MOBILE WELL-BEING IN PREGNANCY: SUGGESTIONS FROM A QUASI-EXPERIMENTAL CONTROLLED STUDY .

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Abstract

“BenEssere Mamma” app, is a mobile self-help intervention containing mindfulness meditations and “savoring the present moment” exercises for use during pregnancy. The goal of this study is to investigate the effectiveness of this app in enhancing the psychological well-being of healthy childbearing women. A quasi-experimental controlled study was conducted with 74 pregnant women randomly assigned to experimental group (APP - mobile app and antenatal care) or control group (routine antenatal care). Participants were assessed on their psychological well-being before, after the four weeks of use of the app, and during the first three months after the birth of the child, using Ryff’s Psychological Well-Being Scale. Women’s acceptance and user experience with the app were also assessed through an ad hoc questionnaire. Experimental group reported an increase in sense of autonomy after intervention and after childbirth, and greater self-acceptance after the childbirth compared to the control group. These results suggest that a self-help mobile intervention can be effective for enhancing women’s psychological well-being. Future researches are needed to understand if a more interactive content or a longer intervention could achieve more effective results and if other populations could take advantage of this opportunity.

Word Count : 3480 words

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INTRODUCTION

Today e-health and m-health are becoming the new way to promote healthcare by using information and communication technologies worldwide^{1,2}. The rapid expansion of mobile technologies gives the opportunity to improve well-being thanks to self-care programs that foster healthy behaviour and extend prevention and care-seeking culture. “Self-care” is a broad concept subsuming self-management, self-monitoring, and symptom management performed by oneself to achieve, maintain, or promote optimal health”.³ Self-care programs supported by mobile technologies have demonstrated their effectiveness in promoting mental health⁴⁻⁶ and overcoming some limits related to traditional supports such as time, resources, flexibility, accessibility, and availability. Thanks to these features, digital technologies could be useful to achieve the United Nation Millennium Development Goals (MDGs) including maternal health.^{4,7-9}

Studies demonstrated that scarce emotion regulation, high negative affect, prenatal depression and anxiety represent risk factors for complications such as, preterm delivery and low birth weight, post-partum depression¹⁰⁻¹² and long-term adverse implications for newborns, such as poorer cognitive development;¹³ moreover, psychological well-being is recognized as a critical protective factor against the occurrence of pre and post-partum depression.¹⁴ Psychological well-being is a multidimensional construct, that concerns the full growth and self-realization of the individual through the resolution of existential life challenges and consists of six dimensions¹⁵: autonomy, namely the perceived ability to resist social pressures and to regulate one’s behaviour; environmental mastery, a sense of competence in managing life's events; personal growth, a feeling of continued development and a sense of realising one’s potential; positive relations, that is having warm, satisfying and trusting relationships with others; purpose in life, having goals and a sense of directedness; and self-acceptance, possessing a positive attitude toward the self, including good and bad qualities.

To increase maternal well-being, several interventions exist, such as progressive muscle relaxation, mindfulness meditation, yoga therapy, breathing instructions, and guided imagery, and have shown promising results.¹⁶ Mindfulness-based interventions have been shown to be effective for promoting pregnant women’s psychological well-being.¹⁷ Mindfulness meditation can be described as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment”.¹⁸ In particular, two skills enhanced by mindfulness, attention monitoring and acceptance, allow women to adopt an attitude of openness and nonjudgment toward internal and external

experiences and are recognized as effective strategies for emotional regulation and stress reduction.¹⁹ Mindfulness-based interventions have demonstrated their effectiveness in coping with a number of adverse prenatal and postnatal outcomes, such as fear and pain of childbirth, depression, anxiety and negative affect^{20,21}, providing pregnant women with more empowerment and satisfaction with childbirth by increasing positive affect, self-compassion and maternal-foetal attachment.²² According to the review by Matvienko-Sikar and Dockray²³, mindfulness interventions are effective in promoting maternal well-being especially in terms of decreased levels of negative affect, depression, and anxiety during pregnancy and increased self-acceptance.

