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The effect of unintended pregnancy on the development of parental-fetal attachment: a prospective cohort study

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Abstract

Background A strong parental (maternal/ paternal)-fetal attachment predicts a stronger parental-infant attachment after the child is born. An unintended pregnancy has been associated with weakened development of a maternal–fetal attachment. However, the knowledge of association between an unintended pregnancy and the development of a paternal-fetal attachment is scarce. This study aims to investigate the development of a parental-fetal attachment during the pregnancy among parents who have intended and unintended pregnancies.

Methods This study is part of The Central Satakunta Maternity and Child Health Clinic (KESALATU) Study, which is a prospective follow-up study in the primary health care sector of the Satakunta region in Southwest Finland. Families were recruited during their first maternity clinic visit between September 1, 2016 and December 31, 2019. In the self-report questionnaire, parents separately reported whether the pregnancy was planned or unplanned. Parents completed the Maternal/Paternal Antenatal Attachment Scale (MAAS/PAAS) self-report questionnaire three times during the pregnancy. In the first trimester of pregnancy, 211 mothers and 152 partners participated in the study; in the second trimester, 199 and 140; and in the third trimester, 170 and 116, respectively. Repeated measures models were used to estimate the association between intended versus unintended pregnancy and the scores of maternal/paternal-fetal attachment throughout their pregnancies.

Results Paternal-fetal attachment scores were significantly higher throughout the pregnancy among partners with an intended pregnancy compared to those with an unintended pregnancy (b = 4.23, 95% confidence interval (CI) = 0.82–7.64, p = 0.015). There was no significant difference in the development of the attachment as the pregnancy progressed between the groups ($p = 0.104$). There was no significant difference in the maternal–fetal attachment ($b = 0.12$, CI = -2.86–3.10, $p = 0.938$), nor its development during the pregnancy between the groups ($p = 0.405$). Both the paternal-fetal and maternal–fetal attachments predictably strengthened as the pregnancy progressed regardless of whether the pregnancy was intended or unintended.

Conclusions The paternal-fetal attachment was significantly weaker throughout the pregnancy among partners who reported an unintended pregnancy. Thus, it is crucial for maternity clinics to provide comprehensive support to the entire family, aiming to enhance both the parental-fetal attachment and its development.

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Keywords Paternal, Maternal, Prenatal attachment, Pregnancy, Unplanned pregnancy

Introduction

Parents starts to develop an emotional bond to their unborn child during the pregnancy. This bond is called a maternal- and paternal-fetal attachment [1], which refers to the emotional level commitment that occurs in the parent, manifested both in parents' behavior and in the content and richness of prenatal mental representations related to the baby [1, 2].

It is known that the parental (maternal/paternal)-fetal attachment strengthens as the pregnancy progresses [3, 4]. The use of ultrasound screening for prenatal care is shown to strengthen the maternal–fetal attachment [5]. A strong parental-fetal attachment predicts a stronger parental-infant attachment after the child is born [6]. Among mothers, a stronger prenatal attachment has been found to predict mothers to be more involved in postnatal interactions [7] and to associate with better neonatal [8] and child [9] developmental outcomes and less difficult temperamental characteristics of the child [9]. Having a strong maternal–fetal attachment has also been found to predict more positive maternal prenatal health practices [8, 10], and it may protect mothers from depressive symptoms in the third trimester of pregnancy and up to 6 months postpartum [11]. The importance of a paternal-fetal attachment has been less studied. A meta-analysis found that paternal-infant attachment insecurity was associated with a higher prevalence of externalizing and internalizing behavior in the offspring [12].

There are individual variations in the development of an attachment to the fetus, both regarding the time and intensity of the awakening of the attachment among parents. The reasons for individual variation are not yet known exactly, but certain psychosocial risk factors, such as the parent's substance abuse problem and depression, have been linked to a weaker attachment to the fetus during the pregnancy in previous studies [13–17]. An unintended pregnancy is also a risk factor [18–21] that may compromise the development of a parental-fetal attachment, and should therefore become more carefully explored.

The prevalance of unintended pregnancies varies among studies. Per the questionnaire for families with children, one out of five respondents reported their first pregnancy as unintended in Finland [22]. Unintended pregnancies are more common among younger and less educated women [22, 23]. In addition, multiple previous pregnancies, drug abuse, being single or having a non-cohabiting relationship, and experiencing intimate partner violence increase the risk of unintended pregnancies [24]. The maternal–fetal attachment has been found to be weaker among mothers with an unintended pregnancy compared to mothers with an intended pregnancy [18, 19]. To our knowledge, the development of a paternal-fetal attachment during unintended pregnancies has not been studied earlier.

This prospective cohort study aims to compare the development of a parental-fetal attachment during the pregnancy between intended and unintended pregnancies. We hypothesized that the parental-fetal attachment is stronger throughout the pregnancy among parents with an intended pregnancy compared to those with an unintended pregnancy.

