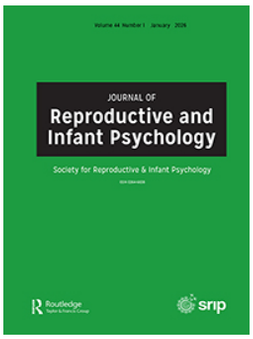

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Prenatal representations of women with minor depressive symptoms: a randomised controlled trial of an interactive ultrasound intervention

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ABSTRACT

Background: Maternal depressive symptoms are common during pregnancy and may negatively impact the mother-infant relationship, particularly the development of maternal prenatal representations. This study used a randomised controlled trial to examine whether the interactive ultrasound intervention could improve the quality of prenatal representations of the child among pregnant women with minor depressive symptoms.

Methods: Participants ($n = 105$) were recruited after the routine screening for structural abnormalities between gestational weeks 19 and 21. Prenatal representations were assessed twice during pregnancy, at gestational weeks $M = 25$ and $M = 35$, using the Working Model of the Child Interview. Participants were randomly selected either to the intervention group, which received three interactive ultrasound intervention sessions following the protocol, or the control group, receiving standard care. The intervention aimed to support the prenatal mother – infant relationship by facilitating and strengthening pregnant women's representations of their foetuses, and by increasing maternal involvement and emotional connection with the foetus.

Results: Women in both groups showed high levels of nonbalanced, particularly distorted, representations. For 25% of participants, nonbalanced representations became balanced during the study period. However, the intervention did not improve the quality of representations beyond changes observed in both groups. Especially, balanced prenatal representations remained substantially stable in both groups.

Conclusion: The interactive ultrasound intervention did not have a significant effect. However, the findings provide unique insights into the quality of prenatal representations among women with minor depressive symptoms and highlight the importance of supporting their representational processes during pregnancy.

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Introduction

Pregnancy prepares a woman to motherhood. The maternal emotional bond with the expected baby develops simultaneously with mental representations that focus on the child and their relationship (Benoit, Parker, et al., 1997; Raphael-Leff, 2005; Slade et al., 2009; Tambelli et al., 2020). These representations are based on parents' own experiences in close relationships, particularly with their caregivers, and are influenced by parental mental well-being (Benoit, Parker, et al., 1997; George & Solomon, 2008; Stern, 1995). Perceived foetal movements further strengthen the representational process, and as the pregnancy progresses, representations increasingly reflect the actual relationship with the child, which is influenced by the individual characteristics of the foetus (Ammaniti et al., 1992; Brodén, 2004; Mayseless, 2006; Slade et al., 2009).

However, psychological and physiological changes that occur during pregnancy may increase maternal vulnerability and risk for different psychopathological conditions, such as depression (Clark et al., 2024; Davis & Narayan, 2020; Korja et al., 2024). Approximately 12 to 17% of expectant women are affected by depressive symptoms which often persist to postpartum (Korja et al., 2018; Paulson et al., 2016; Underwood et al., 2016; Woody et al., 2017). Depressive symptoms, even in the absence of clinical depression, may negatively affect the mother – infant relationship and early interactions with the baby increasing a child's risk for psychopathology and negative developmental outcomes (Ahlqvist-Björkroth et al., 2016; Dayton et al., 2010; Fan et al., 2024; Mandl et al., 2024; Na et al., 2023; Rollè et al., 2020).

Consistent evidence shows that the quality of prenatal representations impacts postnatal parental caregiving behaviours and parent – child interactions (Benoit, Parker, et al., 1997; Bowlby, 1982; Huth-Bocks et al., 2011; Solomon & George, 1996; Stern, 1995; Tambelli et al., 2020; Theran et al., 2005). The representations can be assessed using interviews such as the Working Model of the Child Interview (WMCI), which categorises them as *balanced*, *disengaged*, and *distorted* based on the quality, content, and emotional tone of parental narratives (Benoit, Zeanah, et al., 1997; Zeanah et al., 1994). Balanced prenatal representations, which are characterised by warmth, sensitivity, acceptance, and coherence in the parental narrative, promote high-quality parent – child interactions, a secure attachment in the child, and higher social-emotional competence (Benoit, Parker, et al., 1997; Dayton et al., 2010; Lindstedt et al., 2020, 2024). These representations also demonstrate high stability into postnatal period and seem beneficial for the mother – child relationship even when representations become nonbalanced (i.e. disengaged or distorted) after birth (Benoit, Parker, et al., 1997; Madigan et al., 2015; Theran et al., 2005).

