EÖTVÖS LORÁND UNIVERSITY
FACULTY OF EDUCATION AND PSYCHOLOGY

Theses

A STUDY OF FACTORS INFLUENCING PATERNAL-FETAL ATTACHMENT CONSIDERING RELATIONSHIP AND INTERGENERATIONAL RELATIONSHIP CHARACTERISTICS

Andrea Andrek

ELTE PPK Doctoral School of Psychology
Head of the Doctoral School: *Zsolt Demetrovics*, PhD, DSc
Behavioral Psychology Doctoral Program
Program leader: *Anna Veres-Székely*, PhD

Doctoral advisor: *Katalin Varga*, PhD

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Guest professor at ELTE PPK †

Submitted: 2019

EÖTVÖS LORÁND TUDOMÁNYEGYETEM
PEDAGÓGIAI ÉS PSZICHOLÓGIAI KAR

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INTRODUCTION

It has always been a part of parents' experience but by now a vast amount of scientific evidence has confirmed that the relationship between mother, father and child begins developing at least as early as the pregnancy. Expectant parents not only carry the fetus physically and psychologically, but as they are establishing the foundations of their parenting they also reevaluate the patterns offered by their own parents, setting out on their own path of motherhood and fatherhood.

As the pregnancy goes forward, emotions towards the fetus intensify, experiencing fetal movements increase attachment. The clearly distinguishable active and watchful but passive fetal behaviors in the third trimester prompt parents to react to signals in accordance with the fetus's state. Interaction and bonding with the child through interaction happen through multiple channels, which makes it especially challenging to scientifically operationalize the phenomenon. To date, the majority of scientific studies on this subject have mainly examined the effects of demographic and psychosocial variables, primarily in relation to maternal-fetal attachment. Only a handful of researchers have taken to examining the factors influencing paternal-fetal attachment. Upon review of the relevant scientific literature, I have not found any studies that map the wide range of factors influencing maternal-fetal and paternal-fetal attachment *with a systemic approach*: taking demographic, psychosocial, relational and intergenerational relationship factors into account collectively.

In my doctoral thesis I therefore set out to examine which of these factors, when considered collectively, will best predict the degree of prenatal attachment for expectant mothers and fathers. To my knowledge this is the first study that views parental-fetal attachment as a phenomenon embedded in a system spanning over generations and examines influencing factors and their effects in their full complexity.

THE OBJECTIVES OF THIS THESIS

1. A significant objective of this thesis is **to introduce the professional debate around the concept of prenatal attachment**, and to start a discourse aimed at discussing the concept of prenatal attachment and the significance of relevant study results in professional circles working in the field of early attachment.
2. Another objective of my work is **to translate the most frequently used measurement tool in the international field, the Maternal Fetal Attachment Scale, into Hungarian**, **and conduct testing of the necessary psychometric parameters** (Cranley, 1981). Another objective is **to adapt the questionnaire to measure paternal-fetal attachment**, and to determine the psychometric parameters.
3. The ultimate objective of my research is **to explore the influencing factors of maternal-fetal and paternal-fetal attachment, examining demographic and psychosocial aspects, relationship factors between the parents and between the generations (intergenerational aspects).** Also, the aim of this work is **to determine the collective predictive power of these factors on the strength of prenatal attachment.**

THEORETICAL BACKGROUND

1. Intrauterine development and fetal competences serving the attachment process

In terms of the development of intrauterine cognitive functions it has been proven that the fetus is capable of perceiving stimuli from its environment in each sensory modality, processing information and reacting adequately. The most important role of functions developed in utero is to ensure healthy structural and functional development as well as the development and deepening of the relationship between parents and their fetus (Blum, 1993; Hepper, 2005; Lecaunet & Schaal, 2002; Prechtl, 1988; Schaal, Marlier, & Soussignan, 2000). The fetus is an active participant in interactions with his/her close and wider environment from the beginning. The fetus gains experience of the intra- and extrauterine environment through various channels, and also influences it. These early, intrauterine interactional experiences can be related to later interactional situations.

2. The semantic layers of attachment and prenatal attachment

According to John Bowlby's definition, human children's attachment behavior is an integral, primary need, its purpose is to increase proximity to the mother/primary caregiver in the event of danger, and to prompt the mother to behave in a way that soothes the infant (Bowlby, 1958). In the course of their research, Bowlby and Ainsworth found that the primary caregiver has a key role in the organization of attachment behavior into a pattern. When in danger, the primary caregiver reacts sensitively to the infant's signals and provides a *safe haven*, while in peaceful situations he/she plays the role of a *secure base*, enabling the activation of the exploration system (Ainsworth & Bowlby, 1991). The infant's inner mental representations of relationship create the so-called *internal working model* that helps him/her predict the expected outcome of events, and the quality of his/her relationship with the caregiver. According to Ainsworth, over the development of individual patterns of attachment, *maternal sensitivity*, the quality of the mother's accessibility and the accurate and quick reading of the child's needs have decisive significance (Ainsworth, 1969). Ainsworth's research inspired the development of several modern theories of mind, including for instance the concepts of Gergely and Watson's *maternal mirroring* (Gergely & Watson, 1996) or Fonagy's *reflective self* (Fonagy, 1991).

