room on the platform that let them connect with other program users. To ensure anonymity, users were encouraged to choose a pseudonym as their username. To ensure user-friendliness, the program utilizes a responsive design and the content is accessible in an interactive design via a web browser or a mobile app.

2.4. Measures

2.4.1. Primary outcome measures

The primary outcomes of this pilot study were feasibility, user satisfaction and adherence to the intervention. To assess user satisfaction, participants were asked to rate the content of each module on a 10-point visual-analogue-scale ranging from 0 (“not at all satisfied”) to 10 (“highly satisfied”), and to rate the module length on a 3-point scale (“too short”, “just right”, “too long”) after completing a module. Participants were also asked to indicate their use of the module workbooks and to evaluate their level of interest in the module-specific content. Additional individual comments could be made in a free text field. Moreover, user experience was assessed with the User Experience Questionnaire (UEQ; Laugwitz et al., 2008) at mid-assessment 2 weeks postpartum (T2) and at post-assessment 5 weeks postpartum (T3). The UEQ consists of six subscales (Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, Novelty). These six factors were assessed by rating 26 opposing item pairs. The subscales Perspicuity, Efficiency and Dependability assess goal-directed aspects, while Stimulation and Novelty reflect hedonic aspects of the intervention evaluation. Scale means can range from −3 (“horribly bad”) to 3 (“extremely good”). Means below −0.8 indicate a negative user experience, means between −0.8 and 0.8 indicate a neutral experience, and means above 0.8 indicate a positive user experience.

We also assessed the perceived working alliance using the Working Alliance Inventory – Short Revised (WAI-SR; Hatcher and Gillaspy, 2006; German version: Wilmers et al., 2008, adapted for online interventions) after the completion of three PandaMom modules (T1, interim assessment), at mid-assessment 2 weeks postpartum (T2), and at post-assessment 5 weeks postpartum (T3). The WAI-SR focuses on three aspects of the therapeutic alliance: Agreement on (1) intervention goals, (2) tasks, and (3) the personal client-online-coach bond. The questionnaire comprises 12 items, which were rated on a scale ranging from 1 (rarely) to 5 (ever).

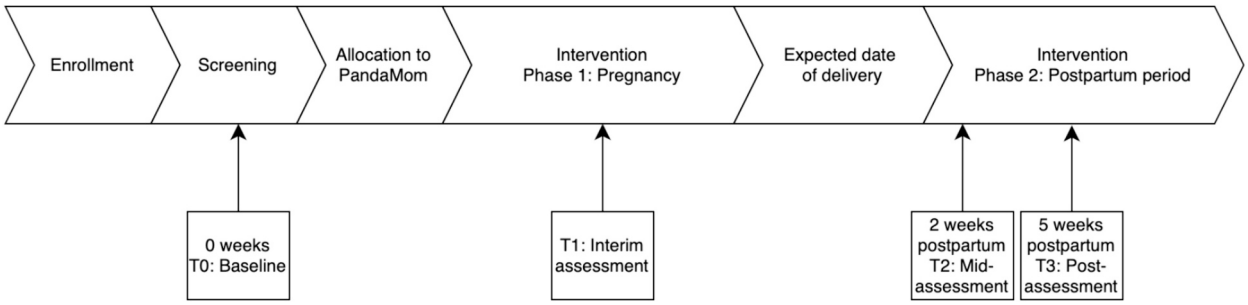

Fig. 1. Study design.

Additionally, we assessed intervention expectancy and credibility using the adapted Credibility-Expectancy-Questionnaire (CEQ; Devilly and Borkovec, 2000) at baseline (T0) and at mid-assessment 2 weeks postpartum (T2). Participants rated their confidence on how useful and helpful the intervention will be. This 6-item questionnaire includes two factors: the cognitive-based factor credibility and the affective-based factor expectancy. Item scales ranged from 1 ("no usefulness/helpfulness assumed") to 9 ("large usefulness/helpfulness assumed").

Intervention adherence was defined as the number of accessed and completed modules and the percentage of usage per module. Furthermore, we evaluated study drop-out (Eysenbach, 2005), defined as the number of participants lost from baseline to post-measurement. Study completers were defined as participants completing the post-assessment, and intervention completers were defined as participants completing the six basic modules.

2.4.2. Secondary outcome measures

Secondary outcomes were depressive symptomatology, anxiety, and stress, assessed at baseline (T0), at mid-assessment 2 weeks postpartum (T2), and at post-assessment 5 weeks postpartum (T3). Depressive symptoms were measured with two peripartum-specific questionnaires: (1) the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987; German Version: Bergant et al., 2008), and (2) the peripartum Depression-Anxiety-Stress-Scale (Depression-Angst-Stress-Skala für die Peripartalzeit, DASS-P; Martini et al., 2009). The EPDS is an internationally established self-report questionnaire and the most-used instrument to screen for depression during pregnancy and postpartum. It consists of 10 items answered on a four-point-scale ranging from 0 to 3 leading to a scale sum score between 0 and 30. The most commonly used cut-off scores are $\geq$10 and $\geq$ 13 with sensitivity and specificity values of 85 % and 84 %, and 66 % and 95 %, respectively (Levis et al., 2020). A cut-off score of 9/10 is recommended for routine use to identify a possible depression and a cut-off score of 12/13 is suggested for detecting severe depression (Cox et al., 1987).

We also administered the DASS-P to assess symptoms of depression, anxiety, and stress. The 15-items questionnaire has been validated for pre- and postpartum use. The items are answered on a 4-point scale ranging from 0 ("never") to 3 ("very often"), resulting in a total score between 0 and 45. The authors recommend a cut-off score of >5 as an indicator for maternal stress (Martini et al., 2009).

2.5. Statistical analyses

The trial was conducted in compliance with the Declaration of Helsinki and the CONSORT guidelines.