Depressive symptoms during pregnancy are a known risk factor the mother – infant relationship and negatively affect the quality of prenatal representations (Ahlqvist-Björkroth et al., 2016; Korja et al., 2009). Nonbalanced, particularly distorted, representations are more common among women experiencing depressive symptoms during pregnancy and the postpartum period (Ahlqvist-Björkroth et al., 2016; Korja et al., 2009; Rosenblum et al., 2002; Theran et al., 2005; Wood et al., 2004). Women with distorted representations are often preoccupied with or overwhelmed by the infant's needs and experiences, and their descriptions of the child and their relationship lack overall coherence (Benoit, Zeanah, et al., 1997). In

contrast, nonbalanced disengaged representations are characterised by emotional distance and a lack of acknowledgement of the infant's needs (Benoit, Zeanah, et al., 1997).

There is limited knowledge about the changes that occur in the quality of representations during pregnancy, as evidenced in both low-risk and at-risk populations. However, positive postnatal changes are more likely among women with fewer prenatal depressive symptoms (Theran et al., 2005). Even when representations become balanced after birth, initially nonbalanced prenatal representations may still negatively affect maternal caregiving behaviour (Theran et al., 2005). Furthermore, combined symptoms of depression and nonbalanced representations increase the risk of insecure attachment in the child (Huth-Bocks et al., 2011).

Early intervention is beneficial for both maternal prenatal mental health and the quality of the mother – infant relationship (Bellhouse et al., 2023; Bind et al., 2021; Matacz et al., 2025; Newman et al., 2016). To reduce the negative impact of nonbalanced prenatal representations and depressive symptoms, it is crucial to support women in developing balanced representations. In the present study, an interactive ultrasound intervention was used to support the prenatal mother-infant relationship of expectant women with minor depressive symptoms to facilitate and strengthen pregnant women's representations of their foetuses, and to increase maternal involvement and emotional connection with their foetuses.

During pregnancy, most women participate in routine ultrasound scanning, typically performed using standard 2D ultrasound. Positive ultrasound experiences have been shown to enhance emotional bonding with the foetus (Skelton et al., 2024; Walsh, 2020). Unlike standard 2D ultrasound examinations, the 3D/4D ultrasound used in the present study allows pregnant women to observe facial expressions and movements of the foetus. Using 3D/4D ultrasound may make the foetus more real, enhance parental mental images, and help parents reflect on characteristics of their baby (Ji et al., 2005; Pretorius et al., 2006; Pulliainen et al., 2019). These experiences may also increase emotional closeness and feelings of attachment towards the expected baby (Pulliainen et al., 2019). Furthermore, the manner in which professionals conduct the ultrasound examinations, how they narrate and interpret the images, as well as the quality of interaction between professionals and parents, contributes to expectant parent's representations of the baby (Walsh, 2020). In the interactive ultrasound intervention examined in this study, the foetus is observed together with the expectant mother, an obstetrician, and a psychologist, and discussed according to an intervention procedure (Pulliainen et al., 2022). To our knowledge, this is the first study to examine the use of interactive ultrasound as a means of influencing the quality of prenatal representations among pregnant women with depressive symptoms.

This study has two main objectives: to assess the effects of the interactive ultrasound intervention and to examine the quality of prenatal representations of women with minor depressive symptoms. Specifically, it explores the stability and potential changes in representation classifications, as well as the impact of the intervention on these representations. Additionally, the qualitative characteristics and changes in representations are investigated using the qualitative and content scales of the WMCI.