Today, mindfulness meditation has been successfully included in mobile interventions that have been demonstrated to be effective in helping people practice stress management techniques, in reducing anxiety and stress symptoms and in promoting well-being.^{7,8,24,25} Moreover, pregnancy apps and web-sites are widely accepted by pregnant women and may represent important sources of information and improve perinatal outcomes by supporting healthier lifestyles and strengthening informed decision-making.^{9,26–30} For all these reasons, promoting maternal well-being and increasing optimal pregnancy outcomes by developing and applying cost effective self-care treatments using electronic and mobile devices represent a health care challenge worldwide.

Starting from these premises, this study was conducted to examine the effectiveness and feasibility of the BenEssere Mamma app—a 4-week self-help mindfulness-based intervention delivered through a smartphone—on women's psychological well-being during pregnancy. Researchers hypothesized that the use of the app would increase psychological well-being in the experimental group during pregnancy and after childbirth, measured within three months after childbirth, compared to the control group.

METHODS

The study had a quasi-experimental design and was carried out in the maternity wards of 3 hospitals in Northern Italy. Recruitment was conducted from August 2016 to January 2017: women who asked to be registered for childbirth education were allocated to the classes by the hospital staff based on the availability of places. Childbirth education classes at each hospital were randomly assigned to the intervention group or to the control group by the researchers. Data were collected at baseline (first lesson), after the 4-week intervention and a follow up assessment within 3 months after childbirth. Self-report questionnaires were used to

determine changes in psychological well-being and to evaluate the acceptability of the intervention proposed during pregnancy.

The study was approved by the Ethics Committee of the Psychology Department of the Università Cattolica del Sacro Cuore of Milan (Italy). Written informed consent was obtained from all women, who were assured that participation was voluntary, that they were free to exit the study any time and that all data were confidential.

The researchers met women at the first lesson of their antenatal childbirth education course to explain the purpose of the study and to invite them to participate. Women who agreed to participate signed written informed consent forms and were enrolled (Figure 1). The inclusion criteria were: women age at least 18 years old, first pregnancy, in the third pregnancy trimester, low-risk pregnancy at the start of the intervention, internet access, fluent in Italian (the app and the guided meditations proposed were in Italian) and able to complete the questionnaires.

G-power software was used to estimate the number of participants required. Assuming a medium effect (Cohen d 0.5), in line with the PPI intervention's impact on well-being³¹, a minimum sample of 44 (22 in each group) was needed to detect the effects of the intervention, with a statistical power of .95 and an alpha of .05. It was also assumed that repeated measures scores had a moderate-to-strong correlation of .5. Accounting for the high attrition rate typical for Internet-based intervention research²⁴, and the difficulties in retention of pregnant women and new mothers in the post-partum period³², researchers decided to recruit a sample of at least 66 participants (50% more).

Figure 1. Recruitment and participant flow diagram

MATERIALS AND METHODS

Procedures

To be homogeneous, childbirth education classes of each hospital were randomly and equitably distributed to the intervention App BenEssere Mamma protocol (4 classes -, n=57), or to the control group (4 classes - n=51).

All women who agreed to participate in the study completed the questionnaires at baseline. At baseline the BenEssere Mamma APP group received the app with instructions on how to install it. The app was available only for Android: participants who did not own an Android device were given an Android tablet, free of charge, for use throughout the trial period, with the app already installed.

After 4 weeks, researchers met the participants during their last lesson and asked them to fill in the questionnaires a second time. All women were contacted by email after the delivery of their child for a post-partum assessment.

