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Kjersti Sandnes

Mothers' internal representations of their infants: An effect study in primary care

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of
Philosophiae Doctor
Faculty of Medicine and Health Sciences
Department of Mental Health



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Trondheim, April 2024

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Sammendrag

En effektstudie av oppfølging på helsestasjon sammenlignet med videobasert veiledning på mødres forestillinger om deres spedbarn

En sentral del av foreldres forhold til deres barn er de indre forestillingene, tankene, følelsene og forventningene de har til dem. Slike forestillinger, som kalles representasjoner, inneholder også foreldres tanker og følelser om relasjonen til deres barn og om seg selv som omsorgsgiver. Foreldres representasjoner av deres barn dannes allerede i svangerskapet og påvirker hvordan de utøver foreldrerollen etter at barnet er født. Det er derfor viktig å kunne gi hjelp så tidlig som mulig til foreldre som har svært negative representasjoner av deres barn og relasjonen til dem.

Målet med denne randomiserte, kontrollerte studien var å undersøke om en veiledningsmetode som bruker videoopptak av foreldre-barn samspillet, Video-feedback of Infant Parent Interaction (VIPI), hadde en annen effekt på mødrenes representasjoner av deres barn sammenlignet med effekten av vanlig oppfølging på helsestasjonen. Deretter undersøkte vi om bedring av negative representasjoner hadde sammenheng med bedring i mor-barn samspillet. I klinisk arbeid med belastede familier har man funnet en slik sammenheng, men det er ikke tidligere undersøkt hos mødre med lav- til moderat risiko for at deres barn vil få problemer. For å gjøre dette måtte vi først finne ut om det standardiserte, kliniske intervjuet for kartlegging av foreldres representasjoner, the Working Model of the Child Interview (WMCI), er gyldig i et norsk lav- til moderat risiko-utvalg. Intervjuet er velkjent i internasjonale fagmiljø, men i Norge har det til nå vært brukt i klinisk arbeid med foreldre til små barn, uten at det er forsket på. Effektstudien fant sted mellom 2008 og 2014 i bydeler i Trondheim og Oslo, og 6 mindre kommuner på Østlandet. Ved oppstart bestod deltakerne av 152 mødre med barn fra 0–2 år, og 71% av dem var førstegangsmødre. Deltakerne ble rekruttert av helsepsykeplerne på helsestasjonen eller fagfolk fra andre kommunale tjenester.

Resultatene viste at foreldreintervjuet WMCI målte mødrenes representasjoner på en gyldig og pålitelig måte. I løpet av undersøkelsesperioden på i gjennomsnitt 11 måneder bedret ikke bare mødrene som fikk videobasert samspillsveiledning sine negative representasjoner, men de ble også bedret hos dem som fikk vanlig oppfølging på helsestasjon. Det var ingen forskjell mellom mødrene i de to gruppene i hvordan deres representasjoner endret seg. Representasjonene ble mindre engstelige, de hadde mindre irrasjonell frykt for barnets sikkerhet og oppfattet barnet som mindre vanskelig. Vi fant også at mødrene i begge gruppene ble litt mindre sensitive etter hvert som barnet ble eldre, sannsynligvis fordi det er vanskeligere å være sensitiv til en 2-3-åring sine sterke protester enn overfor et hjelpeløst spedbarn. Vi fant ikke at bedringene av de negative aspektene ved mødrenes representasjoner hang sammen med at de fikk et bedre samspill med barnet sitt, noe som indikerer at representasjoner og atferd også kan endres uavhengig av hverandre.

Oppsummert tyder studien på at god støtte og oppfølging på helsestasjonen hadde en like positiv effekt på mødres negative forestillinger om deres spedbarn som en langt mer tidkrevende foreldreveiledning med bruk av video. For å endre både mødres negative representasjoner av deres barn og kvaliteten på samspillet mellom mor og barn trengs det intervensjoner som mer spesifikt setter søkelys på begge områder. Det trengs mer forskning på hvordan kjerneelementer i slike intervensjoner kan innlemmes i helsestasjonene, som i Norge er en unik arena for å gi hjelp ved tidlige tegn på uheldige foreldre-barn-relasjoner og dermed forebygge negativ utvikling for barnet.

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Summary

Parents develop thoughts, feelings, and ideas—or representations—of their infant. These representations include expectations and experiences of the infant’s temperament and needs, but also of the parents’ relationship with their infant and of themselves as caregivers. Such representations can reflect balanced perceptions of the infant and the caregiving role, with a high degree of acceptance, flexibility, sensitivity, openness, and joy. Parents’ representations may also be disengaged, general, and rejecting of the infant’s personality and needs, or distorted, confused, and anxiously overwhelmed by the child’s needs and their caregiver responsibilities. Parental representations are formed during pregnancy and guide the parents’ subsequent caregiving and the attachment quality developed by the infant to the parents. Thus, early identification of dysfunctional parent representations holds the promise of increasing the efficacy of both preventive and treatment efforts early in a child’s life.

The overall aim of this thesis was to investigate the effect of a community-based, low-threshold video-feedback parenting intervention on mothers’ representations of their infants compared to treatment as usual. We used data from a randomized controlled trial (RCT) that was conducted between 2008 and 2014 in eight Norwegian municipalities or urban districts. The participants were 152 predominantly first-time mothers and their infants (newborn to two years of age). Most of the families were recruited from the local Well Baby Centers. All participants received the conventional, universal care at the Well Baby Centers, which was the treatment at usual condition. Additionally, half of the mothers received the Video-feedback of Infant Parent Interaction intervention (VIPI), which is a manualized parenting intervention based on the Marte Meo method.

First, we investigated the psychometric properties of a much-used instrument designed to elicit parents’ representations of the child—the Working Model of the Child Interview (WMCI). We then studied whether VIPI could improve negative features of the mothers’ representations of their infants beyond possible changes due to the conventional care at community Well Baby Centers. Finally, we tested whether alterations of the mothers’ representations were related to improvements in the infant-parent interaction quality, which has been reported from a previous investigation. We used data from baseline assessments and 6-months follow-up after the VIPI intervention ended.

The results showed that the WMCI is a valid tool for use in research and clinical practice with a low-to-moderate-risk sample of mothers with infants. The mothers’

representations were independent of the child's gender, the mothers' age, the mothers' level of education, or where the family lived. Both the mothers who received treatment as usual and the mothers who additionally received VIPI improved some negative features of their representations. They became less anxious, less irrationally fearful of the child's health and safety, and perceived the infant as less difficult to care for. Additionally, the mothers' representations became slightly less sensitive as the child grew older, most likely because it is difficult to remain sensitive to a toddler's autonomy demands than to the dependency of an infant. We did not find any relation between improvements of the representations and improved infant-mother interaction quality.

In summary, the results from this study indicate that the supportive services at the Well Baby Centers had a positive effect on aspects of the mothers' representations of their infants. The sample comprised of predominantly first-time mothers; thus, these seem to benefit the most from these services. Interventions aiming to improve the mother-infant relationship should address both maternal representations and the infant-mother interaction, and evaluations of both domains should be conducted. More research is needed to investigate core components of interventions that influence parents' negative representations, and how changes of representations improve the parent-infant interaction quality. There is a particular need for examination of whether such core components can be incorporated in primary care services, as these are unique arenas for detecting early indications of negative parent-infant relationships in the general population and may thus prevent negative development for the child.

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List of papers

Paper I

Sandnes, K., Lydersen, S., Kårstad, S. B., & Berg-Nielsen, T. S. (2021). Measuring mothers' representations of their infants: Psychometric properties of the clinical scales of the Working Model of the Child Interview in a low-to moderate-risk sample. *Infant Mental Health Journal*, 42(5)-, 690-704. <https://doi.org/10.1002/imhj.21934>

Paper II

Sandnes, K., Berg-Nielsen, T. S., Lydersen, S., & Kårstad, S. B. (2023). Can mothers' representations of their infants be improved in primary care? A randomized controlled trial of a parenting intervention using video feedback in a predominantly low- to moderate-risk sample. *Frontiers in Psychiatry*, 14, 1232816. <https://doi.org/10.3389/fpsy.2023.1232816>

Paper III

Sandnes, K., Kårstad, S. B., Lydersen, S., & Berg-Nielsen, T. S. (2023). Are changes in mothers' representations of their infants related to changes in observed mother-infant interaction quality? *Infant Behavior and Development*, 73, 101896
<https://doi.org/10.1016/j.infbeh.2023.101896>

Acronyms and abbreviations

AAI	Adult Attachment Interview
AMBIANCE	Atypical Maternal Behavior Instrument for Assessment and Classification
ASQ:SE	Ages and Stages Questionnaire, Social-Emotional
BDI-II	Beck Depression Inventory
CFA	Confirmatory Factor Analysis
CI	Confidence Interval
CPS	Child Protective Services
EA	Emotional Availability Scales
EFA	Exploratory Factor Analysis
GSEM	Generalized Structural Equation Modeling
ICC	Intra-class Correlation Coefficient
IWM	Internal Working Model
MLMV	Maximum Likelihood Missing Values
MTP	Mother and Toddler Program
PCF	Principal Component Factor
PCHP	Primary Child Healthcare Program
PDI	Parent Development Interview
PIP	Parent-Infant Psychotherapy
PRF	Parental Reflective Functioning
PSI	Parenting Stress Index
SD	Standard Deviation
SEM	Structural Equation Modeling
VIPI	Video-feedback of Infant-Parent Interaction

WMCI Working Model of the Child Interview

WMCI-D Working Model of the Child Interview- Disrupted

Key concepts

Attachment: A behavioral system and affectionate bond that develop between the child and the caregiver.

Caregiving system: A set of parental behaviors, guided by mental models of caregiving, that serve to protect the child.

Emotional availability: An individual's emotional responsiveness and attunement to another's needs and goals.

Low-threshold interventions: Interventions that make minimal demands on the person, and that reduce or remove barriers for people to access care.

Mother-infant interaction: A shared, reciprocal experience within the mother-infant dyad, whereby the experience of each has an impact on the experience of the other.

Parents representations of the child: A parent's expectations, thoughts, feelings, and ideas of the child, of the parent-child relationship, and of themselves as a parent.

Primary Child Healthcare Program: Standard, universal, healthcare program provided by Well Baby Centers, which monitors the child's physical, psychological, and social health, and safety.

Primiparous: First-time parent.

Reflective functioning: The capacity to interpret ones' own and others' behavior in terms of mental states.

Risk factors: Characteristics that precede and are associated with a higher likelihood of negative outcomes.

Sensitivity: The ability to correctly interpret and respond appropriately to the infant's signals.

Well Baby Centers: Community-located centers providing the universal, standard healthcare program for infants and their parents.

1 Introduction

1.1 Topic of the thesis

The aim of this thesis was to investigate whether mothers' perceptions—or representations—of their infants, of their relationship with the infant, and of themselves as a parent, can be altered by low-threshold community interventions. Further, we investigated whether changes in the mothers' representations were related to improvements in the quality of interaction between the mother and her infant. Before these analyses were conducted, we examined the psychometric properties of the Working Model of the Child Interview, which is a clinical interview that is commonly used to assess parental representations (Zeanah & Benoit, 1995). We drew data from a naturalistic RCT study that was conducted in a low-to-moderate-risk sample of mothers (mean 29.7 years of age) of infants (mean 11.5 months old) between 2008 and 2012 in urban and rural municipalities of Norway.

1.2 Rationale of the thesis

The quality of the relationship between a mother and her infant is crucial for the child's subsequent cognitive and socio-emotional development and outcomes throughout their lifespan (Raby et al., 2015). Indicators of disturbances in the mother-infant relationship can be identified during the first 10 months of the infant's life in a general population (Skovgaard et al., 2008). Thus, such indicators are relevant targets for early preventive interventions.

One part of the mother-infant relationship that can already be identified in pregnancy is the mother's thoughts and feelings about the infant, about her relationship with the infant, and about herself as a parent (Benoit, Parker, et al., 1997; Foley & Hughes, 2018; Theran et al., 2005). The mother's perceptions—or representations—of her infant affect her interpretation of the infant's behavior and needs, and predict her emotional and behavioral responses, the quality of infant-mother interaction, and the child's attachment to the mother (Dayton et al., 2010; Foley & Hughes, 2018; Madigan et al., 2015; Vreeswijk et al., 2012). Negative maternal representations are therefore relevant targets for early identification and preventive interventions (Kennedy et al., 2017).

However, research on the experiences that influence alterations of representations is scarce (Sroufe, 2021). Most RCT studies that aim to alter negative maternal representations have been conducted with high-risk families or with clinical samples (Barlow et al., 2015;

Fukkink, 2008; Kennedy et al., 2017). Although negative representations are prevalent for mothers experiencing extensive stressors or psychopathology, even the representations of mothers living with fewer risk factors can entail negative perceptions and expectations of the infant that are related to later negative infant-parent interaction, child attachment insecurity and negative socio-emotional development (Vreeswijk et al., 2012).

Fathers also develop representations of their infants during pregnancy, but paternal representations are far less studied than those of the mothers. Results from a few studies of fathers indicate that both their prenatal and postnatal representations are more emotionally distanced than mothers' representations, especially for fathers who already have children (Vreeswijk et al., 2014; Vreeswijk et al., 2015). Paternal representations are stable from the prenatal to the postnatal period, and are related to the quality of their interaction with their 4 months old infant (Lindstedt et al., 2021). Furthermore, the representations of expecting mothers and fathers are found to be influenced by different factors. Whereas mothers' prenatal representations are influenced by their depressive symptoms, expecting fathers' representations are influenced by marital distress and not by their depressive symptoms (Ahlqvist-Bjorkroth et al., 2016). In the current theses, the sample comprised of mothers of infants, thus the literature review will focus on maternal representations.

The participating mothers of the current thesis were of predominantly low-to-moderate levels of risk associated with negative parenting and child development. They were mainly recruited by staff at community Well Baby Centers. In Norway, almost all families with infants and toddlers attend such community Well Baby Centers (Statistics Norway, 2023). They offer a free, universal health-promoting and preventive program, the Primary Child Healthcare Program (PCHP), with regular check-ups for monitoring the development of the infants (Norwegian Directorate of Health, 2017). The PCHP includes approximately eleven consultations from when the infant is newborn until the age of 48 months, and extra consultations can be given if the parents or the public health nurses find it necessary. The Video-feedback of Infant Parent Interaction intervention (VIPI), which is a low-threshold intervention that is available at many Well Baby Centers, has shown efficiency in improving observed infant-mother interaction (Høivik et al., 2015). No prior research has tested the effect of VIPI on maternal representations. Establishing that interventions provided by community Well Baby Centers have an effect on maternal representations should inspire a stronger emphasis on high quality primary health care services.

Maternal representations and the interaction between the mother and the infant are distinct yet connected aspects of the multi-faceted mother-infant relationship (Stern, 1991).

For example, when a mother's representations of her infant are highly sensitive, coherent, and accepting, her behavioral responses will most likely be sensitive and attuned to the infant's needs (Zeanah & Benoit, 1995). Although a mother's representations of her infant and her interactional behavior predict each other (Zeynep Biringen et al., 2000; Dayton et al., 2010; Hall et al., 2015; Korja et al., 2010), very few studies have investigated whether change in one effects change in the other (Suchman et al., 2018; Suchman et al., 2012). For clinicians working with troubled mother-infant relationships, it is relevant to know whether interventions addressing the representational level also affect the behavioral level, or vice versa. Therefore, we tested whether changes in mother-infant interaction quality and changes in maternal representations were related. The instrument for assessing parental representations that is most often used in the infant mental health field in Norway, the WMCI, has not been investigated for psychometric properties in this cultural setting. This was therefore conducted as the first step of the current study.

The Nordic Council of Ministers recently published a policy recommendation for the governments in the Nordic countries, with an overall aim to support healthy emotional development and good mental health during the first 1,000 days of life (from conception to two years) (Daníelsdóttir & Ingudóttir, 2022). The policy recommendation encourages more research, knowledge and understanding about this important period of life, and emphasizes the need for comprehensive, high-quality supportive services for infants and their families that can identify and respond systematically to risk factors. Several of these recommendations are addressed in the current thesis.

1.3 Review of research/Theory/Central concepts

1.3.1 What are maternal representations?

“We don’t see the world as it is, we see it as we are” (Anaïs Nin)

The main concept in this thesis is mothers’ representations of their child, which entail their subjective ideas, beliefs, experiences, expectations, and emotional reactions to their child’s personality, needs and potential, and to the relationship with the child. These representations also include the meaning of the relationship to the mother, as well as her thoughts and expectations about herself as caregiver to the child (George & Solomon, 2008; Zeanah & Benoit, 1995). For example, one pregnant mother feeling the kicks from her infant may describe her infant as smart, curious, and lively. Another pregnant mother feeling the kicks of the unborn baby may say that “He’s trying to annoy me, just like his father. Now I have two against me.”

Maternal representations are hypothesized to derive from experiences of receiving care from primary attachment figures early in life (Bowlby, 1982b; Main et al., 1985). These early experiences generalize and become the prototype of other close relationships, including with one’s own children (Madigan et al., 2015; Main et al., 1985). More specifically, the ways in which past experiences of being parented are currently organized and represented in the mother’s mind seem to influence the development of her representation of caring for her child (George & Solomon, 1996). For example, a mother whose representations of past attachment experiences are secure, trusting, flexible, and balanced, will most likely have capacity to be sensitive to her child’s signals and respond accordingly. However, a mother who is too preoccupied with her past attachment experiences, or is emotionally distant to such experiences, will most likely respond insensitively to the child’s signals and needs (Atkinson et al., 2005; Benoit, Zeanah, et al., 1997). Maternal representations of the child are found to predict the mothers’ parenting behavior (Dayton et al., 2010) and the child’s attachment security and socio-emotional problems (Guyon-Harris et al., 2022; Madigan et al., 2015), so such attachment representations are hypothesized to be the vehicle of

intergenerational transmission of attachment patterns and risk (Madigan et al., 2015; Verhage et al., 2016).

1.3.2 How do mothers' representations of their infants develop?

The concept of representations of early care experiences was first described as “internal working models” (IWMs) in the theory of attachment (Bowlby, 1973, 1980, 1982a, 1982b, 1988). According to this theory, an infant develops an attachment bond to a person who provides some form of continuous care (Bowlby, 1982a). The quality of this care will determine the child’s trust, or security, in the availability of care from this person (Ainsworth et al., 1978). Based on the experiences of care, the child develops IWMs that entail subjective cognitions and feelings about the attachment relationship and themselves as being worthy of love, care, and respect from the caregiver. Such IWMs function as a forecast of what to expect within the relationship. If the infant’s signals of physical and psychological needs are consistently and sensitively responded to by the mother, the infant may develop a secure and trusting representation of the relationship, and will most likely develop a secure-balanced attachment to the mother. If the needs are not sensitively responded to, the infant may develop an insecure representation (i.e., anxious ambivalent or avoidant) of the relationship, and expect inconsistent or rejecting responses to his or her needs (Ainsworth et al., 1978; Benoit, Parker, et al., 1997; Bowlby, 1982b). Also, if the mother’s behavior indicates that she is frightened or frightening in response to the child’s needs, the child’s attachment can be disorganized, which reflects a disruption of the child’s strategy for seeking the caregiver when distressed (Main & Solomon, 1986).

A mother’s representation of her infant is part of her caregiving system, which is one of several biologically rooted human behavioral systems that coordinate rules and behaviors that are associated with achieving a specific goal or adaptive function (George & Solomon, 2008; Stern, 1991). Accordingly, the caregiving system is a set of caregiving behaviors that are guided by a representation of the current parent-infant relationship (George & Solomon, 1996; Solomon & George, 1996). The psychological processes the mother goes through during pregnancy reactivate her own experiences of being protected and cared for, and transform into representations of providing protection and care for the infant (Madigan et al., 2015). Research has shown that, by the third trimester, a majority of pregnant women have developed distinct and clear representations of their unborn infants and of themselves as mothers (Ammaniti et al., 1992). Concordance between mothers’ prenatal representations and

their post-natal representations has been documented (Benoit, Parker, et al., 1997; Theran et al., 2005). Whereas balanced representations have shown 79–89% stability, non-balanced representations have shown 37–85% stability (Benoit, Zeanah, et al., 1997; Theran et al., 2005). Stability coefficients ranging from .41 to .49 across toddlerhood (15 months to 28 months) have also been reported (Aber et al., 1999).

Although the mother's representation of the child derives from her own attachment representations, they are not completely the same. It has been argued that a caregiving representation is specific to the child, and it captures the caregiver's experiences with the child together with memories of their own attachment history (George & Solomon, 2008).

1.3.3 Measuring mothers' representations

Within the developmental and clinical psychology approach to attachment, which is the framework for the current thesis, representations are usually assessed with clinical interviews (George & Solomon, 2008). Compared to self-report measures, interviews are more resource-consuming. They take longer to conduct and require substantial training for coding and interpretation. The advantage of interviews is that they provide more detailed, in-depth information from the parent, which gives a more complex picture of the parent's cognitions and emotions (Foley & Hughes, 2018). Moreover, whereas self-report questionnaires tend to focus on the parent's present thoughts, interviews often tap into parents' perceptions about past and present experiences and future expectations. Thus, interviews may be more sensitive in capturing early indicators of future parenting behavior, which is valuable for early interventions.

The interview most often used for assessing the quality of one's representations of early attachment experiences is the Adult Attachment Interview (AAI) (George et al., 1996). In this interview, the person's way of talking about past and current experiences with the primary attachment figure discloses their current state of mind, or representations, regarding those experiences. These representations are referred to as secure-autonomous when the interviewee can talk about positive and negative experiences in a coherent and balanced way. When the interviewee idealizes childhood and devalues close relationships in their own life, the representation is denoted insecure-dismissing, while an insecure-preoccupied representation reflects that the interviewee is still emotionally entangled with past attachment experiences. Finally, when memories of loss or trauma are manifested in lapses in reasoning and coherence, the representation will be categorized as insecure-unresolved (George et al.,

1996; Hesse, 2008). Parents' representations of their early attachment experiences are found to predict their child's attachment pattern, and two meta-analyses have found evidence of transmission of attachment, with larger effect sizes for secure attachment than for unresolved attachment (van IJzendoorn, 1995; Verhage et al., 2016).

Several tools for assessing parents' representations of their child are modeled on the AAI. Whereas the AAI reflects the adult's current state of mind of early attachment experiences, parental interviews seek to describe the parents' current state of mind regarding the specific child. Examples of such interviews are the Working Model of the Child Interview (WMCI) (Zeanah et al., 1994) and the Parent Development Interview (PDI) (Aber et al., 1985). These interviews aim to elicit the parents' descriptions of affect, cognition, and experience with the child, of themselves as parents, or of the relationship with the child (George & Solomon, 2008).

The PDI and the WMCI are said to be "conceptual cousins" as the design of both of these instruments is based on the structure and coding of the AAI (Slade, 2005). The PDI provides a scoring form with continuous scales for rating qualitative features (i.e., richness of details and coherence) and a variety of affects (i.e., anger, pleasure, joy) of the parents' responses in the interview. These scales are used to code three major features of the parents' representations of the child: I) the affective aspect of parenting, II) the child's affective experience, and III) the parent's state of mind regarding the child (Aber et al., 1985). A factor analysis of the PDI variables yielded three factors: I) joy-pleasure/coherence, II) anger, and III) guilt-separation distress (Slade et al., 1999).

1.3.4 The Working Model of the Child Interview (WMCI)

In the current thesis, mothers' representations of their infants were measured using the Working Model of the Child Interview. This is a semi-structured interview designed to elicit parents' thoughts, perceptions, and emotional reactions with regard to their infant, the relationship with the infant, and themselves as caregiver to the infant (Zeanah & Benoit, 1995; Zeanah et al., 1996; Zeanah et al., 1997). The questions posed to the parent are emotionally charged, and concern situations from the pregnancy, the present, and the future. An example of a question to a mother about her pregnancy is: "What did you picture the baby would look like, would be like? What did you picture it would be like to take care of the baby?" An example of a question from the present is: "What about your child's behavior now

is most difficult for you to handle?”, and the following is an example of a question about the future: “What do you expect your child to be like as an adolescent?”

The WMCI provides a scoring form with 15 clinical scales for rating the parent’s responses—or how features of the parents’ representations are reflected during the interview. A description of each scale is provided in Appendix A, Table A1. Six of these scales indicate qualitative features of the parents’ representation—for example how flexible, detailed, sensitive, accepting, and coherently organized the descriptions of the child are. Additionally, two scales reflect whether the content of the parents’ narratives contain excessive fear for the infant’s health and security, and whether the parent finds the child difficult to relate to or care for. The last scales assess the affective tones that color the parent’s descriptions—for example joy, pride, anger, and indifference (Zeanah et al., 1996).

The WMCI clinical scales are mostly used clinically for planning intervention targets and for post-intervention evaluation. For research purposes, the pattern of the WMCI scale ratings informs assignment to one of three representation categories: balanced, disengaged, or distorted. A parent’s balanced representations reflect coherent, sensitive, flexible, and warm descriptions of the child and the relationship with the child. One example of a balanced representation is the following description a mother had of her relationship with her 3-year-old son: “Our relationship today? It’s close. He knows he can come to me, that I’m here for him. But every now and then, sometimes, I’m frustrated because I don’t understand him, I don’t know what he wants.” The same mother used the following words to describe their relationship: “secure, trusting, loving, and playful.” This example illustrates how a parent with a balanced representation of the child accepts both the positive and the challenging sides of the child and of parenting, and is not overwhelmed by the child’s needs, emotions, or behaviors.

In contrast, disengaged representations reflect an emotional distance to the child, and a rejection of the child’s dependency and attachment needs. This can be illustrated with this response from a father of an 18-month-old boy, when asked how he felt inside when his son had been physically hurt: “Well, he’ll learn from it. I don’t feel bad about it, as it wasn’t my fault. I’m just thinking: Sorry, kid, that’s life. You’ll learn.”

Parents with distorted representations of the child and the relationship with the child typically use contradicting, confused, and incoherent descriptions, and often express that they become overwhelmed by the child’s attachment needs (Zeanah et al., 1996). For example, one mother of a 13-month-old daughter said this when asked to describe her impression of her daughter’s personality: “Oh, she’s such a whiner, so demanding. She completely drains

me of all my energy.” A few minutes later, the same mother picked quite different and contradicting words to describe her daughter’s personality: “Oh, she’s a really good girl. She’s smart, helpful, much too fat [laughs]... mostly happy.”

The WMCI categories converge with the child attachment classification system (balanced, avoidant, or ambivalent) (Ainsworth et al., 1978) and the AAI categories (autonomous, dismissing, or preoccupied) (George et al., 1996). The WMCI-disrupted (WMCI-D) (Crawford & Benoit, 2009) was developed as a representational equivalent to the child’s disorganized attachment pattern, which was identified later than the categories balance, avoidant, and ambivalent (Ainsworth et al., 1978; Main & Solomon, 1986). The WMCI-D can be scored by using items from the Atypical Maternal Behavior Instrument for Assessment and Classification (AMBIANCE) (Lyons-Ruth et al., 1999), which identifies a parent’s disrupted caregiving behavior. This is an important development of the WMCI, as a child’s disorganized attachment pattern predicts later psychopathology (Dozier et al., 2008; Zeanah et al., 2003).

The psychometric properties of the WMCI categories (balanced, disengaged, and distorted) have been documented both in clinical and non-clinical samples (Benoit, Parker, et al., 1997; Madigan et al., 2015; Rosenblum et al., 2004; Vreeswijk et al., 2012). Studies of the psychometric properties of the WMCI clinical scales are more scarce, so this is therefore one of this thesis’ research questions (Paper I). To our knowledge, only two studies have reported the factorial structure of some of the clinical scales of the WMCI. In the first, Huth-Bocks and colleagues (2004) constructed a latent factor labeled Prenatal Representation of Caregiving, based on correlations between five of the clinical scales, in a sample of pregnant women experiencing interpersonal violence (Huth-Bocks et al., 2004). The second study, which was conducted in a sample of mothers who had maltreated their child (mean age 6.5 years), found that 12 of the WMCI clinical scales loaded on to three factors labeled qualitative features, affective tones, and indifference (Sprang et al., 2005). Both studies were conducted in high-risk samples. Thus, their results cannot be generalized to samples of lower risk. In a non-clinical group, about 53% of the mothers are classified as balanced, whereas in a clinical group (where either the child or the parent has a clinical problem) most maternal representations are non-balanced (23–34% disengaged or 43–44% distorted) (Vreeswijk et al., 2012). A rigorous psychometric evaluation of the WMCI clinical scales in a low-to-moderate-risk sample was therefore necessitated.

1.3.5 Representations and mentalizing

A related concept to the parent's representations of the child is the parent's ability to mentalize the child. Parental mentalizing refers to the ability to see the child as an independent agent with their own psychological experiences, not colored by the parent's needs, and the capacity to attune to the child's actual state of mind (Sharp & Fonagy, 2008). Parents' mentalizing capacities are found to be an important mediating factor in transmission of attachment patterns across generations and adaptive outcomes (van IJzendoorn & Bakermans-Kranenburg, 2019). It is proposed that this ability is the mechanism by which representations influence the mother-infant relationship and the mechanism behind the effect of interventions on maternal representations (Camoirano, 2017; Fonagy et al., 1998; Rosenblum et al., 2018).

Parental reflective functioning (PRF) is one of the most frequently used concepts operationalized from mentalization (Medrea & Benga, 2021; Zeegers et al., 2017). PRF refers to the parent's capacity to interpret their own and the child's behavior in terms of mental states (Fonagy & Target, 1997). A parental reflective functioning scale was developed as a coding scheme for rating the parent's ability to hold the child's mental and emotional state in mind while talking about the child and the parent-child relationship (Slade, 2005). Studies have found that maternal reflective functioning was significantly related to maternal IQ and executive functioning (Håkansson et al., 2018) and the quality of the mother-child relationship (Camoirano, 2017). The PRF scale can also be applied to the WMCI and other representation assessment interviews such as AAI and PDI (Camoirano, 2017; Fonagy et al., 1998; Vreeswijk et al., 2012). The Parental Reflective Functioning Questionnaire (PRFQ) is a recently developed self-report questionnaire that assesses parents' mentalization of children below the age of 3 years (Peter Fonagy et al., 2016). The PRF scale has a self-reflective component and a child component, which distinguishes between the parent's ability to separate the child's mental processes from their own (Slade, 2005). Previous RCTs have found that attachment-informed interventions can influence either self-focused or child-focused PRF (Sealy & Glovinsky, 2016; Suchman, DeCoste, Castiglioni, et al., 2010; Suchman, DeCoste, Leigh, et al., 2010; Suchman et al., 2011). A systematic review and meta-analysis found a non-significant trend towards an effect of PRF-focused interventions on parent-child interactions (Barlow et al., 2021). Another systematic review found that the relations between PRF and parenting behaviors are stronger when measured in stressful settings and with samples of low socio-economic background (Stuhrmann et al., 2022).

1.3.6 The stability of maternal representations

Early theory of attachment suggested that representations are relatively stable, as their function is to forecast what to expect within the relationship, although they are open for revision (Bretherton & Munholland, 2008). Originally, representations were denoted as working models, which indicated that they are both shaped and revised in a dynamic interplay between the individual and the environment (Bowlby, 1982a; Bretherton & Munholland, 2008). Furthermore, Stern (1991) noted that the mother's representations of the unborn child are open for elaboration after the infant is born, in order to adapt to the specific child (Stern, 1991). It is theorized that the parents' representation of the child may be influenced by several factors related to the child's characteristics, the quality of other relationships the parent has, stressful life experiences, and altered metacognitive processes (e.g., mentalization) (Bretherton & Munholland, 2008; Stern, 1991).

Previous research has confirmed that maternal representations, as measured with the PDI and WMCI, are relatively stable across the perinatal period, and through toddlerhood (Aber et al., 1999; Benoit, Parker, et al., 1997; Theran et al., 2005; Vreeswijk et al., 2012). Interestingly, balanced representations seem to be more stable than non-balanced representations. Two studies have reported more stability for balanced representations during the period from pregnancy to when the infant was 1 year old, compared to representations that were classified as disengaged or distorted (Benoit, Parker, et al., 1997; Theran et al., 2005). For balanced representations, 79% stability was found, while 48% of disengaged representations and 37% of representations categorized as distorted were stable (Theran et al., 2005). Moreover, 62% of the mothers with non-balanced representations (disengaged and distorted collapsed) in pregnancy were non-balanced one year after, which means that 38% of the mothers became balanced (Theran et al., 2005). Benoit et al. (1997) found 89% stability for balanced representations, while 12.5% of disengaged and 85% of distorted representations were stable. The sample of Benoit and her colleagues' study had higher socio-economic status than the sample of Theran and colleagues' study, which could explain the differences in stability. Aber and colleagues found that the structure, mean levels, and individual differences of mothers' representations of their 15–28-months-old sons were relatively stable across toddlerhood (Aber et al., 1999). Although these studies showed that representations were consistent over time, they also indicated that change could occur.

