Title: Prenatal reflective functioning in primiparous women with a high-risk profile.

Abstract

The concept of maternal reflective functioning (RF) is gaining increasing interest as a possible intermediate mechanism in associations between a wide range of psychosocial risk factors and poor child outcomes. The purpose of the present study was to determine which psychosocial risk factors are linked to prenatal reflective functioning (RF) in a high-risk (HR) group of primiparous women. Differences in prenatal RF between the HR-group and a low-risk (LR) control group were also examined. The sample consisted of 162 women (*M* = 22.22 years, *SD* = 2.39; 83 classified as HR). RF was coded from the Pregnancy Interview (Slade, 2007a). Risk status was assessed by means of the Mini-International Neuropsychiatric Interview-plus (M.I.N.I.-plus; Sheehan et al., 1997) and several questionnaires. The HR-women demonstrated significantly lower RF-quality than the LR-group. Regression analyses indicated that maternal education, size of social support network and substance use during pregnancy were the strongest predictors of prenatal RF for the HR-group. The results suggest that the quality of maternal RF could be an important target for those prevention and intervention programs that aim to reduce adverse psychosocial development in offspring of HR-mothers.

Keywords: reflective functioning, ‘at risk’ sample, social support, maternal education, substance use, pregnancy

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Introduction

The transition into motherhood can be a challenging and stressful period (Heinicke, 1995). During pregnancy women develop a new and different mind-set (Stern, 1995). Pregnancy results in the activation of internalized representations of the self and the other. A woman's representations of herself as a mother and of the baby become increasingly specific during pregnancy (Slade, Cohen, Sadler, & Miller, 2009). Around the third trimester these are fairly consolidated and become relatively stable over time (Theran, Levendosky, Bogat, & Huth-Bocks, 2005). Psychological adjustment to motherhood is partly determined by the ability to visualize oneself in the maternal role and by one's reflective functioning capacity (RF) (Slade et al., 2009). RF in the context of parenting has been defined as the mother's ability to think about herself as a parent, her child, and the relationship with her child in terms of mental states and to use this understanding to guide her responses to the child (Slade, Sadler, & Mayes, 2005). The understanding of mental states in oneself and the other is necessary to make sense of, predict, and anticipate another person's actions (Fonagy & Target, 1998). The mother's ability to adapt to the challenges and changes of pregnancy has been shown to affect children's outcomes (Darvill, Skirton, & Farrand, 2010; Paulson, Dauber, & Leiferman, 2006; Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999).

Maternal RF has been related to parenting behaviors (Grienenberger, Kelly, & Slade, 2005; Koren Karie, Oppenheim, Dolev, Sher, & Etzion-Carasso, 2002; Pajulo et al., 2008; Sokolowski, Hans, Bernstein, & Cox, 2007), attachment security (Slade, Belsky, Aber, & Phelps, 1999; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005), and child development (Benbassat & Priel, 2012; Slade, 2007b; Suchman,

DeCoste, & Mayes, 2009). For example, it has been shown that maternal RF plays a key role in helping children to develop flexible and adaptive mechanisms of self-regulation, and to establish productive and sustaining relationships (Sharp & Fonagy, 2008; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005). Previous research predominantly investigated maternal RF in the postnatal period. A woman's emotional experience of pregnancy and the nature of her developing relationship with her baby are expected to influence her postnatal representations and interactive behavior with her child. Therefore, to optimize children's socio-behavioral development that may be affected by poor parenting practices and parent-child interactions, it is important to understand which factors determine the quality of prenatal RF.

The conditions under which a pregnancy take place vary greatly, due to the amount and type of internal and external resources available. These factors could affect prenatal maternal RF. Maternal characteristics that have been negatively related to RF include psychiatric illness (Fonagy & Luyten, 2009; Levinson & Fonagy, 2004; Perry, Newman, Hunter, & Dunlop, 2013; Toth, Rogosch, & Cicchetti, 2008), substance use during pregnancy (Pajulo et al., 2012), single parenthood (Huth-Bocks, Levendosky, Bogat, & Von Eye, 2004), unavailability of support from family and friends (Larney, Cousens, & Nunn, 1997; Sadler et al., 2007; Smith, 1999), scarcity of material resources (e.g. regarding housing or financially) and low educational attainment (Pajulo, Helenius, & Mayes, 2006; Rosenblum, McDonough, Sameroff, & Muzik, 2008; Sadler et al., 2007; Theran, Levendosky, Bogat, & Huth-Bocks, 2005; Vrieze, 2011). These factors have also been used to define risk status with respect to child socio-behavioral outcomes (World Health Organization, 2005). However, these risk factors have been investigated separately but not simultaneously in relation to RF, especially not in relation to prenatal RF.

The purpose of the present study was to determine which risk factors are most strongly related to prenatal RF in a sample of primiparous women with a high-risk profile (HR-group). Given that many studies on maternal RF in the peripartum period have been conducted in either low-risk samples or clinical and/or high-risk samples without a control group (Grienenberger, Kelly, & Slade, 2005; Miller, 2008; Schechter et al., 2005; Suchman, DeCoste, Leigh, & Borelli, 2010), it was first examined whether prenatal RF in first-time mothers differed between the HR-group and a low-risk control group (LR-group). Women in the HR-group were expected to have lower RF as prior studies have shown that HR-women generally tend to have more negative prenatal representations about their child, self and partner (Pajulo, Savonlahti, Sourander, Piha, & Helenius, 2001). Next, the relation between number of risk factors and prenatal RF was examined in the HR-sample. The presence of more risk factors was expected to negatively impact prenatal RF, because these stressors could preoccupy the mothers-to-be and interfere with their mental space to think reflectively. To provide insight in the relative contribution of each risk factor in the prediction of prenatal RF in the HR-group, a number of factors that have been related to RF-quality separately in earlier studies, were examined concurrently. It was expected that all factors associated with risk status in this study would have independent contributions to quality of prenatal RF. Since this is the first time that these risk factors were investigated together, no specific hypotheses were made about the relative weight of each risk factor.