More and more authors note that **the attachment process** begins as early as the pregnancy due to the dynamics developing between mother and fetus (Alhusen, 2008; Branjerdporn, Meredith, Strong, & Garcia, 2016; Cannella, 2005; Erickson, 1996). The authors use the concept of ***prenatal attachment*** to describe the altered maternal behavior that can be observed as a result of events of the pregnancy and the developing relationship with the fetus.

The phenomenon's exact definition proves difficult using the traditional attachment terminology when we want to name the unique bond between mother and child as a single unit, which integrates the child's *attachment* and the mother's *caregiving* system. Mothers who perceive the fetus's various excited states sensitively and give nuanced responses to these states already conduct an active dialogue with their child during the pregnancy. This state of being mutually attuned to each other and functioning in sync beyond the verbal channel is basically a psycho-vegetative, often not consciously observed "exercise field" for attuning to the infant and decoding nonverbal signals (DiPietro, Irizarry, Costigan & Gurewitsch, 2004; Stainton, 1990).

As the term "bonding" used widely in relevant literature does not have an equivalent in Hungarian and I presume that the fetus, through his/her attachment behavior, contributes to the close emotional bond that ensures its survival, in the Hungarian version of my thesis I use the terms *prenatális kötődés (prenatal attachment)* and *anya-magzat/apa-magzat kötődés (maternal-fetal/paternal-fetal attachment)*. This also reflects the multi-actor, interactive nature of this phenomenon.

3. Options for measuring prenatal attachment

Cranley published the first objective measuring tool developed to measure the construct of maternal-fetal attachment in 1981 (Cranley, 1981: Mother Fetus Attachment Scale, MFAS). The 24 items of the scale examine the mother's behavior towards the child, and her feelings towards pregnancy and the future child. Since its publication, several new tools have been developed and used to measure maternal-fetal attachment, such as Condon's Maternal Antenatal Attachment Scale (Condon, 1993) and the Prenatal Attachment Inventory introduced by Müller (Müller, 1993). In recent years additional measuring tools have been developed, e.g. the pictorial representation of attachment measure (Van Bakel, Maas, Vreeswijk & Vingerhoets, 2013). Despite promising attempts, there is still no consensus regarding the conceptual construct of maternal-fetal attachment and its measurement.

4. Factors influencing prenatal attachment

Among *socio-demographic factors,* a negative correlation was found between **the mother's age and education** and maternal-fetal attachment (hereinafter MFA) measured with the aforementioned scales (Cataudella, Lampis, Busonera, Marino, & Zavattini, 2016; Lindgren, 2001; Mercer, Ferketich, May, DeJoseph, & Sollid, 1988), while others did not confirm these findings (Cataudella et al., 2016; Fuller, Moore, & Lester, 1993; Grace, 1989). Results concerning **financial situation** are similarly inconsistent; some found a unidirectional correlation between MFA and financial background, while others did not find the correlation significant (Cannella, 2005; Grace, 1989; Lindgren, 2001; Mercer et al., 1988). A positive correlation between **marital status** and MFA has been reported (Doan, Cox, & Zimerman, 2003; Lindgren, 2001).

Among *factors related to the pregnancy*, the **method of conception** was found insignificant, natural conception and assisted reproduction did not have any correlation with MFA (Hjelmstedt, Widström, & Collins, 2006; McMahon, Ungerer, Beaurepaire, 1997; Stanton & Golombok, 1993). There

is a weak correlation between **planned pregnancies** and the intensity of MFA (Yarchesky, Mahon, Yarcheski, Hanks, & Cannella, 2009). The **gestational age** and the perception of **fetal movements** significantly increase the intensity of MFA (Doan, et.al., 2003; Heidrich & Cranley, 1989; Lerum & LoBiondo-Wood, 1989; Yarchesky et al., 2009). No significant correlation was found between **the sex of the fetus** and prenatal attachment (Cranley, 1981; Grace, 1989). Mothers **expecting a second or subsequent child** reached significantly lower scores on the attachment scale and reported significantly lower marital satisfaction than first-time mothers (Nichols, Roux, & Harris, 2007). Some studies did not find correlation with prior **perinatal loss** (Armstrong, 2002; Cataudella et al., 2016; Sedgmen, McMahon, Cairns, Benzie, & Woodfield, 2006), while others reported a negative correlation to MFA (Bielawska-Batorowicz & Siddiqui, 2008). The bond between mother and fetus can be strengthened the most by the **ultrasound** examination performed at the beginning of the second trimester, as it can support the mother's health preserving behavior (e.g. reducing alcohol and tobacco consumption, following a diet for diabetic mothers etc.), and it can help the development of representations of the child's internal characteristics (Sedgmen et al., 2006; Zeanah & Stewart, 1990).