1.3.7 Predictors for change of maternal representations

Knowing which factors predict alterations of parents' representations could indicate where preventive interventions should be directed. In Theran's longitudinal study (2005), 38% of the mothers in the sample changed representational category during their infant's first year of life. Predictors for change from balanced to non-balanced maternal representations were related to contextual factors such as single parenthood and family income (Theran et al., 2005). Furthermore, mothers whose representations became balanced from non-balanced had fewer depressive symptoms and were more likely to have a partner and higher income than mothers whose representations remained non-balanced. Additionally, mothers who were victims of interpersonal violence during the pregnancy were more prone to become non-balanced (Theran et al., 2005). Moreover, one study reported that maternal personality traits such as openness and agreeableness buffered the effect of interpersonal violence on maternal representations during pregnancy, whereas conscientiousness magnified the effect (Lannert et al., 2013). Representations can also be altered by other contextual factors across toddlerhood. For example, Aber et al. (1999) found that daily hassles increased angry aspects of mothers' representations of their boys (15-28 months).

Some studies indicate that the parents' representations may be affected by the child's characteristics in line with the transactional model of development (Sameroff, 2010). For example, one study found that, after gaining experience with the newborn infant, approximately 50% of the mothers who had disengaged representations in the pregnancy changed to having balanced representations after birth (Vreeswijk et al., 2015). Another study found that 80% of mothers with a prematurely born child were non-balanced 6 months after the infant was born, compared to 53% of the mothers in a control group (Borghini et al., 2006). Interestingly, the representations of mothers of low-risk premature infants were more often disengaged, whilst the mothers of high-risk premature children were more likely to be distorted (Borghini et al., 2006). A study from Finland found no differences in WMCI categories between mothers with premature infants and mothers of full-term infants (Korja et al., 2009). However, according to the clinical scales, the representations of mothers of preterm infants were coded as less sensitive, less accepting, and less coherent, and had more fear for the infant's safety (Korja et al., 2009). The difference in distribution of the categories between the Borghini and Korja studies of mothers of preterm infants was most likely due to

confounding factors such as the families' structure and socio-economic status (Korja et al., 2009). Furthermore, studies have found that having a child with a clinical diagnosis, such as sleep disorders, ADHD, cerebral palsy, epilepsy, or failure to thrive, is associated with the mother's non-balanced representations (Benoit, Zeanah, et al., 1997; Button et al., 2001; Coolbear & Benoit, 1999; Darling Rasmussen et al., 2019), although there are mixed findings for example for cerebral palsy (Kårstad et al., 2022). Notably, as these are results from cross-sectional studies, it is not clear whether the mothers' representations became non-balanced due to the clinical status of the child or if they were non-balanced from pregnancy.

In sum, although parents' representations are relatively stable, normative changes do occur. Predictors of change seem to be personal factors (e.g., psychopathology), contextual factors (e.g., interpersonal violence), or experiences with the child's characteristics (e.g., prematurity).

1.3.8 Mother-infant interaction quality: Measurement and stability

The qualities of the interactions between a mother and her infant are fundamental for the infant's social, emotional, and cognitive development, their attachment, and their academic achievements into adulthood (Raby et al., 2015; Skovgaard et al., 2008). Several factors associated with both the mother and the infant and the mutual influences of these factors over time and context, determine the dyad's interaction quality (Sameroff, 2010).

It has been proposed that sensitivity is the core concept of the mother's contribution to the mother-infant interaction quality (Bakermans-Kranenburg et al., 2003; De Wolff & van IJzendoorn, 1997). Several definitions of mothers' sensitivity exist. However, one definition that was derived from a concept analysis emphasizes the quality of a mother's sensitive behavior based on her abilities to perceive and interpret her infant's cues and respond contingently to them (Shin et al., 2008). Other definitions include some or all of the following elements: I) awareness of the infant's state, perceptions and interpretations of the infant's signals, and the responses to these signals, II) behavioral response to distress, improving the infant's comfort, III) timed, appropriate, and non-intrusive responses, IV) ensuring mutual interaction, understanding developmental appropriateness, and V) providing consistent emotional support and availability (Deans, 2020). The child also contributes to the quality of the interaction by expressing signals and cues, thus providing both positive and negative feedback to the mother, and by bidding for responses to its feelings and needs and initiating further interaction (Biringen et al., 2014).

A systematic review of tools for measuring observed parent-infant interaction identified 24 instruments that have been evaluated for psychometric properties with rigorous methodology (Lotzin et al., 2015). A wide range of components are covered by these instruments, but most prevalent are contingent and sensitive responsiveness, and emotional availability (Lotzin et al., 2015). Furthermore, observing how the parent scaffolds and supports the child's exploration is frequently included in such tools, as are parental behaviors that are negative for the child's development, such as control, intrusiveness, and hostility (Lotzin et al., 2015). The most often rated child components are engagement, involvement, and responsiveness (Lotzin et al., 2015). The child's facial or vocal positive or negative affect, as well as the clarity of the child's cues, are also often assessed by these instruments (Lotzin et al., 2015).

One of the instruments listed in the review is the Emotional Availability Scales (EA) (Biringen, 2008), which is also used in the current thesis. The EA Scales assess the dyadic interaction behaviors of both the parent and the child and how they affect each other (Biringen, 2000). The observations are rated on six dimensions. Four dimensions assess the parent's interaction qualities such as sensitivity, structuring, non-intrusiveness, and non-hostility. The remaining dimensions pertain to the specific behaviors of the child, such as child responsiveness and child involvement (Biringen et al., 2014; Biringen & Easterbrooks, 2012a, 2012b). The EA scales are related to several child outcomes, such as attachment, language, sleep state regulation, emotion regulation and social behaviors, and to mothers' own attachment experiences, as measured with the AAI (Z Biringen et al., 2000; Biringen et al., 2014; Saunders et al., 2015).

Observations of mother-infant interaction quality have been found to be relatively stable across various settings, such as in laboratories or in the homes of the observed families (Bornstein et al., 2006). However, situational variables within those settings may influence the quality of such interactions (Maas et al., 2013). In a study of mothers and their 6-months-old infants, the dyads' interaction quality was assessed in different situations (face-to-face, free play, and diaper change) in a home visit situation (Maas et al., 2013). The results showed that mothers were more sensitive and positively responsive in face-to-face play than in free play or diaper changing. During free play, the mothers were more stimulating towards the infant than in the other settings. Finally, mothers were neither stimulating nor positively responsive during diaper changing (Maas et al., 2013).

A longitudinal four-wave study of the stability and change of the EA Scales across infancy and pre-school age found mixed results (Célia et al., 2018). The scales for sensitivity

and structuring were stable, but the scale for maternal hostility lacked relative stability across time (Célia et al., 2018). Furthermore, the dimensions child initiative and child responding were more unstable, indicating that most children are increasingly responsive and take more initiatives when interacting with their mothers as they grow older (Célia et al., 2018).

1.3.9 The overall model of parent-child relationships

Stern-Bruschweiler and Stern (1989) presented a theoretical model of the mother-infant relationship that had four main components: I) the mother's representation of the child, II) the mother's interaction behaviors, III) the child's representation of the relationship with the mother, and IV) the child's interaction behaviors. Stern-Bruschweiler and Stern argued that the model's four elements were in dynamic interaction, in an interdependent system where alterations in one element depended on the input from the other elements (Stern-Bruschweiler & Stern, 1989). Furthermore, any of the four components of the model may be a port of entry for interventions—i.e., behavioral targeted interventions may alter the representations, and vice versa, interventions aiming to alter the representational level will consequently lead to behavioral changes (Sameroff, 2004; Stern-Bruschweiler & Stern, 1989).

1.3.10 Improving the mother-child relationship

In accordance with Stern-Bruschweiler & Stern's model (1989), interventions aiming to improve the mother-infant relationship may target the mother's representations or the mother's behaviors when interacting with the child, or a combination of the two (Bakermans-Kranenburg et al., 2003; Duschinsky, 2020; Fukkink, 2008; Kennedy et al., 2017). Interventions targeting the representational level will engage the parent in discussions about attachment experiences from the past and the present, aiming to restructure the parent's state of mind regarding these experiences toward a more balanced and coherent representation (Bakermans-Kranenburg et al., 1998; Barlow et al., 2015). The rationale is that altering the parent's representation will eventually lead to more sensitive behaviors when interacting with the child. On the other hand, interventions targeting the behavioral level aim to teach the parent observational skills to better detect the child's signals by modeling sensitive parenting behavior, or reinforce the parent's sensitive behaviors when interacting with the child by using video-feedback (Juffer et al., 2023).

1.3.11 Video-feedback interventions

Meta-analyses and systematic reviews have concluded that interventions using video-feedback are more likely to improve a mother's sensitivity and her child's attachment security than interventions that do not include video-feedback (Bakermans-Kranenburg et al., 2003; Balldin et al., 2018; Fukkink, 2008; Mountain et al., 2017). Video-feedback interventions often address the behavioral level of the parent-infant relationship, although some also include the representational level of the parent.

One example of a video-feedback intervention that has been thoroughly tested is the Video-feedback Intervention to Promote Positive Parenting (VIPP) (IJzendoorn et al., 2008). The VIPP aims to reinforce sensitive parenting by giving personal feedback to the parent from video recordings of the parent-child interaction. The VIPP can also include a focus on using sensitive discipline strategies when the parent-child interaction is challenging— the VIPP-SD. Finally, VIPP-R is a program whereby VIPP is combined with representational discussions about the parent's past and current attachment relationships (Juffer et al., 2023).

To the best of our knowledge, it has not been reported whether VIPP-R can improve mothers' representations. However, studies have found that mothers with insecure/non-balanced representations who received VIPP-R improved their observed sensitivity and their infants' attachment security (Cassibba et al., 2015). Interestingly, another study found that mothers with insecure dismissing representations assessed with the AAI benefited more from the VIPP, whereas mothers with insecure/preoccupied representations benefited from the VIPP-R (Bakermans-Kranenburg et al., 1998). Thus, it seems that the ways in which the mothers' attachment experiences are represented in their mind should be considered when choosing which part of entry interventions should target.

1.3.12 The Video-feedback of Infant-Parent Interaction intervention (VIPI)

One intervention similar to the VIPP is that of Video-feedback of Infant Parent Interaction intervention (VIPI) (Onsøien et al., 2007; Aarts, 2000). The current thesis investigated the effect of VIPI on mothers' representations of their infants, as measured with the WMCI. The VIPI originates from the Marte Meo method that was developed in the early 1980s by Maria Aarts in the Netherlands (Aarts, 2000). Marte Meo was one of the first video-feedback methods designed to support interaction and communication in dyads (Marte Meo International). When using the Marte Meo method with parent-child dyads, the parent receives weekly video-feedback sessions based on clips from the parent-child interactions in

daily activities and situations. From these clips, the Marte Meo therapist will scaffold the parent's skills in observing their child, and reinforce the parent's sensitive responses to the child's initiatives and needs (Aarts, 2000). The VIPI provides a standardized manual for using the Marte Meo method with parents of infants up to 2 years of age (Onsøien et al., 2007).

The Marte Meo method has been widely implemented across a variety of dyads in different contexts such as in health care services, child protection services, kindergartens, and schools (Kiamanesh et al., 2018; Rohr et al., 2021). In community settings, the Marte Meo method has demonstrated improved parent-child interaction quality, compared to treatment as usual (Axberg et al., 2006; Høivik et al., 2015). Qualitative studies have reported positive effects on mothers depressive symptoms and the mothers' sensitivity (Gill et al., 2019; Vik & Rohde, 2014). Moreover, qualitative research also indicates that Marte Meo stimulated change in parent-infant interaction, parents' representations, and parental reflective functioning (Gill et al., 2019; Simhan et al., 2021). This has not yet been tested quantitatively with validated measures of parents' representations, which is one of the aims of the current thesis (Paper 2).

1.3.13 Improving parents' representations of their infants

To our knowledge, very few studies with an RCT design have reported improved maternal representations as an effect of an intervention. A systematic review of the effect of parent-infant psychotherapy (PIP), which is a type of intervention that is purported to target parents' representations, yielded limited evidence of improved representations (Barlow et al., 2015). Shortly after the review was published, Fonagy and colleagues (2016) found that, in an adverse sample of mothers with mental health problems, some features of the mothers' representations (helplessness and hostility) did improve after PIP (P. Fonagy et al., 2016).

Two other interventions have reported effects on mothers' representations of their children. The first is the Mother and Toddler Program (MTP), which is a 12-week attachment-based intervention given in addition to out-patient treatment for high-risk, substance-using mothers with children up to 3 years of age (Suchman, DeCoste, Castiglioni, et al., 2010; Suchman, DeCoste, Leigh, et al., 2010; Suchman et al., 2011; Suchman et al., 2012). The mothers in the control group received counseling and educational pamphlets (Suchman et al., 2011). The MTP was later renamed *Mothering from the Inside Out* which

was tested in a second RCT with a new sample of substance using mothers with children (11 months to 5 years of age) (Suchman, 2016). In sum, these studies found improvements of the mothers' representations (measured with the WMCI qualitative scales of acceptance, openness, sensitivity, richness, involvement, and coherence) at posttreatment and at 3months follow-up (Suchman, DeCoste, Castiglioni, et al., 2010; Suchman et al., 2011; Suchman et al., 2017).

The second intervention, known as the Mom Power, is also a group-based attachment-informed 10-week parenting program (Rosenblum et al., 2018). To the best of our knowledge, Mom Power is the only intervention that has documented effects on mothers' and fathers' representational categories, as measured by WMCI (Julian et al., 2018; Rosenblum et al., 2018). Mom Power enhances social support, teaches attachment-based parenting skills and strategies for the mother's own stress-reduction, coaches infant-parent interaction, and provides referrals to additional care if needed (Rosenblum et al., 2018). More high-risk mothers of children (0-5 years old), who received the Mom Power intervention had balanced representations of their children after the intervention than mothers in the control group who received the Mom Power curriculum by mail (Rosenblum et al., 2018). The Mom Power program has also been tested with military families, of which more mothers and fathers had balanced representations after receiving the program than did parents who received a home-based psychoeducational program (Julian et al., 2018).

In sum, whereas there are many interventions for disturbed parent-infant relationships that report improvements of parents' sensitivity as an outcome, only a few interventions report altered aspects of parents' representations of their child as an outcome variable. All of these interventions are tested with high-risk or clinical samples.

1.3.14 Mothers' representations predict their interaction behaviors

Metanalyses and reviews have evidenced that parents' attachment representations predict subsequent mother-infant interaction quality, whether measured prenatally, postnatally, during infancy, or across toddlerhood, and with samples of different psychosocial risk (Biringen et al., 2014; Foley & Hughes, 2018; Jones et al., 2015; van IJzendoorn, 1995). However, most studies included in these reviews and meta-analyses have used tools that assess the parents' state of mind regarding their own attachment experiences, and not the parents' representations of the specific child.

The previously mentioned longitudinal study of stability and change of maternal representations (Theran et al., 2005) found that mothers who became balanced after having non-balanced representations during pregnancy were still less sensitive, more disengaged, and less warm when interacting with their 1-year-old infant, than mothers who had remained balanced during the same time period. Mothers who had balanced representations during pregnancy but non-balanced when the infant was 1 year old were still more sensitive, less controlling, and expressed more joy when interacting with the 1-year-old, than mothers who had non-balanced representations continuously. Thus, having balanced representations even before the child is born seems to provide a buffer for negative impact of later non-balanced representations on the mother-infant interaction quality (Theran et al., 2005). Conversely, pre-natal non-balanced representations may influence later caregiving quality, even though the mothers' representations become balanced. These results from longitudinal research imply that changes in representations do not necessarily co-occur with changes in the mother-infant interaction quality.

1.3.15 Studies of changes in representations and changes in interaction

The hypothesis that changing one component (e.g. the mother's representations of the child) of the mother-infant relationship leads to change in the other (e.g. the interaction behavior) (Stern-Bruschweiler & Stern, 1989) still serves as a fundamental assumption for clinicians today. When aiming to help dysfunctional mother-infant relationships, interventions targeting either port of entry—the infant-mother interaction or the mother's representations—are assumed to have subsequent consequences for the other components. However, this assumption has scarcely been tested empirically.

To our knowledge, studies of only one intervention have investigated whether changes in mothers' representations of their infants lead to subsequent changes in the observed mother-infant interaction quality (Suchman et al., 2018; Suchman et al., 2012). In two randomized controlled trials, the effect of the previously described Mother and Toddler Program, which was later renamed Mothering from the Inside Out (MIO), was tested in samples of substance-using mothers of infants. The outcome variables were mothers' representations (measured with the WMCI), mothers' reflective functioning (measured with PDI), and mother-child interaction (measured with the curiosity box paradigm (Mayes et al., 1993), and they were measured after the intervention, after 3 months, and at 12-months follow-up after the intervention. In the first trial the infants were aged from newborn to 3

years (Suchman et al., 2011), and in the second trial from 11 months to 5 years of age (Suchman et al., 2017). The results showed that the improvements of the mothers' representations of their children (measured with the WMCI), together with improvements in the mothers' mentalizing capacity (measured with the PDI), mediated the effect of the intervention on the mothers' observed sensitivity when interacting with their infants (Suchman et al., 2018; Suchman et al., 2012). Interestingly, the greatest effect of improved representations and higher reflective functioning on mother-child interaction quality was observed at the 12-months follow-up (Suchman et al., 2017). This indicates that, at least for mothers with high-risk substance-use problems, it may take time for changes in representations and reflective functioning to impact the mothers' interactive behaviors. Suchman and her colleagues (2017) argued that mothers with substance-use problems or mental health challenges may have low tolerance for stress and impaired emotion regulation capability, so addressing their subjective experiences with parenting is therefore necessary before addressing their caregiving behaviors (Suchman et al., 2017). For low-risk mothers it is not known how time influences changes of their representations and their interactive behaviors, and it is not known whether a focus on their subjective experiences is needed before caregiving behaviors can be addressed.

1.3.16 Well Baby Centers in Norway

Risk indicators of disturbed mother-child relationships can be identified early in a child's life in the general population (Skovgaard et al., 2008). In Norway, more than 98% of all families with infants and toddlers (0 to 5 years) attend Well Baby Centers in their communities (Statistics Norway, 2023). The Well Baby Centers are therefore unique arenas for detecting risk indicators, as well as providing supportive, preventive, and promotive interventions to families in the general population (Statistics Norway, 2017).

Children in Norway have a legal right to health-promoting and preventive services, including medical care and check-ups, free of charge, in the municipalities where they live. These services are provided at Well Baby Centers (0 to 5 years) and school health services (5 to 20 years), including youth health centers. These services are universal, with an individual as well as population-oriented approach. The purpose is to promote mental and physical health, promote good social and environmental conditions and prevent illness and injury by identifying children and adolescents at risk. The service is interdisciplinary and staffed by

public health nurses and doctors, while physiotherapists, psychologists, occupational therapists, and social welfare and educational staff can also be summoned when necessary.

The Well Baby Centers provide a universal standard health program—the Primary Child Healthcare Program (PCHP). The PCHP entails a vaccination program and a program for promoting and monitoring the child’s physical, psychological, and social health and safety (Norwegian Directorate of Health, 2017). Over the course of approximately eleven consultations from when the infant is newborn until they are 48 months of age, the parents receive guidance concerning the baby’s development and well-being. Extra consultations can be offered if the parents or the public health nurse find it necessary. Furthermore, the nurses are trained to identify whether the parents have mental health issues, or problematic alcohol or substance use, or whether they are experiencing interpersonal violence. The consultations can be individual or group-based, and medical examinations by a doctor are included at specific consultations (Norwegian Directorate of Health, 2017). Even though this universal program was policy-induced, and the rollout started in the 1930s, very few evaluations of the effect of the program exist. One study conducted by the Norwegian School of Economics found that access to the Well Baby Centers had a positive effect on education and earnings, and there were fewer health risks at age 40 years for those who had attended the program, especially for those who had a low socio-economic background (Butikofer et al., 2015).

A systematic review and meta-analysis of both qualitative and quantitative studies investigating parenthood experiences during the infant’s first year found that parents who felt overwhelmed by the parenting responsibilities were helped by support from public health nurses (Nyström & Öhrling, 2004). The mothers reported that having the opportunity to discuss and reflect on parenting demands and challenges at the Well Baby Centers was especially helpful (Nyström & Öhrling, 2004). This finding was supported by a qualitative study of Swedish first-time mothers who reported feeling concerned and insecure during the first weeks after delivery, and that they needed support and affirmation from the Well Baby Centers to feel more secure in their parenting role (Wilsson & Adolfsson, 2011). Studies conducted in Norway and England indicate that postpartum support from a public health nurse may reduce depression scores in women (Glavin et al., 2009; Morrell et al., 2009). Furthermore, Norway offers postnatal parental leave that is generous in terms of leave duration and benefit amount (Folketrygdloven, 1997). A systematic review recently concluded that generous parental leave policies were associated with reduced risk of poor maternal mental health (Heshmati et al., 2023). In sum, paid parental leave policies, the Well

Baby Centers and a universal, standard health program for all children provide a comprehensive fundament for Norwegian families' well-being.

According to Norwegian law, the municipalities are responsible for making systematic efforts to promote public health and to prevent mental and physical diseases and disorders (Barnevernsloven, 2021; Folkehelseloven, 2021). In recent years, additional responsibilities for interventions and treatments have been delegated to the community health services from the specialist health care system (Prop. 21S (2018-2019)). Therefore, the Well Baby Centers are not only a unique arena for identifying early indicators of risk, but treatment efforts are also, to a larger degree than earlier, a part of their responsibilities. Consequently, effect-evaluated interventions that are available for and applicable to low-threshold community services are much needed.

1.4 Aims of the thesis

The overall aim of this thesis was to examine whether mothers' negative representations of their infants could be identified and altered with low-threshold interventions at community Well Baby Centers, and whether the mothers' representations were related to the quality of the mother-infant interaction. To do so, we first investigated the psychometric properties of the Working Model of the Child Interview (WMCI), which was used to assess the mothers' representations of their child. Secondly, we examined whether a Video-feedback of Infant Parent Interaction intervention (VIPI) intervention could alter the mothers' representations differently than treatment as usual. Finally, we investigated whether changes in representations were related to changes in mother-infant interaction quality.

Paper I

In this study we wanted to establish the psychometric properties of the 15 clinical scales of the Working Model of the Child Interview (WMCI) in our low-to-moderate-risk sample. More specifically, we investigated the 15 clinical scales':

- Inter-rater reliability
- factorial structure
- factorial validity
- concurrent validity
- discriminant validity

Paper II

To answer the research question of whether the Video-feedback of Infant-Parent Interaction intervention (VIPI) could have any effect on maternal representations beyond the effect of the standard universal preventive care at Well Baby Centers (the treatment as usual condition), we used data from the original RCT study. The mothers' representations were measured using:

- the WMCI categories (balanced, disengaged, and distorted)
- the WMCI clinical scales
- the WMCI factors derived from a factor analysis

Paper III

In Paper III we examined whether changes of maternal representations of their child were related to changes in their observed interaction behavior over the study period of 9–13 months.

2 Methods

2.1 Design

The thesis is based on data from a naturalistic, multi-site, longitudinal, randomized controlled trial study that aimed to investigate the effect of the Video-feedback of Infant-Parent Interaction intervention (VIPI) on quality of infant-parent interaction (Høivik et al., 2015).

2.2 Participants

The participants were recruited by nurses at Well Baby Centers or other primary care professionals between March 2008 and September 2012 in the Norwegian cities of Trondheim and Oslo, and in six rural towns in the southeastern part of Norway (Enebakk, Grue, Kongsvinger, Løten, Oppegård, and Ski). The last data were collected in January 2014. Inclusion criteria were an infant between 0 and 24 months of age, and interaction difficulties in the parent-infant relationship either perceived by the parent or widely defined by a professional. There were no exclusion criteria for the infants, but parents with severe mental health or developmental disorders, an ongoing substance-use problem or insufficient Norwegian language proficiency for the completion of questionnaires and interviews were excluded.

There were 158 eligible families, but 6 families withdrew from the study; thus 152 families were included and completed the baseline assessments. During the study period, 40 families withdrew or were excluded from the study because of a parent's illness (physical or mental), the family had moved to another city, or the child had been placed in foster care. At the last data assessment, which was 9–13 months after inclusion (mean 11.5), 112 families were evaluated. Both parents were invited to participate in the study. In all but two families, only the mothers participated for practical reasons, as 64% of them were on paid parental leave at the start of the study period. Therefore, we will refer to study participants as “mothers”.

More than half of the families (50.9%) had asked for help regarding parenting challenges at the time of recruitment. For the rest of the families (49.1%) participation was voluntary but recommended by the nurses at Well Baby Centers or other primary care professionals. Among the recruited families, 69.3% reported the following reasons for participating in the study: concern regarding their infant's regulation difficulties (32.6%), infant-parent interactional problems (14.5%), wanting to learn more (10.8%), parent's mental health (3.6%), developmental delay of the infant (3.2%), concern about the infant's social

development (2.4%), and a need for parenting support (2.2%). The professionals' most frequently cited reasons for recruiting were their assumption of maternal depressive symptoms (60–70%), interest in parenting (10–20%), concern about the child's development (10%) and insensitive parenting (10%).

In Paper II, Table 1 presents the sample characteristics of the intervention group, and the group receiving treatment as usual (TAU), and the two groups combined (total sample) at inclusion. For the total sample, 48.9 % of the infants were male, and the mean age of the infants was 7.3 months (SD= 5.1 months). In 71.2% of the families, the included infant was the first-born child. The participating mothers' mean age was 29.7 years (SD= 5.6), and 63.3% had a bachelor's degree or higher education. Most mothers were of Norwegian (79.8%) or European (6.4%) origin.

As shown in Paper 1, Table 1, the participating mothers did not have problems along multiple risk indicators associated with negative effects on parenting such as depression, anxiety, alcohol use, low level of education, or low family income. Furthermore, for the total sample, the infants' development and the mother-infant interaction quality indicated no risk. Five families (3.3%) received financial or other support from the Child Protection Service (CPS). The sample was relatively heterogeneous and low-to-moderate-risk, with only a few high-risk cases. Thus, no confounding effects of the sample's risk factors were expected. All participants provided informed written consent and were not offered incentives for enrolling on the study.

2.3 Procedure

In the original study, data were collected at three time points: baseline, post-intervention (3 months after baseline evaluation), and at a follow-up 6 months after the VIPI intervention ended. The intervention period lasted for 3 months, and the study period lasted for a total of 9–13 months (mean 11.3 months). In the investigations of the current thesis, we used data from the assessments at baseline (N = 152) and at follow-up (n = 112). One of our main outcome variables (the WMCI) was only conducted at these two time points, for two reasons: Firstly, to minimize the assessment burden for the participating mothers, and secondly to avoid the mothers repeating their responses.

Three research assistants with bachelor's degrees in social work, nursing, or preschool education collected data during 2 to 3 visits in the families' homes, conducted over a period of 1–2 weeks. At the first visit, socio-demographic data were obtained in an interview, and

the mothers completed self-report inventories (e.g., Beck's Depression Inventory, BDI-II, and Parent Stress Index, PSI). At 1-2 weeks after the first visit, the interview with the parents about their representations of their child—the Working Model of the Child Interview (WMCI) (Zeanah & Benoit, 1995)—was conducted, in addition to a 30-minute structured observation of the infant and the parent interacting in everyday, naturalistic situations (playing, feeding, or changing diapers). To facilitate subsequent coding, the research assistants video-recorded the observations of the mother-infant interaction and the interview with the mothers about their representations of their child, the WMCI. The recorded infant-mother interaction was later coded using the Emotional Availability Scales (EA) (Biringen, 2008) and the recorded interview was coded according to the WMCI manual (Zeanah et al., 1996).

From the baseline evaluation, 10 WMCIs were missing or excluded due to poor recording quality, thus 142 WMCIs were coded. At follow-up, 8 WMCIs were missing, thus 104 were coded. For recordings of the infant-parent interaction observation, 152 were included from baseline, and 112 were included from follow-up. Four tapes were missing, and 2 tapes were excluded because the tapes were damaged.

2.3.1 Randomization

The flowchart of the recruitment and randomization process is depicted in Figure 1 in Paper II. After the baseline evaluation, the families were randomized to the VIPI or TAU by a successive 1-2-1-2 allocation ratio within each rural municipality or urban district. The randomization was administered by a clinical psychologist, who also coordinated the recruitment processes. The sizes of the groups were unequal (VIPI $n = 88$, TAU $n = 72$), which is most likely because the allocation started and ended with the same number (1 = VIPI) and because in five families, twins or siblings were included.

The drop-out rates from baseline assessment to follow-up were 26.2% for the VIPI group and 34.6% for the TAU group. The majority dropped out after allocation to intervention or TAU. In Paper II, Table 2 shows descriptive statistics at baseline for the participating mothers' age, their infants' age, the WMCI factors, and the WMCI clinical scales for both the attrition group and the group who remained, across VIPI vs. TAU.

The research assistants were blinded as to which group the families were randomized to. All families attended the Primary Child Healthcare Program (PCHP), which involves standard care provided by interdisciplinary staff at Well Baby Centers in the communities.

Additionally, families in the intervention group received the VIPI-intervention, which included 8 home visits. The 8 VIPI-therapists were certified Marte Meo therapists. One therapist had completed high school, and the rest had bachelor's degrees in nursing, preschool education, physiotherapy, social work, or child welfare education.

For ethical reasons, all families could consult other professionals in addition to the staff at the Well Baby Centers during the study period. However, the professionals were instructed to not apply video-feedback in these consultations. The professionals with whom the families were in contact were general practitioners (TAU group 23.5%, VIPI group 30.8%), psychologists (TAU group 5.9%, VIPI group 13.3%), physicians (TAU group 11.4%, VIPI group 20.0%), specialists at a somatic hospital (TAU group 1.8%, VIPI group 2.5%), or "others" (special education teachers, interdisciplinary support team or support not specified) (TAU group 3.0%, VIPI group 1.8%). More parents in the VIPI group sought help from other professionals than parents in the TAU group, which was possibly because the intervention gave increased insight into their problems, which motivated them to seek further help.

2.3.2 The Video-feedback of Infant-Parent Interaction intervention (VIPI)

A manual for the VIPI intervention was developed by three experienced Marte Meo supervisors (Onsøien et al., 2007). The manual describes several intervention steps for parents of infants from 0 to 2 years of age. The VIPI includes eight weekly sessions, each of which usually lasts for about an hour, conducted over a period of no more than 3 months. The intervention starts with video-recording daily interaction situations between the parent and the infant in their homes. Edited video clips from these recorded interactions showing the dyad's interactional capacities are the focus of the following sessions. The final two sessions are tailored to the family's individual needs. At each session, mandatory homework is assigned. The parents are asked to register moments of interaction with their infant that are related to the newly introduced topics from the feedback sessions.

The VIPI targets the parent's sensitivity and structuring when interacting with the infant, especially in situations of concern for the parent. The therapist selects a few minutes from the video-recorded parent-infant interactions that demonstrated the following core elements of the Marte Meo method: I) identifying the infant's initiatives to contact the caregiver and initiatives to have a break in the dyadic exchanges, II) attunement and timing of the responses of the parent, III) following the child to support synchronicity, IV) naming the

infant's initiative, emotions, relational signals, and actions, V) step-by-step guidance for structured interactions, and VI) directing attention towards exploration and social interaction.

The parents' responses during the sessions determine the progression of the introduction of each element. While reviewing the edited video recordings, the VIPI therapist invites the parent to engage in a reflective dialogue to scaffold and reinforce sensitive parenting practices and to build an understanding of the infant's state of mind. In some of the participating families, both parents received the VIPI. In those cases, the therapist gave feedback individually to the mothers and the fathers, based on separate videotapes for each infant-parent dyad. We assessed and included data from only the mothers in the analyses.

2.3.3 Treatment fidelity

The eight certified Marte Meo therapists who provided the intervention to half of the families were trained for two days using the VIPI manual. They also received supervision from a licensed Marte Meo supervisor, where the therapists brought video tapes of the infant-parent interactions and of the therapists' feedback sessions with the parents. Treatment fidelity was ensured by the supervisor reviewing the videotapes of the therapists' sessions with the mothers, how they administered registration forms, and how they communicated the intervention's core elements. No deviations from the manual's instructions by the therapists were registered.