Data analyses was performed using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Macintosh, Version 28.0). The statistical significance level was set at $\alpha = 0.5$. Descriptive analyses were conducted to examine sociodemographic data (e.g., age), obstetric data (gestational week), symptomatology (e.g., EPDS- and DASS-P scores), as well as satisfaction with and adherence to the intervention. Correlations between baseline variables, intervention satisfaction, and adherence were examined using the Pearson correlation coefficient. Differences in baseline symptomatology and sociodemographic variables between study drop-outs and study completers, as well as intervention drop-outs and intervention completers were analyzed using a Pearson chi-square test for categorical variables and unpaired two-sided *t*-tests for continuous variables, respectively. Exploratory pre-post completer analyses were conducted to examine the trajectory of the self-reported symptomatology. Means and standard deviations were presented for both measurement time points. In a secondary exploratory analysis, changes from pre-test to post-test were examined for a subgroup of participants scoring above an EPDS cut-off of $\geq$10 or above a DASS-P cut-off of 5 at baseline, indicating a potential risk for developing a peripartum depressive disorder. The exploratory analyses were based on a per-protocol design and included all participants satisfying the protocol treatment (accessed at least one module page) and completing at least the baseline and post-assessment.

Since the focus was on feasibility and acceptability of the intervention and we did no hypothesis testing, no power calculation was required (Leon et al., 2011).

3. Results

3.1. Participants

In total, 149 participants completed the baseline assessment and were assigned to the PandaMom intervention (Fig. 2). Among these, 17 out of 149 participants never logged into the program. Thirty-nine out of 149 (26.2 %) participants completed the mid-assessments two weeks after childbirth, and 40 out of 149 participants (26.9 %) completed the post-assessment five weeks after childbirth. Sociodemographic and obstetric variables as well as baseline data on self-reported symptomatology are summarized in Table 1.

We observed no significant baseline differences either between study dropouts and study completers or between intervention dropouts and intervention completers. Participants endorsing a lifetime mental health disorder were more likely to start a module compared to healthy participants (34/39 vs. 79/110; $\chi^2 = 3.71$, $p = .05$). Additionally, we examined differences between the subgroup of participants completing all basic modules and the non-completer subgroup. No differences were found between the two groups for sociodemographic or obstetric factors such as age or weeks of pregnancy at baseline, or regarding baseline expectancy and credibility.

3.2. Feasibility and acceptability

Twenty-four out of 149 (16.1 %) participants indicated how they became aware of the PandaMom program. Seven participants reported being informed by professionals (gynecologists, midwives, therapists, counseling centres), six participants mentioned the internet, five participants credited their social circle, and two participants cited print media in their personal environment. Additionally, four participants learned about the program through print media in their doctor's waiting room. Eleven participants answered the question about the predominantly used device. Three out of 11 participants accessed PandaMom via their desktop computer, and eight participants accessed the program via the Minddistrict app.

The first participant was enrolled on April 10, 2019, and the last one on December 19, 2019. The intervention content was available to all participants until mid-July 2020. On average, participants had access to the intervention content for 45.8 weeks (SD = 11.67). A total of 132 out of 149 (88.6 %) participants logged into the platform at least once, and 113 out of these 132 participants (85.6 %) opened at least one module. On average, participants opened 4.7 modules (SD = 2.94), comprising 3.3 basic (SD = 1.83) and 1.4 (SD = 1.35) supplementary modules. The first module ("Introduction") was fully completed by 100 out of 113 (88.5 %) participants. Sixteen out of 113 (14.2 %) participants completed the basic modules, and five out of 113 (4.4 %) participants completed the supplementary modules. Four out of 113 (3.5 %) participants completed all PandaMom modules. A considerable decline in the number of active participants (Fig. 3) and thus, the module use was observed after the first module. Thirty-seven out of 113 (32.7 %) participants completed half of the intervention, hence five out of 10 modules. Overall, 112 out of 149 (75.2 %) didn't complete a postpartum module after their expected date of delivery.

At mid- and post-assessment, reasons for non-usage were assessed. At mid-assessment, time constraints ($N = 4$), forgetting about the program ($N = 2$), and lack of usability ($N = 1$) were mentioned. In the post-assessment ($N = 40$), some participants again pointed to time constraints ($N = 10$), forgetting about the program ($N = 11$), lack of interest (N = 1), and lack of confidence in its effectiveness (N = 1) as reasons for

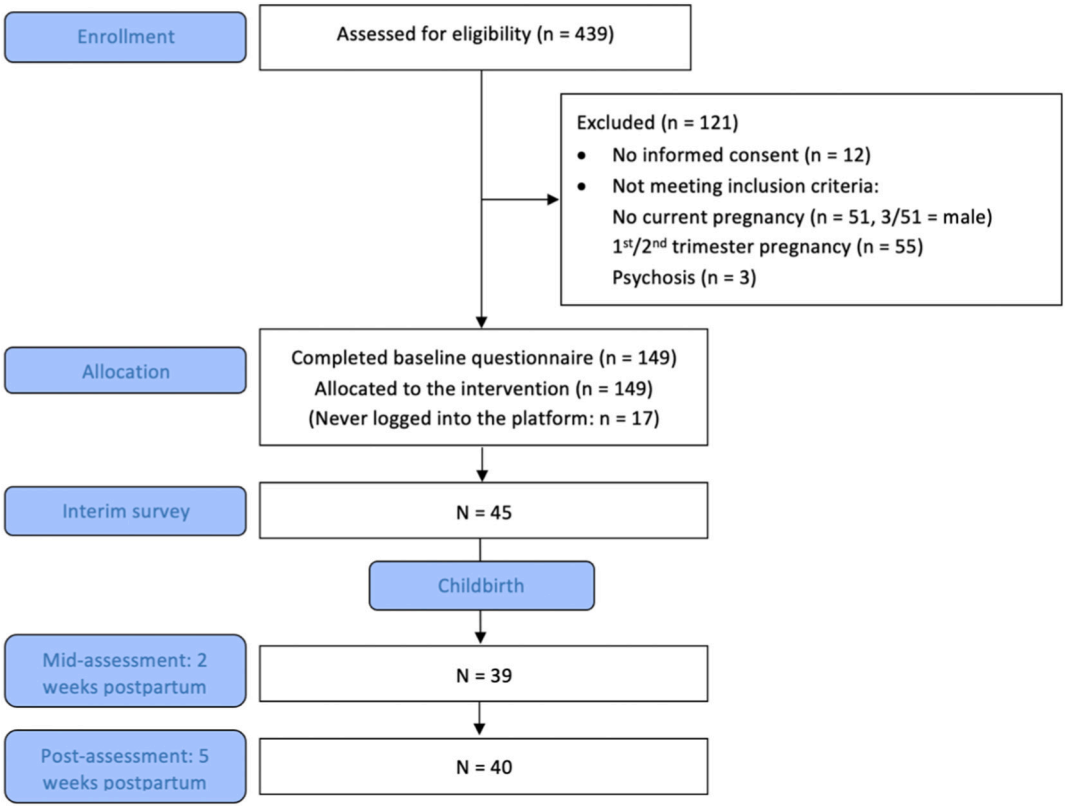

Fig. 2. CONSORT (Consolidated Standards of Reporting Trials) flow diagram.

