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Mamma Mia – A randomized controlled trial of an internet intervention to enhance subjective well-being in perinatal women

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ABSTRACT

Subjective well-being (SWB) may buffer against psychosocial stressors such as the birth of a child. To assess the effectiveness of an unguided internet intervention ('Mamma Mia') on SWB among perinatal women, we investigated (1) whether the intervention group reported higher levels of SWB, (2) whether the effect of Mamma Mia changed over time (i.e. whether the intervention was more effective at some time points), (3) and potential moderators. In total, 1342 pregnant women were randomized to the Mamma Mia or control group. Data were collected at gestational weeks 21–25 and 37, and 1.5, 3, and 6 months after birth. Cognitive well-being was measured using the Satisfaction with Life Scale. Affective well-being was measured using the Positive and Negative Affect Schedule. There were no significant differences in reported life satisfaction and positive affect between the groups. However, participants in the Mamma Mia group showed less negative affect during follow-up, suggesting that Mamma Mia can enhance the affective component of perinatal women's sense of SWB.

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Randomized controlled trial; multilevel modelling; internet intervention; subjective well-being; life satisfaction; positive affect; negative affect

Introduction

The perinatal period is a time when women are at increased risk for developing mental disorders (Melville et al., 2010; Munk-Olsen et al., 2006), with perinatal depression comprising the most common complication of childbirth (O'Hara & McCabe, 2013). Consequently, the primary focus in perinatal mental health has thus far been on risk assessment and reduction of depressive symptoms. Mental health, however, is not just the absence of mental illness, but includes a state of well-being and the capacity to cope with normal stresses of life (World Health Organization [WHO], 2004, 2018). Hence, there is a need for more research and clinical focus on the concepts of subjective well-being (SWB) and the promotion of psychological well-being and resilience among perinatal women (Huppert, 2004; Miller & LaRusso, 2011). Keyes (2005) demonstrated that mental health and mental illness are independent but correlated; and not merely opposite ends of a continuum, such that participants with no mental illness, but low well-being, had equivalently poor psychosocial outcomes as participants with a mental illness. Numerous studies suggest that people with higher SWB are better off (e.g., tend to have more success in their social relationships and marital life, more successful and positively oriented in work settings, more involved in their communities; De Neve et al., 2013). Consequently, promoting SWB and optimal psychosocial functioning is important in its own right.

Subjective well-being is a multi-dimensional construct, which is defined as a person's cognitive and affective evaluations of his or her life (Diener et al., 2009). The cognitive well-being (CWB) component refers to what a person *thinks* about his or her satisfaction with life in general or in specific areas of life, while affective well-being (AWB) refers to the frequency and intensity of *emotions, moods* and *feelings*. CWB may thus differ between and within different stressful life events, while AWB may differ between and within momentary or transient activities (Diener et al., 2009; Luhmann & Eid, 2009; Naragon & Watson, 2009). Thus, profound life events, such as childbirth, may enact changes in CWB, while changes in AWB may be more

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Trial registration: International Standard Randomized Controlled Trial Number (ISRCTN): 91808706; http://www.controlled-trials.com/ISRCTN91808706.

responsive to momentary or transient activities such as increases in expressions of gratitude or pleasant activities (e.g., having a baby shower; Luhmann et al., 2013, 2012). These are independent factors that should be measured and studied separately (Andrews & Withey, 1976; Lucas et al., 1996).

Research on positive psychology interventions (PPIs) has largely focused on SWB. A meta-analysis found that PPIs, generally, have a small positive, but stable effect on SWB (Bolier et al., 2013). Examples of PPIs found to be effective in enhancing well-being are counting one's blessings (Emmons & McCullough, 2003), practicing kindness (Otake et al., 2006), setting personal goals (Sheldon, 2002), expressing gratitude (Seligman et al., 2005; Sheldon & Lyubomirsky, 2006) and using personal strengths (Seligman et al., 2005). The majority of these interventions are delivered in a self-help format. While interventions that are delivered face-to-face overall generate larger effects, self-help interventions have the potential to reach more people and in turn have a major impact on a population's well-being (Bergsma, 2008; Den Boer et al., 2004; Huppert, 2009).