In addition to the childbirth education classes, women in the experimental group were invited to use the app for practising meditation daily. The BenEssere Mamma app is a 4-week self-help intervention including twenty meditation exercises and aimed at promoting childbearing women's psychological well-being. The application includes activities and materials divided in three areas (see Figure 2): an informative area, including the "Good to know" (explanations about stress, pregnancy and relaxation practices), the "Other Proposal" (proposal of other exercises such as mindful eating) and the "Story of Your Actions" (the application activities trace) sections; an emotional awareness area, "Mood Diary", to help women to monitor their mood day-by-day and become more aware of their own emotional state and an experiential area, and "Your Path", that contains 20 daily exercises lasting from 3 to 20 minutes each, for five days a week. Thus, every week women can freely choose between five meditation exercises inspired by mindfulness practice, adapted for use during pregnancy (Table 1). Practices are designed to develop awareness of the present moment, including thoughts, emotions, and bodily sensations, and to develop compassion towards oneself, the baby in the womb and others.

To maximize applicability and generalizability of results^{33,34}, participants did not have any kind of constraints related to the use of the app (timing, location, etc.), but were strongly encouraged to practice one exercise a day for four weeks. Women in the control group were invited to participate in the 4-week childbirth education classes.

Table 1. Type and description of exercises included in BenEssere Mamma App and promoted skills^a

Exercises	Duration	Description	Promoted skills
Breathing meditation	From 3 to 9 minutes	Women is invited to sit comfortably and focus their attention on breath and body movements (particularly on the chest and on the belly). When the mind wanders, they are invited to notice what distracted them and then return to observe their breathing.	Decentering from internal experiences that can reduce reactivity and increase acting with awareness ⁵⁶
Body scan meditation	From 7 to 20 minutes	Women, sitting or lying in a comfortable position, are invited to focus their attention on various regions of the body and to accept any discomfort or pain or any other bodily sensation.	Increased interoceptive awareness and acceptance ⁵⁷ to better manage pain and discomfort.
Connection with unborn baby & inner smile meditation	From 8 to 10 minutes	Mothers-to-be are requested to send loving thoughts to the unborn child and to form a smile on their lips and then to extend it inwardly to all their body, to the unborn baby and to all the people in the world.	Increased self-compassion to promote psychological well-being ⁵⁸ and strengthen prenatal attachment ⁵⁹
Savoring the moment activities	From 10 to 20 minutes	Eating mindfulness, the mindful shower, “a mindful snuggle with unborn and daddy,” relaxation exercises, etc.	Promoting positive emotion and decreasing elements of negative affect ⁷ to enhance psychological well-being.

^a BenEssere Mamma app proposed five guided meditations a week for four weeks, lasting from 3 to 20 minutes. Women were expected to practice a single meditation daily, by freely choosing an exercise of the current week.

Source: Feldman et al.⁵⁶; Duncan et al.⁵⁷; Zessin et al.⁵⁸; Mohamadirizi et al.⁵⁹; Corno et al.⁷

Figure 2. BenEssere Mamma App: home page

Materials

Demographic characteristics, including age, employment status, educational level, marital status, gestational trimester and other information about previous experience of meditation or other relaxation techniques, were collected at baseline .

The Psychological Well-being Scale was used to measure the level of psychological well-being.^{35,36} The scale consists of 84 items reflecting 6 distinct components of psychological well-being (each assessed with 14 items): 1) autonomy (e.g., “I have confidence in my opinions even if they are contrary to the general consensus”); 2) environmental mastery (e.g., “I am quite good at managing the many responsibilities of my daily life”); 3) personal growth (e.g., “I think it is important to have new experiences that challenge how you think about yourself and the world”); 4) positive relations (e.g., “Most people see me as loving and affectionate”) 5) purpose in life (e.g., “Some people wander aimlessly through life, but I am not one of them); and 6) self-acceptance (e.g., “In general, I feel confident and positive about myself”). Women rate statements from a scale of 1 to 6, with 1 indicating strong disagreement and 6 indicating strong agreement, thus the score for each dimension ranges between 1 and 6 with higher values indicating better psychosocial functioning. The Psychological Well-being

subscales showed good psychometric properties and good test–retest reliability ranging in this study between .75 and .86 in a six-week interval.