Method

Participants and procedure

This randomised controlled trial was conducted at the Maternity Outpatient Clinic of Turku University Hospital in collaboration with the Department of Psychology and Speech-Language Pathology, University of Turku. The study protocol is described in detail by Pulliainen et al. (2022). Participants were recruited between September 2018 and February 2024 through social media and brochures distributed during routine ultrasound screening at gestational weeks 20 and 21. Due to the COVID-19 pandemic, the recruitment was suspended from March 16 to 22 September 2020, but continued after that. Pregnant women completed the digital Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) and those scoring 10–15 were contacted for the study participation ($n = 172$). A total of 117 pregnant women met the following inclusion criteria: singleton pregnancy, minor depression (score 10 to 15 on the EPDS), body mass index below 35, over 18 years of age, and fluent Finnish. Exclusion criteria included psychotic or self-destructive symptoms and foetal abnormalities. Finally, 105 pregnant women agreed to participate in the study.

Participants were interviewed twice during the pregnancy using a semi-structured interview examining their representations of the expected baby. The first interview was conducted between gestational weeks 22 and 30 (T1) ($M = 24.53$, $SD = 1.53$), with the majority (90.6%) taking place between weeks 23 and 26. Participants were randomised to the intervention or control group after the first interview. The intervention group attended three interactive ultrasound examinations, which followed the intervention protocol, while the control group received standard care. After the intervention period, the second interview was conducted between gestational weeks 32 and 38 (T2) ($M = 34.21$, $SD = 1.45$), with 87.1% of participants completing the interview between weeks 33 and 36. Only women who completed both interviews were included in the present study ($n = 85$). Of these, 26 (31%) were recruited before the COVID-19 pandemic. Twenty participants were excluded due to missing data. The excluded participants did not differ from those included in any of the background variables or randomisation group status.

Ethics

The study was registered with ClinicalTrials.gov (NCT 03424642) and approved by the Ethics Committee of the Hospital District of Southwest Finland. Informed consent was obtained from all participants who were included in the study. All women who scored 16 or more on the EPDS or reported suicidal thoughts were contacted by the researchers.

Measures

Edinburgh postnatal depression scale

Depressive symptoms were assessed using the 10-item Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987), which is also valid for prenatal use (Bergink et al., 2011). The EPDS is a self-rating scale, scored from 0 to 3, which is used for screening and assessing the intensity of depressive symptoms over the past seven days. Total scores range from 0

to 30 with higher scores indicating a higher probability of clinical depression. The cut-off score for minor depression is 10 (Bergink et al., 2011; Bunevicius et al., 2009; Cox et al., 1987) and for major depression between 13 and 15 (Matthey et al., 2006; Rubertsson et al., 2011). Participants completed the EPDS questionnaire during the recruitment, and both before and after the intervention.

Working model of the child interview

Maternal prenatal representations were assessed using the prenatal version of the Working Model of the Child Interview (WMCI; Benoit, Parker, et al., 1997; Zeanah et al., 1994). The one-hour semi-structured interview examines parent's thoughts, feelings, and perceptions about the expected baby and relationship with the baby. The interviews were carried out by trained master's students in psychology and recorded either in the laboratory or home setting with remote connections.

The interviews were coded according to the coding manual (Zeanah et al., 1996) by two trained coders, with 20% of the interviews double-scored to calculate inter-rater agreement. First, the quality and content of the maternal narrative were evaluated based on eight subscales using 5-point Likert scale (1 = *none*, 2 = *limited*, 3 = *moderate*, 4 = *considerable*, 5 = *extreme*) (Zeanah et al., 1996). The six qualitative scales were Richness of perceptions, Openness to change, Intensity of involvement, Coherence, Caregiving sensitivity, and Acceptance. Higher scores in these scales indicate more positive quality of the parental narrative (Zeanah et al., 1997). The two content scales were Infant difficulty and Fear for the infant's safety. Higher scores in these scales indicate more negative content of the parental narrative (Zeanah et al., 1997). Maternal representations were then classified into three global categories: balanced, disengaged, and distorted. Disengaged and distorted representations can also be combined and referred as the nonbalanced category. Interrater agreement for the three main categories was 75% at T1 ($\kappa = .61$) and 80% at T2 ($\kappa = .70$). Disagreements were resolved by consensus, and consensus classifications were used for data analysis.