In terms of *psychosocial factors*, the results concerning **the mother's anxiety**, **depression** and **mental state** show a unidirectional correlation: mothers who score lower on the attachment scale show higher state and trait anxiety and higher depressional values than those with high MFA scores (Cataudella et al., 2016; Hart & McMahon, 2006;). The **relationship with the partner** is the medium through which mental wellbeing and MFA come into correlation (Cataudella et al., 2016; Walsh, Hepper, & Marshall, 2011). **Social support** is an important predictive factor for MFA according to some sources (Cranley, 1981; Mercer et al., 1988; Sandbrook & Adamson-Macedo, 2004; Yarchesky et al., 2009). Others did not find significant correlation between social support and MFA (Damato, 2004; Van den Bergh, 2010; Wilson, White, Cobb, Curry, Greene, & Popovich, 2000). Schwerdtfeger and Nelson-Goff (2007) found significantly lower MFA scores in mothers who had been **physically or sexually abused** as children, and **positive family dynamics** and family cohesion have a beneficial effect on prenatal attachment (Wilson, White, Cobb, Curry, Greene, & Popovich, 2000).

5. Paternal-fetal attachment and its effects

Fathers are capable of providing a secure base and a safe haven despite the fact that they usually spend much less time with the child than mothers (Cataudella et al., 2016; Lamb, 2010). During the time spent together, they

give very different stimuli to the children than mothers: they support the exploration system through a dynamic, challenging, stimulating presence (Feldman, 2015; Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-Englisch, & Zimmermann, 2002).

Using the first questionnaire measuring paternal-fetal attachment (Paternal Fetal Attachment Scale), positive correlation was shown between attachment to the fetus and the quality of the relationship of the parents (Weaver & Cranley, 1982; Wilson et al., 2000). It was found that fathers also mourn a lost fetus, which suggests attachment and its loss (Badenhorst & Hughes, 2007; Einaudi, Le Coz, Malzac, Michel, D'Ercole, & Gire, 2010; McCreight, 2004). The intensity of paternal prenatal attachment predicts the quality of later attachment (Condon, Corkindale, Boyce, & Gamble, 2013).

The development of attachment is a complex phenomenon in which physiological and psychological processes are closely intertwined, an optimal birth and uninterrupted contact between the baby and the mother in the hours after birth support the infant-father bonding process (Harvey, 2010; Hildingsson, Cederlöf & Widén, 2011). Time spent between the father and the newborn, possibly with skin-to-skin contact also supports the fathers' sensitive perception and selective response (Chen, Gau, Liu, & Lee, 2017; Erlandson, Dsilna, Fagerberg, & Christensson, 2007; Shorey, Hong-Gu, & Morelius, 2016).

6. The intergenerational quality of attachment

There is a range of reliable studies confirming that attachment is based on the parental-fetal relationship developed in the prenatal period. Mothers who can express intensive emotions towards their fetus can more easily be attuned to their new maternal role, face less difficulty in the postpartum period and give more proximity stimuli (touching, hugging) to their infant than mothers with lower scores (Fuller, 1990; Leifer, 1977; Müller, 1996; Siddiqui & Hägglöf, 2000). The close correlation between maternal-fetal attachment and maternal attachment style suggests that prenatal attachment is a part of the whole attachment construct: mothers scoring higher in prenatal attachment had more secure attachment patterns (Alhusen, Hayat, & Gross, 2013; Maas, de Cock, Vreeswijk, Vingerhoets, & van Bakel, 2016). Research studies emphasize the *two-directional* quality of mother-fetus relationship: they found consistent temporal association between fetal movements and maternal heartrate and skin reaction. The fetus's movement caused an increase in both parameters two to three seconds after the movement, while it did not reach the level of the mother's conscious perception. Thus, the maternal perception system does not

become habituated, it remains sensitive to fetal signals over the course of the pregnancy (DiPietro, Irizarry, Costigan, & Gurewitsch, 2004; DiPietro, Voegtline, Costigan, Aguirre, Kivlighan, & Chen, 2013).

These findings suggest that *we should regard maternal-fetal attachment as a two-directional, continuous process from the beginning of the relationship*.

Behavioral genetics provides exciting possibilities to establish the *biological foundation* of attachment theory, while environmental criteria and the caregiver's sensitivity are at least as important as genetics. The so-called *intergenerational transmission gap* (van Ijzendoorn, 1995) between the parent's and the child's attachment cannot be bridged by genes alone or by gene/environment study results. There is a complex pattern of neurobiological endophenotypes in the background of attachment, and it is the challenge of future research to explore it (Bakkermans-Kranenburg & van Ijzendoorn, 2016).