Methods

Participants

The present study is part of the Mother-Infant Neurodevelopment Study in Leiden, The Netherlands (MINDS - Leiden). MINDS – Leiden is a large ongoing longitudinal study into neurobiological and neurocognitive predictors of early behavior problems. The study was approved by the ethics committee of the Department of Education and Child Studies at the Faculty of Social and Behavioral Sciences, Leiden University, and by the Medical Research Ethics Committee at Leiden University Medical Centre. All participating women provided written informed consent. Women were recruited during pregnancy via midwifery clinics, hospitals, prenatal classes and pregnancy fairs. Dutch speaking primiparous women between 17 and 25 years old with uncomplicated pregnancies were eligible to participate. We chose to oversample on women from a high-risk background to attain sufficient variance in children's early socio-emotional and cognitive development. After completing the prenatal visit in the third trimester of pregnancy, women were allocated to the low-risk or high-risk group. Classification in the HR-group was based on the following criteria (Mejdoubi et al., 2011; World Health Organization, 2005): 1) positive screening on current psychiatric disorder(s) or substance use (alcohol, tobacco and/or drugs) during pregnancy; or 2) presence of two or more of the following risk factors: no secondary education, unemployment, poverty or financial problems, limited social support network, single status, and maternal age (<20 years). In case only one risk factor was present - other than an indication for current psychiatric disorder(s) or substance use - women were discussed in a clinical expert meeting to determine whether placement in the HR-group was appropriate.

The total sample consisted of 79 LR-women (*M* age = 23.47 years, *SD* = 1.79 years) and 83 HR-women (*M* age = 21.05 years, *SD* = 2.28 years). Maternal demographic variables are summarized in Table 1.

Procedure and measures

All participants completed a 2-to-2.5-hour home visit, conducted by two trained female researchers, ideally around 27 gestational weeks. The home visit included an interview regarding the emotional experience of the pregnancy, a semi-structured psychiatric interview, and a variety of questionnaires concerning demographic information, lifestyle, social support, and health of the mother-to-be.

Maternal reflective functioning. A Dutch translation (Smaling & Suurland, 2011) of the Pregnancy Interview – Revised (PI-R; Slade, 2007a) was administered to assess the level of prenatal reflective functioning. The PI-R is a 22-item semi-structured interview. The questions tap into the emotional experience of the pregnancy, mother's prenatal representations of her relationship with her unborn child and of herself as a parent. The PI-R was digitally recorded and transcribed verbatim. Coding for RF was performed using the Reflective Functioning Scoring Manual designed for use on the PI (Slade & Patterson, 2005; Slade, Patterson, & Miller, 2007). The mother's responses to the individual questions were scored and from these an overall score on a 11-point scale from -1 (negative RF) to +9 (full or exceptional RF) was assigned. Scores under 5 indicate either negative, absent, or low RF, whereas scores of 5 and above indicate clear evidence of mentalizing (Slade et al., 2007). Transcripts were coded by trained research assistants under supervision of the first author. 15% of the interviews were coded by a second rater. Inter-rater agreement with intra-class correlations for individual passage scores were .87 and .90 for the overall RF-score.

Psychiatric disorders. The Mini-International Neuropsychiatric Interview (M.I.N.I; Sheehan et al., 1997) is a short structured diagnostic interview to screen for DSM-IV and ICD-10 psychiatric disorders. The current study used the Dutch version of the M.I.N.I.-plus (Van Vliet, Leroy, & Van Megen, 2000) to screen for the presence

of the following disorders: depressive disorder (current), dysthymic disorder (past 2 years), suicidality, mania (current), panic disorder (current and lifetime), agoraphobia (current), social phobia (current), other type of phobia (current), obsessive-compulsive disorder (OCD; current), generalized anxiety disorder (GAD; current), posttraumatic stress disorder (PTSD; current), alcohol dependence and abuse (current and lifetime), drug dependence and abuse (non-alcohol, current and lifetime), attention deficit hyperactivity disorder (ADHD; lifetime), and antisocial personality disorder (ASPD; lifetime). Current is defined as 'in the past month' for all diagnoses except GAD, which has a 6-month time frame, and alcohol abuse/dependence and drug abuse/dependence for which a 12-month time frame is used. The interviewer rates each disorder with a score of 0 (absent) or 1 (present). The M.I.N.I.-plus has been shown to have good psychometric qualities (Van Vliet & De Beurs, 2007).

Social network. To gain more insight in the size of mother's social support system, the Norbeck Social Support Questionnaire (NSSQ; Norbeck et al., 1981; Norbeck, Lindsey, & Carrieri, 1983) was administered. Participants are asked to list each significant person in their lives who provides personal support to them and indicate the kind of relationship they have with them (e.g., spouse or partner, family members, friends, work or school associates, neighbors, health care providers, counselor or therapist, minister/priest/rabbi, other). The total number of persons listed was used in current analyses. A categorical variable was also created and coded as 1 ($<$ 4 individuals listed) or 0 ($\geq$ 4 individuals listed). The NSSQ has been judged a valid and reliable instrument to assess total network support and has been used often with pregnant women (Meadows-Oliver, Sadler, Swartz, & Ryan-Krause, 2007; Norbeck & Anderson, 1989).

Demographics, health and life style. Demographics and information about maternal health and life style (including substance use) was gathered using a Dutch translation of the 'Becoming a mother' questionnaire from the Cardiff Child Development Study (Hay et al., 2011). Educational level of the participants was registered using five response categories: (1) no education, (2) primary, (3) lower secondary, (4) higher secondary, and (5) tertiary education. Current substance use (tobacco, alcohol, other drugs) was assessed using three response categories: 1) never used any substance during pregnancy, 2) substance use only until pregnancy was acknowledged (first trimester only), or 3) continued substance use during pregnancy. Dichotomous variables were created for current substance use, unemployment, single parenthood, and financial problems and were coded as present (1) or absent (0). Maternal age was coded dichotomous as ≥ 20 years (0) and < 20 years (1). Maternal educational level also coded as no secondary education (1) or secondary education or higher (0).

Risk Status. The M.I.N.I-plus, NSSQ, and 'Becoming a mother' questionnaire were used to assess the presence of risk factors. The dichotomous variables that were created for the eight HR/LR-classification factors were added together to create a total score of risk factors (possible range 0 – 8).

