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Development and Initial Reliability and Validity of a New Measure of Distorted Maternal
Representations: The Mother-Infant Relationship Scale

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Abstract

Distorted Maternal Representations (DMRs) - mother's ideas, understanding, and feelings about the infant - shape early interaction and the emerging relationship. Distorted interactions reportedly affect infant attachment and socioemotional development and may be associated with maternal early adversity and trauma. Limited measures are available that could be used as screening tools of DMRs. The aims of this study were to (1) describe the development of the Mother-Infant Relationship Scale (MIRS) and (2) to evaluate its psychometric properties. The development and validation of the MIRS closely followed standard guidelines for the development of psychometric tests. Psychometric properties were examined across 2 samples: 78 adult psychiatric patients with features of borderline personality, and 86 individuals from a non-clinical sample (N=164). The scale demonstrated excellent internal consistency (Cronbach's alpha .91) for clinical and adequate (.78) for non-clinical sample, excellent test-retest reliability (*ICC* .81), and good concurrent validity with an observational (Pearson's correlation coefficients ranging from -.35 to -.54) and a representational measure (.53). Factor analysis revealed 3 components: DMRs specific to (1) maternal hostility/rejection of the infant, (2) issues about parenting/attachment (3) anxiety/helplessness about infant care. Findings suggest the MIRS is a reliable and valid screening tool of DMRs. Potential uses in clinical and research settings are discussed.

Keywords:

distorted maternal representations, assessment of parent-infant interaction, relational disturbance, screening tool, infant mental health.

There are few measures available that can be used as screening tools of disturbance in the mother-infant relationship clinically or in research, despite burgeoning research

specifying severe consequences of early relational disturbance on infant developmental outcomes. This study reports the development and initial psychometric properties of a new measure of distorted maternal representations – The Mother-Infant Relationship Scale - a screen of disturbance in mother-infant interaction at the level of representation.

Background

Distorted Maternal Representations (DMRs) are disturbed ideas, thoughts, and feelings that a mother holds about her infant and herself as a parent. They are influenced by the mother's early attachment-related trauma history and her capacity to develop a psychological understanding of the infant (Slade, 2005). Maternal representations impact on several aspects of the mother-infant relationship including perception and understanding of infant affective communication, affect attunement and regulation, emotional availability, sensitivity, responsivity, and in turn socioemotional development of the infant including stress regulation, attachment organisation, and impact on self-development (Stern, 1985; Schore, 2003; Fonagy, Gergely, Jurist, & Target, 2004). In high-risk cases where maternal trauma history is denied or unresolved, DMRs manifest as disturbances in the mother-infant interaction and are characterised by hostility, negativity, rejection and fear of the infant and self as a nurturing parent/attachment figure (George & Solomon, 1996; Lyons-Ruth, Bronfman & Parsons, 1999; Lyons-Ruth, Melnick, Bronfman, Sherry, & Llanas, 2004). Risk factors for DMRs include maternal psychopathology, for example, Borderline Personality Disorder (BPD) and trauma related mental disorder, severe depression, and a history of attachment-related trauma, which are frequently associated with current difficulties in interpersonal relationships, emotional dysregulation and social risk (Flykt et al., 2012; Lyons-Ruth et al., 2004; Newman & Stevenson, 2008). Further, longitudinal research has linked DMRs and disturbances in the mother-infant interaction to poor child developmental

outcomes, such as disorganised infant attachment, emergence of internalising and externalising problems in middle childhood, and onset of BPD in adolescence (for meta-analyses see Van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999; Madigan, Bakermans-Kranenburg, Van IJzendoorn, Moran, Pederson, & Benoit, 2006). However, limited measures are available that could be used as screening tools to identify mother-infant dyads at-risk of relational disturbance, to provide assessment and treatment where appropriate.

Early identification of disturbances in mother-infant interaction presents an opportunity for early intervention which could improve developmental trajectories of infants otherwise vulnerable to consequences of transgenerational trauma (Sleed & Fonagy, 2010; Svanberg, 2009). In addition, this could lessen longer-term social and economic cost of childhood attachment disorders (Barnett, 1996; Oates, 2007). However, research has found that practitioners who have a key role in early identification (e.g., maternal health nurses) are inconsistent in their assessment of risk of disturbance in mother-infant interaction due to a lack of resources and training in the assessment of parent-infant relationships (Appleton, Harris, & Oates, 2008).

Currently available measures are complex to administer, code, and score and require resources not reflected in the economic circumstances of most present-day health systems. Well established observational measures, such as the Atypical Maternal Behaviour Instrument for Assessment and Classification (AMBIANCE; Lyons-Ruth et al., 1999), the Emotional Availability Scales (EAS; Biringen, 2000, 2008), and the Child and Adult Relational Experimental Index (CARE-Index; Crittenden, 2007) require high level of training for reliable use. Further, their administration requires videoing of the mother-infant interaction under controlled conditions designed for research purposes, and coding is

complex and time consuming. Hence, they are not used as clinical screening tools and remain mostly utilised in research.