Studies concerning the evolution of attachment patterns spanning over generations have proven that the childhood memories of expectant mothers about their upbringing are related to the attachment they develop with their fetuses (Siddiqui, Hägglöf, & Eisemann, 2000). The expectant mother's attachment to her own mother is of key importance in the development of mental representations concerning parental care (Main, Kaplan, & Cassidy, 1985). Further long-term impact studies are needed to help us get closer to the understanding of the process of transmission and evolution of attachment patterns with regard to the complexity and interaction of influencing factors. Results from prenatal attachment studies can contribute further puzzle pieces to exploring the interplay of factors influencing the development and transmission of attachment patterns.

INTRODUCTION OF EMPIRICAL STUDIES

1. Hypotheses of the studies

1.1. Hypotheses concerning the factors influencing maternal-fetal attachment

1.a hypothesis: Based on earlier research study results I presume that the intensity of maternal-fetal attachment can be predicted by considering each of the following demographic and psychosocial factors: the mother's age, parity, marital status, gestational age, perception of fetal movements,

knowledge of fetus's sex, mother's mental health status, prior perinatal loss experiences and willingness to breastfeed.

2.a hypothesis: I presume that positive intergenerational and current relationship experiences are also good predictors of better maternal-fetal attachment. I presume that the collective impact of each following factor is predictive: the loving, supportive presence of the mother's parents, the mother's own birth experience, perceived care in the relationship.

3.a hypothesis: I presume that including intergenerational and current relationship factors in addition to factors known from the scientific literature provides significant added value. If I add the relationship factors tested in hypothesis 2 to the model tested in hypothesis 1 the resulting model will have significantly better predictive power.

4.a hypothesis: I presume that the mother's childhood experiences of close, loving relationships affect attachment through the perceived care in the current relationship.

1.2. Hypotheses concerning the factors influencing paternal-fetal attachment

1.b hypothesis: Based on earlier research study results, I presume that the intensity of paternal-fetal attachment can be predicted by considering each of the following demographic and psychosocial factors: the father's age, parity, marital status, the fetus's gestational age, perception of fetal movements, father's physical health during pregnancy and prior perinatal loss experiences.

2.b hypothesis: I presume that positive intergenerational and current relationship experiences are also good predictors of a more beneficial paternal-fetal attachment. I presume that the collective impact of each following factor is predictive: the loving, supportive presence of the father's parents, the father's own birth, perceived care in the relationship.

3.b hypothesis: I presume that including relationship factors in addition to factors known from the scientific literature provides significant added value. If I add the relationship factors tested in hypothesis 2 to the model tested in hypothesis 1 the resulting model will have significantly better predictive results.

4.b hypothesis: As in the case of mothers, I presume that the fathers' childhood close, loving relationship experiences affect paternal-fetal attachment through the care perceived in the current partnership.

2. Study procedure

The research study was approved by the Ethics Committee of the Institute of Psychology at Károli Gáspár University of the Reformed Church in Hungary (KRE) (*ethics approval number: 389/2012/P*) as my research was conducted in cooperation with the work group of KRE's Department of Developmental Psychology.

Expectant parents were approached personally in compliance with written instructions by *health visitors* in Budapest and healthcare *assistants* at *ultrasound* examinations who had been prepared for recruiting research subjects. Participation was voluntary and anonymous, based on informed consent, without financial compensation. Research participants were given the questionnaire package in an envelope, they completed the questionnaires on site while waiting for their appointment for the examination, and the couples answered the questions independently from each other. Nobody refused participation in the study, 4 questionnaires were removed because they were not fully completed. After completion the closed envelopes were placed in a designated collection box by the research participants themselves. The questionnaires were numbered in advance, couples received the same numbers marked with an M (mama for mother) or P (papa for father) so that their responses can be searched together. Research subjects were offered an information sheet and a phone number to take home in case they have any questions later about the subjects discussed in the questionnaire. No participant took this opportunity.

3. Introduction of the research sample

My research included 233 **expectant mothers** between the ages of 20 and 44 years, their average age is 32 years. The criteria for participation – in addition to being currently pregnant – was only literacy and voluntary participation. They were mostly in the second and third trimester of their pregnancies. 97.7% were in a relationship and cohabited with the fetus's father, 69.5% of the above in a marriage, 28.4% as common-law partners. 51% of mothers participating were first-time mothers, 26.6% expected their second child, 12.9% their third, 12 mothers their fourth and 7 their fifth child. Almost 70% of the sample had graduate level education, around 20% had secondary education and 10% were still studying. Most of the respondents

viewed their financial situation average or above average, with two-thirds of mothers contributing significantly.