Methods

Procedure

This study is part of The Central Satakunta Maternity and Child Health Clinic (KESALATU) Study, which is a prospective follow-up study in the primary health care sector of the Satakunta region in Southwest Finland. The primary aim of the KESALATU study was to explore different factors affecting parents' smoking behavior, and especially how smoking may be connected with individual differences in the psychological process of becoming a parent. Families were recruited during their first maternity clinic visit between September 1, 2016 and December 31, 2019. The follow-up continued until the child reached an age of 1.5 years. The inclusion criteria were that parents should speak and understand Finnish fluently. Initially, 591 pregnant women and their partners were asked to participate in the study. The study population consisted of 248 (42.1%) pregnant women and 160 (27.1%) partners [25]. The study protocol was approved by The Ethics Review Committee of the Hospital District of South-West Finland. Written informed consent was obtained from all subjects. The participants did not receive any rewards for participating in the study.

Self-report questionnaires were independently filled in by both parents three times during the pregnancy; during the first trimester (approximately at 12 weeks of gestation), during the second trimester (27 weeks of gestation), and during the last trimester of the pregnancy (36 weeks of gestation). The questionnaires included (a) detailed questions about their parental background and (b) standardized self-report questionnaires, which assess the areas of specific interests: parental–fetal/infant attachment, parental mentalization, depressive and anxiety symptoms, and quality of life during and after the pregnancy [25]. Only the data regarding parental background factors, including prenatal depressive symptoms, intention/intendedness of the pregnancy, and the parental-fetal attachment, are reported in this paper.

Measures

Background characteristics

In this study, the information regarding the following issues were derived from the self-report questionnaire during the first trimester of the pregnancy: whether the pregnancy was intended or unintended (dichotomous), data regarding parental background factors, including parental age, education, smoking/use of nicotine products, alcohol and drugs during the pregnancy, marital status, and maternal parity.

The first questionnaire was filled by 217 (88.2% of participants) pregnant women and 158 (98,8%) partners. The current sample consists of those 211 (97.2% of those who filled in the questionnaire) pregnant women, and 155 (98.1%) partners who answered the question of intendedness/intention of this pregnancy.

Standardized measures

Prenatal depressive symptoms

The Edinburgh Postnatal Depression Scale (EPDS) was used as a measure of depressive symptoms of the parents during pregnancy and postpartum [26, 27]. EPDS is used routinely in all primary health care units in Finland during pregnancy. It consists of 10 items, which assess the amount of depressive symptoms during the past seven days, on a scale of 0 to 3. A total score exceeding 12 points is considered indicative of depression, in which case a clinical examination should be performed [26].

Parental prenatal attachment

The prenatal attachment was assessed with the 19-item version (α = 0.81–0.83) of the Maternal Antenatal Attachment Scale (MAAS) and the 16-item version (α = 0.85–0.86) of the Paternal Antenatal Attachment Scale (PAAS) [1, 28–30] three times during the pregnancy. The self-report questionnaire was filled in by 211 pregnant women and 158 partners during the first trimester, by 199 pregnant women and 140 partners during the second trimester, and by 170 and 116, respectively, during the last trimester of pregnancy. In the instruments, the participants choose the individualized response that best fits their experience over the previous two weeks. The two sub-scales assess (1) the quality of attachment and (2) time spent in attachment mode (or the intensity of preoccupation). The sub-scale of the quality of attachment for MAAS (α = 0.71–0.74) and PAAS (α = 0.81–0.82) consisted of 10 and 8 items, respectively. The sub-scale of the time spent in an attachment role for MAAS (α = 0.74–0.77) and PAAS (α = 0.72–0.76) consisted of 8 and 6 items, respectively.

Statistical analysis

Repeated measures models were used to estimate the association between intended versus unintended pregnancy and the scores of maternal/paternal-fetal attachment throughout the pregnancy. The pregnancy intendedness and the covariates were added as the independent variables and maternal/paternal-fetal attachment as the dependent variables in to the model. Age and the EPDS score were added as a continuous covariate, and marital status, education, smoking (mothers) or use of nicotine products (partners), and parity (mothers) as a binomial covariate into the model. The normality of the distributions was assessed both graphically and with the Shapiro–Wilk test. The repeated measures design could not be used when analyzing the quality of maternal–fetal attachment due to the skewness of the data. Thus, the Wilcoxon test with the Bonferroni method was used to examine the maternal–fetal attachment separately at each trimester. Differences in continuous background characteristics between the groups (intended versus unintended pregnancy) were studied using the independent sample T-test. For the categorical background characteristics, the chi-square test or Fisher's exact test was used.

The statistical analyses were performed with commercially available software (SAS, version 9.4; SAS Institute Inc, Cary, North Carolina). Differences in the results were evaluated by using 95% confidence intervals and p values. Non-overlapping confidence intervals and P values < 0.05 were considered to be significant.

Results

Parental background characteristics are shown in Table 1. Out of the 211 women, 191 (90.5%) reported that their pregnancy was intended and 20 (9.5%) reported that their pregnancy was unintended. Pregnant women who had unintended pregnancies were younger, more often single, more often smokers, and had lower attained education compared to those women with an intended pregnancy. None of the pregnant women reported using drugs or alcohol during their pregnancy. Out of the 155 partners, 138 (89.0%) reported that their pregnancy was intended and 17 (11.0%) reported that their pregnancy was unintended. Partners who had unintended pregnancies were more often single and had higher EPDS scores compared to those partners with an intended pregnancy.