Data analyses

Before testing the main study hypotheses, all variables were examined for outliers and violations of assumptions applying to the statistical tests used. First, we examined whether the HR-group and LR-group differed on prenatal RF using analysis of variance (ANOVA). Since a maximum of only one risk factor (other than substance use and indication for psychiatric disorder) could be present in the LR-group,

subsequent analyses were performed for the HR-group only. First, the relation between the number of risk factors and prenatal RF was examined for the HR-sample. Subsequently, associations were examined between all risk factors and prenatal RF. Finally, to examine the relative strength of each risk factor associated with prenatal RF in the HR-group, a regression analysis was conducted with the risk factors that were shown to be associated with prenatal RF in the correlational analyses. All analyses were conducted using the Statistical Package for Social Sciences (SPSS for Windows, version 21.0, SPSS Inc., Chicago, IL).

Results

Descriptive statistics

Descriptive statistics and differences between HR- and LR-group for all variables are shown in Table 1. RF-scores for the whole sample ranged from two (inexplicit references to mental states) to seven (marked RF). For the HR-group the RF-scores ranged from two (12.1%) to five (normal RF, 10.8%), with 50.6% scoring a three (low RF). In the LR-sample scores ranged from three (22.8%) to seven (1.3%), with 39.2% scoring a four (rudimentary RF). More than half of the HR-women had an indication for current psychiatric disorder(s) (56.6%, N = 43), with 15.7 % (N = 13) having even two or more diagnoses on the M.I.N.I.-plus. 10 women scored positive on current depressive disorder, 4 on dysthymic disorder, 2 on suicidality, 5 on panic disorder, 6 on agoraphobia, 2 on social phobia, 1 on other type of phobia, 2 on PTSD, 6 on alcohol dependence and abuse, 4 on drug dependence and abuse (non-alcohol), 6 on ADHD, and 9 on ASPD. In the HR-group, 37.3% women continued smoking tobacco (N = 31), 3.6% continued drinking alcohol (N = 3), 1.2% continued using cannabis (N = 1), 3.6% were smoking tobacco and drinking alcohol (N = 3), and 3.6% continued

smoking both tobacco and cannabis (N = 3) during pregnancy. Due to small numbers per subgroup, classification was based on continued substance use regardless of the substance of choice. Table 2 displays the number of risk factors present in HR-group.

Risk status and reflective functioning

Analysis of variance showed a significant difference in prenatal RF between the HR-group (M = 3.36; SD = 0.84) and LR-group (M = 4.28; SD = 0.97): $F(1,160) = 41.56$; $p < .001$, $\eta_p^2 = .21$, with the HR-women scoring significantly lower.

Correlation analysis showed that for the HR-group the total number of risk factors was negatively associated with prenatal RF (r = -.34, $p < .001$), indicating that the presence of multiple risk factors was related to lower RF. The sum-score of risk factors explained 12% of the variance in prenatal RF.

Reflective functioning in the high-risk sample

For the HR-group associations were calculated between the variables determining HR/LR-classification and prenatal RF. Pearson correlation was used to measure the association between continuous variables, while point-biserial correlations and the phi coefficient were used for the dichotomous variables. As Table 3 shows, a moderate, negative correlation was found between RF and substance use during pregnancy, indicating that substance use during pregnancy was related to lower RF. Positive correlations were found between prenatal RF and age, educational level, and size of social support network, indicating that a larger support network, higher maternal age, and higher education level were related to better RF.

Next, all risk factors significantly correlating with prenatal RF were entered in a linear regression predicting RF for the HR-group (Table 4). The regression model

was significant ($F(4, 78) = 7.88$; $p < .001$, $\eta_p^2 = .25$), and maternal education (β = .23), size of social support network (β = .32), and substance use during pregnancy (β = -.25) were all unique predictors of prenatal RF. Maternal age was not a significant predictor of prenatal RF over and above the effects of educational attainment, social support and substance use.

Discussion

The present study examined whether prenatal RF differed between primiparous 'at risk' women (HR-group) and a low-risk control group (LR-group), and determined which specific risk factors were associated with prenatal RF in HR-women. As hypothesized, HR-women demonstrated significantly lower levels of prenatal RF compared to the LR-group. The total number of risk factors had a moderate, negative relation with RF-quality. This indicates that the presence of more risk factors places a higher demand on the mother-to-be resulting in less mental resources to think about the future child and the upcoming motherhood. These findings are in line with the majority of existing studies indicating that the presence of risk factors negatively affect mother's RF-ability, with HR-women have lower RF and more negative mental representations (Huth-Bocks et al., 2004; Leigh, 2011; Seng & Prinz, 2008; Theran et al., 2005). Exception to the rule is a study by Perry et al. (2013) who found similar prenatal RF-levels for HR- and LR-women. However, their sample size was limited and consisted mainly of multiparous women. In addition, employment status and income were not assessed, which may have impacted between-group comparisons.

For the HR-group, a number of risk factors that have separately been related to RF-quality were examined simultaneously to provide insight into their relative contributions to the quality of prenatal RF. Maternal age, educational attainment,

social support, and substance use during pregnancy had moderate associations with prenatal RF in the HR-group. Contrary to our expectations, indication for current psychiatric disorder(s), financial problems, single parenthood, and unemployment had no significant associations with prenatal RF in this group.

The non-significant association between positive screening for current psychiatric disorder(s) and prenatal RF in our HR-group may be the most surprising (see Katznelson, 2014). The present study used a dichotomous measure as an indication for current psychiatric disorder(s). This may have resulted in loss of information regarding subclinical symptoms, and hence to non-significance of effects. It is possible that the HR-women without a current diagnosis according to the M.I.N.I.-plus still had psychiatric problems. Support for this suggestion comes from the fact that a large proportion of HR-women had experienced psychiatric problems in the past (and received treatment for their disorder), but were currently stable or doing 'well enough' to not qualify for a diagnosis. Furthermore, when the regression analysis was performed in all participants (both LR- and HR-women) an indication for psychiatric disorder(s) was a close to significant predictor of RF, suggesting that an increase in variance (with "the absence of psychiatric problems" in LR-women) increases the role of psychiatric disorder(s) as a predictor. Despite the fact that this is not the only study that failed to find associations between psychiatric problems and RF in a HR-population (Rudden, Milrod, Target, Ackerman, & Graf, 2006; Schechter et al., 2005; Vrieze, 2011), it would not be wise to discard psychiatric problems as a possible predictor of RF-quality based on the present results. We suspect that more in-depth clinical assessments using a more continuous scale to assess psychiatric disturbances and not self-reports are most likely to yield meaningful data. More research is

necessary to further unravel the possible role of current and past psychiatric problems in relation to maternal RF.