The interactive ultrasound intervention

The intervention included three interactive ultrasound examinations conducted by an obstetrician and a psychologist (Pulliainen et al., 2022). The intervention visits followed a structured course and lasted approximately 40 minutes. During the intervention sessions, the foetus was observed together following the wishes of the pregnant woman who were supported to reflect on her own feelings and thoughts about the expected child during the scanning. The professionals avoided making any interpretations about the foetus and commented the foetus behaviour as it was happening, leaving space for maternal reflections. The intervention is described in detail in Pulliainen et al. (2022).

Statistical analyses

All analyses were performed using IBM SPSS Statistics (version 29.0). Nonparametric analyses were performed as a deviation from the normal distribution was found for the majority of variables. Comparisons were performed using Fisher's exact test for contingency tables, Kruskall-Wallis test and Wilcoxon signed rank test. Cohen's kappa (κ) was

calculated to examine the stability and change of the WMCI classifications. The association between WMCI qualitative scales at T1 and T2 was examined with Spearman correlation and Mann-Whitney U test. For all analyses, the significance level was set as $p < 0.05$ and Bonferroni correction was used in multiple comparisons. Because the study period overlapped with the COVID-19 pandemic, time of recruitment was controlled for in the analyses.

Results

Sample characteristics

Sample characteristics are reported in Table 1. Depression scores decreased statistically significantly between T1 and T2 in both the intervention group ($z = -3.87$, $p < .001$) and the control group ($z = -2.997$, $p = .003$) (Table 1). Participants in the control group more often reported using psychiatric medication before the pregnancy than participants in the intervention group, $p = .001$ for Fisher's exact test (Table 1). No other differences in the background variables were found between participants.

Table 1. Background and family characteristics for the participants.

	All ($n = 85$)			Intervention ($n = 46$)			Control ($n = 39$)		
Variable	*n (%)*	*M (SD)*	*Range*	*n (%)*	*M (SD)*	*Range*	*n (%)*	*M (SD)*	*Range*
Maternal age		32.48 (4.12)	23–50		32.54 (4.53)	23–50		32.41 (3.63)	25–39
Primiparity	29 (34)			18 (39)			11 (28)		
Number of siblings (missing $n = 3$)									
One sibling	42 (79)			23 (82)			19 (76)		
More than one sibling	11 (21)			5 (18)			6 (24)		
Planned pregnancy	76 (89)			41 (89)			35 (90)		
Civil status									
Married/Cohabited/In relationship	81 (95)			43 (94)			38 (97)		
Divorced/Separated	1 (1)			1 (2)					
Single	3 (4)			2 (4)			1 (3)		
Education > 12 years	62 (73)			31 (67)			31 (80)		
Monthly income									
Low, < 2000€	39 (46)			21 (46)			18 (46)		
Intermediate, 2000–4000€	45 (53)			25 (54)			20 (51)		
High, > 4000€	1 (1)						1 (3)		
Prenatal symptoms of depression (EPDS)									
T1 (missing $n = 26$)		11.34 (3.46)	2–19		10.66 (3.75)	2–19		12.15 (2.96)	7–19
T2 (missing $n = 5$)		8.57 (3.60)	2–19		8.22 (3.46)	2–15		9.06 (3.78)	3–19
Psychiatric medication									
Before pregnancy	19 (22)			4 (9)			15 (39)		
During pregnancy	12 (14)			3 (7)			9 (23)		

Table 2. The distribution of representation classifications at T1 and T2 in the intervention and control groups.