Paternal-fetal attachment

Paternal-fetal total attachment scores were significantly higher throughout the pregnancy among partners with an intended pregnancy compared to those with an unintended pregnancy ($b = 4.23$, 95% confidence interval (CI) = 0.82–7.64, $p = 0.015$, Table 2). The effect size, calculated using Cohen's d, was 0.54, indicating a medium practical significance. There was no significant difference in the development of the attachment as the pregnancy progressed between the groups ($p = 0.104$, Fig. 1A). The

Table 1 Characteristics of the pregnant women ($n=211$) and the partners ($n=155$)

	Pregnant women		*P*-value	Partners		*P*-value
	Intended pregnancy	Unintended pregnancy		Intended pregnancy	Unintended pregnancy	
	n (%)*	n (%)*		n (%)*	n (%)*	
Total	191 (90.5)	20 (9.5)		138 (89.0)	17 (11.0)	
Age						
< 25	31 (16.2)	11 (55.0)	< 0.001	10 (7.4)	3 (17.6)	0.093
25–34	130 (68.1)	9 (45.0)		91 (66.9)	7 (41.2)	
35 or higher	30 (15.7)	0 (0.0)		35 (25.7)	7 (41.2)	
Parity						
0	85 (44.5)	12 (60.0)	0.186			
1 or more	106 (55.5)	8 (40.0)				
Marital status						
Single	7 (3.7)	6 (31.6)	< 0.001	5 (3.6)	3 (17.6)	0.014
Married/cohabiting	184 (96.3)	13 (68.4)		133 (96.4)	14 (82.4)	
Education						
Under 9 years	12 (6.3)	3 (15.0)	0.022	15 (11.0)	3 (17.6)	0.257
9–12 years	92 (48.2)	14 (70.0)		91 (66.9)	13 (76.5)	
Over 12 years	87 (45.5)	3 (15.0)		30 (22.1)	1 (5.9)	
Use of nicotine products during the first trimester						
Yes	21 (11.0)	10 (50.0)	< 0.001	49 (35.5)	8 (47.1)	0.351
No	170 (89.0)	10 (50.0)		89 (64.5)	9 (52.9)	
EPDS, mean (SD)	5.33 (4.11)	6.68 (3.77)	0.091	3.29 (2.80)	3.88 (3.10)	< 0.001

*if not stated otherwise. *EPDS* Edinburgh Postnatal Depression Scale. All of the pregnant women who reported their use of nicotine products used tobacco

Table 2 Results of the repeated measures of intended versus unintended pregnancy on the scores of maternal/paternal-fetal attachment throughout the pregnancy

	Intended pregnancy			
	b	SE	95% CI	*P*-value
Paternal-fetal attachment (PAAS)				
Total score	4.23	1.73	0.82–7.64	0.015
The amount of time spent in attachment mode	1.32	0.92	−0.50–3.13	0.155
Quality of attachment	1.99	0.77	0.48–3.50	0.010
Maternal–fetal attachment (MAAS)				
Total score	0.12	1.15	−2.86–3.10	0.938
The amount of time spent in attachment mode	−0.13	0.99	−2.09–1.83	0.896

SE Standard error, *CI* confidence interval. Standardized for age, education, parity, and EDPS score

paternal-fetal attachment predictably strengthened as the pregnancy progressed in both groups ($p<0.001$).

The amount of time spent in attachment mode did not significantly differ between the groups during their pregnancy ($p=0.155$). The development of the amount of time spent in attachment mode as the pregnancy progressed was stronger among partners with an intended pregnancy compared to partners with an unintended pregnancy ($p=0.042$, Fig. 1B). The amount of time spent in attachment mode predictably increased throughout the pregnancy among the partners with an intended pregnancy. The amount of time spent in attachment mode decreased after the second trimester among the partners with an unintended pregnancy. The amount of time spent in attachment mode predictably increased as the pregnancy progressed in the study population ($p<0.001$).

The score for the quality of paternal-fetal attachment was significantly stronger throughout the pregnancy among partners with an intended pregnancy compared to those with an unintended pregnancy ($b=1.99$, CI = 0.48–3.50, $p=0.010$, Fig. 1C). The effect size, Cohen's d = 0.57, suggests a medium practical significance of the difference between the groups. There was no significant difference in the development of the quality of attachment as the pregnancy progressed between the groups ($p=0.257$). The quality of attachment predictably strengthened as the pregnancy progressed in the study population ($p<0.001$).

Maternal–fetal attachment

There was no significant difference in the maternal–fetal attachment ($b=0.12$, CI = −2.86–3.10, $p=0.938$, Table 2), nor its development during the pregnancy between the groups ($p=0.405$, Fig. 2A). The maternal–fetal attachment predictably strengthened as the pregnancy progressed in both intended and unintended pregnancies ($p<0.001$).

The amount of time spent in attachment mode and its development did not significantly differ during the pregnancy between the groups ($p=0.896$, $p=0.096$, Fig. 2B).