Adherence to the intervention was monitored through a practice report, generated by the app at the end of the intervention. Researchers asked participants to send the practice report during the last meeting (after 4 weeks), including their code and the meditations practiced day by day, from the app through a dedicated button. No personal data were included in this log.

In addition to the Psychological Well-Being questionnaire, a short set of questions using a 5-point Likert scale (1 = “strongly disagree; 5 = “strongly agree”) were administered to measure the acceptance of the APP. These questions were inspired by the technology acceptance model³⁷ and included: perceived pleasantness (e.g., “Did you find the proposed practices pleasant?”), perceived usefulness (e.g., “Did the proposed practices help you to relax?”) and willingness to use the app (frequency of use) (e.g., “A practice of 15 minutes a day is acceptable?”; “How often would you like to use the app?”). An evaluation of the practices proposed was also requested (e.g., “Please give a score from 1 “I do not like it at all” to 5 “I like it very much” for each of the types of meditation proposed in the app”).

Data analysis

SPSS software (20.0) was used to analyse data. Student’s t test and the chi-square test were employed to examine differences in the baseline characteristics of the 2 groups and no significant differences emerged. To evaluate possible hospital-specific effects due to the fact that education childbirth classes of each hospital - and not independent pregnant women - were equitably distributed to the intervention protocol, we calculated intraclass correlations (ICC). The ICC ranges in value from 0 to 1, with higher values of the ICC indicating greater proportions of between-level variance and thus likely greater bias if the multilevel nature of the data is not considered. We found that ICC values of each PWB subscale at the baseline, four weeks after the intervention and postpartum were lower than 0.05 (see table 2). Thus, considering that multilevel modelling may provide few benefits when ICCs are less than 0.05³⁸, to assess the effect of the app on psychological well-being we performed a 2 × 2 Repeated Measures ANOVA, with manipulation type (app intervention vs control) as a between-subjects variable and time (baseline vs post-intervention, baseline vs postpartum) as a within-subject factor.

RESULTS

Seventy-four women completed the questionnaire before and after the 4-week intervention and 29 (39.1%) women completed the follow-up evaluation postpartum. No significant differences in the demographic variables were observed between the two groups (Table 3) and no significant differences emerged between participants who completed the program and those who left.

Sense of autonomy showed a significant increase in experimental group compared to the control group, immediately after the 4 weeks of training. No other significant effects were found (Table 4).

In the postpartum assessment, significant interaction effects emerged in Autonomy and Self-acceptance (Table 5): women in the APP group perceived themselves as more self-determined and independent and more able to accept multiple aspects of themselves compared to the control group.

The practice report, created to monitor adherence to the intervention, was sent by most of the participants (86.1%). Women's adherence to daily practice was lower than requested: they did not follow the prescription of one meditation a day (20 meditations suggested in four weeks). The mean (SD) number of practice sessions per week was 3.00 (2.39) and the calculated median of exercises practised during the four-week intervention was about 9 exercises.

To investigate the acceptance of the app, three factors were investigated: perceived pleasantness, perceived usefulness and willingness to use (frequency of use). Regarding perceived pleasantness, women judged the app quite pleasant and engaging ($M=3.14$, $SD=1.00$). Exercises were average in pleasantness (see Table 6) and the app was judged useful ($M=3.11$, $SD=1.10$).

Women believed that a 15-minute practice session could be inserted in their daily life ($M=3.32$, $SD=.81$). Nevertheless, participants showed a preference for less frequent use: 36.4% of respondents would use the app "weekly," 30.3% "sometimes," and 15.2% would use the app according to their needs.