Among self-help PPIs, internet-delivered interventions represent an innovative approach that allows for personalization, anonymity, and scalability, all of which may contribute to the effectiveness of an intervention (Bolier et al., 2013). Perinatal women use the internet frequently to search for information pertaining to pregnancy and postnatal topics and a recent systematic review suggests that the use of eHealth technology has the potential to transform the perinatal healthcare system (Van den Heuvel et al., 2018). In terms of perinatal mental health, there are recent studies on internet interventions that demonstrate their usability (Danaher et al., 2012; Haga et al., 2013; Salonen et al., 2014) and effectiveness in reducing perinatal depressive symptoms (Ashford et al., 2016; Haga et al., 2018; Lau et al., 2017; Lee et al., 2016). At present, however, no systematic effort aimed at enhancing SWB among perinatal women exists.

Aim of the study

Mamma Mia, a universal internet intervention, was developed with two co-primary aims: (1) enhance or maintain SWB during pregnancy and 6 months after birth *and* (2) prevent the onset or reduce symptoms of depression. The results on depressive symptoms were recently published (Haga et al., 2018). The objective of the current study, however, was to test the effectiveness of Mamma Mia on SWB from pregnancy to 6 months after birth. Our main hypothesis was that the Mamma Mia group would display higher levels of life satisfaction and positive affect and lower levels of negative affect compared to the control group. Second, we investigated whether the effect of Mamma Mia changed over time and whether the intervention was more effective at some time points. Finally, we examined whether the effect of Mamma Mia was moderated by age, parity, education, marital status, and ethnicity. To the best of our knowledge, this is the first study to examine the effects of an internet intervention on SWB among perinatal women.

Method

Study design and recruitment

The study was a two-group randomized trial (www.controlled-trials.com;ISRCTN91808706). Participants were randomly assigned to either the intervention group (i.e., internet intervention and usual perinatal care) or control group (i.e., usual perinatal care only; Norwegian Directorate of Health, 2018), with an allocation ratio of one-to-one. Pregnant women were recruited to the study from December 2013 to February 2015 at well-baby clinics across the country during routine prenatal care and via hospitals in Eastern Norway during regular ultrasound (i.e., gestational week (GW) 18–20). Participants that were included had to (a) be pregnant (no more than 24 weeks gestation), (b) ≥18 years, (c) read and write Norwegian, (d) have access to the internet, and (e) have an e-mail account.

Usual perinatal care

The overall goal of perinatal care is the promotion of both physical and mental health, prevention of injuries and disease, and to ensure a continuity of care (Norwegian Directorate of Health, 2004). According to Norwegian national guidelines for perinatal care, all women are offered eight consultations throughout the pregnancy, and during the first 6 months following birth, the woman and her child are offered six consultations; these consultations involve a focus on child development and the physical and psychological well-being of the mother (Norwegian Directorate of Health, 2018).

The intervention – Mamma Mia

Mamma Mia is a freely available self-help, universal internet intervention that starts during pregnancy and lasts until the baby is 6 months old. Pregnancy is considered a time where the woman is particularly open to change. The first phase of the intervention begins during the second trimester in gestation week (GW) 21–25,

when the risk of miscarriage is low and intrinsic motivation is high to engage in healthy behaviors for herself and her baby and ends in GW 37. The second phase starts when the infant is 2–3 weeks old, according to the estimated due date, lasting for 6 weeks with three sessions per week. The final, follow-up phase consists of 10 sessions over an 18-week period. In total, the intervention has 44 sessions over a period of 11.5 months. This intervention applies a tunneled design to guide the woman through the program in a step-by-step fashion in accordance with the psychological preparations of becoming a mother. The intervention is delivered by email and interactive websites, combining text, pictures, prerecorded audio files, and user input.