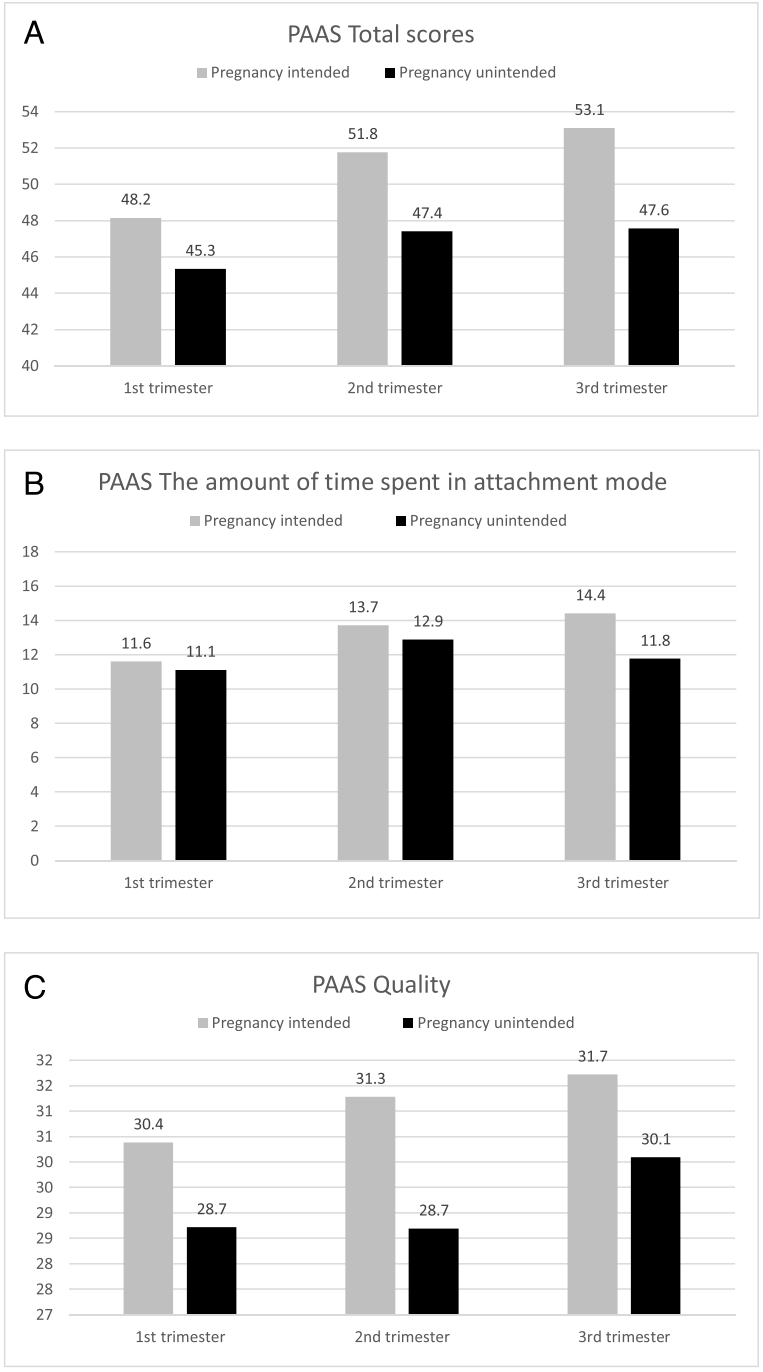

Fig. 1 The development of the paternal-fetal attachment, total score (**A**) of paternal antenatal attachment scale (PAAS), the amount of time spent in attachment mode (**B**), and the quality of paternal-fetal attachment (**C**), during the pregnancy

The amount of time spent in attachment mode increased as the pregnancy progressed in both intended and unintended pregnancies ($p < 0.001$).

The score for the quality of maternal–fetal attachment did not significantly differ during the first ($p = 0.80$), second ($p = 0.152$), and third ($p = 0.680$) trimesters of pregnancy between the groups (Fig. 2C).

Discussion

To our knowledge, this is the first study to investigate the association between an unintended pregnancy and the development of a parental-fetal attachment during the pregnancy among both parents. This prospective cohort study found that an unintended pregnancy was associated with lower levels of a paternal-fetal attachment persisting