A total of 183 **expectant fathers** participated in the study, the partners of the mothers introduced above. The average age of the fathers is 35.2 years, the youngest father was 20 years old, the oldest 66. The average age of fathers was approx. 3 years above than that of the mothers. Most fathers had graduate level education (almost 60%), the rest had secondary education or vocational training or were students. 92% of the fathers also viewed their financial situation average or above average and most of them (96.7%) felt that they contributed significantly to the family income.

4. Study tools

Maternal Fetal Attachment Scale (MFAS, Cranley, 1981)

We measured maternal-fetal and paternal-fetal attachment using the Hungarian language version (MFAS-HU) of the Maternal Fetal Attachment Scale (MFAS). Localization of the questionnaire was performed via the usual translation and retranslation method. Items of the scale developed for mothers were adapted with slight linguistic modifications to fathers. The 24 items can be evaluated on a five-point Likert scale. Answers to each item had a score of 5 or 1 points so the total score achievable on the scale was between 24 and 120 points. Subscales of the questionnaire: 1. Role taking, 2. Differentiation of self, 3. Interaction, 4. Attribution and 5. Giving of self. A higher score on these subscales meant a stronger parental involvement in the given area.

Intrauterine Relationship Questionnaire (IUKK, Hadházi, Andrek, & Kekecs, 2017)

We published the 28 items and the factor structure of the scale for the independently developed Intrauterine Relationship Questionnaire earlier. In my thesis I used the data pertaining to convergent validation testing.

Intimate Bond Measurement (IBM, Wilhelm & Parker, 1988)

To measure the intimate attachment in the relationship, we used the Hungarian translation of the questionnaire (PIK; Hadházi, Gérecz, & Végh, 2011). The scale consists of 24 items, 12 items make up the "Care" and 12 items the "Control" dimension. Answers are evaluated on a four-point Likert

scale. A high score on subscales indicates that the person values their partner's caring or controlling behavior highly.

Parental Bonding Instrument (PBI, Parker, Tulping, & Brown, 1979)

We measured the parental behavior of the respondents' own parents with the Hungarian version of the questionnaire (H-PBI; Tóth & Gervai, 1999). The questionnaire consists of 25 items separately for the mother/stepmother and father/stepfather. It includes three factors: "Love-care", "Overprotection" and "Constraint". Items can be evaluated on a four-point Likert scale, recalling the first 16 years of respondents' lives. High scores on subscales indicate intensive parental love/care, overprotection and constraint.

Relationship Assessment Scale (RAS, Hendrick, 1988)

To measure the quality of the relationship, we used the Hungarian adaptation of the questionnaire (Martos, Sallay, Szabó, Lakatos, & Tóth-Vajna, 2014). All 7 items of this measurement tool belong to one factor for both sexes. Statements can be evaluated on a five-point Likert scale. High scores on the scale indicate satisfaction with the relationship.

Data sheet

Using the Data sheet, we collected information on the demographic traits of participants (age, education, employment status, income, parity) and other psychosocial data (planned or unplanned pregnancy, the method of conception, knowledge of the fetus's sex, prior prenatal loss, physiological and psychological grievances, data pertaining to participants' parents and their own births). The fathers' questionnaire was slightly modified linguistically.

5. Statistical analyses

5.1. Statistical analyses of Phase I of the study

We analyzed the structure of MFAS-HU with *factor analysis*. In the course of the factor analysis we followed Field's (2013) and Costello and Osborne's (2005) recommendations. For the exploratory factor analysis, principal axis factoring was used with oblique rotation due to normality violations (direct oblimin, Delta=0).

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To test the *internal reliability of* the questionnaire used we calculated the Cronbach-alpha coefficient. In the course of a validity test we calculated the correlation with the other Hungarian language questionnaire under development (IUKK).

We tested *the correlation of scores reached on the MFAS-HU questionnaire considering demographic or other psychosocial factors* with a Mann-Whitney U test for ordinal independent variables (for two groups) or Kruskal-Wallis test (for more groups), and for continuous independent variables we used the Spearman correlation process.

We performed the confirmatory factor analysis with the R 3.02 "sem" package and other analyses with the SPSS-24 statistical software package.

5.2. Statistical analyses of Phase II of the study

I examined the psychometric indicators of the MFAS-HU questionnaire for maternal and paternal data in a larger sample as well. Using the Lavaan package of the R statistical software I ran a robust version of *confirmatory factor analysis* with the MLM estimator as the condition of multivariate normality was not met.

I examined the *internal reliability* of the questionnaire for a larger sample as well by calculating the Cronbach-alpha coefficient. In the course of a convergent validity test I calculated the Spearman correlation with two other Hungarian language questionnaires under development (IUKK and MAAS).

I performed *hierarchical multiple regression analysis* on the predictive power of predictors examined in relevant scientific literature and the factors used in my study. I then combined the two models into one and examined the explanatory power of the collective impact.

Using *mediation effect analysis*, I examined whether the parents' childhood close, loving relationship experiences impact their attachment with the fetus directly or mediated by the partnership.