Representation classification	Balanced *n* (%)	Disengaged *n* (%)	Distorted *n* (%)	Total
T1				
Intervention	11 (24)	13 (28)	22 (48)	46
Control	10 (26)	9 (23)	20 (51)	39
Total	21 (25)	22 (26)	42 (49)	85
T2				
Intervention	20 (44)	8 (17)	18 (39)	46
Control	14 (36)	11 (28)	14 (36)	39
Total	34 (40)	19 (22)	32 (38)	85

Maternal representations at T1 and T2

At T1, 25% of women had balanced representations, 26% had disengaged representations and 49% had distorted representations (Table 2). At T2, 40% of women had balanced representations, 22% had disengaged representations and 38% had distorted representations (Table 2). There was no difference in the distribution of representation classifications between the intervention and control groups at either T1 or T2.

Maternal age was associated with WMCI classification at T1 ($H(2) = 13.733$, $p = .001$). Women with balanced representations at T1 ($M = 29.86$, $SD = 3.77$) were approximately four years younger than women with distorted representations at T1 ($M = 34.05$, $SD = 4.04$). A similar difference was observed in both the intervention group ($H(2) = 7.17$, $p = .028$) and the control group ($H(2) = 6.77$, $p = .034$). However, maternal age was not significantly associated with WMCI classification at T2. Depression scores and other background variables were not associated with WMCI classification at either T1 or T2.

Stability of representations

Stability and change in representations were examined separately using both the three main WMCI categories and a dichotomous classification of nonbalanced and balanced categories. A significant difference in the distribution of balanced and nonbalanced representations between T1 and T2 was found in both groups (Fisher's exact test, $p < .001$) (Table 3). Overall, 25% ($n = 16$) of nonbalanced representations at T1 changed to balanced representations at T2. Specifically, distorted representations became balanced for 11 women, while disengaged representations became balanced for 5 women. Of these 16 women, 13 had previous children, and most of them ($n = 11$) were expecting their second child. The calculated odds ratio for the change from nonbalanced representations at T1 to balanced at T2 was 1.54, indicating higher odds of change in the intervention group compared to the control group. However, this difference was not statistically significant.

When categorised into balanced and nonbalanced groups, 78% of women had stable representations ($\kappa = .503$, $p < 001$). In contrast, when using three-way classification of the representations, 67% of the mothers had stable representation classification ($\kappa = .499$, $p < .001$), with similar levels of stability observed in both groups ($\kappa_i = .473$, $p < .001$, $\kappa_c = .533$, $p < .001$) (Table 3). Balanced representations, in particular, demonstrated high stability. Among all women with balanced

Table 3. The distribution of maternal representations at T1 and T2.

	WMCI classification at T2			
WMCI classification at T1	Balanced	Disengaged	Distorted	Total
	n	*n*	*n*	*n*
All participants ($n = 85$)				
Balanced	18	1	2	21
Nonbalanced	16	18	30	64
Disengaged	*5*	*13*	*4*	*22*
Distorted	*11*	*5*	*26*	*42*
Total	34	19	32	85
Intervention ($n = 46$)				
Balanced	10	0	1	11
Nonbalanced	10	8	17	36
Disengaged	*4*	*6*	*3*	*13*
Distorted	*6*	*2*	*14*	*22*
Total	20	8	18	46
Control ($n = 39$)				
Balanced	8	1	1	10
Nonbalanced	6	10	13	29
Disengaged	*1*	*7*	*1*	*9*
Distorted	*5*	*3*	*12*	*20*
Total	14	11	14	39

Abbreviation: WMCI = Working Model of the Child Interview.

representations at T1, 86% maintained balanced representations at T2. Among women with disengaged representations at T1, 59% maintained disengaged representations at T2. Finally, of those women having distorted representations at T1, 62% had distorted representations also at T2. The representations in the intervention and control groups indicated similar stability.

Qualitative scales of maternal prenatal representations

The qualitative scale scores of the WMCI at T1 and T2 correlated significantly in the whole sample, with correlation coefficients ranging from $r = .340$ to $r = .565$ (Table 4). There were no significant differences between the intervention and control groups in qualitative scales scores at either T1 or T2. However, when each group was examined separately, a decrease in Fear for the infant's safety was observed in the control group ($z = -2.324$, $p = .020$) (Table 5). In contrast, an increase in Intensity of involvement was found in the intervention group ($z = 2.132$, $p = .033$) (Table 5). No other qualitative changes were observed in either group.