2.3.4 Treatment as usual

The Primary Child Healthcare Program (PCHP) offered by the Well Baby Centers in the municipalities was this study's TAU-condition. The PCHP is a free of charge, universal, health-promoting and preventive service for families with newborns and children up to 6 years of age, and is used by 97.7 % of Norwegian families (Statistics Norway, 2023). The families receive individual or group consultations from a public health nurse. Routine check-ups by a GP or pediatrician are included when the infant is 3, 12 and 24 months old. The frequency of consultations may vary among municipalities. In the current study, all families had a minimum of one home visit by a midwife after delivery. The consultations at the Well Baby Centers were usually at infant age 6 weeks, and then at infant age 3, 4, 6, 8, 10, 12, 15, 18, 24, and 48 months.

Treatment fidelity for TAU was not investigated. For ethical reasons, a randomization to no treatment or to put participants in a waiting-list control group was not possible, as the

infant's health could not be jeopardized. Also, the public health nurses cannot treat families differently than they should by decree.

2.4 Instruments

A summary of main instruments and variables used in the current thesis, specifying the target concept, target group, method, how the measure was used and psychometric properties of the measure, can be found in appendix B, Table B1.

2.4.1 Demographics

Demographic and socio-economic information was assessed in an interview conducted with the participants by the research assistants.

2.4.2 The Working Model of the Child Interview

The participating mothers' representations of their infants were assessed with the WMCI (Zeanah & Benoit, 1995) at baseline and at follow-up 9-13 months after baseline. The WMCI is a semi-structured interview that takes approximately one hour to complete, and aims to capture the parents' ideas, feelings, perceptions and experiences about their infant's personality and characteristics, and the relationship they have with the infant and to themselves as caregivers. Included in the interview are questions about the pregnancy ("How did you find out you were pregnant? What was your first reaction?"), delivery ("How was the labor? What was your first reaction when you saw your baby?"), the present ("Describe your impression of [name]'s personality, the kind of little kid he/she is."), and future situations with the child ("What do you expect your child to be like as an adolescent?") (Zeanah et al., 1996). Questions about the parents' thoughts and feelings when in attachment-sensitive situations with the infant are also included (e.g., when the child is ill, hurt, or frightened).

The parent's descriptions given in the interview are rated on 15 five-point clinical scales (see Table A1), where a score of 1 = none, and a score of 5 = extreme. Six of the scales measure qualitative features of the parents' representations, two scales measure specific content themes of the representations, and seven scales assess the affective tone of the parents' representations.

The following six scales reflect qualitative features of the representation. The first, richness of perception, assesses how the degree of details in the parent's perceptions reflect how well the parent knows the infant. The second qualitative scale is openness to change,

which concerns the ability of the parent to accommodate new information about the infant and its' changing developmental needs. The third scale, intensity of involvement, measures the parent's level of emotional immersion and preoccupation with the child. The fourth, coherence, reflects the consistency, clarity, and organization of the parent's perceptions. Caregiving sensitivity is the fifth feature, which conveys how the parent understands the child's experiences and needs and responds accordingly. The sixth scale is acceptance, which reflects the parent's acceptance of the child as he or she is, including acceptance of the caregiver's responsibilities.

The next two scales measure specific content themes of the parent's perceptions. The first, infant difficulty, relates to the parent's perception of the child as difficult to relate to and care for. The second content scale is fear for infant health and safety, which measures a parent's *irrational* concern for their infant.

The remaining seven scales measure the presence of different emotional tones (joy, pride, anger, disappointment, anxiety, guilt, and indifference) during the interview.

By evaluating the patterns of ratings on the 15 clinical scales, the representations can be assigned to one of three global categories—namely balanced, disengaged or distorted (Zeanah et al., 1996). The latter two can be collapsed to a non-balanced category (Theran et al., 2005). Parents with balanced representations have open, accepting, sensitive, and coherent descriptions of their child, with a balanced integration of both positive and negative features of the child, the relationship with the child, and caregiving. A disengaged representation is characterized by an emotional distance, a cognitive understanding of the child's personality and needs, and intellectual approach to parenting. A parent with disengaged representations may also seem indifferent, aversive or rejective of the child and the child's needs. Distorted representations often convey incoherent and inconsistent descriptions of the child and of the relationship the parent has with the child. The parent may seem preoccupied and self-absorbed and becomes overwhelmed by the child's needs. A fourth category, disrupted (WMCI-D), which reflects disrupted caregiver behavior associated with infant disorganized attachment pattern, can be assigned by evaluating the interview with items from the AMBIANCE (Lyons-Ruth et al., 1999). This category was not included in the present study as no coders for WMCI-D were available.

Two raters coded the interviews. One rater is a clinical psychologist, and the other rater has a master's degree in pre-school education. Both raters were trained for reliability. The raters were blinded to the randomization status of the families, but not to the time of the interviews. At the beginning of the investigation, only the WMCI from the baseline

assessment were coded, because we did not know whether there would be raters available for coding the WMCI at follow-up. Later, the same raters agreed to code WMCIs from the follow-up assessment, thus it is possible that their coding was influenced by their earlier coding.

From the baseline assessment, the first rater coded 108 interviews, and the second rater coded 55. At follow-up, the first rater coded 104 interviews, and the second rater coded 18. Twenty randomly assigned WMCIs were double-coded at baseline, and 18 WMCIs were double-coded at follow-up. Disagreement on the global categories were settled by conference, but disagreements on the clinical scales were not discussed.

2.4.3 Emotional Availability Scales (EA)

The Emotional Availability Scales (EA) evaluate the quality of the bi-directional infant-parent relationship (Biringen, 2008; Biringen et al., 2014; Easterbrooks et al., 2012). There are six dimensions that assess the quality of communication and emotionality between the infant and the parent, of which four assess the parent's behaviors and two assess the infant's contribution.

The first parent dimension, sensitivity, includes the parent's affects, attunement, synchronicity, responsiveness, awareness of timing, flexibility, creativity in play, verbal and non-verbal congruency and conflict-solving strategies. The second, structuring, conveys the parent's ability to set limits and to remain in charge, but also to follow the child's lead, and to guide and scaffold the child's development. This dimension also includes how the child's response affects the parent. The third dimension is non-intrusiveness, which assesses the degree to which the parent is emotionally available for the child without being intrusive. This includes an evaluation of the parent's ability to not be over-directive, over-stimulating, or over-protective, or to not verbally or physically interfere or interrupt communication. The fourth and last parent dimension is non-hostility. This dimension evaluates the absence of overt or covert hostility (e.g., negative facial or vocal expressions, ridiculing, mocking, being disrespectful in behavior or statements, using silence as a strategy, threat of separation, frightening behavior, or hostile themes in play).

The first child dimension, child responsiveness to the adult, reflects the child's organization and regulation of emotions and behavior, including autonomy seeking and exploration. Child involvement, the second and final child dimension, evaluates how the child initiates interaction and involves the parent in play.

Each dimension of EA is rated on seven subscales, of which two are scored 1 to 7, and five are scored 1 to 3. The total score of EA ranges from 42 to 174 points. High scores represent good emotional availability. The EA Scales can be used for parents with children from 0 to 14 years of age and are evaluated in a variety of contexts (Biringen et al., 2014; Ziv et al., 2000).

Four coders, certified by Zeynep Biringen, independently scored the EA Scales (fourth edition) from 30-minute video recordings of infants interacting with their parents in natural situations in the families' homes. The educational backgrounds of the coders consisted of clinical psychologist, psychiatrist, master's degree in preschool education, and a postgraduate student of clinical psychology. All raters were blinded to demographic information and the randomization status of the participating families. The Intraclass Correlation calculations were based on 36 recordings, which were re-rated, as described in Høivik et al. (2015). The obtained ICC between the raters was 0.461, and Cronbach's alpha was 0.97 (Høivik et al., 2015). The low ICC was caused by the relatively large residual variance (139.739) compared to the between-individual variance (139.284). The inter-rater variance (22.973) is the smallest of these variance components, thus the contribution to the total variance from inter-rater variance is practically negligible. If the variance component had been 0 instead of 22.973, the ICC would still be 0.499. An alternative ICC calculation without adjusting for time point was carried out. In this calculation, the variance components were residual variance (140.052), between-individual variance (194.048), and between-rater variance (21.654). The between rater variance in the alternative analysis was larger, resulting in an ICC equal to 0.545 (Høivik et al., 2015). The re-rating scores were only used for the ICC calculations.

2.5 Instruments used for investigating validity

2.5.1 Parenting Stress Index (PSI)

The PSI is a 120-item self-report scale that measures a parent's experienced stress in the relationship with a specific child (Abidin, 1990). The questionnaire takes 20–25 minutes to complete and consists of seven scales assessing parent characteristics and six scales assessing child characteristics. Additionally, there is one life stress scale. The items are rated from 1 (strongly disagree) to 5 (strongly agree), where higher scores indicate higher levels of stress. The target group of the PSI is parents with children up to 12 years of age. A review of the

psychometric properties of a different version of the PSI was recently published (Ríos et al., 2022). A review of the psychometric properties of the Norwegian version of the PSI reported a median Cronbach's alpha of > 0.90 (Kornør & Martinussen, 2011).

For the current study, we used a modified 67-item version of the original PSI. We computed a parent domain by the subscales: parent competence, attachment, role restriction, spouse, isolation, depression, and health. We also computed a child domain, which included the following subscales: child reinforces the parent, demandingness, and acceptability. Finally, we computed a total score by adding the parent domain and the child domain.

2.5.2 Beck's Depression Inventory (BDI-II)

The BDI-II is a self-report questionnaire of depressive symptoms, containing 21 questions about how the person has been feeling over the past 7 days (Beck et al., 1996). The responses are rated on a scale of 0–3, giving a total score range of 0–63. A score of 0–13 indicates no or minimal depression, a score of 14–19 indicates mild depressive symptoms, a score of 20–28 indicates moderate symptoms, and a score of 29–63 indicates severe depressive symptoms (Beck et al., 1996).

The BDI-II is frequently used in clinical practice, and has been validated in a variety of settings and populations (Wang & Gorenstein, 2013). In the current study, Cronbach's alphas ranged between 0.86 and 0.88 (Høivik et al., 2015).

2.5.3 Ages and Stages Questionnaire: Social-Emotional (ASQ:SE)

The ASQ:SE is a parent-completed screening questionnaire for assessing social and emotional difficulties for infants and children (3–66 months) (Squires et al., 2002). There are eight different schemes with between 19 and 33 questions covering seven areas of the child's social- and emotional development. Each scheme corresponds to different age-spans of the children. The questions are scored 0, 5, or 10. High scores indicate a need for further investigation of social or emotional difficulties.

The psychometric properties of the ASQ:SE used across cultural and contextual factors have been reported (Stensen et al., 2018; Velikonja et al., 2017). For the current investigation, we computed adjusted scores due to the varied scores on the age-specific questionnaires (Høivik et al., 2015).

2.6 Statistical analyses

A power calculation was conducted prior to the study. For an expected standardized difference of 0.5 between the VIPI group and the TAU group, 60 families in each group were required to give a power of 78% at a 5% significance level (Høivik et al., 2015). P-values of less than 0.05 were regarded as statistically significant. Due to multiple hypotheses, p-values between 0.05 and 0.01 were cautiously interpreted. We report 95% confidence intervals (CI) when relevant. Statistical analyses were performed in Stata 15 and SPSS 25, 27 and 28.

2.6.1 Paper I

To investigate inter-rater reliability of the 15 WMCI clinical scales, we calculated Cohen's quadratic weighted κ for the two raters' scores on 20 double coded cases from baseline assessment. A mean of the two scores on the double coded cases was used in the further analyses. Cohen's κ was then calculated for the three global categories (balanced, disengaged, and distorted), and for dichotomized categories balanced vs non-balanced. Additionally, we calculated positive and negative agreement for balanced and non-balanced, respectively.

To investigate the factor structure of the WMCI, we included all 15 WMCI clinical scales. The three groups of WMCI clinical scales (qualitative features, content themes and emotional tone) are different, yet they are not independent of each other. According to the WMCI coding manual, patterns of scores on all scales should be evaluated together when assigning the parent's representation to one of the WMCI categories (balanced, disengaged, or distorted) (Zeanah et al., 1996). This approach has also been applied in another study using the WMCI (Sprang et al., 2005).

First, we conducted an exploratory factor analysis (EFA) on a randomly selected half of the sample, followed by a confirmatory factor analysis (CFA) on the other half of the sample. The CFA did not converge, so we therefore conducted the EFA with WMCI data from baseline assessment followed by a structural equation modeling (SEM) as a generalization of the CFA with WMCI data from baseline and follow-up together with the double-coded cases (n=284). To investigate the factor structure and identify the number of factors, we used the correlation matrix, the factor loadings, scree plot, and eigenvalues generated from the EFA principal component factor (PCF). We then generated a factor score of each factor and computed Cronbach's α to test the reliability of the scales. We then used the command GSEM (generalized structural equation modelling) in Stata 15 to test the EFA-

extracted factors. We included participants as a random effect, coder, time point (follow-up vs baseline), and intervention (vs TAU) at follow-up as fixed effects.

The associations between the extracted factors and the original categories were studied using multinomial logistic regression with the three categories as dependent variables and the three factors as covariates.

We studied concurrent validity by calculating correlations between the extracted factors and the EA dimensions (parental positive interaction, parental non-negative interaction, and child positive interaction), and the PSI total score, child domain and parent domain. Discriminant validity was studied by calculating correlations between the extracted WMCI factors and the ASQ:SE, child age and gender, mother's symptoms of depression (BDI-II), mother's educational level, and type of neighborhood.

2.6.2 Paper II

The difference of change between the VIPI group and the TAU group, was studied using linear mixed model analysis with the WMCI factors and the 15 WMCI clinical scales as dependent variables, one at a time. To determine whether the changes were different between the groups, we included time (follow-up vs baseline), and the interaction between time and intervention (VIPI vs TAU) as fixed factors. We adjusted for the dependent variable's baseline value, as recommended by Twisk et al. with the equation (2c) in their publication (Twisk et al., 2018). We included participants as a random effect.

We investigated change in the WMCI categories (balanced, disengaged, and distorted) from baseline to 6 months follow-up, for the VIPI group, the TAU group, and the total sample separately, and analyzed the changes from baseline to follow-up using the Stuart-Maxwell test of marginal homogeneity.

We found no differences between the VIPI group and the TAU group on change in the WMCI factors and clinical scales. However, for both groups, we observed a change in some WMCI variables. Therefore, to investigate changes in WMCI factors and clinical scales for the total sample, we conducted additional linear mixed model analyses with time as a fixed factor (follow-up vs baseline). Finally, we added the child's age at follow-up to investigate whether any changes in the mothers' representations could be explained by the child growing older.

We did not report p-values for baseline differences between the VIPI group and the TAU group, as recommended by (de Boer et al., 2015; Fayers & King, 2008; Lydersen, 2020, 2022).

2.6.3 Paper III

To answer the research question of Paper III, we calculated the difference between baseline and follow-up scores of the EA total score, EA parental positive, and EA parental non-negative, and the WMCI factors and some WMCI clinical scales (anxiety, fear for infant's safety, sensitivity, and infant difficulty), for the total sample. We then correlated the difference between the scores of the EA variables and the WMCI variables.

2.6.4 Handling missing data

We estimated WMCI factor scores as the mean of available scores on the WMCI clinical scales if data were available for at least half of the scales. Available case analyses were used for the rest, which means that, in each analysis we included observations with complete data on the relevant variables. The linear mixed model analysis included all participants with data from at least one time point. If data were missing at random, the results would be unbiased. A complete case analysis including only participants with data from both time points, however, would be unbiased only under the more restrictive assumption that data were missing completely at random. As shown in Paper II, Table 2, it seems that missing data depend on baseline characteristics. This was handled appropriately by linear mixed model analysis, so that the results were unbiased under this type of deviation from missing completely at random.

2.7 Ethics

The current thesis used data from the study "Video feedback compared to treatment as usual in families with parent-child interaction problems: A randomized controlled trial" (Høivik et al., 2015). The study was approved by the Norwegian Centre for Research Data and later the Regional Committee for Research Ethics in Mid-Norway (REC; reference number 1.2007.2176). The study is registered in the International Standard Randomized Controlled Trial Number registry with the reference number ISRCTN 99793905. Informed written

consent was obtained from all participants. The current study was found to be exempt (REC reference 2017/1723) because data from the original study were anonymized.

3 Results

3.1 Paper I

Measuring mothers' representations of their infants: Psychometric properties of the clinical scales of the Working Model of the Child Interview in a low-to-moderate-risk sample

In this study, we examined I) the inter-rater reliability, II) the factorial structure, III) the factorial validity, IV) the concurrent validity, and V) the discriminant validity of the 15 clinical scales in a low- to- moderate-risk sample.

Regarding agreement between the raters on the 15 WMCI clinical scales for the 20 cases double-coded at baseline, Cohen's quadratic weighted κ for the scales varied from 0.347 to 0.756 (mean 0.539) (Paper I, Table 2). One coder systematically rated the scales higher than the other (mean 0.55 points) (Paper I, Supplemental Material, Tables S1-S15).

Cohen's κ for the three WMCI categories (balanced, disengaged, distorted) was 0.898 (CI: 0.704 to 1.00), and Cohen's κ for balanced vs non-balanced was 0.886 (CI: 0.671 to 1.00). Specific agreement between the coders was 0.929 (positive agreement) and 1:00 (negative agreement). Distribution of the WMCI categories for the 20 double-coded cases is presented in Paper I, Supplemental Material, Tables S16-S17.

The EFA extracted four latent factors. The first factor (labeled Balanced) was loaded by the WMCI clinical scales richness of perceptions, openness to change, intensity of involvement, coherence, sensitivity, acceptance, joy, and pride, which also correlated positively. The WMCI clinical scales anger, disappointment and infant difficulty correlated positively and loaded on to factor 2, labelled Resentful. Factor 3 was labeled Apprehensive and was loaded by the scales anxiety and fear for infant's safety. The scale guilt was identified as a fourth factor, and the scale indifference did not load on to any factor and was excluded from further analyses.

A model with factor 1, factor 2, and factor 3, and the scale guilt as an independent variable converged with evidence of factorial validity (Paper I, Figure 1). Factor 1 corresponded with the original category balanced, while both factor 2 and factor 3 corresponded with the original category distorted.

Concurrent validity of the WMCI factors was confirmed with parental stress (PSI) and infant-mother interaction quality (EA). Mothers with high scores on WMCI factor 1 Balanced experienced less stress than mothers with high scores on WMCI factor 2 Resentful and WMCI factor 3 Apprehensive. The mothers with high scores on factor 1 Balanced also had

more positive and less negative observed behavior when interacting with the infant, compared to mothers with high scores on factor 2 Resentful. The infants of mothers scoring high on factor 1 Balanced had more positive behavior when interacting with their mothers, but we found no association between factor 2 Resentful or factor 3 Apprehensive and the infants' behavior. Factor 3 Apprehensive and the variable guilt were not associated with mother-infant interaction quality (Paper I, Table 6).

The extracted factors and the WMCI scale guilt correlated weakly or not at all with infant variables (age, gender, socio-emotional development), maternal variables (level of education, symptoms of depression), or a socio-demographic variable (type of neighborhood) (Paper 1, Table 6). Thus, discriminant validity was confirmed.

3.2 Paper II

Can a parenting intervention in primary care alter mothers' representations of their infants? A randomized controlled trial of the effect of a video-feedback parenting intervention compared to treatment as usual in a predominantly low- to moderate risk sample

In the second study, we examined whether the VIPI intervention had any effect on maternal representations compared to the effect of the standard universal preventive care at Well Baby Centers, which was the treatment as usual condition.

We found no differences in change on the WMCI factors, clinical scales, or categories from baseline to follow-up between the mothers in the VIPI group and the mothers following the treatment as usual from the community Well Baby Centers (Paper II, Table 3 and Table 4). Additional analyses of changes in WMCI factors and scales for the whole sample were conducted. We found that, at follow-up, for the total sample, the mothers' representations were less anxious, the mothers had less irrational fear for the infant's safety and the mothers perceived their infants as less difficult to care for. The mothers' representations were also less sensitive, which was, to a large extent, explained by the increasing age of the infant. A decrease was observed in the estimated scores from baseline to follow-up for the WMCI factor Resentful and the scale Anger was observed, but only when we adjusted for the age of the child at follow-up (Paper II, Table 5). The estimated mean scores on factor 1 Balanced and the WMCI clinical scales of intensity of involvement and openness to change also decreased from baseline to follow-up. Due to *p*-values ranging between 0.01 and 0.05, we interpret these results with caution.

3.3 Paper III

Are changes in mothers' representations of their infants related to changes in observed mother-infant interaction quality?

In the third study, the research aim was to examine whether changes in mothers' representations of their infants were related to changes in observed mother-infant interaction quality over a period of 9-13 months?

We found no relation between changes in WMCI scores from baseline to follow-up and changes in infant-mother interaction quality. The correlations between the changes from baseline to follow-up in WMCI factors Balanced, Resentful, and Apprehensive, the WMCI scale sensitivity, and infant difficulty, and change from baseline to follow-up in the EA total score, EA parental positive, and EA parental non-negative were close to zero and not significant (Paper III, Table 2).

4 Discussion

4.1 Main findings

The focus of this thesis is on mothers' representations of their infants. First, we investigated the psychometric properties of the clinical scales of the Working Model of the Child Interview (WMCI), which is commonly used to measure parental representations of their child. We then examined whether the mothers' negative representations could be altered by low-threshold interventions provided by community Well Baby Centers. Finally, we examined whether changed aspects of the mothers' representations were related to improved mother-infant interaction quality.

One of the main results in this thesis was that there were no group differences between the mothers receiving the Video-feedback of Infant Parent Interaction intervention (VIPI) and the mothers receiving treatment as usual (TAU) regarding changes in their representations of their infants. However, when analyzing the mothers in both groups, the mothers receiving treatment as usual at Well Baby Centers improved features of their representations just as much as the mothers receiving the VIPI. To the best of our knowledge, this has never been reported before in a low-to-moderate-risk sample of predominantly primiparous mothers.

For both groups, the mothers' representations were less characterized by anxiety, and entailed less irrational fear for their infant's safety and less perceptions of the infant as being difficult to care for. With the increasing age of the infant, the mothers' representations became slightly less sensitive. The age of the child at follow-up had a suppression effect on change from baseline to follow-up on the factor Resentful and WMCI scale anger. This means that the mothers reduced their anger and resentment, but this effect was canceled out by the anger and resentment that increased as the child grew older. Another major result in this thesis is that improvements of features of the mothers' representations were not related to any improvements in the observed infant-mother interaction.

The analyses of these results were based on a factor analysis of the WMCI clinical scales, which yielded three latent factors with evidence of factorial validity, concurrent validity, and discriminant validity. Factor 1 was called Balanced since it corresponded well with the original WMCI category balanced. Factor 2 Resentful and factor 3 Apprehensive both corresponded with the original WMCI category distorted.

4.2 General discussion

4.2.1 The psychometric properties of the Working Model of the Child Interview (WMCI)

Assessing parental representations by semi-structured, clinical interviews such as the WMCI, includes both a coding process and an interpretation of the pattern of scores when assigning a representational category. Although the WMCI categories have previously been examined for psychometric properties (Benoit, Parker, et al., 1997; Madigan et al., 2015; Theran et al., 2005; Vreeswijk et al., 2012), the continuous clinical scales have seldom been investigated, and only with high-risk families (Huth-Bocks et al., 2004; Sprang et al., 2005). Therefore, an investigation of the factorial structure and validity in a sample of lower risk parents was necessitated. In Norway, the WMCI is mainly used among clinical specialists in primary and secondary services. It is also used by social workers in the child protection services, although the interview has never been validated in this setting. Our results support that the WMCI is a valid instrument for clinical and research purposes in primary care with low- to moderate risk mothers of infants (Paper I).

The three latent factors derived from our factor analyses provide a continuous instead of a categorical approach when assessing a parent's representations, which is in line with current research (Fralely & Roisman, 2014; Miljkovitch et al., 2015). When Raby et al. (2022) investigated the latent structure of the Adult Attachment Interview (AAI), on which the WMCI is modeled, they concluded that 'individual differences in attachment states of mind reflect differences in degree, not kind' (Raby et al., 2022). The WMCI factors and scales in our study were sensitive in detecting small and subtle changes (Paper II). The three factors corresponded with the original categories (Paper I), so can thus be used as continuous supplements to the WMCI categories.

The factor Resentful reflects the mother's externalized perceptions, while the factor Apprehensive reflects the mother's internalized perceptions of the infant. This structure is in line with the factorial structure of the Parental Development Interview (PDI) (Slade et al., 1999). Using data from baseline, analyses of validity showed that higher scores on the factors Resentful and Apprehensive were associated with higher levels of stress and somewhat less to depressive symptoms. Additionally, higher scores on Resentful are associated with less positive and more negative behaviors of the mothers when they interact with their infants (Paper I).

The original WMCI category disengaged did not emerge as a latent factor in our analyses. According to the WMCI coding manual, the scale indifference is a strong indicator

of the disengaged category when rated >2 (Zeanah et al., 1996). In our factor analysis, indifference did not load on to any of the latent factors, thus it was excluded from the confirmatory factor analysis. Nonetheless, the scale indifference correlated negatively with the scales that loaded on to the factor Balanced. Further, Paper 1, Table 5 shows that low scores on the factor Balanced predicted the original category disengaged. Thus, we recommend that low scores on the factor Balanced and scores of >2 on the scale indifference can be used as indication of the category disengaged. We note that the same approach has been used in earlier research (Benoit, Zeanah, et al., 1997; Rasmussen et al., 2016).

4.2.2 Can the Video-feedback of Infant-Parent Interaction (VIPI) intervention influence mothers' representations of their infants?

The mothers who received the VIPI intervention altered some aspects of their representations of their child, but not differently than the mothers who received treatment as usual only (Paper II). Thus, our results did not confirm findings from qualitative research (Gill et al., 2019; Simhan et al., 2021)

To the best of our knowledge, only three interventions have so far proved an effect on maternal representations (P. Fonagy et al., 2016; Julian et al., 2018; Rosenblum et al., 2018; Suchman et al., 2011; Suchman et al., 2017). All these interventions were conducted in samples with high risk of negative parenting. In high-risk samples, the mothers' representations are clearly more negative, and improvements are more likely to be detected. For the current low- to moderate-risk sample, the mean scores on the WMCI factors and scales indicated little room for improvements, causing a possible ceiling effect. Thus, improvements caused by the VIPI beyond those of TAU may have been too small to detect.

Furthermore, the mentioned interventions that have reported an effect on parents' representations had a representational focus. Additionally, two of the interventions were parts of more comprehensive programs, which included mothers' self-care and facilitated social support for health, housing, and financial challenges (Julian et al., 2018; Rosenblum et al., 2018; Suchman et al., 2011; Suchman et al., 2017). In our study, all mothers received the comprehensive services at the Well Baby Clinics, which was also the treatment as usual condition. However, the VIPI intervention primarily addressed the behavioral level when working with parents. Although the VIPI therapists invited the mothers to engage in a reflective dialogue when reviewing videoclips of the mother-infant interaction, the focus was

on perceiving the infants' state of mind and on scaffolding sensitive parenting. Scholars have suggested that exploring the parent's perceptions of their own past experiences with their caregivers and how those perceptions might affect the current relationship with the child is a core component in reorganizing parents' non-balanced representations (Kennedy et al., 2017; Schechter et al., 2015; Schechter et al., 2006; Suchman et al., 2011). VIPI mainly directed the mothers' attention to the child and the child's behavior, which may have reduced the intrusion of the mothers' negative representations from their own childhood. VIPI and similar interventions may be effective in altering parents' observed sensitivity and interactive behavior, but without impacting the representations that would normally interfere in these situations (Duschinsky, 2020; Out et al., 2009).

It is, however, possible that the mothers in the VIPI group improved their capability to mentalize their infants, as the VIPI therapist invited the mothers to reflect on the infants' experiences and mental processes. Earlier studies have found that video-feedback interventions improved mothers' reflective functioning (Rosenblum et al., 2018; Schechter et al., 2015; Schechter et al., 2006; Suchman et al., 2011; Suchman et al., 2017). Administering the Reflective Functioning Scale together with the WMCI in the current study could possibly have detected an effect of VIPI on the mothers' reflective functioning. Including the Reflective Functioning Scale should be considered in future studies of parental representations of their children.

4.2.3 Supportive community services likely to have improved features of mothers' representations

For the mothers in both the VIPI group and the TAU group, we found small decreases in features of their representations. They showed less anxiety, less fear for the infant's safety, less perceptions of the infant as being difficult to care for, and somewhat less sensitivity (Paper II). It is possible that especially first-time mothers were anxious and uncertain about parenting, and thus benefitted from the support and guidance they received from the staff at community Well Baby Centers. This interpretation is in line with studies concluding that support from public health nurses at Well Baby Centers was beneficial for insecure and depressed first-time mothers (Glavin et al., 2009; Morrell et al., 2009; Wilsson & Adolfsson, 2011).

Furthermore, the effect of the comprehensive services at the Well Baby Centers, which all families received, could have masked a possible effect of the VIPI intervention. As almost all families with infants in Norway attend the PCHP and the services at Well Baby Centers (Statistics Norway, 2023), a comparison with a group not receiving these services would not be possible. Thus, this hypothesis could not be tested.

We found that for the mothers in both groups, their representational sensitivity reduced as the age of the child increased (Paper II). This finding is consistent with one other study conducted with a high-risk sample (Rosenblum et al., 2020). In our study, the decrease was minimal and the mean score on the scale sensitivity was still above the threshold score of three. Nevertheless, this finding indicates that mothers adjust their perceptions of the child as the child develops. It is not unlikely that, for many mothers, it is harder to be sensitive to a toddler's increasing autonomy demands than to an infant's helplessness.

4.2.4 Changes in mothers' representations and changes in mother-infant interaction—not related?

We did not find a relation between the changes in the mothers' representations of their infants and the changes in the quality of the observed mother-infant interaction (Paper III). Although we found an association between the mothers' representations and the observed mother-infant interaction quality at baseline (Paper I), changes in these measures from baseline to follow-up happened independently of each other (Paper III). Thus, our study did not confirm the theoretical prediction that change in one element of the parent-child relationship would lead to subsequent changes in the other elements (Stern-Bruschweiler & Stern, 1989).

To our knowledge, the only studies that have reported a relation between changes in representations and changes in interaction quality were conducted in samples of mothers who were in treatment for problematic substance-use (Suchman et al., 2018; Suchman et al., 2012). In these studies, it was the combination of improved features of the mothers' representations and increased capability of reflective functioning that explained the increased level of sensitivity in the mothers' interactions. In the present study, the mothers' reflective functioning was not assessed. Whether the mothers' improved representations, combined with their reflective functioning, was related to improved mother-infant interaction quality is not known and should be tested in future research.

The VIPI intervention applied in the current thesis is in many ways comparable to the Video-feedback Intervention to promote Positive Parenting (VIPP) (Juffer et al., 2008). The VIPP has been found to improve the observed maternal sensitivity, especially for mothers with dismissing (disengaged) representations, while VIPP-R, which additionally targets the parents' representations, was most effective for mothers with preoccupied (distorted) representations (Bakermans-Kranenburg et al., 1998). In the current study, it is possible that the VIPI had more effect on the interactive behavior of disengaged mothers or mothers with high scores on the factors Resentful or Apprehensive, and possibly for these mothers, there was a relation between improvements of their representations and improvements of their interaction behavior. This should be studied in future research.

4.2.5 Timing of assessment

According to attachment theory, one should expect a time-lag before parents' representations or their interaction behaviors are updated in response to alterations (Bowlby, 1973). In Suchman's study (2017), which assessed quality of interactions at posttreatment, 3 months follow-up, and 12 months follow-up after intervention, the greatest improvements of interaction quality were evident at 12 months follow-up (Suchman et al., 2017). This finding indicates that a sleeper effect may remain undetected if the follow-up assessment is conducted too early after an intervention. Again, the sample of that study consisted of high-risk mothers in treatment for problematic substance-use, who possibly needed more time being nourished by the self-care focus provided by the Mothering from the Inside Out (MIO)-intervention before they could attend to the relationship with the infant. In the present study, the last wave of data was assessed six months after the intervention had ended. Whether low-to-moderate-risk samples also need longer time before change of interaction behavior occurs as a result of the representational changes is not known and should be investigated in future research.