Taking this into account, the question remained whether within the HR-group there were specific risk factors adding to the prediction of RF-quality. Results showed that size of social support network was the strongest of the predictors of prenatal RF. The availability of social support appears to benefit the adjustment to upcoming motherhood (Sadler et al., 2007; Smith, 1999) resulting in stable perceptions of the future infant in the last trimester of pregnancy (Larney et al., 1997). Feeling supported facilitates women to gain confidence in the new perceptions of themselves and eases the transition into motherhood (Darvill et al., 2010). One may speculate that social support also reduces the impact of emotional stressors and simulates psychological well-being thereby resulting in more mental space to think reflectively.

Substance use during pregnancy was the second strongest predictor of prenatal RF. Studies examining RF in substance abusing mothers have consistently found that substance abuse has detrimental effects on RF (Pajulo et al., 2012; Pajulo et al., 2008; Suchman, DeCoste, Leigh, & Borelli, 2010). The most commonly used substances in those studies were opiates and amphetamines, and to a lesser extent cannabis and alcohol. While in the study by Pajulo et al. (2012) all abusing women were also excessive smokers, most studies did not report data specifically regarding nicotine-use. The preferred substance in our sample was tobacco, with few women using a second or other substance (alcohol or cannabis). This is the first study showing that smoking during pregnancy can be linked to lower prenatal RF. Since there are no other studies - that we know of - that have related (prenatal) RF to maternal smoking, we can only speculate about the underlying mechanisms. During pregnancy and perinatal phases, neurobiological changes take place in the mother’s brain (especially in the reward

system) that lead to a state of "maternal preoccupation" (Swain, Lorberbaum, Kose, & Strathearn, 2007). One could speculate that - at least in substance abusing mothers - the substance use might weaken the mother's capacity to invest in a close relationship with her future baby by interfering with natural sources of reward and satisfaction (Allen, Fonagy, & Bateman, 2008). The substance use likely leads to a preoccupied or absent mind, making it more difficult to make adequate inferences about intentions and emotions of oneself and one's future child (Suchman, DeCoste, McMahon, Rounsaville, & Mayes, 2011). Another possibility is that women with lower RF are more inclined to smoke or continue smoking during pregnancy. Perhaps a limited capacity to think reflectively impairs the women's ability and willingness to fully understand the detrimental effects of substance use for their unborn child and themselves. So low RF might make it easier to smoke despite the pregnancy. Furthermore, both RF and smoking have been linked to other risk factors. For example younger, single, poorer, and less educated women are more likely to smoke during pregnancy (Cnattingius, Lindmark, & Meirik, 1992; Kaneko et al., 2008; Lu, Tong, & Oldenburg, 2001; Ockene et al., 2002). Also both RF and maternal smoking have been associated with poor outcomes in mothers (Jacobsen et al., 2005; Yanbaeva, Dentener, Creutzberg, Wesseling, & Wouters, 2007) and their children (Benbassat & Priel, 2012; Durmuş et al., 2011; Huijbregts, van Berkel, Swaab-Barneveld, & van Goozen, 2011; Huijbregts, Warren, de Sonneville, & Swaab-Barneveld, 2008). Therefore, RF-smoking associations might still represent the influence of yet-to-be-revealed different factors, although the majority of those seem to have been taken account in the present study. Still, more research is necessary to unravel the exact nature of the association between (prenatal) RF and maternal smoking.

The third and final predictor of prenatal RF was maternal education. Maternal education has been associated with mothers' engagement in (appropriate) mind-minded commenting, a construct closely related to maternal RF (Meins et al., 2003; Rosenblum, McDonough, Sameroff, & Muzik, 2008). Scoring RF is dependent on language (Slade & Patterson, 2005; Slade, Patterson, & Miller, 2007). Mothers-to-be who have had limited education and who struggle with environmental adversity may use language more instrumentally and less as a means of describing more complex emotional and cognitive experiences, resulting in lower RF. Previous research relating educational attainment and RF has shown some mixed results (Button et al., 2001; Pajulo et al., 2012; Suchman, DeCoste, Leigh, & Borelli, 2010). A possible explanation for these mixed results is that most studies have relied on samples that were fairly restricted with regards to socio-demographics and risk status and used years of education to assess education level. Current study used a categorical measure of educational level, which has been related to maternal RF before (Rosenblum et al., 2008).

Finally, when looking at a model to predict prenatal RF from the sum-score of risk factors, the predictive power was inferior to the proportion explained variance by a model consisting of a specific combination of risk factors. Although the significant prediction of the sum-score provides some degree of support for the cumulative risk hypothesis (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987), these results also suggest that the influence of risk factors is not equal and more complex. Future studies should investigate combinations of risk factors (e.g. moderating effects) in addition to single and additive effects. Based on the data of the present study, we argue that there should be a further expansion of attention to the complex of environmental contexts of pregnancy.

Certain limitations regarding this study should be noted. First, assessment of current psychiatric disorder(s) was done using a psychiatric interview based on common dichotomous psychiatric classification systems. Due to small numbers per subgroup and comorbidity, no distinctions between the various psychiatric disorders or severity of the disorder(s) were made in our analyses. Second, the restricted age range of the sample limits generalizability of results. Our sample consisted of fairly young women. It is important to note that the psychosocial and biological context of pregnancy change with increasing maternal age. Older maternal age has been associated with psychological benefits (more resilience, fewer symptoms of depression and anxiety) and socio-demographic factors likely to contribute to optimal adjustment (home ownership, professional occupation) (McMahon et al., 2011). In line with such findings, it may be the case that the relations of different factors associated with prenatal RF change with age as well. Third, a cross-sectional design was used, which limits the possibility to make causal inferences. Finally, the present study used a global RF-score based on the interviewee's responses across all interview questions. This could have obscured differences that exist in relation to the more specific aspects of prenatal RF. RF is thought to have a self-reflective and an interpersonal component that together provide an individual with a capacity to distinguish inner from outer reality and intrapersonal mental processes from interpersonal ones (Fonagy, Gergely, Jurist, & Target, 2002). Future research should examine if prenatal RF can be regarded as a two-dimensional construct with a more child-related RF component and self-related RF component.