Table 1
Sociodemographic and obstetric sample characteristics and psychiatric symptomatology at baseline ($N = 149$).

Characteristic	Descriptive statistics
Sociodemographic variables	
Age in years, mean (SD)	32.73 (29.76)
Educational level, n (%)	
Lower secondary education	11 (7.4 %)
Upper secondary education	30 (20.1 %)
Bachelor's or master's degree, diploma	85 (57 %)
Doctoral degree	10 (6.7 %)
Other (e.g., state examination)	13 (8.7 %)
Marital status, n (%)	
Married or cohabitating	136 (91.2 %)
Living apart	5 (3.4 %)
Living alone	4 (2.7 %)
Other	4 (2.7 %)
Number of children	
0	101 (67.8 %)
1	30 (20.1 %)
2	12 (8.1 %)
≥ 3	6 (4 %)
Obstetric variables	
Weeks pregnant, mean (SD)	32.3 (4.3)
Symptomatology	
EPDS, mean (SD)	8.37 (5.23)
EPDS score > 9	$n = 61$ (40.9 %)
EPDS score ≥ 12	$n = 41$ (27.5 %)
DASS-P, mean (SD)	8.56 (6.74)
DASS-$P > 5$	$n = 89$ (59.7 %)
Prior history of psychiatric disorders, n (%)	
Yes	39 (26.2 %)
No	110 (73.8 %)
Prior psychotherapy, n (%)	
Yes	48 (32.2 %)
No	101 (67.8 %)

Note: EPDS = Edinburgh Postnatal Depression Scale; DASS-P = Depression-Angst-Stress-Skala für die Peripartalzeit.

non-usage.

Evaluation of the satisfaction with the module content revealed mean values between 6.63 (SD = 2.38, module 1, "Introduction") and 8.60 (SD = 1.35, module 4, "Self-care") for the single basic modules. Mean values ranging between 6.52 (SD = 2.34, module "Time-management") and 8.50 (SD = 2.36, module "Relaxation") were shown for the single supplementary modules (Fig. 4). Module length was predominantly rated as "just right" for each basic module. Module 4 ("Self-care") indicates the highest satisfaction with module length, evaluated as "just right" by 93.8 %, whereas the length of module 6 ("Changes during motherhood") resulted in the lowest satisfaction rate (53.8 % for "just right") and 38.5 % for "too long". The supplementary modules were predominantly rated as "just right", and none of them were perceived as "too long".

We found no associations between module use and sociodemographic variables, except for education, which was significantly correlated with the number of started ($r = 0.212$, $p = .025$) and completed modules ($r = 0.204$, $p = .031$). Thus, participants with a higher educational level were more likely to start and complete the intervention modules.

The baseline assessment ($N = 144$) indicated a medium-range intervention credibility (mean = 17.07, SD = 5.34) and slightly lower expectancy ($N = 143$, mean = 15.64, SD = 4.81). Credibility scores increased slightly from baseline to mid-assessment ($N = 39$), with a mean credibility score of 17.51 (SD = 6.07), whereas expectancy scores showed a slight decrease (mean = 14.79, SD = 6.77).

Perceived pre-intervention credibility was associated with EPDS and DASS-P scores at baseline ($r = 0.295$, $p < .001$; $r = 0.272$, $p < .001$; respectively). Mid-assessment credibility and expectancy were associated with the therapeutic alliance factors "agreement on therapy goals" ($r = 0.667$, $p < .001$; $r = 0.595$, $p < .001$; respectively) and "agreement on tasks" ($r = 0.689$, $p < .001$; $r = 0.763$, $p < .001$; respectively). Additionally, significant correlations were found between credibility at mid-assessment and the overall number of modules opened by users ($r =$

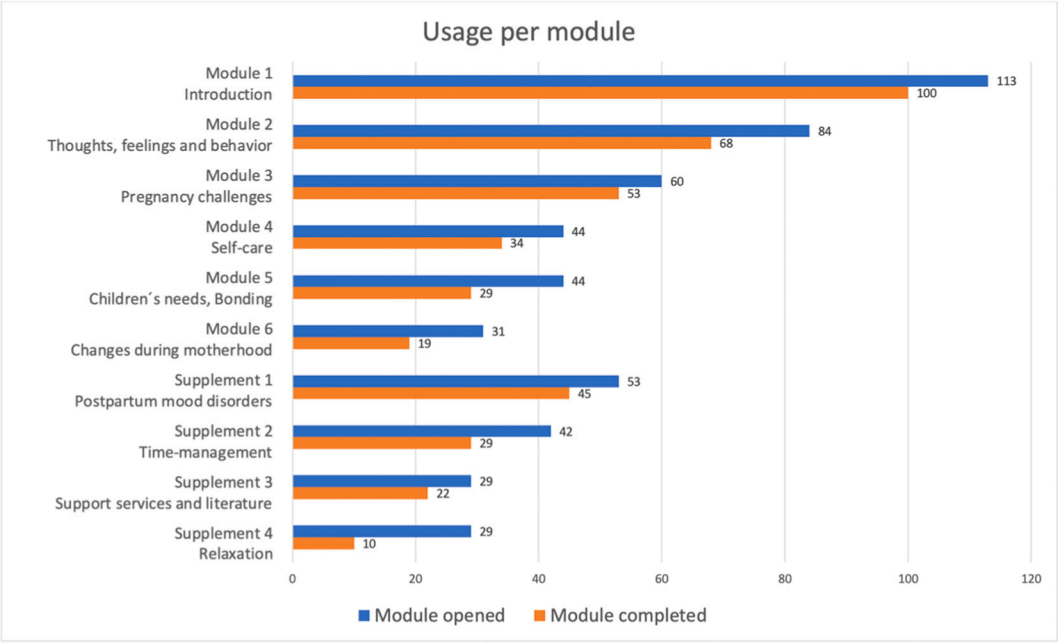

Fig. 3. Number of participants that opened or completed the modules.