4.2.6 Which parent-infant situations should be observed?

The observation setting and context of the mother-infant interaction may influence which maternal behaviors are elicited (Maas et al., 2013). In the present study, the mothers and their infants were observed for 30 minutes in everyday situations (playing, mealtime and diaper changing) in a naturalistic home environment. The amount of time is considered sufficient for assessing and evaluating mother-infant interactions. However, more time may be necessary to

detect serious interactional difficulties (Biringen et al., 2005). Furthermore, for low risk samples the observation situation should evoke some frustration in order to assess the mother's level of hostility (Biringen et al., 2014). Also, the relations between a parent's reflective functioning and their parenting behaviors are stronger when measured in stressful settings (Stuhrmann et al., 2022). The observation situation in the current study did not involve any stressful tasks that could potentially have evoked both the mothers' and their child's negative behaviors and activated the mothers' negative representations. The mothers of the current sample could perform at their best, which possibly contributed to low variance on the scores on the EA Scales (Paper III). With scores of such restricted range, the correlation coefficient estimates may be too small to detect a significant relation between the scores (Bland & Altman, 2011).

4.3 Strengths

The current study has several strengths. The first pertains to the RCT-design in a naturalistic setting in multiple sites. This made it possible to test the effect of a low-threshold intervention in primary care compared to treatment as usual at community Well Baby Centers. Both conditions are much used but have not been thoroughly tested. Research on low threshold interventions for improving infant-parent relationships and preventing parental risk to influence their children's development is highly valuable.

Second, all data were collected in the participating families' homes. It is probably that being in their familiar setting ensured the families were comfortable, which should strengthen the external validity of the results. Furthermore, the participating families were representative of the target families the VIPI intervention aims to help, which also strengthens the external validity of the study.

A third strength is the assessment of the WMCI at two time points, which has rarely been done in prior research. Coding the WMCI is both time- and resource-consuming, and very few reliable WMCI raters are available in Norway. Therefore, this study gives a unique opportunity to investigate various research questions, including change over a mean period of eleven months as an effect of interventions (Paper II). Moreover, this study investigated the psychometric properties of the WMCI and validated the clinical scales and identified three latent factors (Paper I). To the best of our knowledge, such a thorough psychometric investigation of the WMCI has not been published before. Both the WMCI clinical scales and

the latent factors enable the continuous measurement of mothers' representations, which is more in accordance with current recommendations for attachment research than merely using a categorical approach.

Using multiple assessment methods, such as self-report questionnaires (e.g., the PSI, BDI-II, ASQ:SE), observational tools (EA Scales) and a clinical interview (WMCI) is a fourth strength worth mentioning. Each approach to data collection contributes uniquely to the understanding of the complexity of infant-mother relationships.

However, these strengths do not preclude some limitations.

4.4 Limitations

First, the sample consisted almost exclusively of mothers of infants. Thus, the results cannot be generalized to fathers. Previous research has found that mothers' and fathers' representations of their infants differ (Ahlqvist-Bjorkroth et al., 2016; Lindstedt et al., 2021; Vreeswijk et al., 2014; Vreeswijk et al., 2015). We cannot rule out that mothers' and fathers' representations may also differ in how they respond to interventions.

4.4.1 Randomization and allocation

The randomization process was less than ideal, according to current standards, as the study was designed and participants enrolled before 2010, when the Consort Guidelines were effectuated. The families were allocated in a 1-2-1-2 sequence within each site. The group size differed between VIPI (n = 88) and TAU (n = 72), which could be due to the allocation starting and ending with the same number (1 = VIPI). The recruiters may have been aware of this allocation pattern, which could have influenced their decision to recruit families or not. Some of the recruiters were skeptical about recruiting families in need of help to TAU. The group size inequality may also be due to five siblings or twins being allocated to the same group.

4.4.2 Attrition

There was some attrition from both the VIPI group and the TAU group, which is expected in a longitudinal study. At inclusion, 88 families were randomized to the VIPI group and 72 families to the TAU group. At baseline, 86 families in the VIPI group and 66 in the TAU

group were evaluated. At the follow-up, 6 months after intervention, 65 families in the VIPI group and 47 families in the TAU group were assessed. The attrition rates were highest after group allocation, but before the intervention started (14.8 % in VIPI group; 20.8 % in TAU group). Another 9.1% (VIPI) and 6.9 % (TAU) dropped out before follow-up assessments. Thus, total dropout rates were 26.2 % (VIPI) and 34.6 % (TAU). Because of the dropout rates, the sample size should have been larger than the power analysis estimated (Høivik et al., 2015).

The mothers who dropped out of the VIPI group were at baseline, somewhat younger than drop-out mothers in the TAU group (VIPI mean 26.9 years; TAU mean 28.9 years), as were their infants (VIPI mean 7.4 months; TAU mean 9.3 months) (Paper II, Table 2). With regard to the scores on the WMCI, the mothers who were in the attrition group from VIPI had higher mean scores on the factor Balanced, and lower mean scores on the factors Resentful and Apprehensive (Paper II, Table 2). As for the WMCI categories, the drop-out mothers from the TAU group were less balanced (VIPI 47.1%; TAU 43.8%) and less disengaged (VIPI 41.2%; TAU 25.0%), but more distorted (VIPI 11.8%; TAU 31.3%) at baseline. Furthermore, compared to mothers who dropped out from the VIPI group, the drop-outs from TAU had lower scores on infant-mother interaction quality (EA Scales), and showed more depressive symptoms, but were less worried about their infant's socio-emotional development at baseline (Høivik et al., 2015). Additionally, as presented in the methods section, the mothers in the VIPI group received more help from professionals than mothers in the TAU group. It is possible that receiving the VIPI intervention made the mothers more conscious about their challenges, which motivated them to seek more help, whereas the mothers receiving TAU may have felt more resigned.

These differences between the VIPI group and the TAU group at baseline were not controlled for, thus they may potentially have had a confounding effect. However, we did not anticipate any notable effects of attrition on the main variables because we used linear mixed model analyses, which includes all participants with data from at least one time point. The results are unbiased if data are missing at random (MAR), while a complete case analysis including only participants with data from both time points would only be unbiased under a more restrictive missing completely at random assumption (MCAR).

4.4.3 Treatment as usual

The naturalistic study design had its benefits, but there were also limitations attached to it. All participating families attended the PCHP at the Well Baby Centers, which was the TAU condition in the study. In Norway, 99% of all families still attend the standard program at the Well Baby Centers when the child is two years of age (Statistics Norway, 2023). Without a control group not attending the PCHP, we cannot conclude that this standard program caused the alterations of the mothers' representations. Moreover, the multidisciplinary staff at the Well Baby Centers were bound by their ethical standards and guidelines, and could not therefore restrict additional services or referrals if needed. Help from other professionals could have interfered with the effect of the VIPI intervention.

4.4.4 Confounders

We cannot rule out that other confounding factors could have interfered with the results. Earlier studies have found that single parenthood, mothers' depression, income, and domestic abuse predict change of representations (Theran et al., 2005). In the investigation of concurrent and discriminant validity, we found that, at baseline, the mothers' representations did not correlate significantly with their level of education, the type of neighborhood, the child's gender, or the social-emotional development of the child (Paper I). Additionally, the factor Resentful correlated weakly with the age of the child, and both factor 2 Resentful and factor 3 Apprehensive correlated weakly with the mothers' symptoms of depression. As the correlations were weak or not present at all, we did not expect any confounding effects of these variables.

The second WMCI was assessed at 6 months follow-up, which precluded us from investigating an effect of the VIPI immediately after the intervention had ended. This also complicated controlling for other factors that could have influenced the results.

Moreover, the study sample was predominantly low-to-moderate-risk, and the study was conducted in Norway, which is a country of high socio-economic status and high-quality systems for education, welfare, medical care, and parental leave policies, which have positive effects on maternal mental health (Heshmati et al., 2023). It is possible that this impact of parental leave on mothers' mental health also affects features of their representations of their infants.

A further limitation pertains to the WMCI raters. Very few raters trained for reliability are available in Norway, thus the same raters coded the WMCI from both baseline and

follow-up. Moreover, the raters coded the interviews from video recordings, which means that the participants were not deidentified. The raters were unfortunately not blinded to the time of the interview. However, they were blinded to whether the participants had received the VIPI intervention or TAU, thus we did not expect this information to affect their ratings.

Lastly, the inter-rater reliability of the WMCI clinical scales was mostly moderate (Paper I), which could be considered a limitation. The weighted κ values may have been due to systematic differences in coding, but it is also likely that the prevalence of the scores on the WMCI clinical scales influenced the results. Nevertheless, other indications of rater agreement that are less influenced by prevalence and bias were high, thus the inter-rater agreement was acceptable (Paper I).

4.5 Implications for Well Baby Centers

The current study confirms that predominantly first-time mothers' negative representations, which may influence the quality of mother-infant interaction, can be detected and improved, even in a general population attending the local Well Baby Centers. The mothers with Resentful and Apprehensive representations of their infants are more likely to be stressed than balanced mothers. However, only the mothers with Resentful representations had less positive and more negative behaviors when interacting with the child. Notably, these results were evident regardless of the mothers' level of education or where they lived. The WMCI is not a screening tool that is suitable for the Well Baby Center nurses. Until such an instrument has been developed and made available for primary care services, the Well Baby Center nurses should be particularly aware of mothers who have angry or disappointed perceptions of the child or who find the child difficult to care for. Our results indicated that the supportive and promotive services provided by the staff at Well Baby Centers contributed to reduced anxious and fearful aspects of the mothers' representations, and to reduced perceptions of finding the infant difficult to care for. These findings should encourage even more emphasis on comprehensive, high quality, low threshold community services. They are especially beneficial for first-time mothers and their infants, who are particularly vulnerable and need support, information, and an arena for reflection upon parenting challenges.

4.6 Implications for clinical practice

When researchers investigate multi-faceted interpersonal phenomena there is a real danger that simplifying tremendously complex concepts reduces their relevance to the clinical field. This is true for the relationship between a mother and her child in general, and for a mother's representation of her child in particular. Maternal representations cannot be observed directly, and any assessment tool will therefore, to some degree, be an interpretation of what we think expresses a mother's perceptions of her child, the relationship with the child and herself as a caregiver, and how they are (partly unconsciously) represented in her mind. Both clinicians and researchers should keep in mind that the way in which we assess such complex concepts will influence the outcome. As some researchers have discussed: What do we measure when we measure representations? With language-based representational interviews, do we measure a mother's ability to speak clearly and coherently about her child, rather than her representation that underlies what she really does when interacting with her infant? (Sleed et al., 2020). These intricate questions support the idea of applying a multi-informant assessment approach, and imply that well-validated instruments should be used, but only by professionals who have been thoroughly trained and who are mindful about the strengths and limitations of the instrument.

That said, the findings of this thesis have some implications for clinical practice. They confirm that the WMCI clinical scales and the factors extracted from our analyses can be used in clinical practice as they are sensitive in detecting subtle yet clinically relevant alterations of mothers' representations even in predominantly low- to moderate risk populations. We suggest that the extracted factors can be used as a continuous measure in addition to the original WMCI categories, as the factor Resentful and the factor Apprehensive offer a dimension measuring externalized vs internalized negative representation, of which the externalized should be carefully noted when working with families.

Until we know more about the relation between changes in a mother's representations and changes in the quality of the mother-infant interaction quality, interventions should target both the representational level and interaction/behavioral level. Evaluations of both domains should be conducted after the intervention. Both aspects of the mother-infant relationship have consequences for long-term developmental outcomes for their infants. When observing interactions in low-risk samples, clinicians should include stressful tasks that would help in identifying negative interactional patterns that are not easily detectable in non-stressful environments.

4.7 Theoretical contribution

This thesis confirms that mothers' representations of their infants may be detected even with mothers of low- to moderate risk associated with negative parenting, and that the WMCI clinical scales are valid for use in research as well as in clinical practice with this population. Examining the psychometric properties of the WMCI clinical scales with rigorous methodology extracted three latent factors that may be used as continuous measures supplementary to the original WMCI categories. Moreover, this thesis confirms that although their representations of their child are relatively stable, mothers alter features of these representations to adjust to the child's development across infancy and toddlerhood. Supportive and preventive low threshold community services may also contribute to such alterations. Finally, this study suggests that alterations of representations may happen independently of improved mother-child interaction quality, although representations and interactions are theorized to be related parts of the mother-infant relationship.

4.8 Suggestions for future research

Clinical interviews such as the WMCI are time-consuming to learn, administer, code, and interpret, and are not suited for many professionals in primary care services. Innovating a screening tool to identify parents' representations associated with negative mother-infant relationships in such services should be the focus of future research. For clinicians using the WMCI, efforts should be made to revise the WMCI coding manual to include a clarifying description of how to rate all the WMCI clinical scales, and thereby facilitating the coding process.

Future research should investigate the efficacy of interventions targeting representations that are designed for and applicable to primary care services, as well as the core components of such interventions. Although we did not find evidence of an effect of VIPI on maternal representations of their infants beyond that of TAU, studies should investigate whether mothers with non-balanced representations benefit more from VIPI compared to TAU. Furthermore, assessing the mothers' mentalizing capacity together with the WMCI could provide more insights into how maternal representations change in low-to-moderate-risk samples.

More research over an extensive period is needed to examine developmental trajectories of how change in maternal representations of their child and change in the mother- infant interaction quality relate to each other. Little is known about whether

alterations that occur in natural circumstances are more sustainable than induced alterations. Finally, it is not yet known whether altered representations lead to more lasting effect on the quality of the parents' interaction behavior, or if improved interactive behavior without altered representations will fade as new developmental stages of the child require different behaviors from the parent.

5 Conclusions

In conclusion, the WMCI is a valid tool for assessing low-to-moderate-risk mothers' representations of their infants. Although the original WMCI categories have their advantages in distinguishing the main types of attachment representations, the WMCI clinical scales provide a complex and detailed picture of the mothers' perceptions, which is clinically useful. The VIPI did not alter aspects of the mothers' representations of their infants differently than treatment as usual at the local Well Baby Centers. Regardless of intervention group, anxious and fearful aspects of these predominantly first-time mothers' representations, as well as perceptions of the child as being difficult to care for, were improved across the mean study period of 11 months. Additionally, the mothers became slightly less sensitive as the child grew older. Finally, changes in maternal representations happened independently of changes in mother- infant interaction quality.

Public health planners and policy makers should, by all possible means, emphasize high-quality multi-disciplinary supportive, preventive, and promotive services at community Well Baby Centers that see all families. First-time mothers in particular seem to benefit from such services. Validated assessment tools and effect-evaluated low-threshold interventions applicable in primary care services should be developed and implemented to enhance early detection and intervention for families with infants.

6 References

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Appendix

Appendix A

Table A1 Description of the clinical scales of the Working Model of the Child Interview

Name of scale	Description
Richness of perceptions	The richness or poverty of detail of the caregiver's description of the child as an individual.
Openness to change	The flexibility to accommodate new information or insights about the child.
Coherence	The clarity, consistency, and believability of the caregiver's descriptions of the child.
Intensity of involvement	The degree of psychological preoccupation with the child.
Acceptance	The degree of acceptance of the child as is, and appreciation of the balance between dependence and independence.
Caregiving sensitivity	The degree of valuing the child's needs and experiences and responding appropriately.
Child difficulty	The caregiver's perceptions of the child as difficult or burdensome to care for.
Fear for child's safety	The degree of the caregiver's irrational or excessive fear for the safety of the child or fear of losing the child.
Affective tones	The degree of joy, pride, indifference, anxiety, anger, disappointment, or guilt as the overall affective tone throughout the interview.

Appendix B

Table B1 Summary of main instruments and variables used in the current thesis, specifying the target group, method, how the measure was used and psychometric properties of the measure

Name of instrument or variable	Target concept	Target group	Method	Name of scales and ways of scoring	Used as	Original psychometric properties	Psychometric properties of study
The Working Model of the Child Interview (WMCI)	Parent's representation of the child	Mothers	Semi-structured clinical interview	15 scales (richness of perception, openness to change, intensity of involvement, coherence, sensitivity, acceptance, infant difficulty, fear of safety, joy, pride, anger, guilt, indifference, disappointment) scored 0 (non) - 5 (extreme) on Likert scale. 3 categories (balanced, disengaged, distorted). Assignment based on pattern of scores on clinical scales.	Independent variable (study 1, 2 and 3) Dependent variable (study 2 and 3) Variable in correlation analyses (study 1 and 3)	Reliability Interrater agreement Cohen's κ from 0.62 to 1.0 (Schechter et al., 2008; Thernan et al., 2005) From 71 to 80% stability of the WMCI categories from prenatal to 1 year after birth and from 6-18 months after birth (Benoit et al., 1997; Borghini et al., 2006; Thernan et al., 2005; Vreeswijk et al., 2012). For review of research, see (Vreeswijk et al., 2012)	Reliability (Sandnes et al., 2021) <u>Clinical scales</u> Cohen's quadratic weighted κ mean 0.54. <u>Categories</u> Reliability: Cohens κ : 0.90 Positive agreement: 0.93 Negative agreement: 1.00 <u>Latent factors</u> Factor reliability Factor 1 Balanced: $\alpha = 0.97$ Factor 2 Resentful $\alpha = 0.79$ Factor 3 Apprehensive $\alpha = 0.86$ Concurrent validity PSI, EA Discriminant validity ASQ:SE, BDI, age of child, mothers' educational level, neighborhood
Emotional Availability Scale (EA)	Quality of infant-parent interaction	Mothers and infants (0 to 2 years)	Observational measure	3 dimensions: <u>Parental positive interaction</u> (Adult sensitivity+	Independent variable (study 3)	Reliability ICC range from 0.76 to 0.96 (Biringen et al., 2014)	Reliability (Høivik et al., 2015) ICC= 0.461 $\alpha = 0.97$

<p>Emotional Availability Scale (EA) (cont.)</p>				<p>Adult structuring), scored 1-7, <u>parental non-negative interaction</u> (Adult non-intrusiveness + Adult non-hostility reversed), scored 1-3, <u>Child positive interaction</u> (Child responsiveness + Child initiative), scored 1-3 Total score range from 42 to 174 points</p>	<p>Dependent variable (study 3) Variable in correlation analyses (study 1 and 3)</p>	<p>Validity The EA scales associated with family SES, adult variables and child variables (Célia et al., 2018). Maternal scales were relatively stable across time, stability of child scales were low (Célia et al., 2018). Review of research (Biringen et al., 2014; Easterbrooks et al., 2012; Saunders et al., 2015; Ziv et al., 2000)</p>	<p>Concurrent Validity (Sandnes et al., 2021) EA parental positive interaction and WMCI factor 1 Balanced ($r = 0.29, p = 0.001$), WMCI factor 2 Resentful ($r = -0.26, p = 0.002$). EA parental non-negative interaction and WMCI factor 1 Balanced ($r = 0.30, p = 0.001$) WMCI factor 2 Resentful ($r = -0.29, p = 0.001$) EA child positive interaction and WMCI factor 1 Balanced ($r = 0.27, p = 0.001$)</p>
<p>Parenting Stress Index (PSI)</p>	<p>Perception of parenting stress</p>	<p>Mothers</p>	<p>Parent-report questionnaire</p>	<p><u>Parent domain</u> (subscales parent competence; attachment; role restriction; spouse; isolation; depression; health), <u>child domain</u> (child reinforces parent; demandingness; acceptability) and <u>total score</u> (both domains) Subscales rated from 1 (strongly disagree) to 5 (strongly agree)</p>	<p>Variables in correlation analyses (study 1)</p>	<p>Validity, reliability, norms and usefulness confirmed in many studies, for review, see (Ríos et al., 2022).</p>	<p>Concurrent validity (Sandnes et al., 2021) PSI total score and WMCI factor 1 Balanced ($r = -0.32, p = 0.001$), WMCI factor 2 Resentful ($r = 0.51, p = < 0.001$), WMCI factor 3 Apprehensive ($r = 0.21, p = 0.023$) PSI child domain and WMCI factor 1 Balanced ($r = -0.34, p < 0.001$)</p>

<p>Parenting Stress Index (PSI) (cont.)</p>							<p>WMCI factor 2 Resentful ($r = 0.54, p < 0.001$) WMCI factor 3 Apprehensive ($r = 0.20, p = 0.035$)</p> <p>PSI parent domain and WMCI factor 1 Balanced ($r = -0.26, p = 0.006$) WMCI factor 2 Resentful ($r = 0.41, p = < 0.001$) WMCI factor 3 Apprehensive ($r = 0.19, p = 0.039$).</p>
<p>Beck Depression Inventory (BDI-II)</p>	<p>Parents' depressive symptoms</p>	<p>Mothers</p>	<p>Self-report questionnaire</p>	<p>21 questions about how the person has been feeling the last 7 days. Responses rated from 0-3. Range of total score from 0-63</p>	<p>Variable in correlation analyses (study 1)</p>	<p>Reliability Cronbach's α range 0.83 to 0.96 Retest reliability range 0.73 to 0.96</p> <p>Validity Concurrent and discriminant validity, criterion-oriented validity, content and construct validity confirmed. For review of research, see (Wang & Gorenstein, 2013).</p>	<p>Discriminant Validity (6) Correlation with WMCI factor 1 Balanced ($r = -0.13, p = 0.18$) WMCI factor 2 Resentful ($r = 0.28, p = 0.004$) WMCI factor 3 Apprehensive ($r = 0.27, p = 0.005$)</p>

Ages and Stages Questionnaire, social-emotional (ASQ:SE)	Child's social and emotional development	Infants	Parent-report	There are eight different schemes with between 19 and 33 questions covering seven areas of the child's social- and emotional development. Each scheme corresponds to different age-spans of the children. The questions are scored 0, 5 or 10	Variable in correlation analyses (study 1)	Reliability Cronbach's alpha ranged from 0.71 to 0.88, but lower for translated versions ($\alpha=0.62$ to 0.85) Interrater reliability 0.94 Test-retest reliability $r = 1.0$ Sensitivity value 0.71 to 0.80 (less consistent in translated versions). Specificity value 0.74 to 0.91 (translated versions were not consistent). For review of research see (Velikonja et al., 2017).	Discriminant validity (Sandnes et al., 2021) Correlation with WMCI factor 1 Balanced: ($r = -0.03, p = 0.78$) WMCI factor 2 Resentful ($r = 0.13, p = 0.25$) WMCI factor 3 Apprehensive ($r = 0.11, p = 0.32$)
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Papers I-III

Paper I

Measuring mothers' representations of their infants: Psychometric properties of the clinical scales of the working model of the child interview in a low- to moderate-risk sample

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Abstract

The Working Model of the Child Interview (WMCI) is frequently used to measure parents' representations. Beyond the global categories (*balanced*, *disengaged*, *distorted*), the reliability, factor structure, and validity of all the 15 clinical scales have not previously been studied.

The WMCI was administered to 152 Norwegian mothers of infants (mean age = 7.3 months) recruited from community well-baby clinics.

Interrater reliability was adequate for the global categories and moderate for the clinical scales. Exploratory factor analysis and confirmatory factor analysis yielded three factors with evidence of factorial validity: Factor 1 *balanced*; factor 2 *resentful*; factor 3 *apprehensive*. Factor 1 corresponded with the original category *balanced*, while factor 2 and factor 3 corresponded with the original category *distorted*. Concurrent validity was supported as mothers with *balanced* representation (factor 1) were less stressed and the mother–infant interaction was more positive than that of mothers with *resentful* representation. Mothers with *resentful* or *apprehensive* representations (factor 2 and factor 3) reported more stress. The extracted factors and demographic variables correlated weakly or not at all, confirming discriminant validity. Our findings show that the clinical scales of the WMCI can be used in research with low- to moderate-risk samples.

KEYWORDS

Infant, maternal representations, psychometrics, working model of the child interview

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1 | INTRODUCTION

Parents develop internal working models (i.e., representations) of caregiving when they become parents (Bowlby, 1982). These caregiving representations include feelings, thoughts, ideas, and experiences with the child's needs, emerging personality, and potential. Caregiving representations also include parents' thoughts, ideas, and feelings about themselves as caregivers and the relationship they have with the child (Main et al., 1985). Operating at different levels of consciousness and involving different memory systems, these representations provide rules for processing information, which shape the expectation of themselves as parents and of the child. Representations also influence the parents' interpretation of the child's cues and signals and guide their emotional responses and caregiving behavior (George & Solomon, 1996; Verhage et al., 2018). Such representations have been chronicled as important predictors for parenting behavior and child outcomes as well as vehicles in the intergenerational transmission of attachment patterns (Foley & Hughes, 2018; Madigan et al., 2015). Therefore, targeting dysfunctional parent representations holds the promise of increasing the efficacy of preventive as well as treatment efforts.

To achieve this, parents' caregiving representations must be precisely measured. Typically, such representations are assessed through analyses of semistructured interviews modeled after the concept, structure, and coding of the Adult Attachment Interview (AAI) (George et al., 1996). However, whereas the AAI reflects the adult's current state of mind of early attachment experience, other interviews seek to describe the parents' current state of mind with a specific child. Examples of such interviews are the Parent Development Interview (PDI) (Aber et al., 1985; Slade, 2005), and the Working Model of the Child Interview (WMCI) (Zeanah et al., 1994). Both interviews aim to elicit descriptions of the relationship between parent and child as well as affect, cognition, and experience with the child, or themselves as parents (George et al., 2008).

The focus of this inquiry was on the WMCI (Zeanah et al., 1994), which is popular among clinicians and has been used in more than 50 published research articles. The WMCI is a semistructured, hour-long interview containing questions about the parent's subjective emotions, experiences, perceptions, cognitions of their child's characteristics, personality and development, the parent-child relationship, and about their emotional and behavioral responses in specific situations with the child, from pregnancy to present and to future (Zeanah & Benoit, 1995). For clinical use, the WMCI provides a scoring form with 15 clinical scales for rating the parent's description of the relationship with the child and the child's characteristics (i.e., how the parent's descriptions are reflected through

KEY POINTS

- In this study, the reliability of the clinical scales of the Working Model of the Child Interview (WMCI) was mostly moderate to good and the validity of three extracted latent factors was confirmed. Thus, the clinical scales of the WMCI can be used in research as well as in clinical practice with low- to moderate-risk populations.
- Whereas the extracted factor 1 *balanced* corresponded with the original category *balanced*, both factor 2 *resentful* and factor 3 *apprehensive* corresponded to aspects of the original WMCI category *distorted*. The original category *disengaged* did not manifest in the factorial structure, most likely due to the low- to moderate-risk sample. For users of the WMCI, factor 2 *resentful* and factor 3 *apprehensive* can help distinguish between externalized feelings and internalized feelings of the mothers as the clinical scales *anger*, *disappointment*, and *infant difficulty* loaded on to factor 2 *resentful* and the clinical scales *anxiety* and *fear of child's safety* loaded on to factor 3 *apprehensive*.
- Both mothers with high scores on factor 2 *resentful* or factor 3 *apprehensive* were likely to experience stress and symptoms of depression, but only mothers with *resentful* representations were likely to have less positive and more negative observed interaction behavior. The lack of associations between high scores on factor 3 *apprehensive* and mother-infant interaction behavior implies that users of the WMCI should carefully note factor 2 *resentful* when working with families of infants.

the interview) (Zeanah et al., 1997). For example, six of these clinical scales indicate qualitative features of the parent's descriptions such as how rich in detail, flexible, sensitive, accepting, organized, and coherent the descriptions of the child are. In addition, two of the clinical scales indicate the content of the parent's responses (e.g., if the parent perceives the child as difficult to relate to or if the parent holds excessive fear of the infant's safety) and the variety of affective tones (i.e., *joy*, *pride*, *anger*, and *disappointment*) that color the representation. Clinicians use these scales to plan intervention targets and goals and for postintervention evaluation. For research purposes, the ratings on the clinical scales can be assigned to one of three global categories: *balanced*, *disengaged*, or *distorted* (the two latter groups

are denoted *nonbalanced*) (Zeanah et al., 1994). A parent's *balanced* representation is characterized by warm, sensitive, flexible, and coherent descriptions of the child and the relationship with the child. Additionally, the parent is neither distant nor overwhelmed by the child's needs, feelings, or behavior. *Disengaged* representations are characterized by an emotional distance and rejection of the child's emotional needs and dependency. In contrast, *distorted* representations are typically characterized by inherent, confused, and contradictory descriptions of the child and their relationship. The parent is emotionally overwhelmed by the child's needs (Zeanah et al., 1996). Several studies have shown concordance between the categories balanced, disengaged, and distorted and infant attachment patterns secure, avoidant, and resistant/ambivalent (Benoit et al., 1997; Madigan et al., 2015). A representational equivalent to the disorganized attachment pattern is not available by the original coding scheme or the coding manual. The fourth type of category named WMCI disrupted has been proposed (Crawford & Benoit, 2009) by using items from the Atypical Maternal Behavior Instrument for Assessment and Classification (AMBIENCE) (Lyons-Ruth et al., 1999), which reflects disrupted caregiving behavior. Associations between WMCI disrupted, infant disorganized attachment pattern, and mother's unresolved mourning or trauma have been reported (Crawford & Benoit, 2009).

The psychometric properties of the three global categories, or *balanced* and *nonbalanced* (*distorted* and *disengaged* collapsed into one category), of the WMCI have been documented both in clinical and nonclinical samples (Benoit et al., 1997; Madigan et al., 2015; Rosenblum et al., 2004; Theran et al., 2005). The global categories are associated with maternal and child characteristics and outcomes, such as mothers' personality traits (Lannert et al., 2013), maternal psychological distress (Schechter et al., 2015), maternal parenting, and interactive behavior (Hall et al., 2015), and child socioemotional development (Rosenblum et al., 2002).

There is a lack of studies investigating the psychometric properties of the clinical scales most likely because reliability on the subscales is difficult to reach. To our knowledge, despite the WMCI holding clinical popularity, only two studies have investigated the factorial structure of some of the clinical scales. (1) A prospective study of pregnant women experiencing domestic violence constructed a latent factor labeled prenatal representation of caregiving based on correlations of five clinical scales (Huth-Bocks et al., 2004). (2) A study of contributing factors to child (mean age 6.46 years) maltreatment (by mothers) found that 12 clinical scales loaded onto three latent factors (*qualitative features*, *affective tones*, and *indifference*) (Sprang et al., 2005). Only the factor *qualitative features* correlated with child maltreatment, excluding factors *affective*

tones and *indifference* from further analysis. Findings from maltreating and maltreated parents may not generalize to less disturbed parents and parent-child relationships (Sokolowski et al., 2007). Sprang et al. (2005) stated that a rigorous psychometric evaluation of all the clinical scales of the WMCI will enhance future research; thus, investigating the factorial structure and validity of all 15 clinical scales in a low- to moderate-risk sample is necessitated.

In comparison, the PDI, which is a "conceptual cousin" of the WMCI (Slade, 2005) also offers a scoring form with continuous scales for rating qualitative features of the parent's descriptions (i.e. overall coherence and richness of details) and a variety of affects that color the representation (i.e. anger, joy, pleasure). However, whereas the PDI scales are used to code three major features of the representation: (1) the representation of the affective aspect of parenting; (2) the representation of the child's affective experience; and (3) the parent's state of mind in relation to the child, the WMCI scales are used to assign the representations to one of three categories (balanced, disengaged, or distorted). The PDI was validated in a community of middle- and a working-class sample of infant boys (10–21 months) and their mothers (Slade et al., 1999). To investigate the underlying structure of the representations, a factor analysis of the 16 PDI variables yielded three factors: (1) *joy-pleasure/coherence*, (2) *anger*, and (3) *guilt-separation distress*. Construct and predictive validity was confirmed between the three factors, maternal attachment, and observed mothering behavior (Slade et al., 1999).

1.1 | Research aim

In this study, we examined (i) interrater reliability, (ii) factorial structure, (iii) factorial validity, (iv) concurrent validity, and (v) discriminant validity of the 15 clinical scales in a low- to moderate-risk sample.

2 | MATERIALS AND METHODS

2.1 | Participants

We used data from a naturalistic, longitudinal, multi-site, randomized controlled trial study, of a video-feedback infant-parent interaction intervention (Hovik et al., 2015). Of the 158 participating families from urban and rural areas, 50.9% were recruited by nurses at well-baby clinics, a national health service used by over 98% of families with infants in Norway (Statistics Norway, 2018). Other primary care professionals recommended the rest. Six families withdrew from the study, leaving 152 families with completed preintervention evaluation. During the study

period from March 2008 to September 2012, 40 families withdrew or were excluded from the study due to foster care placement of the child, parental illness (mental or physical), or family relocation. There were 112 families that completed the last evaluation 11 months after inclusion. Inclusion criteria were parent–child (0–24 months) interactional problems defined by the parents, nurses, or other professionals. Parents with severe mental health disorders, developmental disorders, substance abuse, or insufficient language skills were not included. At recruitment, the participating parents reported worrying about the infant's regulation problems (32.6%), parent–child interactional problems (14.5%), parental mental health problems (3.6%), developmental delay (3.2%), social development of infant (2.4%), interest in the research study (10.8%), and need for support (2.2%). In all, 30.7% of the parents reported no reason for participating. Both mothers and fathers were invited to the study, but in almost all families, the mothers participated.