Table 2. Estimated Intra-class correlation (ICC) for Psychological Well-Being subscales

PWB subscales	Minimum	Maximum
Autonomy	.000	.040
Environmental Mastery	.000	.006
Personal Growth	.002	.014
Positive Relations	.007	.029
Purpose In Life	.001	.010
Self-Acceptance	.001	.046

Abbreviation: PWB= Psychological Well-Being

Table 3. Characteristics of Participants at baseline (N= 108)

Participants' Characteristics	App Group (N. 36)	Control Group (N. 38)	P Value
Age, mean (SD)	33.47 (3.989)	33.13 (4.431)	.562 ^a
Education Level, (%)			
_Senior high school or below	18	19	.717 ^b
_Bachelor's degree	15	17	
_Master 's degree or higher	3	1	
Employment Status, (%)			
_Working	35	35	.331 ^b
_Not Working	1	3	
Marital Status, (%)			
Single	0	1	.246 ^b
Divorced	0	1	
In a stable relationship	36	35	
Previous Meditation, (%)			
Yes	9	9	.947 ^b
No	27	28	

^a Student's t test. ^b Chi-square test.

Table 4. Effectiveness of the intervention after 4 weeks - Repeated Measures ANOVA – N. 74

	Baseline M (SD)	Post 4 week M (SD)	Main Effect						Interaction Effect		
			Time			Group			Time x Group		
			F	p	η^2	F	p	η^2	F	p	η^2
Autonomy ^a											
APP Group	4.25 (.59)	4.29 (.52)									
Control Group	4.55 (.73)	4.43 (.71)	.720	.399	.010	2.370	.128	.032	3.967	.050	.052
Environmental Mastery ^a											
APP Group	4.56 (.52)	4.55 (.42)									
Control Group	4.59 (.64)	4.56 (.56)	.167	.684	.002	.032	.858	.000	.099	.754	.001
Personal Growth ^a											
APP Group	4.69 (.49)	4.72 (.50)									
Control Group	4.740 (.49)	4.66 (.50)	.348	.557	.005	.002	.962	.000	1.700	.196	.023
Positive Relations ^a											
APP Group	4.63 (.83)	4.62 (.84)									
Control Group	4.92 (.64)	4.82 (.60)	1.737	.192	.024	2.247	.138	.030	.968	.328	.013
Purpose in Life ^a											
APP Group	4.83 (.57)	4.78 (.54)									
Control Group	4.86 (.51)	4.73 (.45)	.3.821	.054	.050	.004	.949	.000	.914	.342	.013
Self-Acceptance ^a											
APP Group	4.57 (.61)	4.67 (.59)									
Control Group	4.68 (.71)	4.63 (.61)	.253	.617	.004	.075	.785	.001	2.763	.101	.037

Effect of App + Childbirth Educational Class (APP Group) vs. Childbirth Educational Class only (Control Group) - Time represents the main effect related to within subject analysis (repeated measures), Group represents the main effect related to between groups analysis, and Time x Group represents the interaction effect between groups at different times (our main research question)

^a Psychological Well-Being Subscales score ranging from 1 to 6; higher scores indicating better psychosocial functioning.

Table 5. Effectiveness of the intervention at postpartum- Repeated Measures ANOVA – N. 29

	Baseline M (SD)	Postpartum M (SD)	Main Effect						Interaction Effect		
			Time			Group			Time x Group		
			F	p	η^2	F	p	η^2	F	p	η^2
Autonomy ^a											
APP Group	4.22 (.71)	4.40 (.60)									
Control Group	4.55 (.63)	4.36 (.93)	.136	.716	.005	.189	.667	.007	4.355	.046	.139
Environmental Mastery ^a											
APP Group	4.65 (.60)	4.55 (.48)									
Control Group	4.69 (.56)	4.42 (.70)	3.815	.061	.124	.044	.835	.002	.748	.397	.023
Personal Growth ^a											
APP Group	4.88 (.45)	4.62 (.47)									
Control Group	4.77 (.42)	4.75 (.43)	3.140	.088	.104	.715	.405	.026	.007	.936	.000
Positive Relation ^a											
APP Group	4.79 (.89)	4.81 (.77)									
Control Group	4.85 (.73)	4.63 (.90)	1.340	.257	.047	.036	.851	.001	1.964	.172	.068
Purpose in Life ^a											
APP Group	4.88 (.58)	4.78 (.51)									
Control Group	4.93 (.49)	4.62 (.74)	5.711	.024	.175	.084	.774	.003	1.425	.243	.050
Self-Acceptance ^a											
APP Group	4.64 (.67)	4.82 (.60)									
Control Group	4.61 (.79)	4.33 (1.13)	.369	.549	.013	.754	.393	.027	7.435	.011	.216