Table 4. Correlation between qualitative scales at T1 and T2.

	WMCI Qualitative Scales at T2							
WMCI Qualitative Scales at T1	1	2	3	4	5	6	7	8
1. Richness of perceptions	.37***	.33**	.20	.27*	.38***	.25*	−.10	−.17
2. Openness to change	.21	.34**	.14	.19	.38***	.32**	−.14	−.01
3. Intensity of involvement	.23*	.30**	.50***	−.01	.33**	.20	−.03	.12
4. Coherence	.25*	.32**	.10	.53***	.47***	.16	−.01	.05
5. Caregiving sensitivity	.32**	.36***	.41***	.39***	.57***	.33**	−.00	.09
6. Acceptance	.36***	.33**	.26*	.32**	.33**	.47***	−.21	.11
7. Infant difficulty	.03	−.10	−.12	−.08	−.05	−.13	.46***	−.09
8. Fear for the infant's safety	−.21	.08	.15	−.12	.02	−.08	.04	.55***

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5. Qualitative and content scales of the mothers' prenatal representations (WMCI).

	Intervention group ($n = 46$)		Control group ($n = 39$)	
Qualitative and content scales	T1 *M (SD)*	T2 *M (SD)*	T1 *M (SD)*	T2 *M (SD)*
Richness of perceptions	2.70 (.87)	2.89 (.74)	2.92 (.87)	2.87 (.77)
Openness to change	2.98 (.58)	3.04 (.63)	3.10 (.64)	2.95 (.69)
Intensity of involvement	3.26 (.71)	3.48 (.81)	3.36 (.87)	3.31 (.69)
Coherence	2.87 (.75)	2.93 (.68)	3.08 (.62)	3.13 (.73)
Caregiving sensitivity	3.07 (.71)	3.11 (.71)	3.23 (.81)	3.18 (.72)
Acceptance	2.87 (.65)	2.89 (.57)	2.87 (.77)	3.03 (.67)
Infant difficulty	1.35 (.53)	1.43 (.58)	1.38 (.59)	1.41 (.64)
Fear for the infant's safety	1.57 (.83)	1.46 (.72)	1.62 (.75)	1.38 (.71)

Abbreviation: WMCI = Working Model of the Child Interview.

Finally, the qualitative characteristics of stable nonbalanced representations ($n = 48$) were compared to those that changed to balanced representations ($n = 16$). At T2, the stable nonbalanced representations showed significantly lower quality in several qualitative scales: Richness of perceptions ($U = 104.00$, $p < .001$), Openness to change ($U = 129.00$, $p < .001$), Coherence ($U = 132.00$, $p < .001$), Caregiving sensitivity ($U = 193.00$, $p < .001$), Acceptance ($U = 188$, $p < .001$), and Infant difficulty ($U = 243$, $p = .011$). Furthermore, the qualitative characteristics of stable distorted representations ($n = 26$) indicated lower quality compared to those that changed to either balanced or disengaged representations at T2 ($n = 16$) in the following scales: Richness of perceptions ($U = 122.00$, $p = .016$), Openness to change ($U = 104.50$, $p = .003$), Coherence ($U = 106.00$, $p = .002$), and Acceptance ($U = 141.00$, $p = .044$).

Discussion

This study investigated changes in maternal representations of the child during pregnancy and the effects of an interactive ultrasound intervention in a group of women experiencing minor symptoms of depression. The results are unique, as previous research has rarely assessed maternal representations of the child at two different time points during pregnancy or specifically focused on women with depressive symptoms. However, we were unable to demonstrate a significant effect of the interactive ultrasound intervention on the quality of prenatal representations.