Sample characteristics are presented in Table 1. At inclusion, the infants' mean age was 7 months (SD 5.1 months); 51% were girls, living with both parents (82.9%) in a household with a median monthly income after tax equal to national numbers. Mothers' mean age at inclusion was 29.7 years (SD 5.6 years); nearly 63% had a bachelor's degree or higher education and were of Norwegian (82.6%) or European (6.5%) origin.

Few high-risk families were in this sample. Only 3% of the families were recruited by Child Protective Services (CPS). The CPS preferred to refer high-risk families to other interventions, thereby forgoing the risk of them being randomized to a control group. For the participating mothers, the mean level of symptoms of depression, anxiety, stress, and alcohol consumption was below the level of concern. The mean developmental status of the infants indicated no risk and the mean score of observed parent–child interaction behavior was moderate (Emotional Availability Scale (EAS) mean total score = 137.9). Moreover, five families (3.3%) received financial or other support from CPS, which is less than in the total population (5.2%). In conclusion, the sample was heterogeneous, low-to-moderate risk, with a minor number constituting a higher risk; for a detailed description of the sample, see Høivik et al. (2015).

2.2 | Procedure

In the original study, data were collected at three time points: preintervention, postintervention (2–3 months after inclusion), and at follow-up 6 months postintervention. In our investigation, we used data from the preintervention evaluation. For one analysis (described later), we

included data from the follow-up assessment. At these two time points, data were collected by three research assistants at two to three visits in a naturalistic setting in the participants' homes, over a period of 1–2 weeks. First, the participating mothers completed self-report inventories about themselves (e.g., symptoms of depression), about the child's social-emotional development, and an interview assessing demographic data. Then, 1–2 weeks after the first visit, the WMCI and a structured infant–parent interaction observation (EAS) were conducted. In order to facilitate coding, the WMCI and the observation of the infant–parent interaction were videotaped by the research assistants.

2.3 | Measures

2.3.1 | Working model of the child interview

The WMCI is a 60- to 90-minute, standardized, semistructured interview designed to elicit the caregiver's thoughts, feelings, and experiences about their infant, themselves as caregivers, and the relationship they have with the child. Examples of questions in the WMCI are

What about your child's behavior now is most difficult for you to handle? Can you give me a typical example? What do you feel like doing when your child reacts this way? How do you feel when your child reacts this way? What do you actually do? (Rosenblum et al., 2004; Zeanah et al., 1996)

The interview is preferably audio/videotaped to facilitate coding (Rosenblum et al., 2004; Zeanah et al., 1996). The parent's descriptions and affects expressed throughout the interview are rated from 1 (*none*) to 5 (*extreme*) on the 15 clinical scales. The following six scales assess qualitative features of the parent's descriptions: (1) *richness of perception*: degree of richness in the parent's description of the infant; (2) *openness to change*: flexibility to accommodate new information about the infant, parenting, and the relationship to the infant; (3) *intensity of involvement*: degree of psychological preoccupation or immersion in the relationship with the infant; (4) *coherence*: clarity, consistency, and believability of the parent's descriptions; (5) *caregiving sensitivity*: parent's ability to understand and respond sensitively to the infant's unique and changing developmental needs and experiences; (6) *acceptance*: the degree of acceptance for the infant, including parental responsibilities. The next two scales are based on the content of the parent's representation: (7) *infant difficulty*: perception of the infant as burdensome or to difficulty relating; (8) *fear for safety*:

TABLE 1 Sample characteristics at inclusion

Characteristics	N	Mean (SD)	Percentage
Child characteristics	140		
Age at inclusion (months)	141	7.3 (5.1)	
Gender	141		
Boy			49.0
Girl			51.0
Child living with	140		
Both parents			82.9
Mother			15.7
Mother and stepfather			0.7
Mother and father alternately			0.7
Maternal characteristics			
Age at inclusion (years)	140	29.7 (5.6)	
Ethnic origin	96		
Norwegian			82.6
Other European			6.5
Asian			5.4
African			3.3
South American			2.2
Education level	140		
Junior- or senior high school			17.8
Vocational education			19.3
Bachelor's degree			25.0
Master's degree or higher			37.9
Family monthly income after tax (in 1000 Nkr) (Median normal population 2011)	135	33.9 (17.5) (35.9)	
Parent Stress Index (PSI)			
Adult domain	116	125.64 (25.97)	
Child domain	117	83.43 (22.41)	
Total score	116	209.14 (44.44)	
Alcohol consumption (Audit)	105	3.56 (2.78)	
Depression (BDI)	119	12.03 (8.63)	
Anxiety (BAI)	120	5.58 (6.48)	
Child socioemotional development (ASQ: SE)			
6 months	51	29.21 (22.28)	
12 months	23	22.87 (17.73)	
18 months	11	17.27 (7.86)	
24 months	1	15.00	
Parent–infant interaction (EAS)	152	137.91 (28.15)	

Abbreviations: ASQ: SE = Ages and Stages Questionnaire: Social and Emotional; AUDIT = Alcohol Use Disorders Identification Test; BAI = Beck's Anxiety Inventory; BDI = Beck's Depression Inventory; EAS: Emotional Availability Scales.

excessive or irrational fear of the child's safety or loss of the child. Finally, the following seven scales rate the affective tones expressed in the interview: (9) *joy*, (10) *pride*, (11) *anxiety*, (12) *anger*, (13) *guilt*, (14) *indifference*, and (15) *disappointment* expressed during the interview are then scored subsequently. The raters use these scale scores to assign the representations to one of three global categories: *balanced*,

disengaged, or *distorted*. *Balanced* representations are characterized by the integration of both negative and positive aspects of the child, valuing the relationship with them, and considering it important for the child's development. The *disengaged* category indicates an emotional detachment and indifference, giving unelaborated descriptions of the child. *Distorted* representations are inconsistent,

confused, or contradictory descriptions of the infant. The parent seems preoccupied with other concerns, or anxious and overwhelmed by the infant's needs. The category WMCI disrupted can be assessed by including items from AMBIENCE (Lyons-Ruth et al., 1999). This category reflects disruptive caregiver behavior associated with infant disorganized attachment. Unfortunately, no WMCI raters trained for WMCI-disrupted were available for our study. Studies have shown 71–80% overall WMCI category stability from prenatal to 1 year after birth (Benoit et al., 1997; Theran et al., 2005) and 76% postnatal stability 6–18 months after birth (Borghini et al., 2006). Reported inter-rater agreement (Cohen's kappa) ranges from .62 to 1.0 (Schechter et al., 2008; Theran et al., 2005).

In our study, the interviews were coded by two certified raters, a clinical psychologist and a professional with a master's degree in preschool education. Of the completed evaluations at preintervention ($n = 152$), 10 WMCI interviews were missing or excluded due to unsatisfactory recording quality; thus, 142 interviews were coded. For the confirmatory factor analysis (CFA), we included 104 coded WMCI's, conducted at follow-up after intervention (eight were missing or excluded due to poor recording quality). The raters double-coded 20 randomly assigned interviews from preintervention and 18 interviews from the follow-up assessment. Disagreements on the global categories were settled by the conference. Disagreements on the clinical scales were not discussed.

2.3.2 | Emotional availability scales

These scales evaluate the bidirectional quality of parent-child interaction on six dimensions, four of which pertain to the parent's contribution to the interaction (adult sensitivity, adult structuring, adult nonintrusiveness, and adult nonhostility) and two that capture the child's contribution (child responsiveness and child involvement of the adult) (Biringen, 2008). High scores equal positive interactions. Four coders certified by Zeynep Biringen in the fourth edition of the EAS independently scored the recorded EAS. The coders' educational background was either a bachelor's degree in preschool education, specialization in clinical psychology or psychiatry, or a postgraduate student of clinical psychology. The intraclass correlation between the raters was .461 (Høivik et al., 2015). Previous research has indicated that the parent EAS taps two correlated dimensions: sensitivity/structuring and nonintrusiveness/nonhostility (Wichstrøm et al., 2013). We named these dimensions EAS parental positive interaction (sensitivity/structuring) and EAS parental nonnegative interaction (nonintrusiveness, nonhostility). We then computed a measure of the child's contribution to the interaction, EAS

child positive interaction, by combining the dimensions of child involvement and child responsiveness. Parent-child interaction behavior is hypothesized to be related to yet clearly distinct from the construct parental representation, therefore we included the EAS as a measure of concurrent validity (Stern-Bruschweiler & Stern, 1989)

2.3.3 | Parenting stress index

The parenting stress index (PSI) is a self-report measure of experienced stress in a relationship between the parent and a specific child (Abidin, 1990). As the PSI measures parent's perception of parenting stress, this scale is related to, albeit different from, measures of parent's representations of the child, and was therefore included as a concurrent validity measure. At preintervention, all participating mothers filled out a modified 67-item version of the original 120-item scale. The items were rated from 1 (*strongly disagree*) to 5 (*strongly agree*). High scores indicate high levels of stress. We computed a parent domain by the subscales: parent competence, attachment, role restriction, spouse, isolation, depression, and health. Further, a child domain of the subscales, child reinforces parent, demandingness, and acceptability was derived. Finally, a total score was arrived at by adding parent domain and child domain.

The following instruments are included as discriminant validity measures as they are distinct from parental representations:

2.3.4 | Beck depression inventory

Self-report of parent's depressive symptoms was measured at preintervention using Beck's Depression Inventory (BDI; $\alpha = .88$). In BDI, 21 questions about how the individual has been feeling over the past 7 days are rated from 0 to 3. A total score ranged from 0 to 63, where 0–13 indicated no or minimal depression, 14–19 mild depressive symptoms, 20–28 moderate depressive symptoms, and 29–63 severe depressive symptoms (Beck et al., 1996).

2.3.5 | Ages and stages questionnaire, social-emotional

The Ages and stages questionnaire, social-emotional (ASQ:SE) is a validated, parent-completed screening questionnaire on the social and emotional development of the child (Salomonsson & Slead, 2010; Squires et al., 2002). The questions cover seven child developmental areas: self-regulation, compliance, communication, adaptive functioning, autonomy, affect, and interaction. High scores of

the ASQ: SE indicate the need for further investigation of social and emotional difficulties. We computed adjusted scores due to varied content and cutoff values on the different age-specific forms. A normative mean from the ASQ: SE manual was subtracted from the sample mean of each age-specific form, then age-specific adjusted ASQ: SE scores were calculated (Høivik et al., 2015).

2.4 | Statistical analyses

We used 20 WMCI double-coded cases from preintervention assessment to investigate the interrater reliability of the WMCI. First, we calculated Cohen's quadratic weighted κ for the two raters' scores on the 15 scales. Next, Cohen's κ was calculated for the three main classifications (*balanced*, *distorted*, *disengaged*) and a dichotomized classification, *balanced* versus *nonbalanced*. Cohen's κ gives paradoxically low values when there is a high agreement in one classification (most parents were expected to be classified *balanced*). Hence, we calculated positive and negative agreement (agreement for *balanced* and for *nonbalanced*, respectively) (de Vet et al., 2013; Fagerland et al., 2017). In further analysis, we used a mean of the two scores on the double-coded cases.

To investigate the factor structure, we decided to include all 15 WMCI scales into the factor analysis. Even though the three groups of scales (qualitative, content, and affect) are distinct from each other they are not independent of each other as the coding manual emphasizes that patterns of scores on all scales must be evaluated together when classifying the parent's representation into one of the three categories (*balanced*, *disengaged*, or *distorted*). We note that this approach is also applied in another study of the WMCI (Sprang et al., 2005) and of the PDI (Slade et al., 1999). First, we conducted an exploratory factor analysis (EFA) on a randomly selected half of the sample, followed by a CFA to test the identified factors in the other half of the sample. In our attempt, this CFA analysis did not converge, most likely due to the low sample size. Therefore, we conducted the EFA with WMCI data from preintervention followed by structural equation modeling (SEM) as a generalization of the CFA with WMCI data from preintervention and follow-up together with the double-coded cases ($n = 284$). The first step of investigating the factor structure of the WMCI was to study the correlation matrix of the WMCI scales, followed by conducting the EFA with the principle component factor. Then, we used the correlation matrix, factor loadings, scree plot, and eigenvalues to identify the number of factors. We used the oblique rotation *ProMax* to enable the factors to correlate and set the value $> .70$ to distinguish between significant and non-significant loadings (Mehmetoglu & Jakobsen, 2016).

Finally, we generated the factor score of each factor and computed Cronbach's α to test the reliability of the scale, setting $\geq .70$ as the acceptable value.

We then tested the EFA-extracted factors by using SEM with WMCI data from two time points in the study and the double-coded cases. We included participants as a random effect, coder, time point (follow-up vs. preintervention), and intervention (vs. treatment at usual) at follow-up as fixed effects. This SEM analysis was conducted using the routine Generalized Structural Equation Modeling (GSEM) in Stata15.

To assess the association between the extracted factors and the original categories, we compared the mean scores of the factors with the original categories and then carried out multinomial logistic regression with the three original categories as dependent variables and the three factors as covariates.

To test the concurrent validity, we calculated the correlations between the extracted factors and the EAS (parental positive interaction, parental nonnegative interaction, and child positive interaction) and the PSI (total score, child domain, and parent domain). To find discriminant validity, we calculated correlations between the extracted factors and social-emotional development of the child (ASQ: SE), child age, child gender, mother's level of depression, mother's educational level, and neighborhood.

We estimated extracted factor scores as the mean of available scores on the scales if data were available for at least half of the scales. For the rest, we used available case analyses. This means that in each analysis we included the observations with complete data on the relevant variables. p -Values less than .05 were regarded as statistically significant. Due to multiple hypotheses, p -values between .05 and .01 should be interpreted with caution. We report 95% confidence intervals (CI) where relevant. Analyses were carried out in SPSS 25 and Stata15.

2.5 | Ethics

The Norwegian Centre for Research Data (NSD) and later the Regional Committee for Research Ethics in Mid-Norway (REC) approved the collection and storage of data in the original study entitled "A randomized controlled trial of the intervention video-feedback of infant-parent interaction (VIPI) for infants under 2 years of age." The reference number is 1.2007.2176. The study is registered in the International Standard Randomized Controlled Trial Number registry with reference number ISRCTN 99793905. All participants provided their informed written consent. Our study was found to be exempt (REC reference 2017/1723) because data from the original study had been anonymized.

TABLE 2 Rater agreement measured with quadratic weighted kappa (κ_w) and confidence interval for 15 clinical scales in the 20 double-coded cases

WMCI scale	n	κ_w	95% CI
Richness of perception	20	.605	[.302, .908]
Openness to change	20	.537	[.279, .795]
Intensity of involvement	20	.546	[.326, .765]
Coherence	20	.347	[.072, .623]
Caregiving Sensitivity	20	.642	[.427, .858]
Acceptance	19	.514	[.258, .771]
Joy	20	.467	[.234, .701]
Pride	20	.423	[.180, .667]
Anger	20	.725	[.560, .889]
Disappointment	20	.483	[.131, .835]
Anxiety	20	.605	[.359, .852]
Guilt	20	.590	[.115, 1.00]
Indifference	20	.426	[.109, .743]
Infant difficulty	20	.756	[.580, .931]
Fear of safety	20	.420	[.248, .593]

3 | RESULTS

3.1 | Reliability and agreement between coders

Rater agreement on the 15 clinical scales for the 20 double-coded cases from the preintervention evaluation is shown in Table 2. Cohen's quadratic weighted κ for the scales varied from 0.347 to 0.756 (mean 0.539). One coder systematically rated the scales higher (mean 0.55 points) than the other (see Supplemental Material, Tables S1–S15).

The distribution of WMCI global categories of the 20 double-coded cases is presented in Supplemental Material, Tables S16–S17. Cohen's κ for the three factors: *balanced*, *disengaged*, and *distorted* was .898 (CI [.704, 1.00]) and for *balanced* versus *nonbalanced* Cohen's κ was .886 (CI [.671, 1.00]). The specific agreement between the two raters was .929 (positive agreement) and 1.00 (negative agreement).

3.2 | Factor structure of the WMCI scales

The correlations between the clinical scales are presented in Table 3.

The correlations supported the four factors extracted by the EFA with eigenvalues ≥ 1 and rotated factor loadings ≥ 0.7 . The scales *richness of perceptions*, *openness to change*, the *intensity of involvement*, *coherence*, *caregiving sensitivity*, *acceptance*, *joy*, and *pride* were positively correlated with each other ($r = .698$ – $.868$) and loaded on to factor 1, we labeled *balanced* (rotated factor loadings .728–

.984, factor score 3.28, $\alpha = .97$). The scales *anger*, *disappointment*, and *infant difficulty* correlated positively with each other ($r = .447$ – $.650$) and loaded on to factor 2, we labeled *resentful* (rotated factor loadings .821–.877, factor score 1.68, $\alpha = .79$). The scales *anxiety* and *fear* for safety correlated positively ($r = .750$) and loaded on to factor 3, we labeled *apprehensive* (factor loadings .703 to .898, factor score 1.82, $\alpha = .86$). The EFA identified the WMCI scale *guilt* as factor 4 with rotated factor loading .858 (Cronbach's α not defined). The scale *indifference* did not load on to any of the four factors; thus, we excluded it from further analyses.

The GSEM is presented in Figure 1. The data did not converge when we tested a 4-factor model, possibly because only one scale (*guilt*) loaded on to factor 4. Thus, we tested a model with factor 1, factor 2, and factor 3, and *guilt* as an independent variable. This model converged.

3.3 | Associations between the extracted factors and the original categories

The distribution of the assigned original categories is presented in the Supplementary Material, Table S18. Table 4 compares the mean scores on the factors by the assigned original categories. Factor 1 was higher for mothers in the original *balanced* category, compared to mothers in the *disengaged* or *distorted* categories. The mean scores on factor 2 and factor 3 were higher for mothers in the *distorted* category compared to mothers in the *balanced* category. These findings were supported by the multinomial logistic regression (presented in table 5), which showed that factor 1 predicted the *balanced* category ($p < .001$), while both factor 2 and factor 3 predicted the *distorted* category ($p = .034$ and $p = .028$, respectively).

3.4 | Concurrent and discriminant validity across instruments

To test the concurrent validity of the extracted factors, we investigated the correlations between factor 1 *balanced*, factor 2 *resentful*, factor 3 *apprehensive*, and the variable *guilt*, with the PSI (child domain, adult domain, and total score) and the observational measure EAS (parent positive interaction, parental nonnegative interaction, and child positive interaction). Factor 1 *balanced* correlated negatively with the PSI total score ($r = -.318$, $p = .001$), the PSI child domain ($r = -.335$, $p < .001$), and the PSI parent domain ($r = -.258$, $p = .006$). Factor 2 *resentful* correlated positively with the PSI total score ($r = .510$, $p < .001$), the PSI child domain ($r = .544$, $p < .001$) and the PSI parent domain ($r = .406$, $p < .001$). Factor 3 *apprehensive* and the

TABLE 3 Correlation matrix for the 15 clinical scales of the WMCI

	Openness to change	Intensity of involvement	Coherence	Acceptance	Sensitivity	Joy	Pride	Anger	Diss-appointment	Indifference	Child difficulty	Anxiety	Fear of safety	
Perception	1.000													
Openness to change	.803	1.000												
Intensity of involvement	.803	1.000	1.000											
Coherence	.795	.791	.791	1.000										
Acceptance	.698	.761	.761	.806	1.000									
Sensitivity	.762	.805	.805	0.828	.805	1.000								
Joy	.778	.786	.786	.758	.788	.774	1.000							
Pride	.778	.765	.765	.741	.749	.712	.868	1.000						
Anger	-.216	-.276	-.276	-.328	-.477	-.362	-.299	-.299	1.000					
Disappointment	-.315	-.262	-.262	-.316	-.409	-.279	-.375	-.349	.347	1.000				
Indifference	-.490	-.453	-.453	-.490	-.415	-.528	-.430	-.457	.350	.283	1.000			
Child difficulty	-.302	-.305	-.305	-.426	-.562	-.353	-.376	-.362	.650	.574	.230	1.000		
Anxiety	-.073	-.091	-.091	-.157	-.092	-.073	-.101	-.076	.205	.176	.081	.228	1.000	
Fear of safety	.031	-.007	-.007	-.055	-.016	-.035	-.025	-.033	.263	.111	.135	.295	.750	1.000
Guilt	-.157	-.231	-.231	-.310	-.316	-.199	-.283	-.205	.040	.233	-.046	.233	.356	.112

Table 3 shows the correlations for the 15 clinical scales of the WMCI. The scales loading onto factor 1 *balanced* are marked with yellow, factor 2 *resentful* are marked in green, and factor 3 *apprehensive* are marked in blue.

TABLE 4 Mean score of the extracted factors by the original categories

Original category	Factor 1 <i>balanced</i> M (SD)	Factor 2 <i>resentful</i> M (SD)	Factor 3 <i>apprehensive</i> M (SD)
Balanced (n = 81)	3.874 (0.647)	1.407 (0.483)	1.707 (0.758)
Disengaged (n = 32)	2.487 (0.432)	1.969 (0.880)	1.625 (0.914)
Distorted (n = 26)	2.510 (0.357)	2.216 (0.610)	2.462 (1.148)

variable *guilt* both correlated positively with the PSI total score ($r = .213, p = .023$ and $r = .190, p = .043$, respectively) and with the PSI child domain ($r = .197, p = .035$ and $r = .186, p = .046$, respectively). We found weak positive correlations between factor 3 *apprehensive* and the PSI parent domain ($r = .194, p = .039$). To summarize, mothers who scored highly on factor 1 *balanced* experienced less parental stress than mothers who scored highly on factor 2 *resentful* and factor 3 *apprehensive*.

Factor 1 *balanced* and factor 2 *resentful* correlated with the observational measures of parent–infant interaction. Factor 1 *balanced* correlated positively with the EAS parental positive interaction ($r = .289, p = .001$), the EAS parental nonnegative interaction ($r = .301, p = .001$), and the EAS child positive interaction ($r = .273, p = .001$). Factor 2 *resentful* correlated negatively with both the EAS parental positive interaction ($r = -.258, p = .002$) and the

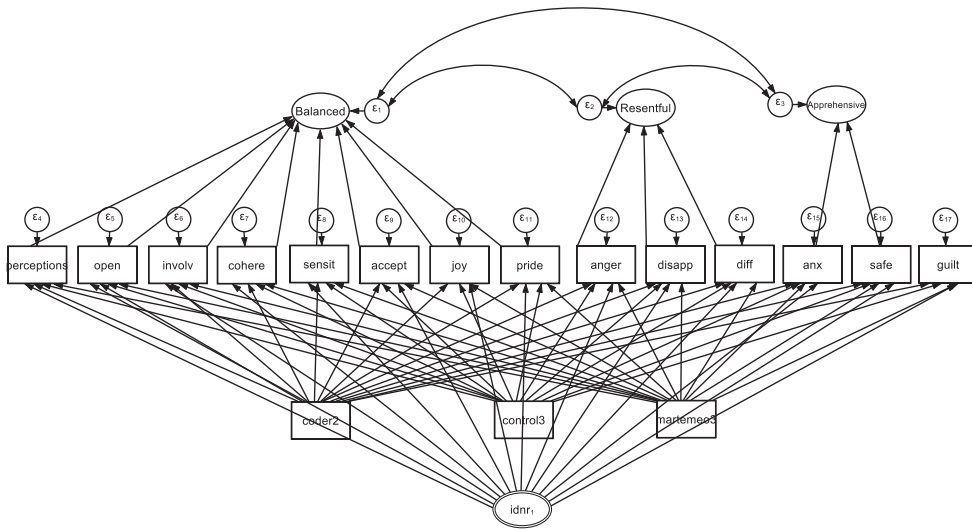
EAS parental nonnegative interaction ($r = -.292, p = .001$). This means that mothers with high scores on factor 1 *balanced* had more positive and less negative observed behavior when interacting with the infant than mothers scoring highly on factor 2 *resentful*. The infants of mothers scoring highly on factor 1 *balanced* also had positive observed interactional behavior, but we found no association between the infants’ observed behavior and factor 2 or 3. Factor 3 *apprehensive* and the variable *guilt* were not associated with parent–child interaction behavior. As Table 6 displays, the three factors derived from this sample correlated with PSI domains, and factor 1 *balanced* and factor 2 *resentful* correlated with EAS dimensions, indicating concurrent validity between these measures.

We tested the three extracted factors and the variable *guilt* for discriminant validity with infant and maternal variables: child social- and emotional development, child

TABLE 5 Extracted factors’ prediction of the original categories, derived by multinomial logistic regression analysis

Original category	Extracted factors	B	p
Disengaged	Factor 1	-5.653	.001
	Factor 2	1.133	.089
	Factor 3	0.271	.588
Distorted	Factor 1	-6.221	.001
	Factor 2	1.451	.034
	Factor 3	1.117	.028

Note: reference category was *balanced*.



Abbreviations: perceptions= Richness of perceptions; open= Openness to change; involve= intensity of involvement; cohere= Coherence; sensit= Caregiving sensitivity; accept= Acceptance; disapp= Disappointment; diff= Infant difficulty; anx= Anxiety; safe= Fear of safety; coder2= Coder 1 vs coder 2; control3= timepoint; martemec3= intervention vs TAU group; idnr= participant

FIGURE 1 Results of the GSEM with participants as a random effect, coder, time point, and intervention as fixed effects

TABLE 6 Correlations between three extracted factors and the guilt variable with maternal and infant variables

	Factor 1 balanced	Factor 2 resentful	Factor 3 apprehensive	Guilt
Concurrent validity				
PSI Child domain	-.335**	.544**	.197*	.186*
PSI Parent domain	-.258**	.406**	.194*	.166
PSI total score	-.318**	.510**	.213*	.190*
EAS Parental positive interaction	.289**	-.258**	-.106	-.036
EAS parental nonnegative interaction	.301**	-.292**	-.150	-.103
EAS child positive interaction	.273**	-.145	-.006	-.039
Discriminant validity				
BDI total	-.130	.275**	.268**	.174
ASQ: SE sentrert	-.031	.128	.110	.159
Child age	-.007	.247**	.001	.129
Child gender	-.121	.081	.139	.103
Mother's level of education	-.057	-.070	-.113	-.057
Neighborhood	-.144	.136	.067	.030

* $p \leq .05$ (two-tailed).

** $p \leq .01$ (two-tailed).

Abbreviations: ASQ: SE, Ages and Stages Questionnaire: Social and Emotional.; BDI, Beck's Depression Inventory; EAS, Emotional Availability Scales; PSI, Parent Stress Index.

age and child gender, mothers' depressive symptoms, maternal level of education, and type of neighborhood. There were no significant correlations between the extracted factors and child socioemotional development and child gender, but we found significant positive correla-

tions between factor 2 *resentful* and the child's age ($r = .247, p = .005$). Moreover, factor 2 *resentful* and factor 3 *apprehensive* both significantly correlated positively with mothers' depressive symptoms ($r = .275, p = .004$ and $r = .268, p = .005$, respectively), but neither of the extracted factors

correlated with the mother's level of education or type of neighborhood. In summary, the factors derived from this sample were weakly correlated or not associated at all with the infant or maternal sociodemographic variables, the infants' socioemotional development, or the mothers' symptoms of depression. We conclude that the extracted factors are independent of these variables (Table 6).

4 | DISCUSSION

This study is the first to examine the psychometric properties of all 15 clinical scales of the WMCI in a low- to moderate-risk sample of mothers with infants. Our factor analyses extracted three factors, which demonstrated concurrent and discriminant validities with other measures and sociodemographic variables. Interrater agreement on the scales was mainly moderate and interrater agreement on the global categories was adequate. Overall, our results suggest that the clinical scales have satisfactory psychometric properties for use in research and clinical practice with low-to-medium risk populations.

The factor structure in our sample supported the original global categories. The clinical scales *richness of perception*, *openness to change*, *intensity of involvement*, *coherence*, *acceptance*, and *sensitivity*, in addition to the affective scales *joy* and *pride*, loaded on to factor 1 *balanced*. This factor predicted the original category *balanced*. The scales loading on to this factor are presented in the WMCI coding manual as indicators for *balanced* when scores are moderate to high (Zeanah et al., 1996).

Factor 2 was labeled *resentful* as the clinical scales loading on this factor displayed externalized negative affects towards the infant (*anger* and *disappointment*) and negative expectations and perceptions of the infant (*child difficulty*). These clinical scales are described in the coding manual as prominent to the original category *distorted* (Zeanah et al., 1996). The manual describes a subtype of the category *distorted* as the parent being distracted from seeing the child as an individual and focused on the child's difficult behavior. This distraction is often accompanied by parental anger and disappointment, which are the same clinical scales loading on the extracted factor 2 *resentful* (Zeanah et al., 1996). The regression analysis confirmed that factor 2 *resentful* predicted the category *distorted*.

Factor 3 *apprehensive* contains the caregiver's internalized affect like *anxiety* and *fear for the child's safety*. This factor does not accurately correspond to the original global categories, but it does constitute an aspect of the original category *distorted*. As described in the manual, some parents classified with distorted representations can be strikingly bewildered, overwhelmed, and uncertain about the

infant and the relationship with the infant (Zeanah et al., 1996). Possibly, factor 3 *apprehensive*, loaded by the scales *anxiety* and *fear for child's safety*, corresponds to this subtype of the original category *distorted*. The regression analysis confirmed that factor 3 *apprehensive* predicted the original category *distorted*.

Factor 2 showed a nonsignificant trend with the original category *disengaged*, even though 23% of the participating mothers were classified *disengaged*. In the factor analyses, we excluded the clinical scale *indifference* from the model, as it did not load on to any of the extracted factors. The WMCI coding manual describes when rated > 3, the scale *indifference* is a strong indicator of the *disengaged* classification, defined as "[...] lack of caregiver emotional and personal involvement with the infant and infant-caregiver relationship" (Zeanah et al., 1996, p. 16).

Indifference may also indicate repressed hostility and anger (Rosenblum et al., 2002), yet it did not load on to factor 2 *resentful*. It is puzzling that *indifference* did not load on to any of the extracted factors, and we find the following explanations possible. First, more than half of the participating parents (50.9%) were recruited when seeking help with parenting problems, while the well-baby clinic nurses recommended the rest (49.1%) to participate in the study voluntarily. We expect that parents seeking help or who agree to participate in a longitudinal study, are involved in their infant; thus, high levels of *indifference* are not to be expected. Second, the temporal ordering of the assessments could have influenced the mothers' level of involvement. Before the WMCI interview, the mothers filled out questionnaires about the child (ASQ: SE) and perceived parenting stress (PSI). Possibly, this activated their feelings, thoughts, and perceptions of the child, thus reducing emotional distancing. Third, at inclusion, 14.1% of the mothers were rated ≥ 3 and only 1.4% were rated > 3 on the scale *indifference*. The lack of *indifference* could be due to their low- to moderate-risk status. In the high-risk samples, one would expect *indifference* and even neglect to be higher. As displayed in Table 4, the scale *indifference* correlated negatively with the scales that loaded onto the extracted factor *balanced*. This means that the mothers whose representations were less sensitive, open to change, coherent, accepting, involved, and whose perceptions were less rich and colored with *joy* and *pride*, were more likely to be *indifferent*. This finding is in accordance with earlier research concluding that in a clinical sample, low scores in the qualitative scales and high scores on *indifference* usually characterize the *disengaged* category (Benoit et al., 1997). This led us to suspect that in a low-to-moderate sample, low scores on these scales are more prominent for the category *disengaged* than the scale *indifference*.

The EFA extracted the scale *guilt* as a distinct factor. We expected this scale to load on to factor 3

apprehensive, as one of three identified factors of the PDI comprised of *guilt* and *separation distress* (Slade et al., 1999). In our sample, this scale did not show concurrent validity with other measures; thus, guilt was not a significant factor.

In sum, our three extracted factors matched the original WMCI categories even though *disengaged* did not manifest itself significantly in the factor structure. Interestingly, the results from our factor analysis are similar to the results from the factor analysis of the PDI which identified three factors (1) *joy–pleasure/coherence*, (2) *anger*, and (3) *guilt–separation distress* (Slade et al., 1999).