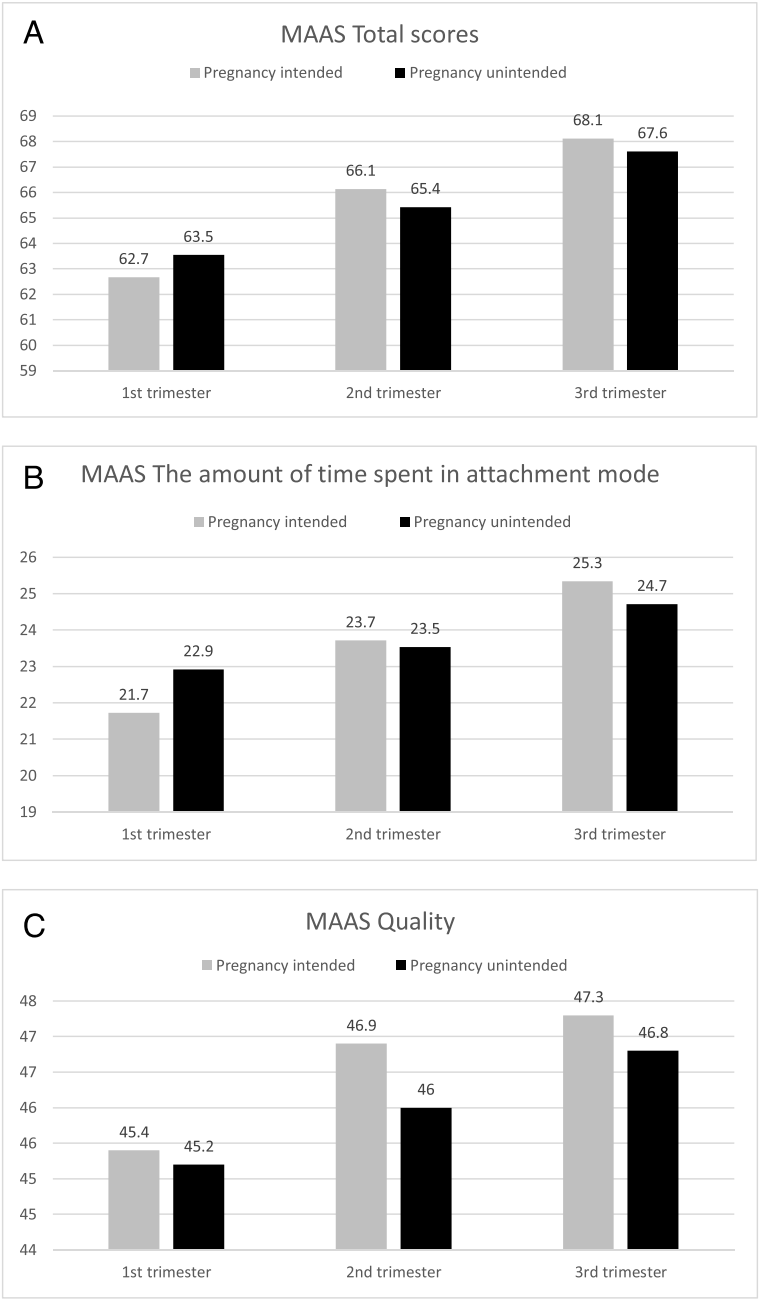

Fig. 2 The development of a maternal–fetal attachment, total score (**A**) of maternal antenatal attachment scale (MAAS), the amount of time spent in attachment mode (**B**), and the quality of maternal–fetal attachment (**C**), during the pregnancy

throughout the pregnancy compared to intended pregnancies. The development of a paternal-fetal attachment did not differ between the groups. We found no significant difference in the maternal–fetal attachment, nor its development during the pregnancy between the groups.

In our study, unintended pregnancies were associated with lower levels of paternal-fetal attachment throughout the pregnancy. The limitation of previous studies is that they investigated the paternal-fetal attachment only once during the pregnancy compared to our study, which included repeated measurements of the paternal-fetal attachment. In previous studies, the paternal-fetal attachment has been found to be weaker during the second [20] and last [19, 21] trimesters of pregnancy when the pregnancy is unintended compared to intended pregnancies. Our results are in line with those results.

Camarneiro et al. [20] studied the parental-fetal attachment during the second trimester of pregnancy and found that the paternal-fetal attachment was weaker among partners with unintended pregnancies compared

to partners with intended pregnancies. The study population consisted of 407 couples and 94 (23.1%) of the couples reported their pregnancy as unintended. Similar to our study, Camarneiro et al. used the Maternal (MAAS) and Paternal (PAAS) Antenatal Attachment Scale to measure the prenatal attachment. In the studies by Ustunsoz et al. [19] and Türkmen et al. [21], unintended pregnancies were associated with lower levels of paternal-fetal attachment during the last trimester of pregnancy compared to intended pregnancies. In the study conducted by Ustunsoz et al. [19], they compared the maternal- and paternal-fetal attachments according to the selected variables, including pregnancy intendedness. The study included 144 pregnant women and 144 partners. Out of the 144 women, 116 (80.6%) reported that their pregnancy was unintended. Ustunsoz et al. used Cranley's maternal–fetal attachment (MFA) scale, which measures the affectionate attachment between the mother and the fetus and Weaver and Cranley's paternal-fetal attachment (PFA) scale, which measures the affectionate attachment between the father and the fetus. Türkmen et al. [21] had a study population of 174 fathers, of whom 34 (19.5%) reported the pregnancy as unintended. They used the Intrauterine Father Attachment Scale (IFAS) to measure the paternal fetal attachment.