Despite the limitations, the results of the present study provide evidence for the presence of specific risk factors associated with the quality of prenatal maternal RF in a HR-population. HR-women appear to have more inaccurate and biased pre-existing

beliefs that impact the way they perceive and respond to information related to the upcoming motherhood and their future baby. Prenatal representations and RF have predictive value for the attachment pattern of the child (Sharp & Fonagy, 2008; Slade, Cohen, Sadler, & Miller, 2009; Slade et al., 2005) and potentially for the mother's postnatal behavior (Arnott & Meins, 2007). Therefore, RF could be one of the possible mechanisms that might mediate associations between risk factors and children's developmental outcomes. Future research should explore the construct of RF in more depth and in a continuous fashion. Most valuable knowledge might arise from studies investigating (longitudinal) associations between prenatal RF, postnatal RF, maternal interactive behavior with her infant, and child development.

Clinical implications

Children from an 'at risk' population generally have higher chances of less favorable developmental outcomes. These risk factors impact child development either directly or indirectly through parenting capacities and parent-child interactions (Cyr, Euser, Bakermans-Kranenburg, & Van Ijzendoorn, 2010; Seng & Prinz, 2008). Parental RF could potentially be an important target for prevention and intervention programs as it has been associated with certain established risk factors, parenting behaviors, and child outcomes (Benbassat & Priel, 2012; Rosenblum et al., 2008; Sharp & Fonagy, 2008). Since the first foundations of the mother-infant relationship are formed prenatally, it is important to enhance the positive experience of growth in the transition to motherhood. Promoting prenatal RF could be an effective way to improve the mother's representations of her unborn child and their developing relationship. Interventions specifically focusing on improving RF of 'at-risk parents' do indeed appear to increase the level of RF (Katznelson, 2014). However, studies with a longitudinal design are

required to further establish prenatal RF as an important intervention target, while at the same time providing evidence for causality. Interventions should start prenatally, since motivation and openness for change is often stronger during the perinatal period (Slade, 2002). Besides focusing on directly enhancing RF, programs should also focus on trying to improve RF indirectly by reducing psychosocial risk factors to further improve their efficacy.

References

Allen, J. G., Fonagy, P., & Bateman, A. W. (2008). *Mentalizing in clinical practice*. Washington, DC: American Psychiatric Publishing Inc.

Arnott, B., & Meins, E. (2007). Links among antenatal attachment representations, postnatal mind-mindedness, and infant attachment security: A preliminary study of mothers and fathers. *Bulletin of the Menninger Clinic, 71*(2), 132-149.

Benbassat, N., & Priel, B. (2012). Parenting and adolescent adjustment: The role of parental reflective function. *Journal of Adolescence, 35*(1), 163-174. doi: 10.1016/j.adolescence.2011.03.004

Button, S., Pianta, R. C., & Marvin, R. S. (2001). Mothers' representations of relationships with their children: Relations with parenting behavior, mother characteristics, and child disability status. *Social Development, 10*(4), 455-472.

Cnattingius, S., Lindmark, G., & Meirik, O. (1992). Who continues to smoke while pregnant? *Journal of Epidemiology and Community Health, 46*(3), 218-221. doi: 10.1136/jech.46.3.218

Cyr, C., Euser, E. M., Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (2010). Attachment security and disorganization in maltreating and high-risk families: A series of meta-analyses. *Development and Psychopathology, 22*(01), 87-108. doi: 10.1017/S0954579409990289

Darvill, R., Skirton, H., & Farrand, P. (2010). Psychological factors that impact on women's experiences of first-time motherhood: a qualitative study of the transition. *Midwifery, 26*(3), 357-366. doi: http://dx.doi.org/10.1016/j.midw.2008.07.006

Durmuş, B., Kruithof, C. J., Gillman, M. H., Willemsen, S. P., Hofman, A., Raat, H., . . . Jaddoe, V. W. (2011). Parental smoking during pregnancy, early growth, and risk of obesity in preschool children: the Generation R Study. *The American Journal of Clinical Nutrition, 94*(1), 164-171. doi: 10.3945/ajcn.110.009225

Fonagy, P., Gergely, G., Jurist, E. J., & Target, M. (2002). *Affect regulation, mentalization and the development of self*. New York: Other Press.

Fonagy, P., & Luyten, P. (2009). A developmental, mentalization-based approach to the understanding and treatment of borderline personality disorder. *Development and Psychopathology, 21*(Special Issue 04), 1355-1381. doi: doi:10.1017/S0954579409990198

Fonagy, P., & Target, M. (1998). Mentalization and the changing aims of child psychoanalysis. *Psychoanalytic Dialogues, 8*(1), 87 – 114.

Grienenberger, J., Kelly, K., & Slade, A. (2005). Maternal reflective functioning, mother–infant affective communication, and infant attachment: Exploring the link between mental states and observed caregiving behavior in the intergenerational transmission of attachment. *Attachment & Human Development, 7*(3), 299-311. doi: 10.1080/14616730500245963

Hay, D. F., Mundy, L., Roberts, S., Carta, R., Waters, C. S., Perra, O., . . . van Goozen, S. (2011). Known risk factors for violence predict 12-month-old Infants' aggressiveness with peers. *Psychological Science, 22*(9), 1205-1211. doi: 10.1177/0956797611419303

Heinicke, C. M. (1995). Determinants of the transition to parenthood. In M. H. Bornstein (Ed.), *Handbook of parenting* (Vol. 3, pp. 277-303). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.

Huijbregts, S. C. J., van Berkel, S. R., Swaab-Barneveld, H., & van Goozen, S. H. M. (2011). Neurobiological and behavioral stress reactivity in children prenatally

exposed to tobacco. *Psychoneuroendocrinology, 36*(6), 913-918. doi: http://dx.doi.org/10.1016/j.psyneuen.2010.12.008

Huijbregts, S. C. J., Warren, A. J., de Sonneville, L. M. J., & Swaab-Barneveld, H. (2008). Hot and Cool Forms of Inhibitory Control and Externalizing Behavior in Children of Mothers who Smoked during Pregnancy: An Exploratory Study. *Journal of Abnormal Child Psychology, 36*(3), 323-333. doi: 10.1007/s10802-007-9180-x

Huth-Bocks, A. C., Levendosky, A. A., Bogat, G. A., & Von Eye, A. (2004). The impact of maternal characteristics and contextual variables on infant–mother attachment. *Child Development, 75*(2), 480-496. doi: 10.1111/j.1467-8624.2004.00688.x