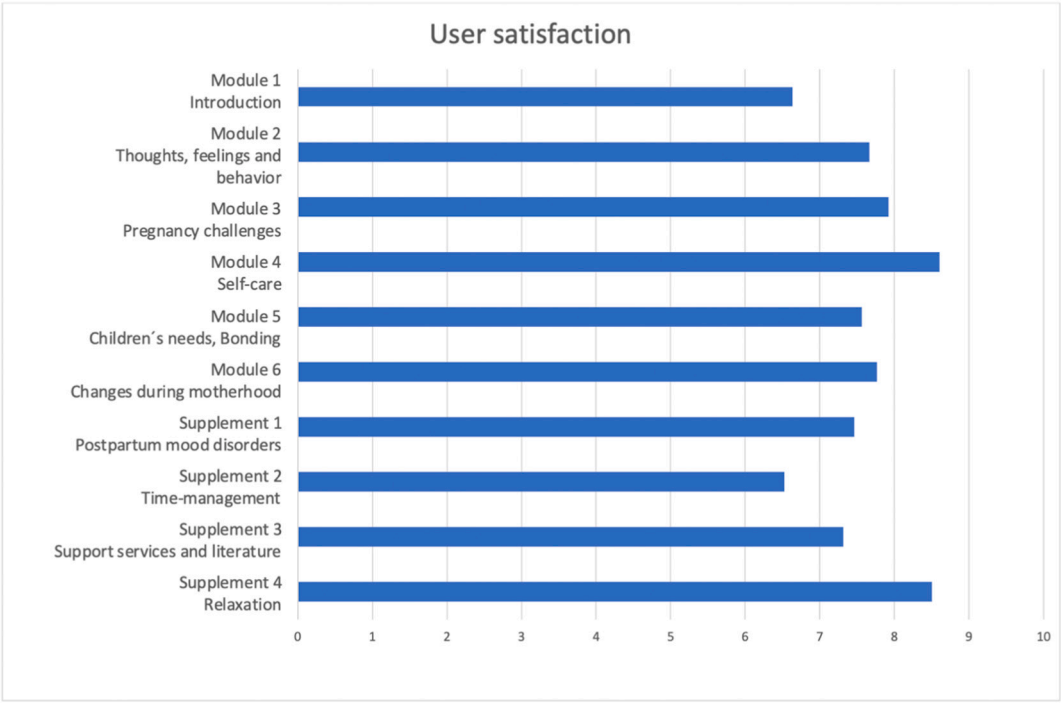

Fig. 4. Mean user satisfaction with the module content (rating between 0 - "not satisfied at all" and 10 - "highly satisfied").

0.372, $p = .020$). A table showing the results of the correlation analyses can be found in Appendix B.

Analyses of the working alliance scores revealed high values on the bond subscale and medium-range scores on the tasks and goals subscales at all assessments. We noted a slight increase from interim to post-assessment (Table 2). Significant associations were found between the number of opened modules and the interim WAI task score ($r = 0.442$, $p = .010$) as well as the WAI task scale at post-assessment ($r = 0.379$, $p = .039$), and between the number of completed modules and the WAI sum score at post-assessment (r.624, $p = .030$).

Table 2
Working alliance scores.

Outcome	Interim-assessment		Mid-assessment		Post-assessment	
	n	mean (SD)	n	mean (SD)	n	mean (SD)
WAI-SR Bond	10	17.6 (2.76)	9	18.11 (1.83)	16	18.81 (1.64)
WAI-SR Task	33	11.79 (3.33)	30	11.9 (3.59)	30	12.77 (3.83)
WAI-SR Goal	31	14.45 (2.86)	25	13.76 (3.36)	26	14.65 (3.31)

Note: WAI-SR = Working Alliance Inventory – Short Revised.

According to the UEQ manual, all scales, except for efficiency, showed a positive evaluation with the highest scores on the scale "perspicuity" (mean = 1.625, SD = 0.71) followed by "attractiveness" (mean = 1.571, SD = 0.51) at post-assessment (Fig. 5). No significant associations existed between the UEQ scales and adherence parameters. A negative association was found between the UEQ scale "perspicuity" and the DASS-P score at mid- and post-assessment.

Analyses of group differences between participants who completed the basic modules and non-intervention completers on user experience measured with the UEQ only revealed significant associations for the UEQ-subscale "novelty" with significantly higher scores in the completer group at mid-assessment (F = 0.037, p = .036).

3.3. Use of communication options

After completing a module, participants received a personalized feedback message from the study team via the program platform within one week. In addition, the participants also had the opportunity to reply to these messages. Sixty-five out of 149 (43.6 %) participants responded to the feedback messages from the study team and wrote an average of 2.6 messages (SD = 2.05, range 1–11). The moderated group chat was used by 24 out of 149 (16.11 %) participants, with an average of 4.54 group messages (SD = 6.64, range 1–30) sent per participant.

3.4. Secondary analyses

Due to the pilot design of this trial, changes in depression, anxiety and stress scores were analyzed descriptively. Among all participants who completed the post-assessment and opened at least one module (N = 40), we observed a slight decrease from baseline (M = 8.88, SD = 5.84) to post-assessment (M = 8.78, SD = 5.46) in the mean DASS-P score, and a slight increase in the mean EPDS score from baseline (M = 7.95, SD = 4.62) to post-assessment (M = 8.78, SD = 5.54). As recommended (Levis et al., 2020), a cut-off of EPDS ≥10 has been applied to form post-hoc subgroups based on the extent of psychological distress. The subgroup with higher initial symptom scores did not differ from those with lower symptom scores in study and intervention dropout rates. The descriptive pre-post analyses of the EPDS and DASS-P scores for the study completers of the respective subgroups are presented in Table 3 and revealed a decrease in both scores from baseline to post-assessment.