The full intervention is described thoroughly elsewhere (see: Drozd et al., 2015). Herein, we describe the PPI components in Mamma Mia that are relevant for SWB, which include mindfulness (e.g., mindful breastfeeding; Chiesa & Serretti, 2009), gratitude (e.g., 3 good things; Boehm et al., 2011), acts of kindness (Sheldon et al., 2012), and other exercises (for example, see Lyubomirsky, 2007). Some of these have also been tested online in previous studies (Parks et al., 2012; Schueller & Parks, 2012). It should be noted that some of the included PPIs were designed for mastery of adverse situations (i.e., expressive writing and cognitive restructuring; see e.g., Pennebaker & Chung, 2011) and that several of these exercises were also adapted to support the processes involved in strengthening the couple relationship (e.g., giving your partner a compliment or savoring past, positive relationship experiences). The PPIs are drip-fed throughout Mamma Mia. Previous studies have shown that administering a broad range of PPIs tends to increase their use and effectiveness (see eg. Schueller & Parks, 2012). The effect of the SWB-component included in Mamma Mia has been found to affect SWB in a general and in an HIV-population (Drozd et al., 2014; Drozd, Skeie et al., 2014). Thus, it is reasonable to assume that Mamma Mia may influence SWB among perinatal women as well. For a demonstration of Mamma Mia, see: www.smarturl.it/mammamia_jpp.

Data collection and randomization

Data were gathered using internet-based surveys. When signing up for the study, all participants reported on demographic information (incl. estimated due date). To ensure that the timing of measurements was similar for all participants, the baseline questionnaire assessing subjective well-being was received between GW 21–25. An automated, unrestricted randomization procedure was carried out upon completion of the baseline questionnaire, allocating 678 (50.5%) and 664 (49.5%) eligible participants to the intervention and control group, respectively. Subjective well-being was assessed twice during pregnancy; at baseline between GW21-25 and at GW37. After birth, SWB was assessed at 6 weeks, 3 and 6 months postpartum.

In line with previous studies on SWB, the present study assessed the level of SWB by using the *Satisfaction with Life Scale* (SWLS; Diener et al., 1985) and the *Positive and Negative Affect Schedule* (PANAS; Watson et al., 1988).

The SWLS is a 5-item measure that assesses satisfaction with one's life in general. Participants rate each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating a higher level of life satisfaction. A sample item includes: 'the conditions of my life are excellent.' The psychometric properties of this scale have been shown to be a valid and reliable measure of well-being (Diener et al., 1985; Pavot & Diener, 1993) including in Norwegian samples (Clench-Aas et al., 2011; Vittersø, 2009). In the current study, the alpha coefficients were calculated to be between .83 and .86 across measurement occasions.

The PANAS is a 20-item measure, with 10 items assessing negative affect (NA) and 10 items assessing positive affect (PA). The mood descriptors are relatively pure markers of either high NA or high PA. The PA scale consists of the items such as *active, alert, attentive, enthusiastic*, among others. The items composing the NA scale include terms such as *afraid, ashamed, distressed, irritable*, and others. Participants rate each item based on how they have felt recently using a 5-point scale ranging from 1 (*very slightly*) to 5 (*extremely*). Higher scores indicate higher positive and negative affect. This is a well-established and reliable measure of affect (Watson et al., 1988). Alpha coefficients in the present study were calculated to be .86 for PA and between .85 and .87 for NA across measurement occasions.

Statistical analysis

Baseline differences between groups were examined descriptively. To assess drop-out after baseline, logistic regression analyses with response status as outcome and group assignment as the main independent variable were carried out for each measurement time, both unadjusted and adjusted for age, parity, education, ethnicity, and marital status. A series of linear mixed effects models was estimated, separately for the time development of each outcome (life satisfaction and positive and negative affect scores) after randomization. Time was included as

a categorical independent variable with four categories (GW37, 6 weeks, 3 and 6 months postpartum), and treatment assignment was included as a dichotomous independent variable (i.e., control or Mamma Mia). All mixed effects models were adjusted for age, parity, education, ethnicity, and marital status together with baseline values of outcome measures. Mixed effects models are often advantageous in longitudinal studies and were chosen as they do not require balanced data, provide valid results under the missing at random assumption and also, in the case of missing data using a long format for repeated measure data ensures that all available data are used, and no cases are deleted. All models included a random intercept. For fixed effects, the first model was by group and time only. The second model also included a group by time interaction to investigate differential dropout between groups during follow-up. The third and final model in addition included interactions of group by parity, age, education, ethnicity, and marital status to investigate group differences in the effects of these variables.