Effect of App + Childbirth Educational Class (APP Group) vs. Childbirth Educational Class only (Control Group) - Time represents the main effect related to within subject analysis (repeated measures), Group represents the main effect related to between groups analysis, and Time x Group represents the interaction effect between groups at different times (our main research question)

^a Psychological Well-being SubScales score ranging from 1 to 6; higher scores indicating better psychosocial functioning.

Table 6. Participants' evaluation of the pleasantness of BenEssere Mamma practices (Mean, SD)

Proposed Practice	M (SD)^a
Inner Smile Meditation	3.48 (1.09)
Breathing Meditation	3.55 (1.09)
Connection with your baby	3.64 (1.13)
Positive Visualization	3.31 (.93)
Body Scan	3.29 (1.01)
Music Listening	3.74 (1.29)

^a 5-point Likert scale with anchors of 1 “I do not like it at all” to 5 “I like it very much”

DISCUSSION

The importance of psychological well-being in pregnancy is well known: psychological well-being positively influences not only the course of pregnancy and childbirth, but also the postpartum period and mother-child attachment.^{11,14,39}

Digital interventions may facilitate stress management also for pregnant women and may promote psychological wellbeing⁴⁰: these media are not simply sources of information, they also operate as performative devices in that they push users to act on and through their bodies via these devices⁴¹. Mobile apps represent a suitable tool to enact an interactive and customized experience according to the users' goals and they are more effective in promoting change in behaviour than static self-help tools.⁴² Although these opportunities, up to now the effectiveness of a very few mobile self-help interventions have been tested. For this reason, the aim of the present study was to test the effectiveness of a mobile app, BenEssere Mamma, as a mindfulness-based mobile self-help intervention for enhancing mother's psychological well-being.

Our hypothesis that the use of the app would be associated with improved psychological well-being was partially confirmed. Data showed different outcomes were achieved after the 4-week intervention and after childbirth. After the 4-week intervention women started to report growing sense of autonomy compared to control group that, vice versa, showed a decrease. In the postpartum period women in the experimental group confirmed this growth in sense of autonomy and reported, in addition, a more positive attitude toward the self, compared to the control group.

Autonomy can be defined as the need to experience being the initiator of one's own actions, and to act in a way that is consistent with one's values. According to Sundar et al.⁴³, mobile apps may offer many choices that let users create customized programs and in this way they could inject in users a real sense of autonomy or self-determination. BenEssere Mamma users were highly involved in customizing their daily activities: the app provided five meditations a week, but users could freely choose exercises (type, frequency and exercise duration). Moreover, interactive technologies that invite users for constant self-monitoring (e.g., step taken, kicks count, calories or weight, etc.) can enhance perceptions of autonomy⁴⁴: BenEssere Mamma encouraged women to monitor daily changes in their emotions state and feelings and to track their activities, thanks to a story of practices carried out. We can suppose, in line with Sundar et al.⁴⁴, that these features have enhanced the women perceptions of autonomy. Thus, experiencing more autonomy can help women in dealing with changing roles^{45,46} and adaptively integrating the expectations of motherhood, influenced by their own idea of perfect motherhood, and the realities.⁴⁷ Promoting their sense of independence and self-acceptance could help women in feeling adequate in their new role as mothers, being less influenced by others' opinions and more confident about making decisions autonomously for themselves and their infants.