4. Discussion

This pilot trial investigated the feasibility and acceptability of an internet-based program aimed to enhance peripartum mental well-being and prevent PPD. Our findings indicated a high initial willingness to use to the intervention, with 88.6 % of all participants logging into the platform at least once, and 88.5 % of the active users completing the first module. However, we observed a decline in module use over time. Participants expressed satisfaction with the content and length of the modules. Despite this positive feedback, along with moderate intervention credibility and expectancy scores, adherence was low. Lack of time and forgetting about the program were cited as primary reasons. Additionally, the modular structure with freely selectable modules may have contributed to low utilization. In contrast to other studies employing a sequential approach, it was not necessary to complete one module to access another (Barrera et al., 2015; Haga et al., 2019). Additionally, some participants were enrolled in the study during the final stages of their pregnancy, shortly before delivery, which limited opportunities to utilize the modules. Our findings align with previous studies that have reported significant attrition rates in internet-based interventions overall (Eysenbach, 2005; Oakley-Girvan et al., 2021), as well as those specifically targeting peripartum depression (Eysenbach, 2005; Fonseca et al., 2020; Mu et al., 2021), even when initial willingness to use is high (O'Mahen et al., 2015). Consistent with this, other studies have also reported substantial dropout rates between the first and the second module (O'Mahen et al., 2013). When compared to PandaMom, prevention studies offering intervention content during pregnancy from the second trimester onwards reported a higher number of provided and completed modules (Duffecy et al., 2019; Haga et al., 2019). Early provision allows users to engage with the content for a longer duration during pregnancy, enabling them to develop helpful strategies for coping with challenges before childbirth. Adapting PandaMom to include additional pregnancy-specific modules is deemed beneficial. This adjustment would make the content accessible earlier, potentially aiding users who did not log in for various reasons after giving birth. Moreover, integrating user-relevant topics specific to the current stage of pregnancy, such as child development, into the modules could enhance their appeal and thereby increase adherence. In this regard, it can also be an adherence-promoting strategy to reward the completion of a module by, for example, unlocking additional elective modules. So far, the intervention only includes personalized messages and a progress bar within the modules and on the dashboard as rewards for module completion.

Despite users generally expressing satisfaction with the module lengths in PandaMom, the identified lack of time as a primary reason for non-usage, along with findings from other studies suggests preference for modules shortened to the extent possible (Davis et al., 2023). Therefore, when adapting the program to include new content, it is crucial to ensure that the length remains user-friendly and customizable, tailored to the circumstances of peripartum women. This could involve dividing existing modules into smaller units. It is important to note that satisfaction with the intervention is only available from participants who completed the assessments. Obtaining insights from study dropouts would thus be of fundamental importance in understanding the reasons for non-completion and optimizing the intervention accordingly. Likewise, when conducting future studies, care should be taken to not only involve potential users in the conceptual design of the intervention, as done in our study, but also to conduct qualitative analyses during and after intervention use.

In general, guidance and communication options are regarded as factors that strengthen the alliance between intervention users and intervention moderators, thereby improving adherence (Mu et al.,

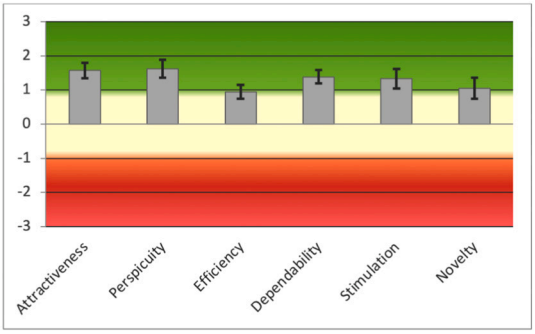

Fig. 5. Results of the user experience questionnaire.

Table 3
Means and standard deviations for secondary outcome measures in the subgroup with psychological distress and the subgroup at high risk.

Outcome	Subgroup with psychological distress (EPDS ≥10, n = 14)		Subgroup at high risk (EPDS ≥12, n = 9)	
	Baseline mean (SD)	Post-assessment mean (SD)	Baseline mean (SD)	Post-assessment mean (SD)
EPDS	13.21 (2.64)	11.14 (4.96)	14.67 (2.12)	12.33 (5.36)
DASS-P	13.21 (4.92)	10.71 (5.61)	14.78 (3.89)	11.89 (5.88)

Note: EPDS = Edinburgh Postnatal Depression Scale; DASS-P = Depression-Angst-Stress-Skala für die Peripartalzeit.

2021). PandaMom moderators provided individual guidance through personal messages and a group chatroom. Approximately 16 % of the sample utilized the chatroom, and nearly half responded to personal messages from the study team. To enhance the cost-effectiveness of the program, offering optional rather than regular personal support could be a viable approach to implementing guidance while also fostering users' sense of autonomy.

The working alliance scores revealed high bond-scale values, indicating a strong connection between participants and their moderator. Moderate levels of agreement and collaboration were noted on the task and goal subscales. Further analyses suggested that participants with a stronger working alliance were more likely to engage in the intervention, which is consistent with findings from previous studies (Mu et al., 2021). Therefore, strategies aimed at bolstering the working alliance appear crucial, particularly considering the reported association between the therapeutic relationship and intervention outcomes in internet-based interventions (Kaiser et al., 2021; Pihlaja et al., 2018; Probst et al., 2022; Solness et al., 2023). Another factor promoting adherence is the provision of more direct reminders, such as phone calls (Lau et al., 2017). In our study, participants received reminders to complete the modules and the assessments via email and platform messages. Many participants may have created a separate email address for the study and then failed to regularly check this address. Therefore, telephone reminders may be a more effective option. Additionally, push messages on users´ cell phones appear to enhance adherence (Oakley-Girvan et al., 2021). Another potential advantage of guidance is its ability to overcome the lack of obligation and commitment to online interventions mentioned in the stakeholder study (Schmidt-Hantke and Jacobi, 2023). In this regard, combining digital applications with personal contact, such as in-person enrollment (Linardon and Fuller-Tyszkiewicz, 2020) or telephone calls appears promising. Personal contact can also be advantageous in another aspect: Offering a brief intervention summary during in-person enrollment may increase perceived intervention credibility and expectancy. Promoting interventions through healthcare professionals could also be beneficial. Intervention credibility and expectation are related to adherence, with participants engaging more in interventions they perceive as credible. To enhance credibility and expectation, clear communication of goals and evidence, individualized support, user-friendly design, appealing content, and tailored materials are critical. These factors contribute to improving adherence and ultimately, outcomes.

Another point that should be considered when adapting the program is the observed positive association between educational level and adherence, suggesting that women with a higher level of education feel particularly targeted by the PandaMom program. To target all educational backgrounds, adaptations in language, content presentation, and structure are recommended. This aligns with the general desire reported in other studies for a tailored intervention that fits individual needs and circumstances.