In our study, the maternal–fetal attachment did not differ according to pregnancy intendedness, even in repeated measurements. Contrary to our study, earlier studies have found that the maternal–fetal attachment is stronger among mothers with an intended pregnancy compared to mothers with an unintended pregnancy [18–20, 31]. O'Malley et al. [18] studied the maternal–fetal attachment at the first antenatal visit. They used Cranley's MFA scale to measure the maternal–fetal attachment, and found that unintended pregnancies were associated with lower levels of maternal–fetal attachment during the first trimester of pregnancy compared to intended pregnancies. The study population consisted of 80 pregnant women and 20 (25%) of them reported the pregnancy as unintended. Camarneiro et al. [20] studied the parental-fetal attachment during the second trimester of pregnancy, and found that the maternal–fetal attachment was weaker among mothers with unintended pregnancies compared to mothers with intended pregnancies. In the study by Ustunsoz et al. [19], they found that the maternal- and paternal fetal attachments were both weaker when the pregnancy was unintended compared to intended pregnancies during the last trimester of pregnancy.

Our contradictory findings on maternal–fetal attachment may be explained by the small number of reported unintended pregnancies in the sample. The small number may be due to not having had the same level of motivation to participate and commit in the long-lasting and demanding study protocol compared to parents with intended pregnancies. An unintended pregnancy can lead to increased stress and the need for parents to adapt to unexpected changes in their lives. Although it is only a speculation, those mothers with unintended pregnancies who participated and committed to our study probably needed to have a stronger maternal–fetal attachment compared to those who were unmotivated or did not have the energy to commit to the study. This may be found in the results indicating that there was not a significant difference in the maternal–fetal attachment level between unintended and intended pregnancies.

The association of pregnancy intendedness on the development of parental-fetal attachment could be explained by several psychosocial and contextual factors. Specifically, considering paternal-fetal attachment, pregnancy intendedness plausibly weakens the attachment even more compared to pregnant women who usually start to have physical signs of pregnancy rather early. In intended pregnancies, partners often have started to psychologically prepare to become a parent before the pregnancy, which then might help to develop fetal attachment.

It is known that the risk of unintended pregnancies is increased, for example, when being single or having a non-cohabiting relationship [24]. Lower socio-economic class and income are also associated with unintended pregnancies [32]. All these factors presumably contribute to the development of maternal- and paternal-fetal attachment in both, planned and unplanned pregnancies.

In addition, increasing age and lower educational status of both pregnant women and their partners are associated with decreased maternal–fetal attachment and paternal–fetal attachment scores [19]. Also having a child or children before or having depressive symptoms are associated with lower levels of attachment [16, 19]. In our study, we gathered similar background information, but did not examine their direct effects on parental–fetal attachment. Instead, these variables were standardized in the analysis to minimize potential confounding. For partners, Turkmen et al. [21] found that having a good relationship with their own father, being happy with the gender of the baby and working in an income-generating job were associated with significantly higher levels of attachment to fetus. In our study, we did not gather information on these background factors.

Regardless of the planned nature of the pregnancy, those attending antenatal controls and prenatal classes with their spouse had higher levels of parental-fetal attachment. Also wanting to take responsibility of the child and help with the baby care and household chores were found to have significantly higher levels of attachment to the intrauterine fetus [21].

One of the strengths of this study was that it was a prospective cohort study. It was conducted during the first, second, and third trimesters of the pregnancy and included both the mothers and their partners. Another strength was that we used high-quality instruments of the MAAS and PAAS to assess the parental-fetal attachment. We measured the parental-fetal attachment repeatedly during the pregnancy, and could follow the development of their attachment during intended and unintended pregnancies, which has not been explored earlier to our knowledge.

We are aware that the study did have some limitations. The participation rate was rather low (42% for pregnant women and 27% for partners), which may affect the ability of the study to draw definitive conclusions. No information was collected on non-participating families. 10% of the pregnant women in our study reported their pregnancy as unintended and 11% of the partners, respectively. In the questionnaire for families with children in Finland, 20% of the respondents reported their first pregnancy as unintended [22]. It is important to acknowledge that it is possible that not all parents with unintended pregnancies participated in our study. Stressful life situations and the risk of having a weaker attachment may also be reasons for not participating in a long-lasting study. As a result, the findings may not fully represent the entire population of individuals experiencing unintended pregnancies and may affect the results of this study. Even tough we lack information on non-participating families, the characteristics of our study population represent the standard Finnish population attending maternity clinics in terms of maternal age, parity, and marital status [25]. Furthermore, it is important to note that using drugs or alcohol is shown to weaken the maternal–fetal attachment and increase the number of unintended pregnancies [14, 17, 24]. As none of the pregnant women in this study reported using drugs or alcohol during their pregnancy, it is possible that those mothers did not participate in the study in the first place. However, this study did include mothers who reported smoking during their pregnancy, which is consistent with the rates of smoking in the general population in Finland at the time of the study [33]. Still, there may be other unmeasured confounders that could influence the results.

There is little previous research on the paternal-fetal attachment; thus, future studies should further explore the paternal-fetal attachment and factors affecting it. Additionally, an important field of study would be the paternal-infant attachment, and the development of the attachment and the bond between the father and the child in cases of unintended pregnancies. In previous studies, the paternal-fetal attachment has been found to be stronger when attending antenatal controls and prenatal classes with their spouse or after 3-/4-dimensional ultrasonography [21, 34]. Our study emphasizes the importance of further developing measures to endorse the development of the maternal/paternal-fetal/infant attachment during and after the pregnancy, as well as developing tools to support also partners/fathers-to be in situations when the pregnancy is unintended.