The results showed that the proportion of distorted representations of the child in the present study was considerably high at both time points, 49% at T1 and 38% at T2, compared to normative data from non-clinical populations (Ahlqvist-Björkroth et al., 2016; Benoit, Parker, et al., 1997; Madigan et al., 2015; Vreeswijk et al., 2015). Previous studies have reported the proportion of distorted prenatal representations to range from 12% (gestational week 26; Vreeswijk et al., 2015) and 18% (gestational weeks 28–32; Ahlqvist-Björkroth et al., 2016) up to 24–26% (gestational weeks >28; Benoit, Parker, et al., 1997; Madigan et al., 2015). Even when compared with other at-risk populations, which report proportions between 20% and 25% (Bailes et al., 2024; Dayton et al., 2010; Huth-Bocks et al., 2004; Theran et al., 2005), the proportion of distorted representations in the present sample remains notably higher. The findings of the present study suggest that minor

depressive symptoms during pregnancy pose a risk for the development of prenatal mother – infant relationship.

Furthermore, considering that the quality of maternal representations of the child is quite stable from pregnancy to the postnatal period, the high incidence of prenatal distorted representations is concerning. Mothers with distorted prenatal representations tend to show more hostility and anger in postnatal mother – child interactions (Dayton et al., 2010). Likewise, postnatal distorted representations have been linked with difficulties in mother – infant interaction, such as maternal rejecting behaviours, reduced sensitivity in caregiving, and a higher likelihood of insecure or disorganised attachment in children (Benoit, Parker, et al., 1997; Korja et al., 2010; Rosenblum et al., 2002; Zeanah et al., 1994).

Many previous interventions have been conducted postnatally (e.g. Nicolson et al., 2022). However, interventions conducted during the perinatal transition that combine approaches targeting both maternal well-being and mother – infant bonding may produce more desirable outcomes (Scorza et al., 2020; Werner et al., 2016). Maternal prenatal depression can have long-lasting consequences, extending even to child behavioural problems at age 12 (Pihlakoski et al., 2013). Therefore, it is crucial to identify effective practices that simultaneously reduce depressive symptoms and support the development of the mother – infant relationship.

However, in this study, participation in the intervention did not have a significant effect on the WMCI classification or on qualitative changes in maternal representations. Nevertheless, this does not necessarily indicate that the intervention was ineffective; rather, the sample size may have been too limited to detect statistically significant effects of this size. This paper reports on secondary outcomes from a randomised controlled trial whose primary aim was to examine the effects of the intervention on depressive symptoms of expectant women. The sample size was calculated a priori to detect the impact of the intervention on depression scores (Pulliainen et al., 2022), not on qualitative changes in maternal representations. A larger sample size might have produced different results in the present study.

Although the study period overlapped with the COVID-19 pandemic, time of recruitment had no impact on the results. However, the ongoing pandemic may have influenced the experiences of the expectant women in ways that could not be controlled in the study. Furthermore, participation in the WMCI interview itself may have supported the representational process of participants in both groups, and the intervention did not appear to exceed this effect. Furthermore, a comparison group of women without depressive symptoms was not included, which is a limitation. Consequently, it was not possible to compare changes in the quality of maternal representations with those of non-depressed controls. Another limitation is that 80% interrater agreement on the WMCI at T1 was not achieved between coders, potentially reducing the reliability of the findings. In addition, maternal attachment history and potential experiences of interpersonal trauma were not examined in the present study, although they may be associated with depressive symptoms and difficulties in the prenatal mother-infant relationship (Ahlfs-Dunn et al., 2022; Ahlqvist-Björkroth et al., 2016).

Nevertheless, in the present study, a considerable number of prenatal nonbalanced representations of the child became balanced during the study period. In the entire study sample, 25% of women who initially had nonbalanced representations

demonstrated a change into balanced representations as the pregnancy progressed. The majority of these women were not primiparous. Previous research has shown that multiparous parents are more likely to have nonbalanced, particularly disengaged, prenatal representations of the child compared to primiparous parents (Vreeswijk et al., 2015). It is possible that the relationship with the foetus may take more time to develop among multiparous women compared to first-time mothers. The interview may have provided these women with a unique opportunity to concentrate on their expected baby in a way that is not possible during their everyday family life. Therefore, the changes in the quality of representations observed in this study may more likely demonstrate the normative development of prenatal representations among parous women. However, as this is one of the first studies examining the quality of representations at two time points during pregnancy, further research is needed to support this interpretation.