The secondary outcomes were measured with well-established self-report questionnaires. The results suggest that overall, depression scores did not improve from baseline to post-measurement. However, it is possible that PandaMom might have a buffering effect compared to a control group, as previous research has shown that the prevalence of depressive symptomatology tends to increase after giving birth (Gavin et al., 2005; Zikic et al., 2024). Nevertheless, a decrease in depression, anxiety and stress scores was observed among high-risk women (i.e., those with a baseline EPDS score of 10 or higher) and intervention completers. Previous studies have shown that especially women at risk benefit more from internet-based interventions (Mu et al., 2021). This result suggests that the internet-based intervention may be particularly effective for women at increased risk for PPD. A possible explanation for these results may be that the intervention is not adequately tailored to the individual needs and challenges of postpartum women and does not fit the needs of women with low depression levels in late pregnancy. These women might not have felt addressed by the intervention content or may not have experienced a sense of psychological distress, leading to non-use of the materials. Additionally, assessments in this study were very close to birth, at two and five weeks postpartum, representing the time points with the highest reported prevalence rates. First-time mothers who had no symptoms of maternal stress or depression at baseline were confronted with various postpartum challenges for the first time after giving birth, which may have led to an increase in EPDS scores in the low-risk group.

5. Limitations

The results of this study should be interpreted in light of several limitations. First, the study applies a non-randomized design without a control group, which limits the reliability of the secondary analyses. Second, the mid- and post-assessments were conducted close to the time of birth, without any follow-up assessments. Third, a high attrition rate was observed in this study. Future larger-scale studies should focus on participants who dropped out or did not engage with the intervention content to identify reasons and develop strategies. Despite these limitations, this pilot study offers valuable insights into the feasibility and acceptability of the first German internet-based intervention for the prevention of PPD. By employing a user-centered design approach to address the needs of relevant stakeholders, we were able to develop a tailored intervention that includes desired content and features, such as personal guidance through individual feedback messages and a moderated group chat. The exploratory analyses suggest that the intervention may be effective in certain subgroups, highlighting the need for further research in this area.

6. Conclusions

In summary, this pilot study demonstrates the acceptability and feasibility of an internet-based program for pregnant women in the last trimester and postpartum period. However, further research is needed to evaluate the efficacy and user experience of the adapted intervention through a large randomized controlled trial, particularly among women at risk. This knowledge can inform the tailoring of the intervention to better meet the needs of various target subgroups and facilitate the implementation of strategies to promote user motivation and adherence in IMIs.

Future research should prioritize the development of effective prevention strategies to enhance mental well-being during the peripartum period and mitigate long-term negative impacts on both the mother and child. Additionally, exploring methods to integrate internet- and mobile-based prevention into routine prenatal care is crucial for increasing access to preventive services, potentially through collaboration with prenatal care providers such as midwives and gynecologists.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.invent.2024.100765.

References

Abraham, C., Michie, S., 2008. A taxonomy of behavior change techniques used in interventions. Health Psychol. 27, 379–387. https://doi.org/10.1037/0278-6133.27.3.379.

American Psychiatric Association, 2013. Diagnostic and statistical manual of mental disorders, fifth ed. American Psychiatric Association. doi:https://doi.org/10.1176/appi.books.9780890425596.

Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., Hedman, E., 2014. Guided internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: a systematic review and meta-analysis, 13, 288–295. https://doi.org/10.1002/wps.20151.

Ashford, M.T., Olander, E.K., Rowe, H., Fisher, J.R., Ayers, S., 2018. Feasibility and acceptability of a web-based treatment with telephone support for postpartum women with anxiety: randomized controlled trial. JMIR Ment Health 5, e19. https://doi.org/10.2196/mental.9106.

Barrera, A.Z., Wickham, R.E., Muñoz, R.F., 2015. Online prevention of postpartum depression for Spanish- and English-speaking pregnant women: a pilot randomized controlled trial. Internet Interv. 2, 257–265. https://doi.org/10.1016/j.invent.2015.06.002.

Bergant, A.M., Nguyen, T., Heim, K., Ulmer, H., Dapunt, O., 2008. Deutschsprachige Fassung und Validierung der. Edinburgh postnatal depression scale 123, 35–40. https://doi.org/10.1055/s-2007-1023895. Dtsch. Med. Wochenschr.

Boyd, R.C., Le, H.N., Somberg, R., 2005. Review of screening instruments for postpartum depression. Arch. Womens Ment. Health 8, 141–153. https://doi.org/10.1007/s00737-005-0096-6.

Cox, J.L., Holden, J.M., Sagovsky, R., 1987. Detection of postnatal depression: development of the 10-item Edinburgh postnatal depression scale. Br. J. Psychiatry 150, 782–786. https://doi.org/10.1192/bjp.150.6.782.

Davis, J.A., Ohan, J.L., Gregory, S., Kottampally, K., Silva, D., Prescott, S.L., Finlay-Jones, A.L., 2023. Perinatal Women's perspectives of, and engagement in, digital emotional well-being training: mixed methods study. J. Med. Internet Res. 25, e46852 https://doi.org/10.2196/46852.

Devilly, G.J., Borkovec, T.D., 2000. Psychometric properties of the credibility/expectancy questionnaire. J. Behav. Ther. Exp. Psychiatry 31, 73–86. https://doi.org/10.1016/S0005-7916(00)00012-4.

Duffecy, J., Grekin, R., Hinkel, H., Gallivan, N., Nelson, G., O'Hara, M.W., 2019. A group-based online intervention to prevent postpartum depression (Sunnyside): feasibility randomized controlled trial. JMIR Ment Health 6, e10778. https://doi.org/10.2196/10778.

Duffecy, J., Grekin, R., Long, J.D., Mills, J.A., O'Hara, M., 2022. Randomized controlled trial of Sunnyside: individual versus group-based online interventions to prevent postpartum depression. J. Affect. Disord. 311, 538–547. https://doi.org/10.1016/j.jad.2022.05.123.

Ebert, D.D., Van Daele, T., Nordgreen, T., Karekla, M., Compare, A., Zarbo, C., Brugnera, A., Øverland, S., Trebbi, G., Jensen, K.L., Kaehlke, F., Baumeister, H., 2018. Internet- and Mobile-based psychological interventions: applications, efficacy, and potential for improving mental health: a report of the EFPA E-health taskforce. Eur. Psychol. 23, 167–187. https://doi.org/10.1027/1016-9040/a000318.