Results

The number of respondents in the total sample was 1 342 at baseline, 1 128 (84.1%) at GW37, and 975 (72.7%), 905 (67.4%), 865 (64.5%) at 6 weeks, 3 and 6 months postpartum, respectively (Figure 1). In total, 678 (50.5%) participants were randomly assigned to the Mamma Mia group, and 664 (49.5%) were randomly assigned to the control group.

Mean maternal age was comparable with that of the average age of all births in Norway, which is 30.8 years (Statistics Norway, 2017) (Table 1). In terms of education and parity, more than half of the mothers reported having higher education (i.e. ≥4–5 years in college or university) and being primipara. Using mothers' first language as a proxy for ethnicity, the proportion of mothers with non-Scandinavian language was 7.7%. Nearly all the participants were living with a partner (97%).

As can be seen in Table 2, both, the Mamma Mia and control group displayed high and stable levels of life satisfaction and positive affect. In terms of negative affect, both

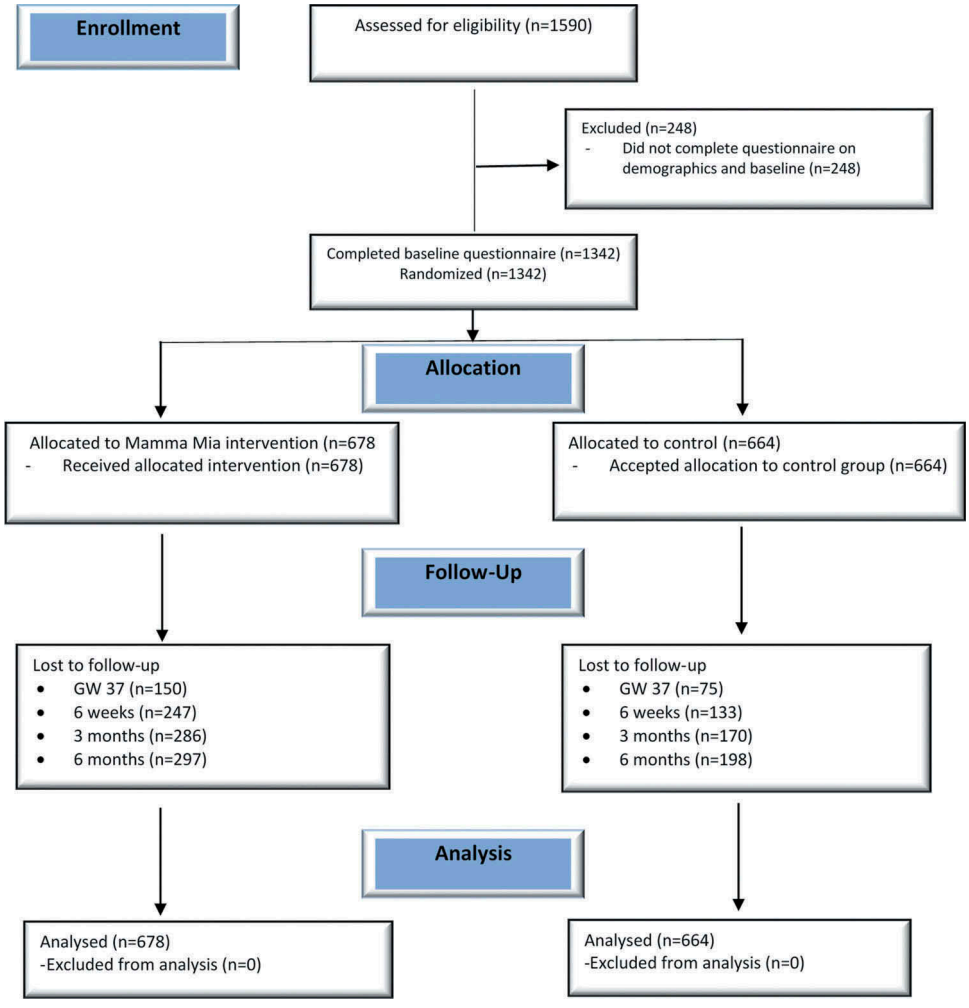

Figure 1. Participant flow chart.