Previous studies have demonstrated that particularly balanced representations of the child are stable from the prenatal to the postnatal period (Benoit, Parker, et al., 1997; Theran et al., 2005). In the present study, balanced representations of women experiencing minor depressive symptoms remained considerably stable during pregnancy, from the second to the third trimester. Balanced representations have previously been linked to sensitive parenting, a higher likelihood of secure attachment among children, and positive social-emotional development in children (Benoit, Parker, et al., 1997; Korja et al., 2010; Lindstedt et al., 2024; Zeanah et al., 1994). Even if representations become nonbalanced after childbirth, having balanced prenatal representations of the child is associated with higher maternal sensitivity, fewer controlling behaviours, and more expressed joy during mother – infant interactions (Theran et al., 2005). Therefore, balanced prenatal representations appear to enhance the quality of postnatal mother – infant interactions and contribute to positive developmental outcomes in children (Lindstedt et al., 2024; Theran et al., 2005). Taken together, these findings highlight the importance of developing balanced representations during pregnancy.

Only a few changes were observed in the qualitative scales of the representations during the follow-up. Intensity of involvement, which reflects the parent's psychological preoccupation with the infant and immersion in the relationship (Zeanah & Benoit, 1995), increased in the intervention group, which is in line with the aims of the intervention. Similarly, a previous study exploring maternal experiences of the interactive ultrasound intervention reported that it strengthened maternal mental images of the foetus and evoked positive emotions towards the expected baby (Pulliainen et al., 2019). Additionally, in the present study, fear for the infant's safety decreased in the control group, and a similar trend, although non-significant, was observed in the intervention group. The number of distorted representations was moderately high in both intervention and control groups. According to the WMCI manual, some parents with distorted representations can be bewildered, overwhelmed, and uncertain about the infant and the relationship, experiencing irrational fears related to child well-being (Zeanah et al., 1996). Although the likelihood of infant survival typically increases as pregnancy progresses, women may simultaneously become more focused on the upcoming childbirth, and fears related to labour may be intensified by symptoms of depression (Brodén, 2004; Raphael-Leff, 2005; Storksen et al., 2012). It is therefore possible that the non-significant decrease in fear for infant safety, together with increase in intensity of involvement in the

intervention group, reflects higher maternal attention to the infant and awareness of the infant's well-being in late pregnancy. It is also possible that some other differences between the intervention and control groups, which were not examined in the present study, such as levels of experienced social support, may have affected the results. On the other hand, as the ultrasound intervention did not lead to substantial qualitative changes in maternal representations overall, it may be more effective to support these representations either without the ultrasound or in combination with additional intervention approaches.

The results also offer unique insights into the qualitative features of prenatal maternal narratives that may be associated with stable nonbalanced representations. These features include lower coherence, reduced richness of perceptions about the child, limited openness to change, and less acceptance of the child. However, it remains unclear whether these qualitative characteristics are associated with stable nonbalanced representations in general or are specific to the narratives of expectant women with minor depressive symptoms.

Conclusion

In the present study, the interactive ultrasound intervention did not result in a significant change in the classification of prenatal representations among women experiencing minor depressive symptoms. However, the findings underscore the importance of addressing the representations and developing mother – infant relationships of these women during pregnancy due to the high prevalence of nonbalanced, particularly distorted, prenatal representations. Additionally, the quality of prenatal representations appears to be moderately stable at both categorical and qualitative levels. Nonetheless, most observed changes were positive, including an increase in balanced representations over the course of pregnancy. Notably, approximately 40% of initially distorted representations were no longer classified as distorted later in pregnancy.

From a preventive and supportive perspective, maternity services should pay attention to minor depressive symptoms. Furthermore, future efforts should focus on developing targeted interventions for this particular group of expectant parents, utilising a family-systems perspective and including spouses in the intervention. Future interventions should specifically target the qualitative characteristics, such as richness of perceptions, openness to change, coherence and acceptance, that appear to be important for the adaptive change of distorted prenatal representation.

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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