Eysenbach, G., 2005. The law of attrition. J. Med. Internet Res. 7, e11 https://doi.org/10.2196/jmir.7.1.e11.

Fonseca, A., Alves, S., Monteiro, F., Gorayeb, R., Canavarro, M.C., 2020. Be a mom, a web-based intervention to prevent postpartum depression: results from a pilot randomized controlled trial. Behav. Ther. 51, 616–633. https://doi.org/10.1016/j.beth.2019.09.007.

Forsell, E., Bendix, M., Holländare, F., Szymanska von Schultz, B., Nasiell, J., Blomdahl-Wetterholm, M., Eriksson, C., Kvarned, S., Lindau van der Linden, J., Söderberg, E., Jokinen, J., Wide, K., Kaldo, V., 2017. Internet delivered cognitive behavior therapy for antenatal depression: a randomised controlled trial. J. Affect. Disord. 221, 56–64. https://doi.org/10.1016/j.jad.2017.06.013.

Gavin, N.I., Gaynes, B.N., Lohr, K.N., Meltzer-Brody, S., Gartlehner, G., Swinson, T., 2005. Perinatal depression: a systematic review of prevalence and incidence. Obstet. Gynecol. 106, 1071–1083. https://doi.org/10.1097/01.AOG.0000183597.31630.db.

Haga, S.M., Drozd, F., Lisøy, C., Wentzel-Larsen, T., Slinning, K., 2019. Mamma Mia – a randomized controlled trial of an internet-based intervention for perinatal depression. Psychol. Med. 49, 1850–1858. https://doi.org/10.1017/S0033291718002544.

Hanach, N., de Vries, N., Radwan, H., Bissani, N., 2021. The effectiveness of telemedicine interventions, delivered exclusively during the postnatal period, on postpartum depression in mothers without history or existing mental disorders: a systematic review and meta-analysis. Midwifery 94, 102906. https://doi.org/10.1016/j.midw.2020.102906.

Hatcher, R.L., Gillaspy, J.A., 2006. Development and validation of a revised short version of the working alliance inventory. Psychother. Res. 16, 12–25. https://doi.org/10.1080/10503300500352500.

Howard, L.M., Molyneaux, E., Dennis, C.-L., Rochat, T., Stein, A., Milgrom, J., 2014. Non-psychotic mental disorders in the perinatal period. Lancet 384, 1775–1788. https://doi.org/10.1016/S0140-6736(14)61276-9.

Jones, A., 2019. Help seeking in the perinatal period: a review of barriers and facilitators. Soc. Work Public Health 34, 596–605. https://doi.org/10.1080/19371918.2019.1635947.

Kaiser, J., Hanschmidt, F., Kersting, A., 2021. The association between therapeutic alliance and outcome in internet-based psychological interventions: a meta-analysis. Comput. Hum. Behav. 114, 106512 https://doi.org/10.1016/j.chb.2020.106512.

Lau, Y., Htun, T.P., Wong, S.N., Tam, W.S.W., Klainin-Yobas, P., 2017. Therapist-supported internet-based cognitive behavior therapy for stress, anxiety, and depressive symptoms among postpartum women: a systematic review and Meta-analysis. J. Med. Internet Res. 19, e138 https://doi.org/10.2196/jmir.6712.

Lau, Y., Cheng, J.-Y., Wong, S.-H., Yen, K.-Y., Cheng, L.-J., 2021. Effectiveness of digital psychotherapeutic intervention among perinatal women: a systematic review and meta-analysis of randomized controlled trials. World J Psychiatry 11, 133–152. https://doi.org/10.5498/wjp.v11.i4.133.

Laugwitz, B., Held, T., Schrepp, M., 2008. Construction and evaluation of a user experience questionnaire. In: Holzinger, A. (Ed.), HCI and Usability for Education and Work, Lecture Notes in Computer Science. Springer, Berlin Heidelberg, Berlin, Heidelberg, pp. 63–76. https://doi.org/10.1007/978-3-540-89350-9_6.

Leon, A.C., Davis, L.L., Kraemer, H.C., 2011. The role and interpretation of pilot studies in clinical research. J. Psychiatr. Res. 45, 626–629. https://doi.org/10.1016/j.jpsychires.2010.10.008.

Levis, B., Negeri, Z., Sun, Y., Benedetti, A., Thombs, B.D., 2020. Accuracy of the Edinburgh postnatal depression scale (EPDS) for screening to detect major depression among pregnant and postpartum women: systematic review and meta-analysis of individual participant data. BMJ m4022. https://doi.org/10.1136/bmj.m4022.

Lin, P.-Z., Xue, J.-M., Yang, B., Li, M., Cao, F.-L., 2018. Effectiveness of self-help psychological interventions for treating and preventing postpartum depression: a meta-analysis. Arch. Womens Ment. Health 21, 491–503. https://doi.org/10.1007/s00737-018-0835-0.

Linardon, J., Fuller-Tyszkiewicz, M., 2020. Attrition and adherence in smartphone-delivered interventions for mental health problems: a systematic and meta-analytic review. J. Consult. Clin. Psychol. 88, 1–13. https://doi.org/10.1037/ccp0000459.

Loughnan, S.A., Joubert, A.E., Grierson, A., Andrews, G., Newby, J.M., 2019. Internet-delivered psychological interventions for clinical anxiety and depression in perinatal women: a systematic review and meta-analysis. Arch. Womens Ment. Health 22, 737–750. https://doi.org/10.1007/s00737-019-00961-9.

Martini, J., Einbock, K., Wintermann, G.-B., Klotsche, J., Junge-Hoffmeister, J., Hoyer, J., 2009. Die Depression-Angst-Stress-Skala für die Peripartalzeit: Ein Screeninginstrument für die Schwangerschaft und das Wochenbett. Klinische Diagnostik und Evaluation 4 (2), 288–309.

Milgrom, J., Danaher, B.G., Gemmill, A.W., Holt, C., Holt, C.J., Seeley, J.R., Tyler, M.S., Ross, J., Ericksen, J., 2016. Internet cognitive behavioral therapy for women with postnatal depression: a randomized controlled trial of MumMoodBooster. J. Med. Internet Res. 18, e54 https://doi.org/10.2196/jmir.4993.

Mu, T., Li, Y., Xu, R., Chen, J., Wang, Y., Shen, C., 2021. Internet-based interventions for postpartum depression: a systematic review and meta-analysis. Nurs. Open 8, 1125–1134. https://doi.org/10.1002/nop2.724.