Jacobsen, L. K., Krystal, J. H., Mencl, W. E., Westerveld, M., Frost, S. J., & Pugh, K. R. (2005). Effects of smoking and smoking abstinence on cognition in adolescent tobacco smokers. *Biological Psychiatry, 57*(1), 56-66. doi: http://dx.doi.org/10.1016/j.biopsych.2004.10.022

Kaneko, A., Kaneita, Y., Yokoyama, E., Miyake, T., Harano, S., Suzuki, K., . . . Ohida, T. (2008). Smoking trends before, during, and after pregnancy among women and their spouses. *Pediatrics International, 50*(3), 367-375. doi: 10.1111/j.1442-200X.2008.02582.x

Katznelson, H. (2014). Reflective functioning: A review. *Clinical Psychology Review, 34*(2), 107-117. doi: http://dx.doi.org/10.1016/j.cpr.2013.12.003

Koren Karie, N., Oppenheim, D., Dolev, S., Sher, E., & Etzion-Carasso, A. (2002). Mother's insightfulness regarding their infants' internal experience: Relations with maternal sensitivity and infant attachment. *Developmental Psychology, 38*(4), 534-542.

Larney, B., Cousens, P., & Nunn, K. P. (1997). Maternal representation reassessed. *Clinical Child Psychology and Psychiatry, 2*(1), 125-144. doi: 10.1177/1359104597021009

Leigh, B. (2011). Mentalization and reflective functioning: An introduction *Australian Psychological Society: Perinatal and Infant Psychology Interest Group Presentation* (pp. 269-281). Melbourne: Australian Psychological Society.

Levinson, A., & Fonagy, P. (2004). Offending and attachment: The relationship between interpersonal awareness and offending in a prison population with psychiatric disorder. *Canadian Journal of Psychoanalysis, 12*(2), 225-251.

Lu, Y., Tong, S., & Oldenburg, B. (2001). Determinants of smoking and cessation during and after pregnancy. *Health Promotion International, 16*(4), 355-365. doi: 10.1093/heapro/16.4.355

McMahon, C. A., Boivin, J., Gibson, F. L., Hammarberg, K., Wynter, K., Saunders, D., & Fisher, J. (2011). Age at first birth, mode of conception and psychological wellbeing in pregnancy: findings from the parental age and transition to parenthood Australia (PATPA) study. *Human Reproduction, 26*(6), 1389-1398. doi: 10.1093/humrep/der076

Meadows-Oliver, M., Sadler, L. S., Swartz, M. K., & Ryan-Krause, P. (2007). Sources of stress and support and maternal resources of homeless teenage mothers. *Journal of Child & Adolescent Psychiatric Nursing, 20*(2), 116-125. doi: 10.1111/j.1744-6171.2007.00093.x

Meins, E., Fernyhough, C., Wainwright, R., Clark-Carter, D., Das Gupta, M., Fradley, E., & Tuckey, M. (2003). Pathways to Understanding Mind: Construct Validity and Predictive Validity of Maternal Mind-Mindedness. *Child Development, 74*(4), 1194-1211. doi: 10.1111/1467-8624.00601

Mejdoubi, J., Van den Heijkant, S., Struijf, E., Van Leerdam, F., HiraSing, R., & Crijnen, A. (2011). Addressing risk factors for child abuse among high risk pregnant women: Design of a randomised controlled trial of the nurse family partnership in Dutch preventive health care. *BMC Public Health, 11*, 823. doi: 10.1186/1471-2458-11-823

Miller, M. R. (2008). *The impact of a home-based intervention program on maternal reflective functioning in first-time mothers.* (Ph.D. 3325468), City University of New York, United States -- New York. Retrieved from http://search.proquest.com/docview/304671364?accountid=12045 ProQuest Dissertations & Theses A&I; ProQuest Dissertations & Theses A&I database.

Norbeck, J. S., & Anderson, N. J. (1989). Psychosocial predictors of pregnancy outcomes in low-income African American, Hispanic, and white women. *Nursing research, 38*(4), 204-209.

Norbeck, J. S., Lindsey, A. M., & Carrieri, V. L. (1981). The development of an instrument to measure social support. *Nursing research, 30*(5), 264-269.

Norbeck, J. S., Lindsey, A. M., & Carrieri, V. L. (1983). Further development of the Norbeck social support questionnaire: Normative data and validity testing. *Nursing research, 32*(1), 4-9.

Ockene, J. K., Ma, Y., Zapka, J. G., Pbert, L. A., Valentine Goins, K., & Stoddard, A. M. (2002). Spontaneous cessation of smoking and alcohol use among low-income pregnant women. *American Journal of Preventive Medicine, 23*(3), 150-159. doi: http://dx.doi.org/10.1016/S0749-3797(02)00492-0

Pajulo, M., Helenius, H., & Mayes, L. (2006). Prenatal views of baby and parenthood: Association with sociodemographic and pregnancy factors. *Infant Mental Health Journal, 27*(3), 229-250. doi: 10.1002.imlj.20090

Pajulo, M., Pyykkönen, N., Kalland, M., Sinkkonen, J., Helenius, H., Punamäki, R.-L., & Suchman, N. (2012). Substance-abusing mothers in residential treatment with their babies: Importance of pre- and postnatal maternal reflective functioning. *Infant Mental Health Journal, 33*(1), 70-81. doi: 10.1002/imhj.20342

Pajulo, M., Savonlahti, E., Sourander, A., Piha, J., & Helenius, H. (2001). Prenatal maternal representations: Mothers at psychosocial risk. *Infant Mental Health Journal, 22*(5), 529-544. doi: 10.1002/imhj.1016

Pajulo, M., Suchman, N., Kalland, M., Sinkkonen, J., Helenius, H., & Mayes, L. (2008). Role of maternal reflective ability for substance abusing mothers. *Journal of Prenatal & Perinatal Psychology & Health, 23*(1), 13-31.