Conclusions

In conclusion, we found that an unintended pregnancy seems to be a risk factor for a weaker paternal-fetal attachment throughout the pregnancy. This emphasizes the importance for prenatal care providers to inquire whether the pregnancy was intended or not. It is crucial to recognize and support the entire family—not just the mother—in efforts to support the parental-fetal attachment and its development, as the prenatal attachment has been found to be significantly important in postnatal interactions and parents' relationship with their baby.

Abbreviations

MAAS	Maternal Antenatal Attachment Scale
PAAS	Paternal Antenatal Attachment Scale
EPDS	Edinburgh Postnatal Depression Scale
CI	Confidence interval
MFA scale	Maternal Fetal Attachment scale
PFA scale	Paternal Fetal Attachment scale
IFAS	Intrauterine Father Attachment Scale

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Authors' contributions

A.B. and M.O.E. conceived the study, planned the study design, and performed the analyses. A.B. performed the report write-up and drafted the manuscript. M.O.E., A.T.R., and M.P. contributed to reviewing the draft document and manuscript. All authors read and approved the final manuscript.

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Data availability

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the privacy of the families involved in the study.

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. The protocol was approved by The Ethics Review Committee of the Hospital District of South-West Finland. The ethics approval reference number is 4/1801/2016. Written informed consent was obtained from all subjects.