Table 1. Participant characteristics.

Characteristic	Mamma Mia (n = 678)	Control (n = 664)
Age (years) mean (SD)	31.0 (4.6)	31.1 (4.5)
Education *n* (%)		
≤high school	100 (14.7)	107 (16.1)
1–3 years college or university	189 (27.9)	183 (27.6)
≥4–5 years college or university	389 (57.4)	374 (56.3)
Marital status *n* (%)		
Married/cohabiting	656 (96.8)	644 (97.0)
Single	20 (3.2)	20 (3.0)
First language *n* (%)		
Scandinavian	630 (92.9)	609 (91.7)
Non-Scandinavian	48 (7.1)	55 (8.3)
No. of previous children *n* (%)		
No previous children	393 (58.0)	382 (57.5)
≥1 children	285 (42.0)	282 (42.5)

groups displayed the highest levels at baseline. During follow-up, the Mamma Mia group consistently displayed lower levels of negative affect compared to controls.

Drop-out and missing data

At all measurement times, drop-out was greater in the intervention group [Life satisfaction odds ratio (OR) = 1.93–2.41; PANAS OR = 1.88–2.32 in the unadjusted analyses, with somewhat larger differences in adjusted analyses (all *ps* < .001)]. For the whole sample, later dropout was significantly predicted by lower education and in some cases by having previous children and a non-Norwegian ethnic background.

Adherence to the intervention

A total of 33% of participants completed all 44 Mamma Mia sessions, 51% completed 36 or more sessions, and only 6% of participants did not use the intervention at all.

Subjective well-being

Our main hypothesis was that the level of subjective well-being as assessed by the level of life satisfaction, positive and negative effect, would differ between the Mamma Mia and control group. The first model, by group assignment and time, showed a significant

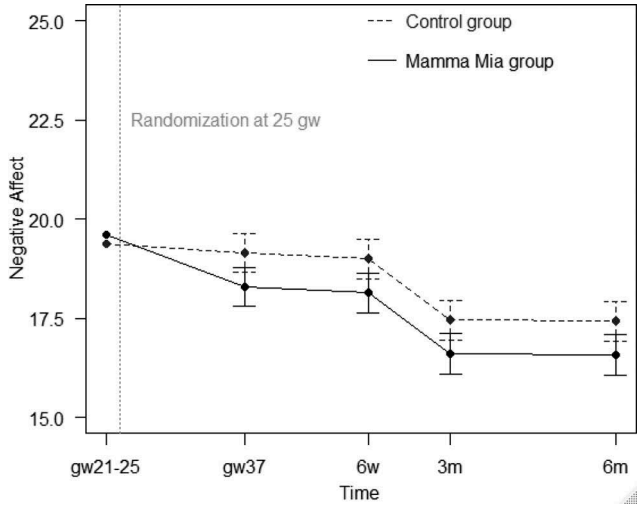

Figure 2. Mamma Mia and control group trajectories of negative affect, in the model without time by group interaction. Numbers at baseline are means, while numbers during follow-up are model-based estimates. Estimates include 95% confidence bounds.

effect of Mamma Mia on negative affect (*ps* < .001; see Figure 2), but no significant effect on positive affect (p = .989) and life satisfaction (p = .648).

Effect on subjective well-being over time and moderating variables

In the second model, there were no significant time by treatment interactions for any of the subjective well-being outcomes (p for interaction ≥ .142). However, as can be seen in Table 3, participants in the Mamma Mia group had significantly lower scores on negative affect than the control group at GW 37, 6 weeks postpartum and 6 months, but not at 3 months postpartum. In the third model, all interactions were clearly non-significant (all *ps* ≥ .149), therefore no details on these possible moderation effects are reported.