Paulson, J. F., Dauber, S., & Leiferman, J. A. (2006). Individual and combined effects of postpartum depression in mothers and fathers on parenting behavior. *Pediatrics, 118*(2), 659-668. doi: 10.1542/peds.2005-2948

Perry, N., Newman, L. K., Hunter, M., & Dunlop, A. (2013). Improving antenatal risk assessment in women exposed to high risks. *Clinical Child Psychology and Psychiatry, 0*(0), 1-22. doi: 10.1177/1359104513499355

Rini, C. K., Dunkel-Schetter, C., Wadhwa, P. D., & Sandman, C. A. (1999). Psychological adaptation and birth outcomes: The role of personal resources, stress, and sociocultural context in pregnancy. *Health Psychology, 18*(4), 333-345. doi: 10.1037/0278-6133.18.4.333

Rosenblum, K. L., McDonough, S. C., Sameroff, A. J., & Muzik, M. (2008). Reflection in thought and action: Maternal parenting reflectivity predicts mind-minded comments and interactive behavior. *Infant Mental Health Journal, 29*(4), 362-376. doi: 10.1002/imhj.20184

Rudden, M., Milrod, B., Target, M., Ackerman, S., & Graf, E. (2006). Reflective functioning in panic disorder patients: A pilot study. *Journal of the American Psychoanalytic Association, 54*(4), 1339-1343. doi: 10.1177/00030651060540040109

Sadler, L. S., Swartz, M. K., Ryan-Krause, P., Seitz, V., Meadows-Oliver, M., Grey, M., & Clemmens, D. A. (2007). Promising outcomes in teen mothers enrolled in a school-based parent support program and child care center. *Journal of School Health, 77*(3), 121-130. doi: 10.1111/j.1746-1561.2007.00181.x

Sameroff, A. J., Seifer, R., Barocas, R., Zax, M., & Greenspan, S. (1987). Intelligence quotient scores of 4-year-old children: Social-environmental risk factors. *Pediatrics, 79*(3), 343-350.

Schechter, D. S., Coots, T., Zeanah, C. H., Davies, M., Coates, S. W., Trabka, K. A., . . . Myers, M. M. (2005). Maternal mental representations of the child in an inner-city clinical sample: Violence-related posttraumatic stress and reflective functioning. *Attachment & Human Development, 7*(3), 313-331. doi: 10.1080/14616730500246011

Seng, A., & Prinz, R. (2008). Parents who abuse: What are they thinking? *Clinical Child & Family Psychology Review, 11*(4), 163-175. doi: 10.1007/s10567-008-0035-y

Sharp, C., & Fonagy, P. (2008). The parent's capacity to treat the child as a psychological agent: Constructs, measures and implications for developmental psychopathology. *Social Development, 17*(3), 737-754. doi: 10.1111/j.1467-9507.2007.00457.x

Sheehan, D. V., Lecrubier, Y., Harnett Sheehan, K., Janavs, J., Weiller, E., Keskiner, A., . . . Dunbar, G. C. (1997). The validity of the Mini International Neuropsychiatric Interview (MINI) according to the SCID-P and its reliability. *European Psychiatry, 12*(5), 232-241. doi: http://dx.doi.org/10.1016/S0924-9338(97)83297-X

Slade, A. (2002). Keeping the baby mind: A critical factor in perinatal mental health. *Zero to three, 22*(6), 10-16.

Slade, A. (2007a). *The pregnancy interview - revised*.

Slade, A. (2007b). Reflective parenting programs: Theory and development. *Psychoanalytic Inquiry, 26*(4), 640-657. doi: 10.1080/07351690701310698

Slade, A., Aber, J. L., Berger, B., Bresgi, I., & Kaplan, M. (2003). *The parent development interview - revised*. City University of New York. New York.

Slade, A., Belsky, J., Aber, J. L., & Phelps, J. L. (1999). Mothers' representations of their relationships with their toddlers: Links to adult attachment and observed mothering. *Developmental Psychology, 35*(3), 611-619. doi: 10.1037/0012-1649.35.3.611

Slade, A., Cohen, L. J., Sadler, L. S., & Miller, M. (2009). The psychology and psychopathology of pregnancy. In C. H. Zeanah (Ed.), *Handbook of infant mental health* (3rd ed.). New York: Guilford Press.

Slade, A., Grienenberger, J., Bernbach, E., Levy, D., & Locker, A. (2005). Maternal reflective functioning, attachment, and the transmission gap: A preliminary study. *Attachment & Human Development, 7*(3), 283-298. doi: 10.1080/14616730500245880

Slade, A., & Patterson, M. (2005). *Addendum to reflective functioning scoring manual for use with the pregnancy interview*. Manuscript.

Slade, A., Patterson, M., & Miller, M. (2007). *Addendum to reflective functioning scoring manual for use with the pregnancy interview, version 2.0*.

Slade, A., Sadler, L. S., & Mayes, L. C. (2005). Minding the Baby: Enhancing parental reflective functioning in a nursing/mental health home visiting program. In L. J. Berlin, Y. Ziv, L. Amaya-Jackson & M. T. Greenberg (Eds.), *Enhancing early attachments: Theory, research, intervention, and policy* (pp. 152–177). New York: Guilford Press.

Smaling, H. J. A., & Suurland, J. (2011). *Zwangerschapsinterview – herziene versie*. Unpublished instrument. Faculty of Social and Behavioural Sciences. Leiden University. Leiden.

Smith, J. A. (1999). Towards a relational self: Social engagement during pregnancy and psychological preparation for motherhood. *British Journal of Social Psychology, 38*(4), 409-426. doi: 10.1348/014466699164248

Sokolowski, M. S., Hans, S. L., Bernstein, V. J., & Cox, S. M. (2007). Mothers' representations of their infants and parenting behavior: Associations with personal and social-contextual variables in a high-risk sample. *Infant Mental Health Journal, 28*(3), 344-365.

Stern, D. N. (1995). *The motherhood constellation*. New York: Basic Books.

Suchman, N. E., DeCoste, C., Leigh, D., & Borelli, J. (2010). Reflective functioning in mothers with drug use disorders: Implications for dyadic interactions with infants and toddlers. *Attachment & Human Development, 12*(6), 567-585. doi: 10.1080/14616734.2010.501988

Suchman, N. E., DeCoste, C., & Mayes, L. (2009). The Mothers and Toddlers Program: An attachment-based intervention for mothers in substance abuse treatment. In C. Zeanah (Ed.), *Handbook of infant mental health* (pp. 485–499). New York: Guilford Press.