We found evidence for the concurrent validity of the three extracted factors and measures of parental stress and observed mother–infant interaction behavior. Mothers with *balanced* representation were less likely to experience parenting stress than mothers with *resentful* or *apprehensive* representations. The mothers with *balanced* representation had more observed positive interaction behavior and less observed negative interaction behavior—their infants also had more observed positive interaction behavior. Mothers with *resentful* representation were observed to have less positive interaction behavior, but there was no association between mothers with *apprehensive* representations and observed mother–infant interaction behavior. These findings are in line with the theoretical model of the four components of the infant–parent relationship: the parents' and the infant's representation of each other and their relationship and the parents' and infant's interaction behavior (Stern-Bruschweiler & Stern, 1989). Similar results were found in the factor analysis of the PDI (Slade et al., 1999); mothers who scored highly on the factor *joy–pleasure/coherence* had more positive observed mothering than mothers rated highly on the factor *anger*. In contrast, the mothers' scores on the factor *guilt–separation–distress* were not associated with observed mothering. Further, our results indicated that the parents' *balanced* representations increased the infant's positive interaction behavior, while the *resentful* and *apprehensive* parental representations influenced the infants' interactive behavior less. Possibly, *resentful*, and *apprehensive* parental representations will have an increasing impact on the infant's interaction behavior over time as the infant gains experience with the parent. Alternatively, in a low- to moderate-risk sample, the infant's development is more robust to negative maternal representations due to the low number of risk factors.

In regard to discriminant validity, we found that the mothers' *resentful* representations correlated positively with the age of the child. This finding indicates that mother's representation is not static as she is more likely to see the child as difficult and hold negative feelings

(i.e., *anger* and *disappointment*) towards a child close to 2.5 years of age than toward a few-months-old infants. A similar result was found in a second study of the mentioned PDI sample, as the mothers' score on the *anger* factor increased with the age of the child (from 15 to 28 months) (Aber et al., 1999). Longitudinal research is needed to investigate the predictability, stability, and change of the extracted factors we found. We found no associations between the three extracted factors in this study and variables like mother's education and type of neighborhood in which the family lived, and infant's gender and socioemotional development. However, we found that mothers with *resentful* or *apprehensive* representations were more likely to have symptoms of depression, which has also been reported by other studies (Rosenblum et al., 2002). The results indicate that mother's representations of the child in this study, as measured by three extracted factors *balanced*, *resentful*, and *apprehensive*, are independent of or minimally influenced by the mothers' education, neighborhood, the child's socioemotional development, the child's age, and gender.

In regard to interrater reliability, the weighted κ values can be interpreted as good on five scales, moderate on nine scales, and fair on one scale (Altman, 1991). The distributions of the ratings are presented in the Supplemental Material (Tables 1–15). The raters systematically coded slightly different from each other (mean 0.55 points). Possibly, booster sessions would have prevented procedural drifting, but it is also likely that the prevalence of the data influenced the weighted κ values on the scales (Byrt et al., 1993). However, the raters were in very good agreement (Altman, 1991) on the global categories *balanced* and *non-balanced* representations, and the indications of interrater agreement less influenced by bias and prevalence (positive agreement and negative agreement) were high. Thus, we concluded that the interrater agreement values were acceptable.

4.1 | Strengths and limitations

The major strength of our study is that it is the first to report the examination of the psychometric properties of the 15 clinical scales of the WMCI. It can be argued that continuous scales are better suited for measuring change than a categorical approach. Our study is a promising step to providing qualitatively rich and potent information from these scales available for research as well as for clinical practice. However, our contribution is not without limitations. One obvious limitation is the reliability of some of the scales, which we already have discussed. Other limitations pertain to our sample, which consisted solely of

mothers. Although fathers initially enrolled in the study, they rarely showed up for interviews and observations.

4.2 | Conclusion, implications, for clinical practice and research

In conclusion, our results confirm that the clinical scales of WMCI provide a valid and reliable measure of parental representations in low-to-moderate risk populations. This has implications for research as well as for clinical practice. Even in low–medium risk populations, stressed or depressed mothers can hold negative representations of the infant that are associated with less positively observed mothering behavior, possibly contributing to future problems in this relationship. Community-based family services should identify mothers with possible negative representations for tailoring preventive interventions to the mother–child interaction. We suggest that the extracted factors can be used in addition to the original WMCI categories, as factor 2 *resentful* and factor 3 *apprehensive* offer a dimension measuring a parent's externalized versus internalized negative representation of which the externalized should be carefully noted when working with families. One possible reason for the lack of published studies using the clinical scales could be difficulty in obtaining high interrater reliability. A revision of the coding manual should include a thorough description of the rating of all scales and a clarification of the guidelines to facilitate coding even for nonclinicians using the WMCI.

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CONFLICT OF INTEREST

We have no conflicts of interest to disclose.

ETHICS

The NSD and later the REC approved the collection and storage of data in the original study entitled "A randomized controlled trial of the intervention VIPI for infants under 2 years of age." The reference number is 1.2007.2176. The study is registered in the International Standard Randomized Controlled Trial Number registry with reference number ISRCTN 99793905. All participants provided their informed written consent. Our study was found to be exempt (REC reference 2017/1723) because data from the original study had been anonymized.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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Supplemental material: Paper I

Online Resource

Article: Measuring mothers' representations of their infants: Psychometric properties of the clinical scales of the Working Model of the Child Interview in a low- to moderate risk sample

Journal: Infant Mental Health Journal

Table S1 *Ratings of WMCI scale Richness of perceptions on double coded cases*

Coder 1	Coder 2				Total
	2	3	4	5	
2	3	0	0	0	3
3	2	1	0	3	6
4	0	0	8	2	10
5	0	0	0	1	1
Total	5	1	8	6	20

Table S2 *Ratings of WMCI scale Openness to change on double coded cases*

Coder 1	Coder 2				Total
	2	3	4	5	
2	1	2	0	0	3
3	1	2	1	3	7
4	0	0	3	4	7
5	0	0	0	2	2
Total	2	4	4	9	19

Table S3 Ratings of WMCI scale Intensity of involvement on double coded cases

Coder 1	Coder 2				Total
	2	3	4	5	
2	2	1	1	0	4
3	1	1	1	1	4
4	0	1	2	9	12
5	0	0	0	0	0
Total	3	3	4	10	20

Table S4 Ratings of WMCI scale Coherence on double coded cases

Coder 1	Coder 2				Total
	2	3	4	5	
2	2	3	0	0	5
3	0	1	1	5	7
4	0	2	4	2	8
5	0	0	0	0	0
Total	2	6	5	7	20

Table S5 Ratings of WMCI scale Caregiving sensitivity on double coded cases

Coder 1	Coder 2				Total
	2	3	4	5	
2	2	1	0	0	3
3	0	4	0	1	5
4	0	2	0	8	10
5	0	0	0	1	1
Total	2	7	0	10	19

Table S6 Ratings of WMCI scale Acceptance on double coded cases

Coder 1	Coder 2					Total
	2	3	4	5		
2	0	1	0	0	1	
3	1	5	1	2	9	
4	0	1	1	5	7	
5	0	0	0	2	2	
Total	1	7	2	9	19	

Table S7 Ratings of WMCI scale Joy on double coded cases

Coder 1	Coder 2					Total
	2	3	4	5		
2	3	2	0	0	5	
3	1	1	2	4	8	
4	0	1	2	4	7	
5	0	0	0	0	0	
Total	4	4	4	8	20	

Table S8 Ratings of WMCI scale Pride on double coded cases

Coder 1	Coder 2					Total
	1	2	3	4	5	
1	1	1	0	0	0	2
2	0	1	3	0	1	5
3	0	0	1	3	6	10
4	0	0	0	1	2	3
5	0	0	0	0	0	0
Total	1	2	4	4	9	20

Table S9 Ratings of WMCI scale Anger on double coded cases

Coder 1	Coder 2					Total
	1	2	3	4	5	
1	11	1	1	0	0	13
2	1	1	1	0	0	3
3	0	0	1	2	1	4
4	0	0	0	0	0	0
5	0	0	0	0	0	0
Total	12	2	3	2	1	20

Table S10 Ratings of WMCI scale Disappointment on double coded cases

Coder 1	Coder 2				Total
	1	2	3	4	
1	13	1	2	0	16
2	1	1	0	1	3
3	0	0	0	1	1
4	0	0	0	0	0
Total	14	2	2	2	20

Table S11 Ratings of WMCI scale Anxiety on double coded cases

Coder 1	Coder 2					Total
	1	2	3	4	5	
1	7	1	2	0	0	10
2	1	0	5	1	0	7
3	0	0	1	1	0	2
4	0	0	0	0	1	1
5	0	0	0	0	0	0
Total	8	1	8	2	1	20

Table S12 *Ratings of WMCI scale Guilt on double coded cases*

Coder 1	Coder 2			
	1	2	3	Total
1	13	1	0	14
2	4	1	0	5
3	0	0	1	1
Total	17	2	1	20

Table S13 *Ratings of WMCI scale Indifference on double coded cases*

Coder 1	Coder 2					Total
	1	2	3	4		
1	10	3	1	0		14
2	2	1	0	1		4
3	0	1	1	0		2
4	0	0	0	0		0
Total	12	5	2	1		20

Table S14 *Ratings of WMCI scale Difficult child on double coded cases*

Coder 1	Coder 2					
	1	2	3	4	5	Total
1	8	0	0	0	0	8
2	3	1	1	2	0	7
3	0	0	1	2	0	3
4	0	0	0	1	1	2
5	0	0	0	0	0	0
Total	11	1	2	5	1	20

Table S15 *Ratings of WMCI scale Fear for child's safety*

		Coder 2					
Coder 1		1	2	3	4	5	Total
	1	7	2	1	0	0	10
	2	0	1	5	2	1	9
	3	0	0	1	0	0	1
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	Total	7	3	7	2	1	20

Table S16 *Distribution of Classifications Balanced, Disengaged and Distorted of the 20 Double Coded Cases*

		Coder 2				
Coder 1	Classification	Balanced	Disengaged	Distorted	Total	
	Balanced	13	0	1	14	
	Disengaged	0	4	0	4	
	Distorted	0	0	2	2	
	Total	13	4	3	20	

Table S17 *Distribution of Classifications Balanced and Non-balanced* of the 20 Double Coded Cases*

		Coder 2		
Coder 1	Classification	Balanced	Non-balanced*	Total
	Balanced	13	1	14
	Total	13	7	20

*Non-balanced = Disengaged and Distorted Collapsed in One Classification

Table S18 *Distribution of WMCI Categories Balanced, Disengaged and Distorted of all participants at pre-intervention evaluation*

WMCI Category	n (%)
Balanced	81 (57)
Disengaged	32 (22.5)
Distorted	26 (18.3)
Missing	3 (2.1)
Total	142 (100.0)

Paper II



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Can mothers' representations of their infants be improved in primary care? A randomized controlled trial of a parenting intervention using video feedback in a predominantly low- to moderate-risk sample

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Introduction: Mothers' representations of their infants are important intervention targets because they predict the observed quality of infant–mother interactions. The current study investigated the influence of a video-feedback infant-parent intervention on mothers' representations of their infants beyond the effect of standard treatment.

Methods: Data from a naturalistic, randomized controlled trial of 152 predominantly low- to moderate-risk mothers (mean age = 29.7 years) with infants (mean age = 7.3 months) were used. At Well Baby Centers, all families followed the universal program, which was treatment as usual (TAU), whereas half of the families also received the intervention. The Working Model of the Child Interview categories and scales as well as three latent factors generated from a factor analysis were used to assess maternal representations at baseline and follow-up (9–13 months after baseline). A linear mixed model analysis was used to analyze the data.

Results: There were no differences in representation changes from baseline to follow-up between the control group (TAU) and intervention group. When both groups were combined, there were minor improvements in the mothers' representations at the follow-up.

Discussion: Aspects of the intervention, the quality of TAU, and the homogeneity scores of the predominantly low-risk sample may explain the intervention's lack of effect on mothers' representations beyond TAU. The supportive services at Norwegian Well Baby Centers as well as the infants' increasing age putatively contributed to the improved features of the mothers' representations in the total sample. That standard community care may affect maternal representations has not been shown before. Future research should identify the core components in interventions targeting maternal representations and examine whether those components can be incorporated in primary care. Including measures of mothers'

reflective functioning could broaden our knowledge of representations and their changeability.

Clinical trial registration: This study is registered in the International Standard Randomized Controlled Trial Number registry under the reference number ISRCTN 99793905.

KEYWORDS

maternal representations, infant, primary care, video-feedback intervention, WMCI

1. Introduction

Mothers develop perceptions and expectations of their infants and of themselves as mothers already during pregnancy (1, 2). Such perceptions and expectations or representations encompass mothers' subjective ideas, fantasies, and emotional reactions about their infant, themselves as a caregiver, and their relationship with their infant (3). Both prenatal and postnatal representations of the infant are related to observed parenting behavior, the quality of infant–mother interactions, and the infant's development of attachment to the mother (2, 4–6). Mothers' negative representations, which develop considerably early and significantly affect their interpretation of the infant and their behavioral responses, make them highly relevant targets for preventive, early interventions (7). Although negative representations are prevalent in both clinical and non-clinical samples, interventions aiming to improve such representations are more often tested with mothers with clinical levels of psychopathology or other risk indicators associated with a negative influence on parenting, such as low socioeconomic status, low educational level, victims of interpersonal violence, and problematic alcohol or substance use (7–9). The effectiveness of interventions suitable for mothers with lower risk are scarcely studied. Thus, the current randomized controlled trial investigated the effect of a low-threshold, video-feedback infant–parent interaction intervention, which is often used at community Well Baby Centers, on the representations of low-to-moderate risk mothers of infants.

Mothers' representations of their infants correspond substantially with how early care experiences are currently represented in the mothers' minds (2). A mother's representation of her infant might emerge within the framework of her current state of mind regarding her own childhood experiences of receiving care (10). For example, a mother with a coherent and flexible representation of her past experiences of receiving care will have a greater capacity to understand her child's signals accurately and respond sensitively to her child's needs. Conversely, a mother who is somewhat preoccupied with past issues, losses, and trauma or is emotionally more distant and dismissive of difficult past

experiences will be less able to correctly perceive the child's signals and more likely respond insensitively (2).

Assessing representations often involves analyzing the discourse in semi-structured interviews. The Adult Attachment Interview (11) is most frequently used for assessing adults' current state of mind regarding their own attachment experiences. For assessing mothers' representations of their infant, two validated interviews are often used: the Working Model of the Child Interview (WMCI) (12) and Parent Development Interview (13). The current study used the WMCI, which rates the qualitative features, content, and emotional tone of a mother's descriptions of her past and present experiences as well as future expectations of the infant (14). Her representations are classified as balanced if her discourse is coherent; her perceptions are open, flexible, and accepting of the child; and she refers to sensitive responses to the child's needs. Alternatively, the mothers' representations can be classified into one of the two non-balanced categories: disengaged or distorted. Disengaged representations are characterized by low emotional involvement and distant or rejecting perceptions of the child's emotional needs, whereas distorted representations are characterized by low coherence and consistency in the mothers' statements. Mothers with distorted representations may seem overwhelmed by their parenting responsibilities or are self-involved and distracted by other concerns (14, 15).

Using measures such as the Adult Attachment Interview, Parent Development Interview, or WMCI, researchers have reported that mothers' representations of their infant were up to 80% stable from pregnancy until the infant was 1 year old (1, 16). Mothers' balanced representations were more stable from pregnancy until the child was 1 year old (79%), compared to those of mothers with disengaged and distorted representations (48 and 37%, respectively) (16). Considerable stability across toddlerhood exists for mothers' representations of their relationship with their child (17). Nonetheless, mothers' representations can be influenced by the infant's characteristics, other interactions parents might have, maternal psychopathology, stressful life experiences, or interventions (18, 19). For example, Theran et al. found that the representational category changed for 38% of the mothers in their sample during the infant's first year of life (16); in the same study, a change from balanced to non-balanced representations was predicted by mothers' depression, single parenthood, experience of interpersonal violence in pregnancy, and family income. Other maternal characteristics such as personality traits have been found to buffer or magnify the effect of interpersonal violence on maternal representations (20). Moreover, research shows that daily

Abbreviations: CI, 95% confidence intervals; PCHP, Primary Child Healthcare Program; PRF, parental reflective functioning; RCT, randomized controlled study; TAU, treatment as usual; VIPI, Video Feedback of Infant–Parent Interaction; VIPP-R, Video-Feedback Intervention to Promote Positive Parenting With Discussions on the Representational Level; WMCI, Working Model of the Child Interview.

hassles increase anger-related aspects in mothers' representations across toddlerhood (17), and that there are associations between children's clinical diagnoses such as failure to thrive, sleep disorders, attention deficit hyperactivity disorder, cerebral palsy, and epilepsy, and mothers' non-balanced representations (21–24). However, such cross-sectional studies cannot examine the direction of influence—that is, whether negative maternal representations result from or contribute to the clinical status of the infant. In one study of a non-clinical sample, mothers were more often disengaged during pregnancy than after the infant was born, which indicates that gaining experience with the child may alter mothers' representations (25). How more specific child characteristics may influence change in mothers' representations has not been studied extensively. One study found that premature birth influenced changes in mothers' representations (26); however, parents' socioeconomic status and family structure may moderate this effect (27).

To our knowledge, very few randomized controlled trials (RCTs) have documented the effect of interventions on mothers' overall representational categories. Mom Power is an attachment-informed, group-based parenting education program; a study found that high-risk mothers who participated in the Mom Power program as an intervention had more balanced representations of their children compared to mothers who received the Mom Power curriculum through the mail (28). The Mom Power program encourages social support and self-care, guides mother-infant contact, and recommends additional care to mothers when necessary. Julian et al. introduced the Mom Power program to military families and discovered that parents (mothers and fathers) who participated in the program had more balanced representations than did parents who followed a home-based psychoeducational program (29).

Two other RCT studies have examined the effect of an intervention on the features of mothers' representations of their infants. Suchman et al. offered the Mother and Toddler Program, a 12-week individual psychotherapy program, in addition to outpatient treatment of substance use problems for mothers of children up to 3 years of age, compared to the control condition of receiving counseling and educational pamphlets (30); the Mother and Toddler Program improved the mothers' combined scores on measures of representational qualities such as openness, acceptance, coherence, and sensitivity.

In 2015, a systematic review concluded that parent-infant psychotherapy, which is a type of intervention designed to target parents' representations, yielded limited evidence of improvement in representations (8). Later, Fonagy et al. reported that parent-infant psychotherapy improved aspects of helplessness and hostility in maternal representations in an adverse sample of mothers with mental health problems (31).

A concept related to parental representations is parental mentalizing, which refers to a parent's capacity to see the child as a psychological agent with their own mental experiences and attune to the child's mental state (32). This capacity is suggested to be the mechanism by which maternal representations influence the mother-child relationship (33), as well as the mechanism behind the effect of an intervention on maternal representations (28). The concept of parental mentalization has been operationalized to other, partly overlapping concepts such as parental reflective functioning (PRF) (32, 34, 35). The Reflective

Functioning Scale was developed to measure parents' mentalizing capacity (32). Further, PRF has a self-reflective component and a child component, which together reflect a parent's ability to separate their own mental processes from those of the child (35). Attachment-informed interventions can improve PRF (36, 37), and prior RCTs have found that interventions may influence either self-focused or child-focused PRF (30, 36, 38, 39).

In terms of improving the infant-parent relationship in general, meta-analyses and systematic reviews conclude that interventions involving video feedback are more effective (9, 40–42). These studies included measures of parental stress, coping measures, self-confidence, and self-appreciation; however, assessments of parents' representations of their infants were not utilized. Interventions using video feedback often focus on the interaction behavior of the mother and infant, although some programs also address the mother's representational level by including discussions of how the mother's past attachment experiences influence the relationship with their infant. One intervention that includes both approaches is the Video-Feedback Intervention to Promote Positive Parenting With Discussions on the Representational Level (VIPP-R) (43). Research has shown that the VIPP-R promotes maternal sensitivity and infant attachment security, but only for mothers with non-balanced representations (44). Whether the VIPP-R also alters mothers' representations has not been reported (44). The purpose of the current study was to examine if Video Feedback of Infant-Parent Interaction (VIPI) could impact mothers' representations of their infants as measured by the WMCI. We used data from an RCT in which VIPI improved mother-infant interaction quality compared to conventional care (22). In Norway, the VIPI intervention is frequently employed in community preventative services. Thus, investigating whether VIPI also influences representations, which presumably precede parent-infant interaction, is relevant for preventative work in primary care.

The VIPI intervention originated from the core principles of the Marte Meo method, which was developed by Maria Aarts in the Netherlands (23) as one of the first video-feedback methods to support parent-child communication and interaction and promote child development. The Marte Meo method follows a solution-focused and resource-oriented approach to working with families, and its goal is to enhance parental efficacy and sensitivity to the child's signals and needs. Marte Meo is often used in early intervention and counseling in primary care but can also be applied to dyadic relationships across ages and contexts (45–49). It is widely implemented, and there are registered Marte Meo professionals in 39 countries across Europe, Africa, Asia, and Oceania (50).

Two RCT studies on the effect of Marte Meo have reported improved caregiver-infant interaction quality and child development outcomes (45, 51). Axberg et al. also identified a medium-to-large effect size on children's symptoms related to antisocial behavior as reported by parents and teachers (51). Qualitative studies have reported positive effects of the Marte Meo method on maternal sensitivity and maternal depression (52, 53). According to Gill et al., Marte Meo and its focus on positive reinforcement may be able to develop and change parents' working models of the child (30). However, this is yet to be tested quantitatively with validated measures of maternal representations.

Most Norwegian families with infants and toddlers (0–5 years) attend the universal, health-promoting, and preventive services at local Well Baby Centers (0–5 years), which offer

a standard, universal health program called the Primary Child Healthcare Program (PCHP) (54, 55). The Well Baby Centers are interdisciplinary and staffed by public health nurses and doctors; however, physiotherapists, psychologists, occupational therapists, and social and educational staff are consulted when necessary. Parents receive guidance on their baby's development and well-being, and PCHP nurses are trained to identify and support parents with mental health issues, alcohol or substance use problems, and domestic violence. Individual or group consultations are available, as is a medical examination by a doctor (31).

Although the PCHP was introduced through policy and first implemented in the 1930s, very few evaluations of its effects have been conducted. According to one study by the Norwegian School of Economics, access to Well Baby Centers had a positive effect on education and earnings, and people who attended the program as children had fewer health risks at the age of 40 years, especially those from low socioeconomic backgrounds (56).

Studies conducted in Norway and England have indicated that postpartum support from a public health nurse may reduce depression in women (57, 58). A systematic review and meta-analysis of qualitative and quantitative studies of mothers' and fathers' experiences during their infant's first year also found that support from nurses at Well Baby Centers helped mothers who felt overwhelmed by being the primary caregiver (59). In particular, the opportunity to discuss and reflect upon the demands of motherhood as part of the PCHP seemed to be helpful for those mothers (59). These findings are supported by a qualitative study of Swedish first-time mothers, who reported feeling concerned and insecure during the first weeks after delivery and sought support and affirmation from nurses at child health care centers to feel more secure in their parenting role (60).

More research on the support and interventions provided at Well Baby Centers is needed. A recent policy recommendation for governments in the Nordic countries concerning infants' first 1,000 days of life (from conception to 2 years old) identified the following areas of improvement: (I) providing comprehensive support for parents during the infant's first 1,000 days of life; (II) identifying and responding systematically to risk factors; and (III) encouraging further research about this early period in a child's life (61). The current study, which aimed to investigate the effect of VIPI beyond standard care, is therefore in line with these recommendations. The original RCT from which the current study drew data sought to explore the effect of VIPI on mother–infant interaction quality beyond the effect of the standard, universal PCHP provided by community Well Baby Centers (22). The study's sample consisted of predominantly low-to-moderate risk mothers with infants (0–2 years) recruited from community Well Baby Centers. The PCHP served as the study's control condition and was followed by all families. Furthermore, half of the families received the VIPI intervention, which had a beneficial short-term effect on the quality of mother–infant contact (22). Given that a mother's representations predict how she interacts with her infant (3, 38), the current study considers the following research question:

Does the VIPI intervention have any effect on maternal representations compared to the effect of the standard, universal preventive care at Well Baby Centers, which is the treatment as usual (TAU) condition?

2. Materials and methods

We used data from a naturalistic, longitudinal, multi-site RCT that investigated the effect of the VIPI intervention on mother–infant interaction quality (45). We examined the effect of the VIPI intervention on maternal representations beyond the possible effect of the PCHP, which was the control condition (TAU). For ethical reasons, the participating families could not be randomized to no treatment or be put on a waiting list control, as that would jeopardize the infants' health, and public health nurses cannot be instructed to treat parents differently than they should by decree.

2.1. Participants

The research participants were mothers of infants. During the study period, public health nurses at Well Baby Centers and other professionals recruited 180 families who were seeking help with infant–parent interaction challenges. The study took place in the cities of Oslo and Trondheim and in six rural towns in the southeastern part of Norway. The inclusion criteria were parent–child interaction problems (defined by a parent or professional) and an infant age of between 0 and 24 months. The study's criteria for exclusion were parents with a severe mental health or developmental disorder, an ongoing substance use problem, or insufficient language skills to complete a self-report questionnaire. There were no exclusion criteria for the infants. Of the 158 eligible families, 152 enrolled and underwent a baseline evaluation. All but two participants were mothers who were on paid parental leave at the time of the study. For simplicity, the study participants are henceforth referred to as “mothers.” No incentives were offered for participation, and all participants provided written informed consent.

Table 1 presents the sample characteristics of the VIPI group (which received the VIPI intervention in addition to the PCHP), the TAU group (which received the PCHP), and the two groups combined (total sample) at the time of inclusion. For the total sample, the mean age of the participating infants was 7.3 months ($SD = 5.1$ months), and 48.9% of them were male. In 71.2% of the families, the included infant was the firstborn child. The mean age of the participating mothers was 29.7 years ($SD = 5.6$ years), and 63% of the mothers had a bachelor's degree or higher education. Most participants were of Norwegian (79.8%) or European (6.4%) origin.

In half of the families (50.9%), the parents had asked for help addressing parenting challenges. For the rest of the families, participation in the study was voluntary but recommended by public health nurses or other professionals. The most frequently cited reasons for participating were as follows: concern regarding the infant's regulation (32.6%), parent–child interactional challenges (14.5%), wanting to learn more (10.8%), parent's mental health (3.6%), developmental delay of the child (3.2%), social development of the child (2.4%), and a need for support (2.2%). Altogether, these reasons were stated by 69.3% of the participants. As their reasons for recruiting, the professionals reported subjective estimations of maternal depressive symptoms (60–70%), interest in parenting (10–20%), concern about the child's development (10%), and insensitive parenting (10%).

TABLE 1 Sample characteristics at baseline for the intervention group receiving Video-Feedback of Infant–Parent Interaction (VIPI), the group receiving treatment as usual (TAU), and the total sample (GROUP).

Baseline characteristics	VIPI (<i>n</i> = 80)			TAU (<i>n</i> = 61)			GROUP (<i>n</i> = 141)		
	<i>n</i> (%)	Mean (SD)	Range	<i>n</i> (%)	Mean (SD)	Range	<i>n</i> (%)	Mean (SD)	Range
Child characteristics									
Age (months)		7.8 (5.6)	1.0–20.0		6.7 (4.3)	1.3–20.0		7.3 (5.1)	1.0–20.0
Male	33 (41.8)			35 (58.3)			68 (48.9)		
First-born	53 (72.6)			41 (69.5)			94 (71.2)		
Mother characteristics									
Age (years)		29.4 (5.3)	19–42		30.1 (6.0)	19–43		29.7 (5.6)	19–43
Ethnicity									
Norwegian	41 (75.9)			34 (85.0)			75 (79.8)		
Other European	3 (5.6)			3 (7.5)			6 (6.4)		
Asian	2 (3.7)			2 (5.0)			4 (4.3)		
African	2 (3.7)			0			2 (2.1)		
South American	1 (1.9)			1 (2.5)			2 (2.1)		
Educational level									
High school/vocational	32 (41.0)			18 (30.0)			50 (36.2)		
Bachelors' degree	16 (20.5)			19 (31.7)			35 (25.4)		
Masters' degree or above	29 (37.2)			23 (38.3)			52 (37.9)		
Family income (in 1,000 N.kr)		33.96 (17.1)			33.90 (18.1)			33.9 (17.5)	

VIPI, Video Feedback of Infant–Parent Interaction intervention; TAU, treatment as usual; GROUP, total sample; SD, standard deviation; N.kr, Norwegian kroner.

Five families received support (financial or otherwise) from the Norwegian Child Welfare Services. Although parent–infant interaction problems were a criterion for inclusion, prior investigations using the same data as the current study, reported that there were no risk indicators associated with negative effects on parenting among the mothers (depression, anxiety, stress, alcohol use, income, and level of education), infants (developmental status), or in terms of the mean quality of infant–mother interaction (45, 62). The sample in this study was relatively homogeneous. Most participants were considered predominantly low-to-moderate risk, and only a few were high-risk cases. Thus, we did not expect any confounding effect of the sample's risk factors.

2.2. Procedure

Data were collected at baseline (*N* = 152) and at follow-up 6 months after the end of the VIPI intervention (*n* = 112). The intervention period lasted 3 months, and the total study period lasted 9–13 months (*M* = 11.3 months). Three trained research assistants with bachelor's degrees in preschool education, nursing, or social work visited the participants' homes twice or thrice over the course of 1 to 2 weeks to collect data. A demographic interview was conducted at both baseline and follow-up, and our main outcome variable (WMCI scores) was assessed only at these two time points for two reasons. The first was to minimize assessment

burden for the participating mothers, as the WMCI takes up to 90 min to complete. The second was to avoid having the mothers participate in the second interview shortly after the first, and thus, repeat their responses. The WMCI was conducted for mothers a few days after the initial visit (40). To aid coding, the interview was filmed. Ten interviews were lost or omitted from the data because of poor recording quality. Consequently, 142 baseline interviews were successfully coded, and after accounting for the missed or excluded interviews, 104 interviews were coded at the follow-up.

2.3. Primary Child Healthcare Program

All participating families followed the PCHP provided by community Well Baby Centers. Although the frequency of routine health visits varied slightly between the included Well Baby Centers, all families had a minimum of one home visit from a midwife within 1 or 2 weeks after delivery, and they visited their local Well Baby Center at 6 weeks and 3, 4, 6, 8, 10, 12, 15, 18, and 24 months. The visits were conducted in either an individual or group setting, and they included pediatric check-ups when the infants were 3, 12, and 24 months old. All families in both groups could seek help, support, and advice from other professionals; however, these professionals were instructed not to conduct any video-feedback intervention.

2.4. Randomization

Figure 1 depicts a flowchart of the recruitment and randomization processes. After the baseline assessment, the participants were randomized to one of two groups—VIPI or TAU—by a successive 1-2-1-2 allocation ratio within each urban district or rural municipality. The inequality of the group sizes (VIPI: $n = 88$, TAU: $n = 72$) could have been due to the allocation starting and ending with the same number (1 = VIPI). Additionally, five pairs of siblings or twins were allocated to the same treatment group, which influenced group size. The research assistants were blinded to the randomization status of the families from whom they collected and handled data.

The cumulative drop-out rates from baseline to 6 months follow-up after intervention were 26.2% for the VIPI group and 34.6% for the TAU group, which is reasonable given that participation in the study required 9–13 months. The majority dropped out from the study after being assigned to the VIPI or TAU group. Table 2 shows the baseline descriptive statistics for the mothers and children's age, WMCI factors, and WMCI scales for the main sample and the attrition group across the VIPI and TAU groups.

2.5. Video Feedback of Infant–Parent Interaction intervention

To standardize the VIPI intervention, three experienced Marte Meo supervisors developed the VIPI manual, which describes intervention steps for families with infants aged 0–2 years. The VIPI intervention is limited to eight weekly sessions, but the last two can be tailored to the individual needs of the family. The duration of each session is not pre-defined; however, it usually lasts about 1 h. Mandatory homework is assigned between sessions. Further, parents are asked to register moments of interaction with their infants in relation to new topics introduced during the feedback session, for which they are given a registration form.

Eight experienced and certified Marte Meo therapists completed a 2-day training on using the VIPI manual, followed by supervision with a licensed Marte Meo supervisor. This supervision included discussions of the videotapes of infant–mother interaction and the therapists' feedback to the mothers. To ensure treatment fidelity, the supervisor reviewed the videotapes of the therapists' feedback to the mothers, how they used the registration forms provided by the manual, and how they explained the core elements of the intervention. None of the therapists deviated from the manual's instructions.

The families in the intervention group completed six to eight at-home video-feedback sessions with the VIPI therapist. The therapist used a selection of pre-recorded video clips of parent–infant interactions that demonstrated the following core elements of the Marte Meo method: identifying the infant's initiatives; attunement and timing of the parent's responses to the infant's initiatives; following the child to support synchronicity; naming the infant's initiative, emotions, actions, relational activities, and transitional situations; structured step-by-step guidance when interacting; and directing attention toward social interaction and exploration. The pace at which new elements were introduced

was dependent on how the parents responded to the intervention. In some families where both parents received the VIPI, the therapist gave individual feedback based on a separate videotape for each parent–infant dyad. For these families, data from only one of the parents were assessed and included in the analyses. While reviewing the video clips, sensitive parenting practices were reinforced through a reflective dialogue between the therapist and parent to build an understanding of the child's state of mind and scaffold parenting practices in daily routine situations.