I performed the confirmatory factor analysis with the R statistics program and other analyses with the SPSS-24 statistical software package.

5.3. Results of the interim study phase

In the first phase of data collection upon analyzing 116 maternal questionnaires I found that *the MFAS-HU questionnaire is a reliable measurement tool* because the Cronbach alpha coefficient measuring *internal reliability* showed a value of 0.87 on the total score. Subscales proved to be statistically less reliable, similarly to earlier studies. *Convergent validation* testing confirmed the MFAS-HU questionnaire's external validity. *Factor analysis* delivered results in accordance to the findings of scientific literature: the original five-factor model of MFAS did not match the Hungarian sample therefore I used the total score of MFAS-HU for further calculations. I reviewed significant socio-demographic and psychosocial indicators in relation to the total score of MFAS-HU and I found that correlation is significant for several factors: e.g. *marital status*, *perceiving fetal movements* and *knowledge of the fetus's sex*.

According to the results of interim analyses, the MFAS-HU questionnaire works adequately, therefore it was beneficial to continue data collection for statistical calculations requiring a larger sample.

5.4. Results of the second study phase

In the second phase of the study, according to the results of calculations done on larger samples, the MFAS-HU scale has an acceptable consistency (maternal sample: N=233, Cronbach alpha 0.84; paternal sample: N=183, Cronbach alpha 0.79). The value of convergent validity, in comparison with the IUKK-R questionnaire is r=0.62; p<0.001 for the maternal sample, compared to the MAAS questionnaire r=0.54, p<0.001; and r=0.697; p<0.001 for the paternal sample in comparison with the IUKK-R questionnaire. We conducted factor analysis on the larger sample as well and once again we found that neither the original five-factor model, nor the one-factor model matches acceptably. In accordance with data from the literature and the results of our calculations we found that the total score is reliable (Cranley, 1992; Müller & Ferketich, 1993).

I examined the factors influencing maternal-fetal and paternal-fetal attachment using three models:

I.   **In the first model I examined the demographic and psychosocial factors predictably influencing maternal-fetal and paternal-fetal attachment.**

For **mothers** I selected variables based on demographic and psychosocial predictive factors known from the scientific literature: mothers' age, parity, prior losses, willingness to breastfeed, fetus's gestational age, perception of fetal movements, knowledge of fetus's sex, marital status.

According to the results of linear regression analysis, the mother's age, the fetus's gestational age and the willingness to breastfeed are significant predictors of the degree of maternal-fetal attachment and explain 16% of the variance of attachment.

The *mother's age* showed a negative correlation with the intensity of attachment, i.e. the younger a mother is, the more intensively she is attached to her fetus (std.β = -0.17 p=0.013). Although it is a significant connection, the correlation has little power. However, in accordance with Damato's conclusion older mothers are probably more conscious in perceiving the changes brought on by motherhood (Damato, 2004). The gestational *age* shows a significant positive correlation with the degree of attachment (std.β = 0.25; p=0.002). This result resonates with the results of several earlier studies (Andrek et al., 2016; Cannella, 2005; Doan, Cox, & Zimerman, 2003; Heidrich & Cranley, 1989; Lerum & LoBiondo-Wood, 1989; Stocker & Hargitai, 2007; Yarchesky et al., 2009). The mother's *willingness to breastfeed* is the third predictor showing the strongest positive correlation in predicting the degree of maternal-fetal attachment (std.β = 0.27; p< 0.001).

For **fathers** I also selected variables based on data from the literature, thus the father's age, parity, marital status, the fetus's gestational age, perception of the fetus's movement, prior perinatal loss and grievances arising over the course of the pregnancy were selected as probably significant predictors.

According to the results of linear regression analysis, parity (std.β = -0.39; p<0.001) and prior perinatal loss (std.β = -0.171; p=0.02) proved to be significant predictive factors for paternal-fetal attachment. Both variables show a negative correlation and explain 20% of the variance of attachment.

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In terms of *parity* several studies found that primiparae achieve significantly higher scores on scales assessing attachment to the fetus than fathers expecting subsequent children (Condon & Corkindale, 1997; Haedt & Keel, 2007; Mercer & Ferketich, 1995). The reason for this may be that in the event that a father has to care for other children during a new pregnancy, the focus of his attention tends to be on the children already born. Fathers also *mourn their lost embryos, fetuses* (Badenhorst & Hughes, 2007; Einaudi et al., 2010; McCreight, 2004). It is noteworthy that this correlation was not significant for mothers, it is possible that fathers process prior perinatal losses "less successfully".

II.   **In the second model I examined the intergenerational and relationship factors predictably influencing maternal-fetal and paternal-fetal attachment.**

The selection of predictive factors was done based on the scientific literature and my clinical experience. I examined the following predictors for **both parents**: the supportive presence of the mother's/father's own parents in their childhood, the divorce/death of parents, the course of their own birth and perceived care in the current relationship.