Discussion

The focus of this study was to evaluate the effectiveness of an internet-based program ('Mamma Mia') on self-

Table 2. Means (standard deviations and *n*) for life satisfaction and positive and negative affect for each measurement time (N= 1 342).

	Mamma Mia (n = 678)			Control (n = 664)		
	SWLS	Positive affect	Negative affect	SWLS	Positive affect	Negative affect
Baseline	20.5 (3.9, 678)	34.2 (6.7, 678)	19.6 (6.8, 678)	20.5 (3.8, 644)	34 (6.7, 644)	19.4 (6.4, 644)
gw37	21.0 (3.8, 532)	35.1 (6.6, 529)	18.4 (6.2, 529)	21.1 (3.4, 576)	34.8 (6.5, 571)	19.2 (6.4, 571)
6 weeks	21.6 (3.3, 437)	37.4 (6.8, 433)	17.9 (5.6, 433)	21.4 (3.3, 518)	37.5 (6.2, 514)	19.1 (6.4, 514)
3 months	21.6 (3.3, 403)	37.9 (6.3, 396)	16.7 (5.8, 396)	21.6 (3.4, 482)	37.9 (6.2, 476)	17.2 (6.1, 476)
6 months	21.3 (3.5, 387)	38.3 (6.2, 382)	16.7 (5.7, 382)	21.3 (3.7, 458)	37.9 (6.2, 450)	17.4 (6.3, 450)

Table 3. Contrasts between the Mamma Mia and control group in negative affect at different time points (N = 1 182).

	Model 2 (Conditional)			
Time	Contrast	Lower 95% bound	Upper 95% bound	p-value
GW 37	−0.88	−1.49	−0.27	.005
6 weeks	−1.27	−1.92	−0.62	<.001
3 months	−0.39	−1.06	0.28	.254
6 months	−0.81	−1.49	−0.13	.020

reported subjective well-being (SWB) from pregnancy to 6 months postpartum. Results indicated that participants in Mamma Mia displayed lower negative affect during follow-up compared to the control group, and the reduction in mean negative affect over time in the intervention group was significant between groups. This difference was significant at GW37, 6 weeks, and 6 months postpartum. There were no significant differences in reported life satisfaction and positive affect between the groups, as both groups displayed high levels across all measurement occasions.

SWB is a multi-dimensional construct, which includes both cognitive (CWB) and affective well-being (AWB). In their studies, Luhmann et al. (2013) illustrate how CWB and AWB are structurally different and that the structural differences may reflect different sources of CWB and AWB. While CWB reflects one's evaluation of global life circumstance, AWB reflects one's evaluation of recent activities and events. As activities and events are more transient than global life circumstances, AWB is more likely to fluctuate over time and thus more easily influenced by an intervention. Luhmann et al. (2013) accentuate how individual-level interventions, such as Mamma Mia, typically aim to alter people's behaviors and activities, and they are more likely to affect AWB than CWB. In the current study, there were more changes in negative than positive affect. These findings are consistent with other studies on SWB during pregnancy. For example, findings from two studies on mindfulness-based interventions for pregnant women suggested that an intervention may significantly decrease the intensity of negative affect without concurrent changes in positive affect (Duncan & Bardacke, 2010; Vieten & Astin, 2008). Other studies of prenatal interventions have not differentiated between negative and positive affect but suggest enhanced well-being overall. For example, Matvienko-Sikar and Dockrey (2017) piloted a gratitude and mindfulness intervention with significant effects on stress, but not on life satisfaction. Internet interventions that target SWB during pregnancy are less common, but studies do suggest the merits of preventive interventions for decreasing depressive symptoms, stress, and anxiety in postpartum women (Lau et al., 2017). The changes in negative affect in this study may reflect the unique ability of the 'Mamma Mia' intervention to foster self-regulation of negative feelings rather than construct new positivity (Aspinwall & Tedeschi, 2010).