2.6. Measures

2.6.1. Demographics

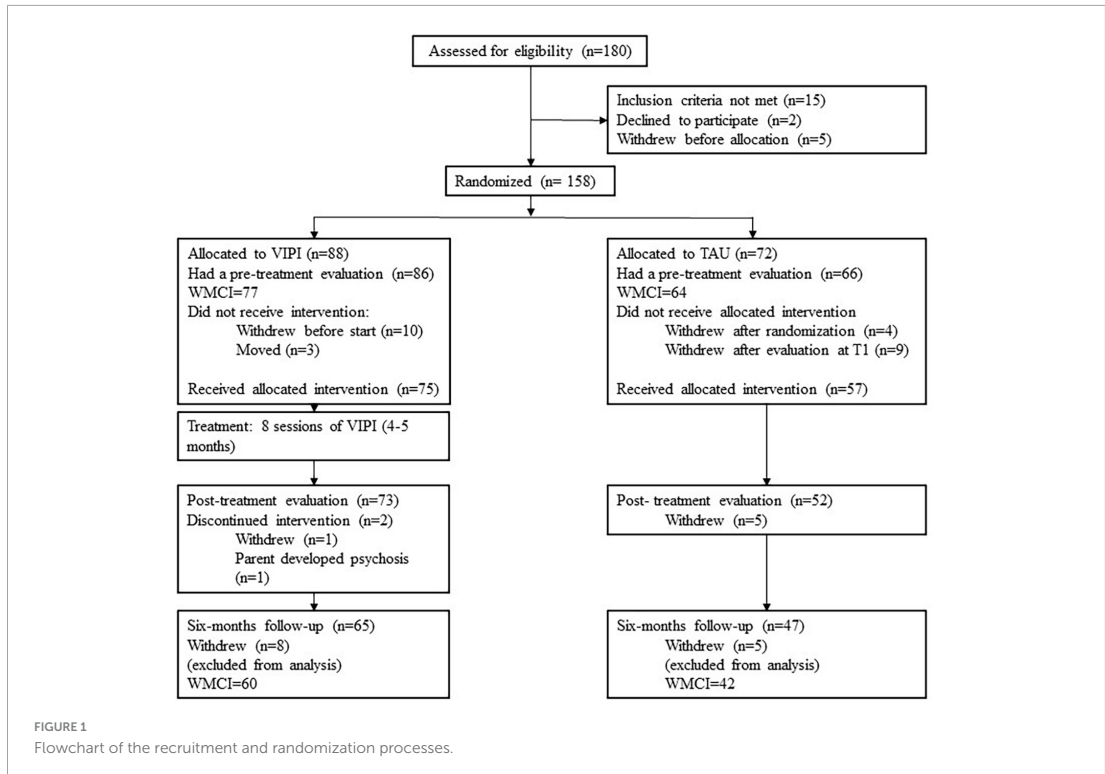
The research assistants interviewed all participants to collect demographic and socio-economic information.

2.6.2. Working Model of the Child Interview

The WMCI was conducted for all mothers at baseline and a follow-up occurring 9–13 months after the baseline. It is a validated interview for eliciting parents' perceptions, emotions, expectations, and cognitions of their specific child, their relationship with their child, and their own role as a caregiver. The WMCI includes questions about the pregnancy, present, and future (15), which typically concern situations where the child's attachment needs are activated (e.g., the child is ill, frightened, or hurt). The questions, for example, include, "What about your child's behavior now is most difficult for you to handle? Can you give me a typical example? What do you feel like doing when your child reacts this way? How do you feel when your child reacts this way? What do you actually do?" (14). The WMCI categories have adequate validity and reliability (5). The stability of these categories is the strongest for balanced representations, and the WMCI qualitative scales are more stable than the two content scales (1).

The interviews were video recorded to facilitate coding. Each mother's descriptions and affective tone throughout the interview were rated on 15 five-point Likert scales (1 = none; 5 = extreme). Six of these scales address six respective qualitative features of the representation. The first is the richness of perception, which conveys the level of detail in the mother's descriptions of the child and how well the mother knows the child. The second, openness to change, refers to accommodating new information about the child and their changing developmental needs. The third, the intensity of involvement, is the degree of emotional immersion in and preoccupation with the child. The fourth, coherence, signifies the clarity, organization, and consistency of the descriptions. The fifth, caregiving sensitivity, is the ability to understand the child's experiences and respond to their needs accordingly. The sixth and last qualitative feature is acceptance, which describes the extent to which the mother accepts the child as they are and accepts the responsibilities of being a mother. The next two scales relate to the specific content themes of infant difficulty (i.e., perceiving the infant as difficult to relate to and care for) and fear for infant safety (i.e., irrationally worrying about the infant's safety or death of the child). The last seven scales measure the presence of seven respective affective tones during the interview: joy, pride, anxiety, anger, guilt, indifference, and disappointment.

Based on the patterns of the scale ratings, representations were assigned to one of three global categories: balanced, disengaged,



or distorted. A two-way categorization of representations into balanced and non-balanced, wherein the disengaged and distorted categories are collapsed within the non-balanced category, could also be applied. A balanced parental representation is characterized by warm, coherent, and elaborate descriptions of the child that integrate the positive and challenging aspects of the child's personality as well as the relationship between the caregiver and child. Such representations indicate not being overwhelmed by the child's needs; further, they denote the acceptance and acknowledgment of the child's individuality and subjective experience and the perception of the relationship as valuable for both the parent and child.

A disengaged parental representation reflects an emotionally distant, cognitive, or intellectual approach to the child and parenting. It describes the child in a general and less affectively involved manner. This type of representation can also signify an elevated level of indifference, rejection of the child's needs, and sometimes even an aversion to the child.

A distorted parental representation is illustrated by inconsistent, incoherent, and contradictory descriptions of the child and the parent's relationship with the child. Parents with representations that fall in this category may be self-involved or preoccupied with other matters. Sometimes, they are unsure or anxiously overwhelmed by the child's needs and are unable to remain focused on the child.

Two certified raters coded the WMCI interviews: one has a master's degree in preschool education and the other is a clinical

psychologist. The raters were blinded to the randomization status of the families but not to the times of the interviews. There are very few reliable WMCI raters in Scandinavia. At the beginning of this project, we did not know if we would be able to find reliable raters to code all the interviews from both time points. Thus, only the pre-intervention interviews were coded at first. About 6 months later, the same raters agreed to code the WMCI data from the 6-month follow-up. All interviews were coded from recordings; consequently, we could not prevent the raters from being influenced by their first-time ratings.

At pre-intervention, the first rater coded 108 interviews and the second rater coded 55 interviews; 20 of these interviews were double-coded. At the 6-month follow-up, the first rater coded 104 interviews and the second rater coded 18 interviews; 18 of these interviews were double-coded. The interrater reliability of the WMCI clinical scales was good for five scales, moderate for nine, and fair for one (Cohen's weighted κ mean = 0.539) (63). A relatively low variance in some scales may have contributed to some of the low kappa values for the WMCI scales (64). The value of Cohen's κ was 0.898 [95% confidence interval (CI): 0.704–1.00] for the balanced, disengaged, and distorted categories and 0.886 (CI: 0.671–1.00) for the balanced versus non-balanced (i.e., disengaged, and distorted) categories. Therefore, we concluded that the interrater agreement was acceptable and the 15 clinical scales would be used in further analyses (62). For the current analyses, we used both the WMCI categories and the 15 clinical scales, as global categories of representations might not be sufficiently

TABLE 2 Descriptive statistics for the main sample and attrition group, for the group receiving Video-Feedback of Infant–Parent Interaction (VIPI) intervention and the group receiving treatment as usual (TAU) separately.

Variables	Main sample				Attrition group			
	VIPI		TAU		VIPI		TAU	
	<i>n</i>	Mean (SD)	<i>n</i>	Mean (SD)	<i>n</i>	Mean (SD)	<i>n</i>	Mean (SD)
Child age (months)	80	7.8 (5.6)	61	6.6 (4.3)	17	7.4 (5.9)	16	9.3 (5.1)
Mother's age (years)	80	29.4 (5.3)	61	31.1 (6.0)	17	26.9 (5.5)	16	28.9 (6.9)
WMCI variables								
Factor 1 balanced	76	3.31 (0.85)	64	3.25 (0.93)	17	3.20 (0.80)	16	2.74 (0.74)
Factor 2 resentful	76	1.71 (0.67)	64	1.67 (0.73)	17	1.78 (0.75)	16	1.95 (0.83)
Factor 3 apprehensive	76	1.82 (0.87)	64	1.82 (0.99)	17	1.87 (1.03)	16	2.06 (1.14)
Richness of perception	76	5.40 (0.99)	64	3.30 (1.06)	17	3.09 (1.00)	16	2.69 (0.70)
Openness to change	76	3.47 (0.95)	64	3.32 (0.99)	17	3.32 (0.95)	16	2.81 (0.89)
Intensity of involvement	76	3.47 (0.95)	64	3.32 (0.99)	17	3.32 (0.95)	16	2.81 (0.89)
Coherence	73	3.32 (1.04)	64	3.16 (1.08)	17	3.41 (0.96)	16	2.56 (0.73)
Sensitivity	73	3.32 (0.97)	64	3.47 (0.93)	17	3.23 (0.75)	16	2.91 (0.86)
Acceptance	75	3.42 (0.92)	64	3.48 (0.93)	17	3.32 (0.81)	16	3.06 (0.77)
Joy	76	3.07 (0.92)	64	3.07 (0.98)	17	3.09 (0.89)	16	3.06 (0.77)
Pride	76	2.91 (0.94)	64	2.87 (1.09)	17	2.77 (0.77)	16	2.42 (0.91)
Anger	76	1.67 (0.82)	64	1.59 (0.84)	17	1.79 (1.08)	16	1.88 (0.96)
Disappointment	76	1.36 (0.67)	64	1.38 (0.62)	17	1.44 (0.86)	16	1.59 (0.80)
Anxiety	76	1.80 (1.00)	64	1.81 (1.06)	17	1.77 (1.09)	16	2.03 (1.22)
Guilt	76	1.31 (0.65)	64	1.38 (0.70)	17	1.15 (0.49)	16	1.50 (0.82)
Indifference	76	1.56 (0.82)	64	1.43 (0.67)	17	1.82 (1.02)	16	1.63 (0.74)
Child difficulty	76	2.11 (0.96)	64	2.06 (1.04)	17	2.12 (0.94)	16	2.38 (1.03)
Fear for infant's safety	76	1.85 (0.88)	64	1.82 (1.01)	17	1.97 (1.07)	16	2.10 (1.10)

VIPI, Video Feedback of Infant–Parent Interaction intervention; TAU, treatment as usual; WMCI, Working Model of the Child Interview; SD, standard deviation.

sensitive to capture subtle yet clinically significant changes (65). In addition, we adopted three WMCI factors that were derived from an examination of the psychometric properties of the WMCI in this sample. A factor analysis yielded three factors denoted by “balanced,” “resentful,” and “apprehensive.” Factor 1, “balanced,” corresponded to the original balanced category and was loaded by the WMCI clinical scales of richness of perception, openness to change, intensity of involvement, coherence, acceptance, sensitivity, joy, and pride. Factor 2, “resentful,” was loaded by the WMCI clinical scales of anger, disappointment, and child difficulty. Factor 3, “apprehensive,” was loaded by the WMCI scales of anxiety and fear for infant safety. Both factor 2 “resentful” and factor 3 “apprehensive” corresponded to the original non-balanced categories. The three derived factors showed evidence of factorial, concurrent, and discriminant validity (62).

2.7. Statistical analyses

We conducted a power analysis prior to the study. For an expected standardized difference of 0.5 between the VIPI and TAU groups, 60 families in each group were required for a power of 78% at a 5% significance level (22).

We conducted linear mixed model analyses with the three WMCI factors (balanced, resentful, and apprehensive) and the 15 WMCI clinical scales as dependent variables one at a time. Time (follow-up versus baseline) and the interaction between time and intervention (VIPI versus TAU) were included as fixed factors to determine whether the change was different between the two groups. We adjusted for the baseline value of the dependent variable as recommended by Twisk et al. with equation (2c) (44). Participants were included as a random effect.

We investigated change in the WMCI categories (balanced, disengaged, and distorted) from baseline to follow-up for the VIPI group, TAU group, and total sample separately. The change from baseline to follow-up was analyzed separately for each group and the total sample using the Stuart-Maxwell test of marginal homogeneity.

We found no differences between the groups in terms of change in the WMCI factors and scales. However, changes were observed in the mothers' representations in both groups. Therefore, we conducted additional linear mixed model analyses with time as a fixed factor (follow-up versus baseline) to investigate changes in the WMCI factors and clinical scales for the total sample. Finally, we added the child's age at follow-up to investigate whether any

changes in maternal representations could be explained by the fact that the child had grown older.

Significant differences between the groups at baseline were not tested, as recommended by Dumville et al. (66), Fayers and King (67), Lydersen (68), Lydersen (69), De Boer et al. (70). It may seem that missing data depend on baseline values (see Table 2). This is appropriately handled in linear mixed model analysis, such that the results are unbiased under this type of deviation from missing completely at random.

We estimated the WMCI factor scores as the mean of available scores on the scales if data were available for at least half of the scales. Otherwise, we handled missing values by available case analysis such that, in each analysis, we included the observations with complete data for the relevant variables. A linear mixed model includes all participants with data from at least one-time point. The results are unbiased if data are missing at random, whereas a complete case analysis including only participants with data from both time points would be unbiased only under the more restrictive missing completely at random assumption. We regarded *p*-values of less than 0.05 as statistically significant; however, because of multiple hypotheses, we interpreted *p*-values between 0.05 and 0.01 with caution. We report 95% CIs where relevant. All analyses were conducted using SPSS 27.

2.8. Ethics

We used data from an original study titled “Video feedback compared to TAU in families with parent–child interactions problems: a randomized controlled trial” (45). The collection and storage of data for the original study were approved by the Norwegian Centre for Research Data and later by the Regional Committee for Research Ethics in Mid-Norway (REC; reference number 1.2007.2176). The study is registered in the International Standard Randomized Controlled Trial Number registry under the reference number ISRCTN 99793905. All participants provided written consent. Our study was found to be exempt (REC reference 2017/1723) because the data from the original study had been anonymized.

3. Results

Table 3 presents descriptive statistics for the WMCI measures at baseline and follow-up and the results for estimated treatment effects from the linear mixed model analyses. There were no statistically significant differences in change from baseline to follow-up between mothers in the VIPI and TAU groups for any of the three WMCI factors or fifteen clinical scales.

Changes in the WMCI categories at baseline and at follow-up for the VIPI group, TAU group, and total sample are presented in Table 4. The changes were not significant in the VIPI group, TAU group, or total sample (*p*-values for the Stuart-Maxwell test were 0.50, 0.22, and 0.16, respectively).

We observed changes in the WMCI factors and scales from baseline to follow-up for the total sample. For primary care service providers, it is clinically relevant to know whether their

practices contribute to improving mothers’ representations, which predict the quality of the infant–mother relationship. Therefore, we conducted additional analyses to further investigate these changes. Table 5 shows results from the mixed model analyses of change from baseline to follow-up, both unadjusted and adjusted for the child’s age. For the total sample, we found that the estimates of Factor 3 “apprehensive” were reduced from baseline to follow-up. Furthermore, at follow-up, the mothers’ scores on the WMCI clinical scales for sensitivity, anxiety, infant difficulty, and fear for infant safety decreased from the baseline values. The child’s age at follow-up had no notable effect on the estimated mean scores at follow-up for Factor 3 “apprehensive” and the WMCI scales of anxiety, child difficulty, and fear for infant safety. However, the fact that the child had grown older, to a large extent, accounted for the reduced scores for the WMCI scale of sensitivity. For Factor 2 “resentful” and the WMCI scale of anger, we found a significant reduction of the estimated scores from baseline to follow-up only when we adjusted for the child’s age at follow-up, which is possibly a suppression effect (71).

We also observed a slight decrease in the estimated mean scores for Factor 1 “balanced” and the WMCI clinical scales of openness to change and intensity of involvement. However, the *p*-values ranged between 0.01 and 0.05, and therefore, were interpreted with caution.

4. Discussion

To our knowledge, this is the first naturalistic, multi-site, RCT to investigate whether a video-feedback mother–infant interaction intervention (VIPI) can improve features of mothers’ representations of their infants in a predominantly low-to-moderate risk sample. Between baseline and follow-up (6 months after the intervention), we found no evidence of the effect of the VIPI on the mothers’ representations beyond TAU. For the total sample, we observed a small decrease in the features of mothers’ representations measured by some of the WMCI factors and clinical scales.

First, it is possible that the VIPI intervention in this study did not target maternal representations sufficiently to alter them. Some scholars have proposed that a key component for changing the aspects of maternal representations is to invite the mother to reflect on her own early attachment experiences and how those influence the present relationship with the child (7, 30, 36, 38). However, in the VIPI intervention, the focus of the reflective dialogue between the therapist and parent when reviewing the video clips was mainly to understand the child’s state of mind and scaffold sensitive parenting practices in daily routines. The intervention was not specifically designed to explore and elaborate upon the origins of the parent’s perceptions. Putatively, the VIPI intervention may be insufficient to improve the aspects of maternal representations measured by the WMCI. However, it is possible that the VIPI influenced the mothers’ ability to mentalize their infant, as the intervention stimulates mothers to reflect on the infant’s mental processes. Prior studies have shown that video-feedback interventions can affect mothers’ reflective functioning (36, 38). Two RCTs of attachment-informed interventions that demonstrated evidence of effects on the representations of high-risk mothers also improved their reflective functioning (28, 30).

TABLE 3 Descriptive statistics for the Working Model of the Child Interview (WMCi) measures at baseline and follow-up, and estimated treatment effect of the Video Feedback of Infant–Parent Interaction intervention (VIPI) vs. treatment as usual (TAU) from mixed model analyses.

Variables	Intervention (VIPI) (<i>n</i> = 76)			Control (TAU) (<i>n</i> = 64)			Difference (group × time)		
	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD	Estimate	95% CI	<i>p</i> -Value
Factor 1 balanced									
Baseline	76	3.31	0.85	64	3.25	0.93			
Follow-up	61	3.13	0.63	42	3.11	0.70	0.06	−0.25 to 0.36	0.71
Factor 2 resentful									
Baseline	76	1.71	0.67	64	1.67	0.73			
Follow-up	61	1.64	0.65	42	1.48	0.50	0.11	−0.13 to 0.36	0.37
Factor 3 apprehensive									
Baseline	76	1.82	0.87	64	1.82	0.99			
Follow-up	61	1.41	0.50	42	1.33	0.53	0.01	−0.28 to 0.30	0.95
Perceptions									
Baseline	76	3.40	0.99	64	3.30	1.06			
Follow-up	61	3.20	0.79	42	3.24	0.81	−0.01	−0.35 to 0.34	0.97
Openness									
Baseline	76	3.47	0.95	64	3.32	0.99			
Follow-up	61	3.23	0.80	42	3.18	0.72	0.06	−0.28 to 0.39	0.75
Involvement									
Baseline	76	3.47	0.95	64	3.32	0.99			
Follow-up	61	3.23	0.65	42	3.18	0.75	0.05	−0.28 to 0.38	0.76
Coherence									
Baseline	73	3.32	1.04	64	3.16	1.08			
Follow-up	60	3.12	0.76	41	3.02	0.81	0.12	−0.25 to 0.49	0.51
Sensitivity									
Baseline	73	3.36	0.97	64	3.47	0.97			
Follow-up	61	3.16	0.69	42	3.10	0.72	0.15	−0.18 to 0.48	0.37
Acceptance									
Baseline	75	3.42	0.92	64	3.48	0.93			
Follow-up	61	3.30	0.77	42	3.21	0.84	0.10	−0.24 to 0.44	0.57
Joy									
Baseline	76	3.07	0.92	64	3.07	0.98			
Follow-up	61	2.96	0.65	42	3.06	0.81	−0.06	−0.39 to 0.27	0.73
Pride									
Baseline	76	2.91	0.94	64	2.87	1.08			
Follow-up	61	2.89	0.70	41	2.87	0.76	0.03	−0.31 to 0.38	0.85
Anger									
Baseline	76	1.67	0.82	64	1.59	0.84			
Follow-up	61	1.66	0.76	42	1.42	0.58	0.19	−0.11 to 0.48	0.22
Disappointment									
Baseline	76	1.36	0.67	64	1.38	0.62			
Follow-up	61	1.36	0.61	42	1.29	0.51	0.06	−0.18 to 0.30	0.60
Anxiety									
Baseline	76	1.80	1.00	64	1.81	1.06			
Follow-up	61	1.42	0.57	42	1.36	0.82	0.01	−0.33 to 0.34	0.97

(Continued)

TABLE 3 (Continued)

Variables	Intervention (VIPI) (<i>n</i> = 76)			Control (TAU) (<i>n</i> = 64)			Difference (group × time)		
	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD	Estimate	95% CI	<i>p</i> -Value
Guilt									
Baseline	76	1.31	0.65	64	1.38	0.70			
Follow-up	61	1.36	0.62	42	1.21	0.47	0.19	−0.05 to 0.42	0.12
Indifference									
Baseline	76	1.56	0.82	64	1.43	0.67			
Follow-up	61	1.46	0.57	42	1.55	0.73	−0.15	−0.41 to 0.11	0.26
Child difficulty									
Baseline	76	2.11	0.96	64	2.06	1.04			
Follow-up	61	1.90	0.78	42	1.73	0.74	0.11	−0.22 to 0.45	0.52
Fear for infant's safety									
Baseline	76	1.85	0.88	64	1.82	1.01			
Follow-up	61	1.39	0.55	42	1.31	0.51	0.06	−0.25 to 0.37	0.70

WMCI, Working Model of the Child Interview; VIPI, Video Feedback of Infant–Parent Interaction intervention; TAU, treatment as usual; SD, standard deviation; CI 95%, confidence interval.

TABLE 4 Change in the Working Model of the Child Interview (WMCI) categories from baseline to 6-month follow-up for the intervention group receiving Video-Feedback of the Infant–Parent Interaction (VIPI), the control group receiving treatment as usual (TAU), and total sample (Total).

Group	WMCI category at baseline	WMCI category at follow-up				
		Balanced	Disengaged	Distorted	Total	Missing
TAU	Balanced	22	3	0	25	12
	Disengaged	4	2	1	7	7
	Distorted	2	3	2	7	6
	Total	28	8	3	39	26
	Missing	0	1	1	3	1
VIPI	Balanced	23	3	4	30	12
	Disengaged	5	3	0	8	9
	Distorted	6	2	2	10	3
	Total	34	8	6	48	24
	Missing	6	2	4	12	1
Total	Balanced	45	6	4	55	24
	Disengaged	9	5	1	15	16
	Distorted	8	5	4	17	9
	Total	62	16	9	87	49
	Missing	6	3	5	14	2

WMCI, Working Model of the Child Interview; TAU, treatment as usual; VIPI, Video Feedback of Infant–Parent Interaction intervention.

However, parent–infant psychotherapy, which addresses mothers' mentalizing ability, did not alter mothers' reflective functioning in a previous study, although the qualities of their representations changed (31). Despite inconsistent results from past studies, administering the Reflective Functioning Scale together with the WMCI in the current sample may have helped detect relevant changes and should be considered in future research.

Second, the universal, preventive Primary Child Healthcare Program (PCHP) at community Well Baby Centers provides extensive, high-quality services from birth through toddlerhood, which could have masked any possible effect of the VIPI intervention. The PCHP includes home visits, individual and

group-based consultations, and access to various specialists if needed. Other studies have reported that support from public health nurses at the community PCHP helped first-time mothers feel secure and develop in their parenting role (60), and reduced symptoms of postpartum depression in mothers (57, 58). Similar results were found in a Swedish study (72) that examined a sample comparable to the present sample. In the Swedish study, no differences were found in the WMCI categories between a group of mothers receiving parent–infant psychotherapy and a group following the standard healthcare program at local child healthcare centers (72).

TABLE 5 Results from the mixed model analyses with estimates of change from baseline to follow-up for the total sample, unadjusted and adjusted for age of child, with the Working Model of the Child Interview (WMCi) measures as dependent variables.

Variables	Unadjusted for age			Adjusted for age		
	Estimate	95% CI	p-Value	Estimate	95% CI	p-Value
Factor 1 balanced	-0.18	-0.36 to -0.01	0.049	-0.07	-0.35 to 0.21	0.626
Factor 2 resentful	-0.11	-0.25 to 0.03	0.128	-0.38	-0.61 to -0.14	0.002
Factor 3 apprehensive	-0.43	-0.60 to -0.26	<0.001	-0.50	-0.78 to -0.22	<0.001
Perceptions	-0.18	-0.38 to 0.01	0.068	-0.09	-0.43 to 0.24	0.582
Openness	-0.21	-0.40 to -0.01	0.040	0.00	-0.31 to 0.31	0.998
Involvement	-0.20	-0.40 to -0.01	0.044	-0.08	-0.39 to 0.22	0.597
Coherence	-0.20	-0.42 to 0.02	0.078	0.01	-0.34 to 0.35	0.988
Sensitivity	-0.29	-0.49 to -0.09	0.005	-0.11	-0.42 to 0.21	0.499
Acceptance	-0.20	-0.40 to 0.01	0.065	-0.07	-0.38 to 0.24	0.653
Joy	-0.08	-0.28 to 0.11	0.406	-0.03	-0.35 to 0.28	0.835
Pride	-0.03	-0.23 to 0.17	0.773	-0.05	-0.37 to 0.27	0.745
Anger	-0.06	-0.23 to 0.11	0.517	-0.37	-0.64 to -0.09	0.009
Disappointment	-0.04	-0.19 to 0.12	0.650	-0.21	-0.44 to 0.02	0.069
Anxiety	-0.41	-0.60 to -0.21	<0.001	-0.52	-0.84 to -0.19	0.002
Guilt	-0.04	-0.18 to 0.10	0.574	-0.24	-0.47 to -0.01	0.042
Indifference	0.004	-0.15 to 0.15	0.960	-0.14	-0.40 to 0.11	0.269
Child difficulty	-0.25	-0.44 to -0.05	0.012	-0.56	-0.89 to 0.24	<0.001
Fear for infant's safety	-0.47	-0.67 to -0.28	<0.001	-0.47	-0.76 to -0.19	0.001

WMCi, Working Model of the Child Interview; CI 95%, confidence interval. Bold text signifies $p < 0.01$.

Third, it is also possible that the lack of an effect of the VIPI intervention may be because of the sample, which was predominantly low-to-moderate risk. The mean scores of the WMCi factors and scales indicated no risk, meaning that for these mothers, there was little room for improvement in their representations and a ceiling effect may have occurred. Earlier studies reporting an effect of interventions on maternal representations were conducted with heterogeneous high-risk samples with clearly negative representations, for which improvements are more likely to be detected (28–31, 73, 74). Relatedly, the mothers who dropped-out from TAU were older, less balanced, more resentful, and more apprehensive than mothers who dropped out from VIPI (Table 2). Also, their infants were older than the infants of the mothers in the drop-out group from VIPI. Possibly, the differences between the VIPI-group and the TAU-group were not unbiased. However, this potential bias should be of little concern since the linear mixed model analysis handles this in a way that makes the results unbiased under this type of deviation from missing completely at random.

The VIPI intervention had no effect on the mothers' representations at follow-up beyond that of the TAU. Nevertheless, we observed that some aspects of the representations improved in both groups, which could imply that the primary care services contributed to the mothers' improved representations. Research on how a universal program influences mothers with infants is scarce; thus, this finding is relevant and in line with policy recommendations (61). We conducted additional analyses that were not part of the original study, and observed minor yet significant reductions in anxiety, fear for infant safety, and

assessment of the child as difficult to care for at follow-up compared to baseline for the entire sample. Nearly three-quarters of the sample was comprised of first-time mothers, who probably felt uneasy about motherhood and caring for an infant. The support, guidance, and knowledge provided by the public health nurses at Well Baby Centers may have made the mothers feel less anxious and fearful and encouraged perceptions of their child as easier to care for. To the best of our knowledge, no other RCTs have found an effect of a standard, preventive, and low-threshold community care program on negative maternal representations. The present finding may inspire an emphasis on high-quality primary care services for infants, which may be capable of influencing fundamental psychological processes in the mothers.

Our results also confirm that mothers' representations may adjust to their child's characteristics, such as the increasing age of the child. In the present sample, the mothers' representations became slightly less sensitive as the child became older. An earlier study reported that high-risk mothers were less sensitive to the demands of an increasingly autonomous toddler compared to that of an infant (75). Our results confirm the same tendency in a low-to-moderate risk sample. Interestingly, the age of the child had a suppression effect on change from baseline to follow-up on the factor "resentful" and the WMCi scale of anger. A suppression effect is a negative confounding effect, meaning that adding a particular variable to the regression equation increases the magnitude of the relation between the independent and dependent variables (71). In our study, this means that the mothers in both groups reduced their representational anger and resentment, most likely because of the supportive services at the Well Baby Centers,

but this effect was practically canceled out by the anger and resentment that increased as the child grew older. These findings indicate that the features of the mothers' representations may be adjusted by child characteristics, such as the age of the child.

4.1. Strengths and limitations

A major strength of our study is its RCT design with two assessment points using the WMCI categories, fifteen clinical WMCI scales, and three factors that were derived from a factor analysis. The design allowed for analyses of change in maternal representations measured both categorically and continuously. The latter approach is found to be more sensitive for detecting change than when measuring categorically (30). In addition, the naturalistic quality of the study is an advantage. All data were collected at the participants' homes; being in a familiar setting increases the likelihood that the mothers and infants were comfortable, which would strengthen the external validity of the WMCI interviews.

Nevertheless, the study has several limitations. First, although fathers were invited to participate in the study, only two participated in the interviews. Therefore, the sample consisted almost exclusively of mothers. Previous research has determined that fathers' and mothers' representations of their children differ (76). Thus, our results cannot be generalized to fathers. Future studies should include fathers to investigate changes across time in paternal representations as measured by the continuous WMCI scales.

Second, the naturalistic design complicates the research despite its benefits. Without a group that did not attend the PCHP, we cannot conclude that the changes in the features of the mothers' representations of their infants were due to the PCHP. The participants were recruited by professionals who were bound by guidelines and ethical standards. Hence, the research team could apply only a few restrictions to the services at the Well Baby Centers. Furthermore, all families had to be given the option to seek help from other professionals, if necessary, which could have interfered with the effect of the VIPI intervention.

Third, the WMCI was conducted first at baseline and subsequently 6 months after the VIPI intervention. Thus, we do not know if VIPI in addition to the PCHP influenced the mothers' representations immediately after the VIPI intervention ended. Moreover, the lack of post-intervention measures of the mothers' representations made it difficult to control for variables that could have influenced the results. Although we controlled for time and the child's age at follow-up, other unknown variables could have played a role as well.

Fourth, by today's standards, the randomization procedure of a sequential 1-2-1-2 allocation is not ideal. The study was designed, and enrollment began before 2010, when the Consort Guidelines were effectuated. We cannot rule out the possibility that the recruiters were aware of the allocation pattern, which may have influenced their decision to recruit or not recruit certain families. Some of the nurses at the Well Baby Centers were hesitant to recruit families because they did not want to risk families in need being allocated to the TAU group.

The fifth limitation pertains to the WMCI raters, who were not blinded to the time of the interview. As very few reliable WMCI

raters were available, the same raters coded the WMCI from both time points. Further, all WMCI were coded from video recordings; thus, they were not deidentified. However, the raters were blinded to whether the participants had received the VIPI intervention or only attended the PCHP at the Well Baby Centers. Therefore, this information should not have influenced their ratings.

Finally, analyzing the WMCI for improvements in the mothers' reflective functioning could have identified an effect of the VIPI intervention compared to TAU. Future research should consider administering the Reflective Functioning Scale along with the WMCI when investigating effects of the VIPI.