According to the results of linear regression analysis, the perceived caregiving in the relationship was the significant predictor for both expectant mothers (std.β =0.35; p< 0.001) and fathers (std.β =0.42; p< 0.001). This model explains 11% of the variance of maternal-fetal attachment and 18% of the variance of paternal-fetal attachment.

III.   **The third, comprehensive model included intergenerational and relationship factors in addition to demographic and psychosocial factors.**

In the maternal sample the comprehensive model was capable of predicting **a significantly larger degree, 20%** of the variance of the MFAS (adj. R^2= 0.2; R^2 change = 0.1; F change (6.182) = 4.25; p=0.001). As in the results of the first model, *age* (std.β= -0.18; p=0.019), *willingness to breastfeed* (std.β = 0.22; p=0.002) and *gestational age* (std. β = 0.2; p=0.016) remained significant predictive factors. Among the newly added predictors, the *Care* subscale of the *Relationship Intimacy questionnaire* had significant predictive power (std. β = 0.28; p<0.001).

In the paternal sample the comprehensive model was capable of predicting **a significantly larger degree, 31%** of the variance of the MFAS (adj. R2 = 0.31; R2 change = 0,12; F change = 4.17; p =0.001). In relation to fathers the increase in the model's predictive power is even more noteworthy since it increased from 20% to 31%. As in the results of the first model, *parity* (std.β = -0.32; p<0.001) remains a significant predictor. Of the newly added predictors, as in the mothers' case, the *Care* subscale of the *Relationship Intimacy questionnaire* had significant predictive power (std.β = 0.33; p<0.001).

Social support is considered one of the most important predictive factors of parental-fetal attachment in numerous studies (Condon & Corkindale, 1997; Cranley, 1981; Mercer et al., 1988; Sandbrook & Adamson-Macedo, 2004; Yarchesky et al., 2009), emphasizing the significance of a partner providing emotional support to **the expectant mother** (Hjelmstedt et al., 2006; Walsh, Hepper, & Marshall, 2011). According to my findings, care perceived in the relationship is also predictive for **expectant fathers** in terms of developing attachment to the fetus.

IV.   Results of mediation analyses

In the course of mediation analysis, for **the maternal sample** I found that the mother's childhood love and care experiences related to her own mother do not have a direct effect on her attachment to the fetus, this effect is mediated by the perceived care in their current relationship (completely standardized indirect effect=0.13; SE=0.32; 95% CI=0.08-0.2). The analysis also showed that childhood experiences related to maternal love and care do not have any significant direct effect beyond the mediated effect (direct effect of x on y=0.02; SE=0.05; 95% CI=-0.08-0.12).

For the **paternal sample** I found the same result: the father's childhood love and care experiences related to his own mother do not have direct effect on his attachment to the fetus, this effect is mediated by the perceived care in their current relationship (completely standardized indirect effect=0.09; SE=0.3; 95% CI=0.04-0.2). Mediator analysis also showed that childhood experiences related to maternal love and caregiving do not have any significant direct effect beyond the mediated effect for fathers either (direct effect of x on y=0.12; SE=0,06; 95% CI=-0.0009-0.23).

Thus, according to my results **the effect of parental treatment** experienced in childhood and adolescence is **mediated by care in the current relationship when one expects their own child**, and beyond this indirect effect I could not show the direct effect of the love and caregiving of the future grandparents on the attachment of the expectant parents and their fetus.

New observations recommended for approval:

1. The MFAS-HU maternal and paternal scales are valid measurement tools, I recommend the use of its total score in the future, as most studies concerning prenatal attachment are performed with this tool internationally. This makes the results of different studies easily comparable and we can get closer to a more accurate definition and a better understanding of the phenomenon.
2. For expectant mothers, the model consisting of the studied psychosocial and demographic factors (mother's age, parity, prior loss, willingness to breastfeed, fetus's gestational age, perception of the fetus's movement, knowledge of the fetus's sex, marital status) are strong predictors of maternal-fetal attachment. Among these factors, the mother's age and willingness to breastfeed, as well as the gestational age of the fetus appear to be especially important (1.a hypothesis).
3. For expectant mothers, the model consisting of the studied relationship factors (supportive presence of the mother's own parents in her childhood, divorce/death of parents, the mother's own birth experience and care perceived in the relationship) is a strong predictor of the degree of maternal-fetal attachment. Among these factors, care perceived in the relationship appears to be especially important (2.a hypothesis).
4. The comprehensive model that considers current relationship and intergenerational relationship factors in addition to demographic and psychosocial factors was able to predict a significantly larger extent of variance of the maternal-fetal attachment for expectant mothers. Considering relationship factors is therefore essential in understanding and predicting maternal-fetal attachment (3.a hypothesis).
5. The mothers' childhood close, loving relationship experiences affect maternal-fetal attachment through the care perceived in the current relationship (4.a hypothesis).
6. For expectant fathers, the model consisting of the studied psychosocial and demographic factors (father's age, parity, marital status, the fetus's

gestational age and perception of its movements, prior perinatal loss and grievances arising during the pregnancy) are strong predictors of paternal-fetal attachment. Among these factors, parity and prior perinatal loss experiences appear to be especially important (1.b hypothesis).