Consent to publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Condon JT. The assessment of antenatal emotional attachment: development of a questionnaire instrument. Br J Med Psychol. 1993;66(Pt 2):167–83.
2. Doan H, Zimerman A. Prenatal attachment: a developmental model. Int J Prenatal Perinatal Psychol Med. 2008;20(1):20–8.
3. Hjelmstedt A, Widström AM, Collins A. Psychological correlates of prenatal attachment in women who conceived after in vitro fertilization and women who conceived naturally. Birth. 2006;33(4):303–10. https://doi.org/10.1111/j.1523-536X.2006.00123.x.
4. van Bussel JCH, Spitz B, Demyttenaere K. Reliability and validity of the Dutch version of the maternal antenatal attachment scale. Arch Womens Ment Health. 2010;13(3):267–77. https://doi.org/10.1007/s00737-009-0127-9.
5. Coté JJ, Badura-Brack AS, Walters RW, Dubay NG, Bredehoeft MR. Randomized controlled trial of the effects of 3D-printed models and 3D ultrasonography on maternal-fetal attachment. J Obstet Gynecol Neonatal Nurs. 2020;49(2):190–9. https://doi.org/10.1016/j.jogn.2020.01.003.
6. Luz R, George A, Vieux R, Spitz E. Antenatal determinants of parental attachment and parenting alliance: how do mothers and fathers differ? Infant Ment Health J. 2017;38(2):183–97. https://doi.org/10.1002/imhj.21628.
7. Siddiqui A, Hägglöf B. Does maternal prenatal attachment predict postnatal mother-infant interaction? Early Hum Dev. 2000;59(1):13–25. https://doi.org/10.1016/s0378-3782(00)00076-1.
8. Alhusen JL, Gross D, Hayat MJ, Woods AB (Nancy), Sharps PW. The Influence of Maternal-Fetal Attachment and Health Practices on Neonatal Outcomes in Low-Income, Urban Women. Res Nurs Health. 2012;35(2):112–20. https://doi.org/10.1002/nur.21464.
9. Branjerdporn G, Meredith P, Strong J, Garcia J. Associations between maternal-foetal attachment and infant developmental outcomes: a systematic review. Matern Child Health J. 2017;21(3):540–53. https://doi.org/10.1007/s10995-016-2138-2.
10. Cannella BL, Yarcheski A, Mahon NE. Meta-analyses of predictors of health practices in pregnant women. West J Nurs Res. 2018;40(3):425–46. https://doi.org/10.1177/0193945916682212.
11. Goecke TW, Voigt F, Faschingbauer F, Spangler G, Beckmann MW, Beetz A. The association of prenatal attachment and perinatal factors with pre- and postpartum depression in first-time mothers. Arch Gynecol Obstet. 2012;286(2):309–16. https://doi.org/10.1007/s00404-012-2286-6.
12. Deneault AA, Bakermans-Kranenburg MJ, Groh AM, Fearon PRM, Madigan S. Child-father attachment in early childhood and behavior problems: a meta-analysis. New Dir Child Adolesc Dev. 2021;2021(180):43–66. https://doi.org/10.1002/cad.20434.
13. Seimyr L, Sjögren B, Welles-Nyström B, Nissen E. Antenatal maternal depressive mood and parental-fetal attachment at the end of pregnancy. Arch Womens Ment Health. 2009;12(5):269–79. https://doi.org/10.1007/s00737-009-0079-0.
14. Sedgmen B, McMahon C, Cairns D, Benzie RJ, Woodfield RL. The impact of two-dimensional versus three-dimensional ultrasound exposure on maternal-fetal attachment and maternal health behavior in pregnancy. Ultrasound Obstet Gynecol. 2006;27(3):245–51. https://doi.org/10.1002/uog.2703.
15. Shieh C, Kravitz M, Wang HH. What do we know about maternal-fetal attachment? Kaohsiung J Med Sci. 2001;17:448–54.
16. Brandão T, Brites R, Hipólito J, Pires M, Lurdes Vasconcelos M, Nunes O. Depressive symptoms, dyadic coping, and attachment to the fetus in expectant fathers: a moderated-mediation analysis. J Child Fam Stud. 2020;29(6):1649–58. https://doi.org/10.1007/s10826-019-01658-4.
17. Alhusen JL. A literature update on maternal-fetal attachment. J Obstet Gynecol Neonatal Nurs. 2008;37(3):315–28. https://doi.org/10.1111/j.1552-6909.2008.00241.x.
18. O'malley EG, Walsh MC, Reynolds CM, Kennelly M, Sheehan SR, Turner MJ. A cross-sectional study of maternal-fetal attachment and perceived stress at the first antenatal visit. J Reprod Infant Psychol. 2020;38(3):271–80. https://doi.org/10.1080/02646838.2019.1637516.
19. Ustunsoz A, Guvenc G, Akyuz A, Oflaz F. Comparison of maternal-and paternal-fetal attachment in Turkish couples. Midwifery. 2010;26(2):e1-9. https://doi.org/10.1016/j.midw.2009.12.006.
20. Camarneiro APF, de Miranda Justo JMR. Prenatal attachment and sociodemographic and clinical factors in Portuguese couples. J Reprod Infant Psychol. 2017;35(3):212–22. https://doi.org/10.1080/02646838.2017.1297889.
21. Türkmen H, Güler S. Factors affecting intrauterine paternal-foetal attachment and the responsibility status of fathers concerning mothers and babies. J Reprod Infant Psychol. 2021. https://doi.org/10.1080/02646838.2021.1904506.
22. Klemetti R, Gissler M, Lammi-Taskula J&, Miettinen A. Lapsiperheiden hyvinvointi 2014. 2014.
23. Chandra A, Martinez GM, Mosher WD, Abma JC, Jones J. Fertility, family planning, and reproductive health of U.S. women: data from the 2002 national survey of family growth. Vital Health Stat. 2005;23(25):160.
24. Goossens J, Van Den Branden Y, Van Der Sluys L, Delbaere I, Van Hecke A, Verhaeghe S, et al. The prevalence of unplanned pregnancy ending in birth, associated factors, and health outcomes. Hum Reprod. 2016;31(12):2821–33. https://doi.org/10.1093/humrep/dew266.
25. Ekblad MO, Wallin HP, Pajulo M, Korhonen PE. Design of a prospective follow-up study on early parenthood and smoking behaviour during pregnancy in Finnish primary healthcare. Scand J Public Health. 2021;49(8):970–80. https://doi.org/10.1177/14034948211022433.
26. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression scale. Br J Psychiatry. 1987;150:782–6. https://doi.org/10.1192/bjp.150.6.782.
27. Kernot J, Olds T, Lewis LK, Maher C. Test-retest reliability of the English version of the Edinburgh postnatal depression scale. Arch Womens Ment Health. 2015;18(2):255–7. https://doi.org/10.1007/s00737-014-0461-4.
28. Condon JT, Corkindale CJ, Boyce P. Assessment of postnatal paternal-infant attachment: development of a questionnaire instrument. J Reprod Infant Psychol. 2008;26(3):195–210. https://doi.org/10.1080/02646830701691335.
29. Condon JT, Corkindale CJ. The assessment of parent-to-infant attachment: development of a self-report questionnaire instrument. J Reprod Infant Psychol. 1998;16(1):57–76. https://doi.org/10.1080/02646839808404558.
30. Condon JT, Corkindale C. The correlates of antenatal attachment in pregnant women. Br J Med Psychol. 1997;70(Pt 4):359–72. https://doi.org/10.1111/j.2044-8341.1997.tb01912.x.
31. Shreffler KM, Spierling TN, Jespersen JE, Tiemeyer S. Pregnancy intendedness, maternal–fetal bonding, and postnatal maternal–infant bonding. Infant Ment Health J. 2021;42(3):362–73. https://doi.org/10.1002/imhj.21919.
32. McCrory C, McNally S. The effect of pregnancy intention on maternal prenatal behaviours and parent and child health: results of an Irish cohort study. Paediatr Perinat Epidemiol. 2013;27(2):208–15. https://doi.org/10.1111/ppe.12027.
33. Rumrich IK, Vähäkangas K, Viluksela M, Gissler M, Surcel HM, Korhonen A, et al. Smoking during pregnancy in Finland – trends in the MATEX cohort. Scand J Public Health. 2019;47(8):890–8. https://doi.org/10.1177/1403494818804417.
34. Pretorius DH, Gattu S, Ji EK, Hollenbach K, Newton R, Hull A, Carmona S, D'Agostini D, Nelson TR. Preexamination and postexamination assessment of parental-fetal bonding in patients undergoing 3-/4-dimensional obstetric ultrasonography. J Ultrasound Med. 2006;25(11):1411–21. https://doi.org/10.7863/jum.2006.25.11.1411.

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