There were no group differences in positive affect and life satisfaction, likely due to a ceiling effect because participants in the current study scored in the highest range of the measures. The mean positive affect scores at baseline in both groups were four points higher compared to another large-scale study of affect in pregnancy (Pesonen et al., 2016). There are several possible reasons for the baseline high levels of positive affect and life satisfaction: First, participants of the Mamma Mia study were highly educated and in the ethnic majority, and thus perhaps already had satisfactory personal resources known to correlate with higher education and ethnic majority (e.g., self-esteem, optimism; Rini et al., 1999). Second, 97% of participants was living with their partner, which is found to have a strong positive effect on positive affect and life satisfaction (Argyle, 2001; Diener et al., 2000). Third, having a baby is a positive life event that may positively influence the level of happiness (Argyle, 2001). Finally, it should be considered that the Mamma Mia study is based in Norway, which is ranked second on the list of 'happiest countries', according to the World Happiness Report (Helliwell et al., 2018). As such, future studies are warranted which engage heterogeneous, diverse populations and which occur in countries that score lower on generalized happiness. In addition, individuals who volunteer for a research study may have a higher and less malleable positive affect, as positive affect is difficult to alter, particularly when baseline levels are high (Fredrickson, 2001). Participants in this research study may also have been engaging in other health-seeking or self-management behaviors unknown to the researchers. Future studies should examine potential confounding variables such as engagement in self-management behaviors, given that individuals who sign up for a study may be engaging in other healthy, resilience-building activities in addition to the intervention.

Although this study did not find any effects of Mamma Mia on life satisfaction or positive affect, it can be considered remarkable that we did find systematic effects on negative affect. Norway has generous healthcare and welfare services for pregnant women with a well-developed pre- and postnatal care system (see, e.g.,, Norwegian Directorate of Health, 2018), which Mamma Mia was tested against. Therefore, it can be expected that future studies in other countries with different or less developed maternity care systems, may yield other, more and/or larger effects. As such, it is also

promising that Mamma Mia, which is more accessible and easily disseminated than guided interventions, can still make an impact while being deployed as a universal intervention. These results must be seen in the light of the prevention paradox. The prevention paradox suggests that greater societal gains can be obtained by achieving small reductions in symptoms or cases of a disease (or increases in other parameters) within a larger group of pregnant women with lesser concerns, than treating a smaller group of pregnant women with serious problems (Rose, 1981, 2008).

Study limitations

A limitation of the study was participant drop-out, although the rates fell within the typical range previously reported for internet-based interventions (Christensen et al., 2009). The drop-out was more pronounced in the intervention than control group and missing data analysis showed that later dropout was predicted by lower education, having previous children, and non-Norwegian ethnic background. The power to detect differences may have been affected by drop-out, particularly at the later measurement occasions where drop-out rates were higher. Participants in the current study scored markedly high on positive affect and life satisfaction, possibly creating ceiling effects with little room for improvement through the intervention, suggesting there is a need to evaluate the effect of Mamma Mia in more heterogeneous populations. As in any effectiveness trial, a mix of good and poor responders will have been recruited, which may have mitigated the effects on measures of subjective well-being.

Conclusion and implications

The mental health of a perinatal woman is of essence, not just to the woman herself, but to her baby and partner. Her mental health constitutes not just the presence or absence of psychopathology, but also her level of subjective well-being. The present study demonstrated promising effects of Mamma Mia on the affective component of SWB among perinatal women, and it is readily available at no cost to the family. Primary health services are in position to relay information about health promoting programs for perinatal women, and Mamma Mia has the potential to support health-care professionals in promoting enhanced subjective well-being in the perinatal population. Enhancing SWB among postpartum women is of great importance as it bolsters health, achievement, and resilience, as well as buffering against depression and anxiety (Huppert, 2004).

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Disclosure Statement

Mamma Mia was developed by Changetech in collaboration with the Regional Centre for Child and Adolescent Mental Health (RBUP) for The Norwegian Women's Public Health Association (N.K.S.).

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Ethics

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The participants were regularly screened for depressive symptoms, and those scoring above a given threshold were provided feedback about where they could receive support and help (beyond what the program could offer). Power analyses were conducted so as not to include (and burden) any more participants than necessary. The trial was approved by the Regional Ethics Committee, Norway, South East (project number: 2012/1716).

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