Nishi, D., Imamura, K., Watanabe, K., Obikane, E., Sasaki, N., Yasuma, N., Sekiya, Y., Matsuyama, Y., Kawakami, N., 2022. The preventive effect of internet-based cognitive behavioral therapy for prevention of depression during pregnancy and in the postpartum period (iPDP): a large scale randomized controlled trial. Psychiatry Clin Neurosci pcn.13458. doi:https://doi.org/10.1111/pcn.13458.

Oakley-Girvan, I., Yunis, R., Longmire, M., Ouillon, J.S., 2021. What works best to engage participants in Mobile app interventions and e-health: a scoping review. Telemedicine and e-health tmj.2021.0176. doi:https://doi.org/10.1089/tmj.2021.0176.

O'Hara, M.W., 2009. Postpartum depression: what we know. J. Clin. Psychol. 65, 1258–1269. https://doi.org/10.1002/jclp.20644.

O'Hara, M.W., McCabe, J.E., 2013. Postpartum depression: current status and future directions. Annu. Rev. Clin. Psychol. 9, 379–407. https://doi.org/10.1146/annurev-clinpsy-050212-185612.

O'Hara, M.W., Wisner, K.L., 2014. Perinatal mental illness: definition, description and aetiology. Best Pract. Res. Clin. Obstet. Gynaecol. 28, 3–12. https://doi.org/10.1016/j.bpobgyn.2013.09.002.

O'Mahen, H.A., Woodford, J., McGinley, J., Warren, F.C., Richards, D.A., Lynch, T.R., Taylor, R.S., 2013. Internet-based behavioral activation—treatment for postnatal depression (Netmums): a randomized controlled trial. J. Affect. Disord. 150, 814–822. https://doi.org/10.1016/j.jad.2013.03.005.

O'Mahen, H.A., Grieve, H., Jones, J., McGinley, J., Woodford, J., Wilkinson, E.L., 2015. Women's experiences of factors affecting treatment engagement and adherence in internet delivered Behavioural activation for postnatal depression. Internet Interv. 2, 84–90. https://doi.org/10.1016/j.invent.2014.11.003.

Pihlaja, S., Stenberg, J.-H., Joutsenniemi, K., Mehik, H., Ritola, V., Joffe, G., 2018. Therapeutic alliance in guided internet therapy programs for depression and anxiety disorders – a systematic review. Internet Interv. 11, 1–10. https://doi.org/10.1016/j.invent.2017.11.005.

Probst, G.H., Berger, T., Flückiger, C., 2022. The Alliance-outcome relation in internet-based interventions for psychological disorders: a correlational Meta-analysis. Verhaltenstherapie 32, 135–146. https://doi.org/10.1159/000503432.

Schmidt-Hantke, J., Jacobi, C., 2023. Investigating perspectives on e-health interventions to enhance maternal mental well-being: results of a stakeholder interview. PLOS Digit Health 2, e0000326. https://doi.org/10.1371/journal.pdig.0000326.

Siddhpuria, S., Breau, G., Lackie, M.E., Lavery, B.M., Ryan, D., Shulman, B., Kennedy, A. L., Brotto, L.A., 2022. Women's preferences and design recommendations for a postpartum depression psychoeducation intervention: user involvement study. JMIR Form Res 6, e33411. https://doi.org/10.2196/33411.

Silang, K.A., Sohal, P.R., Bright, K.S., Leason, J., Roos, L., Lebel, C., Giesbrecht, G.F., Tomfohr-Madsen, L.M., 2022. eHealth interventions for treatment and prevention of depression, anxiety, and insomnia during pregnancy: systematic review and Meta-analysis. JMIR Ment Health 9, e31116. https://doi.org/10.2196/31116.

Slomian, J., Honvo, G., Emonts, P., Reginster, J.-Y., Bruyère, O., 2019. Consequences of maternal postpartum depression: a systematic review of maternal and infant outcomes. Womens Health (Lond. Engl.) 15. https://doi.org/10.1177/1745506519844044, 174550651984404.

Solness, C.L., Holdefer, P.J., Hsu, T., Thomas, E.B.K., O'Hara, M.W., 2023. Relationship factors in internet-delivered psychological interventions for veterans experiencing postpartum depression: qualitative analysis. JMIR Ment Health 10, e46061. https://doi.org/10.2196/46061.

Spek, V., Cuijpers, P., Nyklícek, I., Riper, H., Keyzer, J., Pop, V., 2007. Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: a meta-analysis. Psychol. Med. 37, 319. https://doi.org/10.1017/S0033291706008944.

Stewart, D.E., Vigod, S., 2016. Postpartum Depression. N. Engl. J. Med. 375, 2177–2186. https://doi.org/10.1056/NEJMcp1607649.

Titov, N., 2011. Internet-delivered psychotherapy for depression in adults. Curr. Opin. Psychiatry 24, 18–23. https://doi.org/10.1097/YCO.0b013e32833ed18f.

Westerhoff, B., Trösken, A., Renneberg, B., 2019. About:blank? Online Interventions for Postpartum Depression. Verhaltenstherapie 1–10. https://doi.org/10.1159/000501779.

Wilcox, M., McGee, B.A., Ionescu, D.F., Leonte, M., LaCross, L., Reps, J., Wildenhaus, K., 2021. Perinatal depressive symptoms often start in the prenatal rather than postpartum period: results from a longitudinal study. Arch. Womens Ment. Health 24, 119–131. https://doi.org/10.1007/s00737-020-01017-z.

Wilmers, F., Munder, T., Leonhart, R., Herzog, T., Plassmann, R., Barth, J., Linster, H.W., 2008. Die deutschsprachige Version des Working Alliance Inventory - short revised (WAI-SR) - Ein schulübergreifendes, ökonomisches und empirisch validiertes Instrument zur Erfassung der therapeutischen Allianz. https://doi.org/10.7892/BORIS.27962.

Zikic, O., Stojanov, J., Kostic, J., Nikolic, G., Tosic Golubovic, S., Simonovic, M., Djordjevic, V., Binic, I., 2024. Depression in the perinatal period: course and outcome of depression in the period from the last trimester of pregnancy to one year after delivery in Primiparous mothers. Medicina 60, 970. https://doi.org/10.3390/medicina60060970.