5. Conclusion

The present study did not find evidence of an effect of the VIPI intervention among predominantly low-to-moderate-risk mothers' representations of their infant, possibly because the mothers' own attachment history or state of mind in attachment-related situations was not addressed. The present findings validated prior studies' findings regarding the relative stability of mothers' representations of their infants. Notably, additional analyses of all participants revealed that mothers changed several aspects of their representations of their infant over a period of 9–13 months. The supportive and promotive services provided by community Well Baby Centers may have contributed to the improvement in the anxious and negative features of first-time mothers' representations. Additionally, the aspects of mothers' representations change with the increasing age of their infants and toddlers, which is in line with previous findings indicating that although maternal representations are stable, some features may change in response to support and the child's developmental changes (17, 28, 30, 31). The WMCI clinical scales and variables are suggested for use in research and clinical practice because they are sensitive in evaluating subtle yet clinically relevant changes. Future research is required to investigate the efficacy of representation-targeted treatments tailored to and available in primary care services. Assessing mothers' reflective functioning might provide more detailed insights regarding changes in maternal representations of infants.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Regional Committee for Research Ethics in Mid-Norway (REC). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

TB-N and SK contributed equally to the conception and design of the study. SL contributed to the statistical analyses. KS wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Paper III



Are changes in mothers' representations of their infants related to changes in observed mother–infant interaction quality?

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ABSTRACT

Infant mental health clinicians aiming to improve mother–infant dyads at risk typically target mothers' representations of their infant or mother–infant interactions, assuming that one port of entry leads to change in the other. However, little is known about the relation between changes in mothers' representations and in mother–infant interactions. Therefore, the current study aimed to investigate this in a low- to moderate-risk community sample of 152 mothers ($M = 29.7$ years) of infants aged 0–2 years ($M = 11.5$ months) recruited from rural and urban cities in Norway. The mothers' representations were measured using the Working Model of the Child Interview, and the quality of the mother–infant interactions was measured with the Emotional Availability Scales. We found no evidence of a relation between mothers' changed representations and changed quality of mother–infant interactions. Several explanations concerning the low-risk status of the sample, the observation situation, the time between assessment points, and the homogeneous scores from the instruments used are discussed, as are the implications for clinical practice and future research.

Interventions for mothers and infants at risk typically target two central aspects of mother–infant relationships, namely mothers' perceptions of their infants and of themselves as caregivers and mother–infant interaction quality (Fukkink, 2008; Mountain et al., 2017). In attachment theory, such maternal perceptions are called representations and it has been hypothesized that they are connected to mother–infant interactions (Stern-Bruschweiler & Stern, 1989). Thus, clinicians may assume that either “port of entry” (i.e., maternal representations or interaction quality), when planning interventions for mother–infant dyads at risk, should lead to change in the other “port.” However, little is known about the types of experiences that influence changes in representations (Sroufe, 2021). In the current study, we connect representations to the quality of mother–infant interactions and investigate whether change in one leads to change in the other in a low- to moderate-risk sample recruited from community Well Baby Centers in rural and urban areas of Norway.

1. Mothers' representations of their infants

A mothers' representations of a specific child encompass not only her perceptions but also her thoughts, feelings, expectations, and

Abbreviations: WMCI, Working Model of the Child Interview; EA, Emotional Availability Scales; AAI, Adult Attachment Interview; VIPI, Video Feedback of Infant Parent Interaction.

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experiences of the child's needs, personality, and potential and the relationship she has with the child. Maternal representations also include how the mother regards herself as a caregiver to a specific child (Bretherton & Munholland, 2008), and Bowlby (1982) stated that they derive from the mother's own experiences of the availability and responsiveness of her primary caregiver. Through childhood and into adulthood, the representations generalize and become the direction and organization of attention, memory, and emotions regarding relationships. Accordingly, representations are thought to be the mechanism by which early experiences influence thoughts, feelings, and expectations in later relationships, such as relationship with one's own child (van IJzendoorn, 1992).

2. Measuring mothers' representations and stability over time

Various instruments are used to assess mothers' relationship-specific representations of their children, and these are typically designed as semi-structured interviews modelled after the structure and coding of the Adult Attachment Interview (AAI) (George et al., 1996; George & Solomon, 2008), which captures the adult's current state of mind regarding their own attachment history. For our research purposes, we chose the commonly used Working Model of the Child Interview (WMCI) (Zeanah et al., 1994), which seeks to assess the parent's state of mind specifically regarding their child. The WMCI is validated for research and clinical practice in samples across risk status (Sandnes et al., 2021; Vreeswijk et al., 2012; Zeanah & Benoit, 1995). With the WMCI, a caregiver's responses to emotionally charged questions regarding pregnancy and present and future situations with the infant are first rated dimensionally on 15 clinical scales (Zeanah et al., 1996). The pattern of the scale ratings informs a three-way categorization of balanced (coherent, sensitive, warm, and accepting), disengaged (emotionally distant, rejective, indifferent, and less involved), and distorted (affectively heightened, confused, anxiously overwhelmed, and less coherent) perceptions; note that the latter two may be collapsed into a non-balanced category (Zeanah et al., 1996; Zeanah et al., 1994).

Although representations are described as being dynamically shaped by a bi-directional interplay with the environment (Bowlby, 1973; Bretherton & Munholland, 2008), considerable stability has been reported. Longitudinal studies with both clinical and non-clinical samples, predominantly of mothers, have found between 71% and 86% stability from pregnancy through infancy and toddlerhood, and across contexts (Aber et al., 1999; Benoit et al., 1997; Borghini et al., 2006; Madigan et al., 2015; Theran et al., 2005). Balanced representations are more stable than non-balanced representations, and contextual factors such as single parenthood, mother's depression symptoms, income, and domestic abuse have been identified as predictors for change (Theran et al., 2005). Two RCT studies have reported improvements in overall global measures of parents' representations of their children after attachment-based interventions (Julian et al., 2018; Rosenblum et al., 2018). Other RCT-studies have found that interventions improved features of the representations of high-risk mothers (Fonagy et al., 2016; Suchman et al., 2010).

3. Mother–infant interaction quality

The quality of interactions between the mother and her infant is crucial for the child's socioemotional and cognitive development, development of attachment, and outcomes throughout their lifespan (Lotzin et al., 2015; Raby et al., 2015; Skovgaard et al., 2008). The mother's degree of emotional attunement and sensitive responsiveness to her child have been conceptualized as core components of her contribution to the interaction quality, while how the child's contact initiatives and responses to their parent's contact affect the parent is the child's contribution (Biringen et al., 2014; Lotzin et al., 2015).

4. Measuring mother–infant interaction quality and stability over time

One instrument that is often used to evaluate the relationship between mothers and their infants is the Emotional Availability Scales (EA) (Biringen et al., 2014), which is used in the current inquiry. Based on observations, the dyadic interactive behavior of both the mother and the child and how they emotionally affect each other are rated across multiple dimensions (Biringen et al., 2014). Four of the dimensions address adult interaction qualities (sensitivity, structuring, non-intrusiveness, and non-hostility), and two evaluate the child's specific interaction behaviors (child responsiveness and child involvement) (Biringen et al., 2014; Biringen & Easterbrooks, 2012). Maternal sensitivity and structuring appear to be relatively stable, while maternal hostility was not (Célia et al., 2018). The EA child dimensions initiative and responsiveness are less stable (Célia et al., 2018). The EA is related to several child outcomes (Biringen et al., 2014; Saunders et al., 2015) and to mothers' own attachment representations (Biringen et al., 2000a). Although observations of mother–infant interactions have found considerable stability across settings (i.e., observations in the home or in a laboratory), situational variables (i.e., face-to-face play, free play, or changing diapers) are found to influence the quality of mother–infant interactions (Maas et al., 2013).

5. Representations and parent–infant interaction quality

Studies and meta-analytic reviews have concluded that parents' representations of their infants predict subsequent mother–infant interaction quality when measured prenatally, postnatally, and across infancy and toddlerhood (Biringen et al., 2014; Foley & Hughes, 2018; Jones et al., 2015; van IJzendoorn, 1995). However, most of the studies mentioned above have used self-reporting measures of parents' attachment styles or the AAI, which measures a mother's state of mind regarding her own attachment history and does not completely overlap with more relationship-specific measures of the current mother–infant relationship (Madigan et al., 2015). Moreover, many of these studies have used the child attachment classifications of the Strange Situation Procedure (SSP) (Ainsworth et al., 2015) to measure mother–infant interaction quality (Benoit et al., 1997; Madigan et al., 2015; van IJzendoorn, 1995; Vreeswijk

et al., 2012), but only the child's behavior during the observation is coded in the SSP and not the parent's behaviors in the interaction (Ainsworth et al., 2015).

Two studies have found that better quality of mother–infant interactions predicts balanced representations of the infant (Korja et al., 2010) and features of the mothers' representations of herself as a caregiver (Biringen et al., 2000b). Moreover, two longitudinal studies found that mothers' representations predicted the subsequent quality of their interactions with the infant (Dayton et al., 2010; Hall et al., 2015). For example, balanced representations predicted positive parenting, disengaged representations predicted controlling parenting, and distorted representations predicted hostile parenting behavior toward infants aged 12 months (Dayton et al., 2010). Disrupted representations, which are very distinctively negative representations, have been related to lower sensitivity, more intrusiveness, and more withdrawal during mother–infant interactions when the child is 24 months (Hall et al., 2015).

Research showing the predictive validity between measures of maternal representations and mother–infant interaction quality supports the hypothesis from attachment theory that there is a relation between these two core components of the mother–infant relationship. Thus, clinicians may use interventions targeting either mother–infant interactions or the mother's representations when attempting to help negative mother–infant dyads, assuming improvement in one component will improve the other. Yet this has rarely been tested in clinical practice, and we have only found three papers from one study of a sample of high-risk, substance-abusing mothers of newborn to 3-year-old children (Suchman et al., 2010; Suchman et al., 2010; Suchman et al., 2012). The results showed that improvements in mothers' representations of their children, as well as their reflective functioning (parents' capacity to keep their own and their infants' mental state in mind) (Slade, 2005), explained 8% of the variance in the improvement of the observed maternal interactive sensitivity (Suchman et al., 2012). An investigation of the relation between maternal representations and their parenting behavior would facilitate the development of preventive programs for mother–infant dyads in a general population.

6. The background to the current study

We used data from a naturalistic RCT study of low- to moderate-risk mothers and their infants (0–2 years) that investigated the effect of a Video Feedback of Infant–Parent Interaction (VIPI) intervention on mother–infant interaction quality beyond the effect of the universal Primary Child Healthcare Program provided by Well Baby Centers (Høivik et al., 2015). Mothers receiving the VIPI intervention showed an immediate improvement in their interaction quality after the intervention. However, at 6 months follow-up after the intervention, both groups had improved their interaction quality, and there were no differences between the two groups (Høivik et al., 2015). Using the same sample, the authors of the current inquiry found that at 6 months follow-up after intervention,

Table 1
Sample Characteristics at Inclusion.

Characteristics	<i>n</i>	Mean (SD)	%
Child characteristics	140		
Age at inclusion (months)	141	7.3 (5.1)	
Gender	141		
Boys			49.0
Girls			51.0
First born			72.0
Child living with	140		
Both parents			82.9
Mother			15.7
Mother and stepfather			0.7
Mother and father alternately			0.7
Maternal characteristics			
Age at inclusion (years)	140	29.7 (5.6)	
Ethnic origin	96		
Norwegian			82.6
Other European			6.5
Asian			5.4
African			3.3
South American			2.2
Education level	140		
Junior or senior high school			17.8
Vocational education			19.3
Bachelor's degree			25.0
Master's degree or higher			37.9
Family monthly income after tax (in 1000 Nkr) (Median normal population 2011)	135	33.9 (17.5) (35.9)	
Characteristics	<i>n</i>	Mean (SD)	
Parent Stress Index (PSI) total score	116	209.14 (44.44)	
Alcohol consumption (AUDIT)	105	3.56 (2.78)	
Depression (BDI)	119	12.03 (8.63)	
Anxiety (BAI)	120	5.58 (6.48)	
Emotional Availability Scales (EA) total score	152	137.91 (28.15)	

some features of the representations, such as anxiety, fear for the infant's health and safety, perceptions of the infant as difficult to care for, and sensitivity, but not the overall categories, changed from a baseline assessment for mothers in both groups (Sandnes et al., 2023). The present study aims to extend these results by investigating whether the changes in mother's representations were related to the changes in infant–mother interaction quality.

7. Research aims

The aim of this study is to investigate the following research question: Are changes in mothers' representations of their infant related to changes in observed mother–infant interaction quality over a period of 9–13 months?

8. Materials and methods

We used data from a naturalistic multi-site RCT study that investigated the effect of a Video-feedback of Infant Parent Interaction intervention (VIPI) on mother–infant interaction quality compared to that of conventional care at community Well Baby Centers, which was the treatment as usual condition (TAU) (Høivik et al., 2015). At six months follow-up after the intervention ended, there were no differences between the intervention group and the TAU-group, neither on improvements of interaction quality, nor on alterations of features of the mothers' representations of their infants (Høivik et al., 2015; Sandnes et al., 2023), thus the full sample was included in the current investigation.

8.1. Participants

In the original RCT study, parents with infants from the cities of Trondheim and Oslo and six rural municipalities were self-recruited or invited to participate by public health nurses at Well Baby Centers or other professionals. The inclusion criteria were infant age of 0–24 months and infant–parent interaction difficulties, broadly defined by the parent or a professional. Exclusion criteria for parents were severe mental health disorder (psychosis), developmental disorder, ongoing substance abuse, and insufficient language skills to complete the self-reporting questionnaires. There were no child exclusion criteria. There were 158 eligible families, of which 152 were enrolled and completed the baseline evaluation. Both parents were invited to participate, but in all except for two families, the fathers chose to refrain. At inclusion, 64% of the mothers were on parental leave; thus, the mothers mostly participated for practical reasons. The participants provided informed written consent and were not offered any incentives for enrolling to the study.

Table 1 presents the sample characteristics at the time of inclusion. The infants' mean age was 7.3 months ($SD = 5.1$ months); 51% were female, and 72% of the included infants were the first-born child in the family. The participating mothers' mean age was 29.7 years ($SD = 5.6$ years); 82.6% of the mothers were Norwegian, and 6.5% were from other European countries. Sixty-three percent of the mothers had a bachelor's degree or had pursued higher education.

Of all the enrolled families, 50.9% had asked for help for parenting challenges at Well-Baby Centers. The rest of the families had been advised by public health nurses at Well-Baby Centers or other professionals to voluntarily participate in the study. The motivations for participating in the study among 69.3% of the attending families were as follows: concern regarding their infant's regulation difficulties (32.6%), infant–parent interactional problems (14.5%), wanting to learn more (10.8%), parent's mental health (3.6%), developmental delay of the infant (3.2%), concern about infant's social development (2.4%), and a need for parenting support (2.2%).

Child Protection Services provided financial or other support to five of the included families. The sample was relatively heterogeneous, since the participating families were help-seeking or recruited based on professional evaluations. However, earlier studies concluded that the participants did not have any problems along several risk indicators; thus, the sample was low to moderate risk, with a minor number constituting a higher risk (Høivik et al., 2015; Sandnes et al., 2021).

8.2. Procedure

Data were collected in the families' homes over a period of 9–13 months ($M = 11.5$ months) 1) at baseline ($n = 152$) and 2) at follow up, 9–13 months after baseline ($n = 112$). Throughout the study period, all families received the universal Primary Child Healthcare Program provided by the community Well Baby Centers. Additionally, after baseline assessment, half of the families received the VIPI intervention. The follow-up assessments were conducted 6 months after this intervention had ended (Høivik et al., 2015).

The main outcome variables, namely the EA and the WMCI, were conducted at both time points. Three research assistants, each with a bachelor's degree in one of social work, nursing, or preschool education, collected data during two or three visits to the families' homes during a period of 1–2 weeks. At these visits, the mothers were videotaped while interacting with their infants for 30 min in an everyday, naturalistic situation (feeding, playing, changing diapers). The video recordings were later coded with the EA (Biringen, 2008). At the baseline evaluation and at follow-up, the mothers completed self-reported inventories and demographic interviews and were interviewed with the WMCI (Zeanah et al., 1994), which was recorded to facilitate subsequent coding. Ultimately, 142 WMCI from baseline were coded, since 10 interviews were missing or had been excluded due to the poor quality of the recordings. At follow-up, 104 interviews were coded, since eight were missing or had been excluded.

8.3. Measures

8.3.1. Demographics

Both at baseline and at 6 months follow-up, all the participants provided demographic and socioeconomic information in an interview conducted by the research assistants.

8.3.2. Maternal representations

All participating mothers' representations of their infants were assessed at baseline and at a follow-up 9–13 months after baseline with WMCI (Zeanah & Benoit, 1995). This semi-structured, hour-long interview is a much-used instrument that aims to capture parents' subjective perceptions, experiences, feelings, and thoughts about their infant's characteristics and personality, the relationship they have with their infant, and their caregiving abilities. The interview includes questions about pregnancy, delivery, the present and future, and especially attachment-sensitive situations (i.e., when the infant is hurt, ill, or frightened). Parents' descriptions in the interviews are rated on 15 five-point clinical scales (1 = none; 5 = extreme), six of which measure qualitative features of the representation, two measure content aspects of the representation, and seven assess the emotional tone coloring the representation. The first of the six qualitative scales concerns richness of perception, which refers to how the level of details of the parent's perceptions reflect how well the parent knows the child. The second qualitative scale, openness to change, reflects how the parent accommodates new information about the child and its changing developmental needs. The third qualitative scale, intensity of involvement, measures the parent's preoccupation and degree of emotional immersion with the child. The fourth feature, coherence, conveys the clarity, consistency, and organization of the parent's perceptions. The fifth, caregiving sensitivity, reflects how the parent understands the child's experiences and needs and responds accordingly. The sixth scale, acceptance, taps how the parent accepts the child as it is and how they accept the responsibilities of being a parent. The next two scales relate to the content theme of the parents' descriptions. The first content scale, infant difficulty, measures parents' perceptions of how difficult it is to relate to and care for their child. The second content scale is fear for infant safety and conveys parents' irrational concern for their infant's safety and health. The last seven scales entail the degree to which different affective tones are present during the interview (joy, pride, anxiety, anger, guilt, indifference, and disappointment). The patterns of scale ratings inform designating representation into one of three global categories, namely balanced, disengaged, or distorted (Zeanah et al., 1996). A two-way categorization of balanced and non-balanced can also be applied by collapsing the disengaged and distorted categories into the non-balanced category. A balanced representation is characterized by open, accepting, sensitive, elaborate, and coherent descriptions of the child and the relationship the parent has with the child. The parent integrates both positive and negative features of the child and accepts the child's subjective experiences and individuality. A disengaged representation often reflects an emotional distance with the child, and the parent can have general, intellectual, and cognitive descriptions of the child, the child's personality, and their own approach to caregiving. Sometimes parents with a disengaged representation seem indifferent or aversive and reject their child's needs. Distorted representations can convey inconsistent and incoherent descriptions, and the parent can appear overwhelmed by the child's needs. Also, the parent may be self-absorbed or preoccupied with other concerns and unable to focus on the child.

Two reliable raters coded the interviews. One of them is a clinical psychologist and the other has a master's degree in preschool education. Both were blinded to the randomization status of the study participants but not to the time of the interviews. In the beginning of the present study, we only coded the WMCI baseline assessments due to the availability of raters. The same raters agreed to code the interviews from the follow-up assessments; thus, it is possible that they had been influenced by their first ratings. The interrater reliability of the 15 clinical scales was mostly moderate (Cohen's weighted κ mean = 0.539). For the balanced, disengaged, and distorted categories, Cohen's κ was 0.898 (CI: 0.704–1.00), and for the balanced/non-balanced categories, Cohen's κ was 0.886 (CI: 0.671–1.00).

In a earlier paper, we reported the psychometric properties of the WMCI clinical scales in the current sample (Sandnes et al., 2021). Even though the qualitative scales, the content scales and the affect scales are distinct from each other, they are not independent of each other as the WMCI coding manual recommends evaluating the pattern of scores on all scales when assigning the representations to one of the three WMCI categories (balanced, disengaged or distorted). An exploratory factor analysis identified three factors, which were denoted balanced (loaded by the WMCI scales *richness of perceptions*, *openness to change*, *intensity of involvement*, *coherence*, *caregiving sensitivity*, *acceptance*, *joy*, and *pride*), resentful (loaded by the WMCI scales *anger*, *disappointment*, and *infant difficulty*), and apprehensive (loaded by the WMCI scales *anxiety* and *fear for infant's safety*). The extracted factors (balanced, resentful, and apprehensive) corresponded with the original WMCI categories and demonstrated concurrent validity with parenting stress and observed mother-infant interaction quality, and discriminant validity with socio-demographic variables (i.e. mothers' level of education) (Sandnes et al., 2021).

In a later inquiry, we found that the clinical scales anxiety, fear for infant's safety, sensitivity, and infant difficulty, changed from baseline assessment to follow-up. We wanted to investigate these changes further, thus these WMCI clinical scales were used in the current analysis. Additionally we included the three WMCI factors because using continuous measures offered some methodological advantages since they are more sensitive to subtle but clinically significant changes of aspects of representations when measured repeatedly (Whipple et al., 2011).

8.3.3. Mother–infant interaction quality

The EA evaluate the quality of communication and emotionality in infant–parent interactions (Biringen, 2008; Biringen et al., 2014; Biringen & Easterbrooks, 2012). Six dimensions assess the bidirectional emotional availability between the caregiver and the infant, four assess the parent's behaviors, and the last two rate the child's contribution to the interaction quality.

Sensitivity is the first adult dimension. Most importantly, it includes the parent's authentic and appropriate affects as well as conflict-solving strategies, attunement, awareness of timing, synchronicity, responsiveness, verbal and non-verbal congruency, flexibility, and creativity in play. The second adult dimension, structuring, refers to the parent's ability to set limits and follow their child's lead in ways that scaffold the child's development. This dimension includes how the parent guides the child and how the child's response to this affects the parent. Moreover, this dimension also includes the degree of structuring that the parent provides, how this is done, and the way the parent sets limits and stays in charge when needed. Third, the parent's non-intrusiveness assesses the parent's ability to be emotionally available for the child without being intrusive; that is, the parent's ability to not be over-stimulating, over-directive, over-protective, or to verbally or physically interfere with or interrupt communication. Further, parent's non-hostility is the fourth and final adult dimension. This dimension rates the absence of overt or covert hostility, such as the lack of negative facial and vocal expressions, mocking, ridiculing, or making disrespectful statements or behaviors; the lack of threats of separation and frightening behavior; the lack of using silence as a disciplinary strategy; and the lack of hostile themes in play. The first child dimension is child responsiveness to the adult, which assesses the child's organization and regulation of emotions and behavior, including how the child seeks autonomy and exploration. The final child dimension, child involvement, refers to how and the degree to which the child initiates and involves the parent in interaction and play.

Each EA dimension consists of seven subscales scored as 1–7 (two subscales) or 1–3 (five subscales). The total score ranges from 42 to 174 points, with high scores representing good emotional availability. The scales are validated across a variety of contexts and used for children from 0 to 14 years of age (Biringen et al., 2014; Ziv, Aviezer et al., 2000).

In the original study, from which the current inquiry collected data, four coders independently scored the EA from 30-minute recordings of infant–parent interactions in natural situations in the families' homes. The coders were certified by Zeynep Biringen in the fourth edition of the EA, and their educational background consisted of a master's degree in preschool education, specialization in clinical psychology or psychiatry, and being a postgraduate student of clinical psychology. The intraclass correlation (ICC) calculations were based on 36 video recordings which were re-rated, as described in Høivik et al. (2015). The obtained ICC between the raters was 0.461 (Høivik et al., 2015). This low ICC was due to relatively large residual variance (139.739). The inter-rater variance (22.973) was by far the smallest of the variance components, thus the contribution of the inter-rater variance to the total variance is practically negligible. The ICC would still be 0.499 if this variance component were 0 instead of 22.973 (Høivik et al., 2015). The re-rating scores were only used for the ICC calculations.

To investigate the current research questions, we have used the EA scales total score, the EAS parental positive interaction (sensitivity and structuring) and EAS parental non-negative interaction (non-intrusiveness and non-hostility).

8.4. Statistical analysis

A power analysis was executed prior to the study. An expected standardized difference between the VIPI-group and the TAU-group of 0.5 required 60 families in each group to give a power of 78% at a 5% significance level (Høivik et al., 2015).

To answer the research question, we calculated the difference between the EA total score, EA parental positive and EA parental non-negative at baseline and follow-up and the difference between the baseline- and follow-up scores on WMCI factor 1 balanced, WMCI factor 2 resentful, WMCI factor 3 apprehensive, WMCI clinical scales of anxiety, fear for infant safety, sensitivity, and infant difficulty for the full sample. We then correlated the difference between the scores of the EA and the WMCI scores. The correlation analyses were conducted in SPSS version 28.

We regarded two-sided p-values less than 0.05 as statistically significant, but p-values between 0.05 and 0.01 were interpreted with caution due to multiple hypotheses. We report 95% confidence intervals (CI), where relevant.

Table 2

Pearsons' correlation between change in WMCI factors and scales (sensitivity, fear of safety, infant difficulty and anxiety) and change in EA total score, EA positive and EA non-negative from baseline to follow-up for the full sample.

Variables	1	2	3	4	5	6	7	8	9	10
1. EA total score	-									
2. EA positive	.914 **	-								
3. EA non-negative	.922 **	.814 **	-							
4. WMCI factor 1	.062	.014	.099	-						
5. WMCI factor 2	-.088	-.103	-.154	-.485 **	-					
6. WMCI factor 3	-.036	-.009	-.088	-.069	.103	-				
7. Sensitivity	.058	.037	.093	.861 **	-.429 **	-.063	-			
8. Fear of safety	.072	.080	.035	.017	-.009	.863 **	-.033	-		
9. Infant difficulty	-.134	-.116	-.176	-.448 **	.872 **	.155	-.371 **	.028	-	
10. Anxiety	-.136	-.097	-.188	-.137	.189	.859 **	-.075	.483 **	.241 *	-

Note. WMCI = Working Model of the Child Interview; EA = Emotional Availability Scales; EA positive = EA adult sensitivity + EA adult structuring; EA non-negative = EA adult non-hostility + EA adult non-intrusiveness

*p < .05. **p < .01.

8.5. Ethics

The data used in this inquiry were collected from the original study “A Randomized Controlled Trial of the Intervention Video-Feedback of Infant–Parent interaction (VIPI) for infants under two years of age.” The Norwegian Center for Research Data and the Regional Committee for Research Ethics in Mid-Norway (REC) (reference number 1.2007.2176) approved the collection and storage of data in the original study. The study has been registered in the International Standard Randomized Controlled Trial Number Registry (reference number ISRCTN 99793905). Our study was found to be exempt (REC reference 2017/1723) since all data from the original study were anonymized. Written consent was collected from all the participants.

9. Results

The correlations between the change from baseline to follow-up in WMCI factor 1 balanced, WMCI factor 2 resentful, WMCI factor 3 apprehensive, WMCI clinical scale sensitivity, and WMCI clinical scale infant difficulty and change from baseline to follow-up in the EA total score, EA parental positive, and EA parental non-negative are presented in [Table 2](#). The correlations were close to zero and not significant.

10. Discussion

Mothers’ negative representations of their infants and low-quality mother–infant interactions are core aspects of mother–infant relationships at risk, which can be identified for targeted interventions even in general, low-risk populations ([Fukkink, 2008](#); [Mountain et al., 2017](#); [Skovgaard et al., 2008](#)). However, knowledge of whether change in one aspect is related to change in the other is limited. To our knowledge, this is the first naturalistic study that investigates such relations in a low- to moderate-risk community sample. The results showed no evidence of such relations, which means that in this sample, previously documented changes in mothers’ representations of their infants and changes in the quality of interactions happened independently of each other. We find several possible explanations for these results.

First, the changes in the mothers’ representations were significant but relatively small ([Sandnes et al., 2023](#)). In low- to moderate-risk samples, extremely negative mother–infant interactions and negative aspects of the mother’s representations are rare, causing the scores to be relatively homogeneous. The correlation coefficient will be systematically smaller with more homogeneous scores than heterogeneous scores ([Bland & Altman, 2011](#)), and the correlation coefficient estimates may be too small to detect a significant association.

Second, our findings are not consistent with the results from the study conducted by Suchman and colleagues (2010, 2012) showing that improvements in mothers’ representations of their child combined with improvements in their parental reflective functioning (the capacity to keep their own and the child’s mental state in mind) ([Slade, 2005](#)) explained a small but significant proportion of the variance in improvement of observed maternal sensitivity when interacting with their infant ([Suchman et al., 2010](#); [Suchman et al., 2010](#); [Suchman et al., 2012](#)). A recent meta-analysis concluded that the associations between parents’ reflective functioning and parenting behaviors are stronger when measured in emotionally challenging situations and in samples with a low socioeconomic background ([Stuhrmann et al., 2022](#)). In our study, measures of the mothers’ reflective functioning were not included; thus, we could not perform similar analyses to study such mechanisms of change.

Third, our results are not in line with earlier studies showing that mothers’ representations predict later quality of interactions with their infants, or conversely, that mother–infant interaction quality predicts mothers’ later representations of their infants. The results from studies showing predictions between mothers’ representations and mother–infant interaction quality used samples of risk associated with the infants (prematurity) ([Hall et al., 2015](#); [Korja et al., 2010](#)) or the mothers (victims of interpersonal violence) ([Dayton et al., 2010](#)), or they found predictions with aspects of the mother–infant relationship that were not specifically rated by the WMCI ([Biringen et al., 2000a](#)) or the EA ([Aber et al., 1999](#)). Little is known about whether changes of representations after targeted interventions are different from changes occurring in the nonmanipulated natural settings typically assessed in longitudinal studies ([Sroufe, 2021](#)). Even though the results of the current study indicate that such changes may be different and cannot be compared, research investigating the trajectories of the changes in mothers’ representations of their infants and the quality of mother–infant interactions in different settings is warranted.

Fourth, there may be a time lag before updating the representation in response to a change in interaction, as proposed by early theories of attachment ([Bowlby, 1973](#)). In the current study, the mothers could have altered their representations more or improved their interaction quality further *after* the final data assessment. If so, a possible relation between such changes could be detected after more than six months following interventions. In their study of high-risk mothers of infants, Suchman and colleagues concluded that the effect of changes in mothers’ representations and their parental reflective functioning in the mother–infant interaction quality was evident at 12 months follow-up after the intervention ([Suchman et al., 2017](#)). Again, their study included high-risk mothers; thus, future research should include assessment points later than 6 months after interventions in low- to moderate-risk samples.

Fifth, it is possible that the context of the observations of the mother–child interactions influenced the score variance of the measurement instrument (EA). The families were observed for 30 min in everyday situations, such as feeding, playing, and changing diapers, in a naturalistic and non-stressful setting in their own homes. Even though 30 min is considered a reasonable length of time to assess and evaluate mother–infant relationships, more time may be needed to reveal serious interactional problems ([Biringen et al., 2005](#)). Moreover, in low-risk samples, mothers’ hostility may be difficult to assess unless the observational setting evokes frustration ([Biringen et al., 2014](#)). In our study, the observational situation did not involve any stressful tasks that potentially could have activated

behavior from the child that elicited the mother's frustration and activated her negative representations and negative interaction patterns. Thus, the mothers in our study had the opportunity to display their highest level of parenting quality, which also may have contributed to the low variance in the EA.

10.1. Conclusion

Our results imply that in a low- to medium-risk sample, changes in mothers' representations of their infant and changes in mother–infant interaction quality after primary care interventions are not related. As discussed in this paper, the results may reflect methodological shortcomings, which provides some important implications for clinical practice and research.

For clinicians, our results may imply that both mothers' representations and the quality of the mother–infant interactions should be targets for interventions, and as a norm, both should be assessed after interventions.

When observing interactions between parents and their infants, clinicians and researchers should include stressful tasks that will more likely evoke negative aspects of the mother's representations that possibly influence the negative mother–infant interaction patterns associated with later childhood pathology.

Future research should investigate parents' representations and infant–parent interaction quality from at least three assessments over an extensive period to explore developmental trajectories and how they relate to each other, and to capture changes occurring more than six months after interventions.

10.2. Strengths and limitations

A major strength of this study is the naturalistic design and the relatively large sample, with all data having been collected in the participants' homes. Measuring the mothers' representations continuously using the WMCI clinical scales allowed for the capture of small but clinically relevant changes in addition to the global categories. However, there are also limitations attached to these strengths. Only two fathers participated in this study, even though they had been invited to do so; thus, the results cannot be generalized to fathers. The naturalistic setting complicated the control of confounding variables that possibly influenced the results. Finally, even though the WMCI clinical scales allow for a continuous measure of mothers' representations, moderate interrater reliability could have affected our analyses (Sandnes et al., 2021).

CRedit authorship contribution statement

Kjersti Sandnes: Data curation, Writing – original draft. **Silja Berg Kårstad:** Writing – review & editing. **Stian Lydersen:** Formal analysis. **Turid Suzanne Berg-Nielsen:** Writing – review & editing, Supervision.

Declaration of Competing Interest

None.

Data availability

Data are available for review upon request.

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