The BenEssere Mamma intervention allowed participants to feel more satisfied with themselves and more aware of their abilities, while the women in the control group experienced the opposite sensations. According to Linardon⁴⁸ principles of acceptance, mindfulness, and self-compassion may be learned through self-help interventions delivered via smartphone: it is reasonable to hypothesize that thanks to the increased self-acceptance and the detached attitude stimulated by the mindfulness meditations¹⁹, women developed competences in regulating their behaviors and less dependent on others for their well-being.³² Furthermore, autonomy and acceptance-based processes have been recently recognized as protective factors with regard to the risk of developing depressive psychological symptoms^{46,47}.

This partially confirmation of our hypotheses could be explained, as noted by Villani et al., by the short term stability of psychological well-being.⁴⁹ Maybe short interventions, such as the one proposed, are capable of reducing anxiety, stress, and negative emotions, but it is possible that changes in personal representations of well-being require more than a few weeks of experience. In this respect, the longer the intervention, the greater the improvement in levels of well-being.³¹

Secondly, participants considered the app quite pleasant and useful, even if they did not practice daily. This low adherence can explain the limited impact of our experimental manipulation: it is known that regular practice is beneficial to psychological well-being. Poor motivation and lack of adherence to the instructions could diminish the intervention's effects on well-being.⁵⁰ To meet this concern future studies could add more interactivity, tailored messages, incentives for frequent remind, reward points, and other engagement metrics to increase the adherence to the digital protocol, as indicated by Bellur and colleagues.⁵¹

The findings of this study have some limitations. Results cannot be generalized to a wider population of childbearing women because of the participants' homogenous characteristics. Secondly, a large percentage of women dropped out of the study after giving birth which resulted in a reduction of the sample size at the postpartum assessment. Third, participants practiced irregularly and less frequently than suggested. This fact could have influenced the present results: it is known that to increase self-awareness and mindfulness of one's behaviour, regular practice and commitment is needed, and participants did not necessarily practice regularly. Last, digital literacy of participants was not investigated: it's possible that participant with lower digital literacy were less proactive in navigating through the app and so they felt less autonomous in customise their own experience.⁵²

CONCLUSION

In recent years, many mobile apps for mental health have been developed and have demonstrated to be a viable and cost-effective solution for promoting health in clinical and non-clinical population.^{53,54} Digital technologies, thanks to their ubiquity, multimodality, interactivity and easiness of use, can deliver health interventions effective and useful to achieve the United Nation Millennium Development Goals (MDGs), including maternal health. They, in fact, can be effective in providing pregnant women with instruments to promote well-being and prevent anxiety and post-partum depression, and there is preliminary evidence of their efficacy^{7,55} but despite these opportunities to our knowledge, this is one of the first studies that has investigated the efficacy of a mobile app intervention for promoting pregnant women psychological well-being.

This study showed that a mobile app, inspired on mindfulness meditation, can be a promising intervention for promoting well-being in pregnancy: the proposed path sustained women in changing their role and enhancing their psychological flexibility by taking time to focus on and to accept their own feelings. Preliminary results are encouraging and indicate that

mobile intervention offers several opportunities for promoting women's psychological well-being postpartum.

Thus, although BenEssere Mamma app is an intervention for universal promotion of psychological well-being of pregnant women, further studies are encouraged to assess whether this type of intervention could be more effective given certain women's background characteristics, such as high levels of antenatal anxiety and distress⁵⁵ and to investigate whether a longer intervention or a more interactive content could enhance the effectiveness of the intervention.

Incorporating a meditation self-help program for emotional health into a mobile phone app represents a powerful and flexible methodology for increasing psychological well-being and other populations could take advantage of this opportunity.

ACKNOWLEDGEMENTS

We are especially grateful to the whole staff (manager and midwives) of the three obstetric wards of Saronno, Gallarate and Busto Arsizio Hospitals, who collaborated and gave us permission to recruit the participants in the childbirth classes.

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