7. For expectant fathers, the model consisting of the studied relationship factors (supportive presence of the father's own parents in his childhood, divorce/death of parents, the father's own birth and care perceived in the relationship) is a strong predictor of the degree of paternal-fetal attachment. Among these factors, care perceived in the relationship appears to be especially important (2.b hypothesis).

8. The comprehensive model that considers relationship and intergenerational relationship factors in addition to demographic and psychosocial factors was able to predict a significantly larger extent of variance of the paternal-fetal attachment for expectant fathers. Considering relationship factors is therefore essential in understanding and predicting paternal-fetal attachment (3.b hypothesis).

9. The fathers' childhood love-relationship experiences affect paternal-fetal attachment through the care perceived in the current relationship (4.b hypothesis).

THE LIMITATIONS OF THIS STUDY

Even today there is no consensus among researchers of this subject on either the *definition* or the *measurement* of prenatal attachment, this is inevitably a limitation of my thesis. Operationalizing the concept is underway, several attempts are carried out to *map the construct* (Doster, Wallwiener, Müller, Matthies, Plewniok, Feller, & Reck, 2018). The MFAS questionnaire focuses mainly on *behavioral traits* therefore the fact that this scale does not help as much in revealing the *affective dimensions of prenatal attachment* can also be viewed as a limitation. In the future it would be necessary to conduct *qualitative analyses* in addition to questionnaire surveys to more accurately examine the construct.

The sample's size (233 expectant mothers and 183 fathers), the lack of planning for sample size and the sample's *homogeneity* are also limiting factors. In the course of sample collection, the questionnaire was primarily completed by couples who were motivated to participate in the survey. These circumstances proved to be "a filter" in terms of higher education and

socio-economic status. The *effect of social expectations s*hould also be noted, i.e. the fact that society strongly expects parents to accept and love their child unconditionally.

Further research is necessary to explore how the MFAS-HU works for couples in *low socio-economic situations*, for expectant parents living *in deep poverty*, *in threatening circumstances* or *in a minority cultural setting*. Measurements are needed in Hungarian samples among groups where attachment is made severely difficult, such *as the expectant mother's and/or father's depression*, *pathological anxiety* or *substance abuse* (Condon & Corkindale, 1997; Haedt & Keel, 2007; Lindgren, 2001; Shieh & Kravitz, 2002, 2006).

It is still an open question which score/interval on the MFAS-HU scale reflects *optimal, "healthy" attachment*. We currently do not have any guidance on which scores represent a normal/pathological range in the prediction of prenatal attachment psychopathology.

CONCLUSIONS

The development of perinatal sciences provides an increasing number of research results that rewrite our earlier ideas about human development. A wide range of scientific results confirm that the transfer of life should be viewed from a holistic approach as a transgenerational process from conception to the birth of the next generation.

According to my findings, the parents' emotional/relational components are stronger predictors of the quality of prenatal attachment: the better the quality of the relationship between the parents, which can be understood as the environment around the fetus, the closer bond the parents are able to develop with him/her. **For mothers** *the gestational age* and *perception of movements* are important predictors of the degree of attachment to the fetus. The *mother's* increased *age* affects attachment negatively, which can have several underlying causes: higher level of anxiety due to the mother's conscious approach, or a fear of being unable to carry the child to term or a fear about the baby's health. The *willingness to breastfeed* that solidifies over the course of the pregnancy is also a significant predicting factor for attachment with the fetus. As **for fathers** a negative correlation between *parity* and attachment may signal that the father is beginning to slide out of the family bond, maybe because of negative experiences related to the first child, therefore healthcare professionals

should pay attention to fathers as well during pregnancy care. In terms of emotions and the relationship, expectant fathers need the same as mothers: emotional and physical care from their partners on the verge of a new life stage. Therefore, according to my findings, the quality of care between the partners has the most impact and acts like a funnel, channeling the effects of intergenerational relationships and transmits the past through present quality of care.

Further multi-generation longitudinal studies are necessary that consider prenatal attachment and have sound methodological structure in order to explore the intertwined fabric of factors influencing attachment. I firmly believe that the unique bond developing between parents and their fetus during pregnancy is best described as prenatal attachment semantically. It would be a mistake to call it anything else because an attachment should be viewed as a single unit, as a form of behavior specific to humans from the beginning of life until the end. I strongly believe that we have surpassed the question whether or not prenatal attachment exists, and should ask ourselves what the observable elements of the earliest attachment types are and what methods we can use to study them.

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