Suchman, N. E., DeCoste, C., McMahon, T. J., Rounsaville, B., & Mayes, L. (2011). The mothers and toddlers program, an attachment-based parenting intervention for substance-using women: Results at 6-week follow-up in a randomized clinical pilot. *Infant Mental Health Journal, 32*(4), 427-449. doi: 10.1002/imhj.20303

Swain, J. E., Lorberbaum, J. P., Kose, S., & Strathearn, L. (2007). Brain basis of early parent–infant interactions: psychology, physiology, and in vivo functional neuroimaging studies. *Journal of Child Psychology and Psychiatry, 48*(3-4), 262-287. doi: 10.1111/j.1469-7610.2007.01731.x

Theran, S. A., Levendosky, A. A., Bogat, G. A., & Huth-Bocks, A. C. (2005). Stability and change in mothers' internal representations of their infants over time. *Attachment & Human Development, 7*(3), 253-268.

Toth, S. L., Rogosch, F. A., & Cicchetti, D. (2008). Attachment-theory informed intervention and reflective functioning in depressed mothers. In H. Steele & M. Steele (Eds.), *Clinical applications of the Adult Attachment Interview* (pp. 154-172). New York: Guilford.

Van Vliet, I. M., & De Beurs, E. (2007). The MINI-International Neuropsychiatric Interview. A brief structured diagnostic psychiatric interview for DSM-IV and ICD-10 psychiatric disorders. *Tijdschr Psychiatr, 49*(6), 393-397.

Van Vliet, I. M., Leroy, H., & Van Megen, H. J. G. M. (2000). *MINI plus. International neuropsychological interview. Nederlandse Versie 5.0. 0.[Dutch Version 5.0. 0.]*.

Vrieze, D. M. (2011). *The Role of Parental Reflective Functioning in Promoting Attachment for Children of Depressed Mothers in a Toddler-Parent Psychotherapeutic Intervention*. University of Minnesota. Retrieved from

http://conservancy.umn.edu/bitstream/117538/1/Vrieze_umn_0130E_12320.pdf

WorldHealthOrganization. (2005). Child abuse and neglect. Retrieved November 21, 2013, from http://who.int/violence_injury_prevention/violence/neglect/en/print.html

Yanbaeva, D. G., Dentener, M. A., Creutzberg, E. C., Wesseling, G., & Wouters, E. F. M. (2007). Systemic effects of smoking. *Chest, 131*(5), 1557-1566. doi: 10.1378/chest.06-2179

Table 1. Descriptives of the total sample, and the high-risk and low-risk group.

	LR (*n* = 79)	HR (*n* = 83)	Total (*N* = 162)	*F(*df) **χ2 (df)**
Age (years)	23.47 (1.79)	21.05 (2.28)	22.22 (2.39)	57.10 (1, 160)**
Ethnicity (% Caucasian)	91.1%	78.3%	84.6%	
Monthly family income after tax earnings (in euros)	2,893.53	1,316.94	2,085.77	102.41 (1, 160)**
	(1,038.93)	(943.46)	(1,265.37)	
Prenatal reflective functioning	4.28 (0.87)	3.36 (0.84)	3.81 (1.01)	41.56 (1, 160)**
Size social support network	9.42 (4.20)	6.77 (3.18)	8.06 (3.93)	20.62 (1, 160) **
Unemployed (%)	1.3%	22.9%	12.3%	**17.49 (1)****
Completed at least a secondary education (%)	98.7%	89.2%	93.8%	**6.41 (1)***
Financial problems (%)	0%	21.7%	11.1%	**19.27 (1)****
Indication for current psychiatric disorder(s) (%)	0%	56.6%	29.0%	**63.02 (1)****
Single parenthood (%)	2.5%	24.1%	13.6%	**16.04 (1)****
First-time pregnant (%)	84.8%	72.3%	78.4%	**3.75 (1)**

Unplanned pregnancy (%)	25.3%	72.3%	49.4%	**35.73 (1)****
Substance use during pregnancy (%)	0%	47.0%	24.1%	**48.89 (1)****
Tobacco	0%	44.6%	22.8%	**45.64 (1)****
Alcohol	0%	7.2%	3.7%	**5.93 (1)***
(Other) drugs	0%	4.8%	2.5%	**3.90 (1)***

Note. ***p*<.01; **p*<.05. Standard deviations are in parentheses. Boldface indicates chi-square statistic. LR = low-risk group, HR = high-risk group, df = degrees of freedom. In the sample the main (other) drug used during pregnancy was cannabis, no other illegal substances were used during pregnancy.

Table 2. Number of risk factors present in the high-risk group.

Number of risk factors	*N*	Cumulative percentage
1	24	28.9
2	32	67.5
3	15	85.5
4	7	94.0
5	3	97.6
6	1	98.8
7	1	100.0

Table 3. Associations between risk factors and prenatal reflective functioning in the high-risk sample.

	1	2	3	4	5	6	7	8
1. Reflective functioning	1							
2. Age	.25* [a]	1						
3. Educational level	.38** [a]	.42** [a]	1					
4. Current psychiatric disorder(s)	.05 [b]	.01 [b]	-.33** [b]	1				
5. Substance use during pregnancy	-.27** [b]	-.06 [b]	-.19* [b]	.27** [c]	1			
6. Single parenthood	-.14 [b]	-.13 [b]	-.16 [b]	.09 [c]	.02 [c]	1		
7. Financial problems	-.02 [b]	-.21* [b]	-.17 [b]	.03 [c]	.20 [c]	.05 [c]	1	
8. Unemployment	-.17 [b]	-.22* [b]	-.36** [b]	.23* [c]	.06 [c]	.57** [c]	.13 [c]	1
9. Size social support network	.37** [a]	.27** [a]	.26** [a]	.11 [b]	.10 [b]	-.27** [b]	-.10 [b]	-.31** [b]

Note. N=83, **p<.01; *p<.05, [a] = Pearson correlation, [b] = point-biserial correlation [c] = Cramer's φ.

Table 4. Regression analysis testing predictors of prenatal reflective functioning in the high-risk sample.

Variable	*B*	*SE B*	β	*t*	*p*	*Adjusted* R^2
Age	0.02	0.04	0.05	0.46	.648	.25
Education level	0.24	0.11	0.23	2.13	.036*	
Substance use	-0.41	0.16	-0.25	-2.52	.014*	
Size social support network	0.09	0.03	0.32	3.18	.002**	

Note. β is the standardized regression coefficient; N=83, **p<.01; *p<.05.