On the other hand, observational measures that have specifically been developed to enable clinicians to assess the quality of the parent-infant relationship have limited evidence for their psychometric properties, or they lack clinical utility as screening tools. For example, although the Nursing Child Assessment Satellite Training (NCAST; Barnard, 1994; Kelly & Barnard, 2000) is widely used to assess postpartum clinical issues including mother-infant relationship quality (Svanberg, Barlow & Tigbe, 2013), there have been no studies reporting its reliability or validity. The Parent-Infant Relational Assessment Tool (PIRAT; Broughton, 2008) incorporates many relational elements including indicators of risk of severely compromised parent-infant relationship, however to date, only one study has reported adequate inter-rater reliability (ICC = 0.79) (Broughton, 2010). The Parent-Infant Interaction Observation Scale (PIIOS; Svanberg et al., 2013) has high inter-rater reliability (0.94, 95% CI, 0.93-0.95) internal consistency (Cronbach's alpha α = 0.96), and concurrent validity (-0.86 correlation with the CARE-Index), however, it requires specialist training in administration and coding which is not routinely available in Australia (Svanberg & Barlow, 2013). Psychometric properties of the Keys to Interactive Parenting Scale (KIPS; Comfort & Gordan, 2006; Comfort, Gordan, & Unger, 2006) and the Indicator of Parent-Child Interaction (IPIC; Baggett & Carta, 2008) have not been evaluated using mother-infant dyads at risk of relational disturbance and hence it is not known whether they could be reliably used as screening tools for this purpose.

Other measures of DMRs are typically based on interview data providing rich information, however, like the research focused observational measures, they do not meet clinical utility standards as screening tools such as well-timed administration and scoring. For

example, the Parent Development Interview (PDI; Aber, Slade, Berger, Bresgi, & Kaplan, 1985) is arguably the most widely used global measure of (deficits) in parental reflective function (PRF) i.e., the mother's capacity to conceive of infant's states of mind in terms of thoughts, feelings, and desires. Although the PDI has good predictive validity in terms of attachment disorganisation and disturbance in interaction (for reviews see Schribbor et al., 2013; Grienenberg, Kelley, & Slade, 2005), administration can take up to 2 ½ hours, after which the interview needs to be transcribed, coded and scored. This lengthy process renders it impractical as a clinical screening tool even if the concept of PRF is becoming more widely used as a clinical marker of parenting self-competency and attachment (Judd, Newman, & Komiti, 2018). Other interview-based measures such as the Working Model of the Child Interview-Disrupted (WMCI-D; Crawford, & Benoit, 2009), the Hostile/Helpless coding system of the Adult Attachment Interview (H/H; Lyons-Ruth; 2005), and the Assessment of Representational Risk coding system of the PDI (AAR; Wain, 2010; Slead, 2013) have been specifically designed to evaluate DMRs in high-risk populations. However, these also require specialist training for lengthy interview and complex coding processes which are impractical as clinical screening tools in most public health settings.

Research studies on self-report measures that have been developed to address limitations associated with observational and interview-based measures and increase clinical utility as screening tools have yielding mixed findings in terms of their reliability and validity. There have been two modifications of the Parent Bonding Questionnaire (PBQ; Brockington et al., 2001; Brockington, Fraser & Wilson, 2006) designed to screen for disturbance in mother-infant interaction in high-risk cases, including possible child abuse. The PBQ is reportedly used in clinical practice due to its practicality as a parent completed questionnaire linked with maternal mental health (Brockington, 2011), however, studies of its concurrent validity using observational i.e., 'gold standard' measures of disturbance in

mother-infant interaction, have not been reported. The Maternal Postpartum Attachment Scale (MPAS; Condon & Corkindale, 1998) and the Mother to Infant Bonding Scale (MIBS; Taylor, Atkins, Kumar, Adams, & Glover, 2005; Wittkowski, Wick, & Mann, 2007) are also predictive of maternal mood disorder, however, it is not known if they are able to reliably identify disturbance in the mother-infant interaction. Although maternal mood disorders and disturbance in mother-infant interaction are often associated clinically, evidence suggests the two disorders differ in their severity, course, treatment approach needed, and to some extent, their cause (Righetti-Veltema, Conne-Perreard, Boussquet, & Manzano, 2002; Brockington, 2011). For this reason, measures designed to screen for relational disturbance need to be able to reliably and validly identify disturbances in the mother-infant interaction and DMRs, rather than associated postpartum mental health disorders, which may or may not be indicative of relational disturbance.

More recently, Luyten, Mayes, Nijssens, & Fonagy (2017) have developed the Parental Reflective Functioning Questionnaire (PRFQ) with initial evidence for its construct validity. However, to date, there are currently no available data considering its reliability as a screening tool for disturbance in interaction in high-risk samples.

Taken together, this body of research highlights a clear need for development and evaluation of measures of early relational disturbance. Specifically, development of measures that could be reliably used as screening tools to identify dyads at-risk of disturbance and offer assessment and subsequent support where appropriate are warranted.

Therefore, the aim of this study was to develop a brief screening measure of disturbance of mother-infant interaction (the Mother-Infant Relationship Scale; MIRS) at the level of representation (i.e., DMRs), and in turn to evaluate its psychometric properties in clinical and non-clinical groups. Internal consistency, and test-retest reliability, and construct and convergent validity of the Mother-Infant Relationship Scale (MIRS) were evaluated.

Method

The development and validation of the MIRS closely follows standard guidelines for the development of psychometric tests (DeVellis, 2012). The process of development and evaluation was divided into several stages, (1) generating the pool of items for the measure, (2) selection of items based on ratings from expert and patient focus groups (3) evaluation of psychometric properties.

STAGE 1 – Measure development: Generating the items

Procedure

In the first stage, potential items for the measure were generated based on a careful review of existing measures and wider research literature of DMRs in the context of early mother-infant relational disturbance. This included psychotherapy literature (Baradon et al., 2005; Freiberg, 1975, 1980; Lieberman & Van Horn, 2008; Stern, 1985; Winnicott, 1965, 1971), attachment and reflective function literature (Fonagy, 2001; Fonagy et al., 2004; Solomon & George, 2011), DMRs activated during pregnancy and postpartum (Ammaniti, Tambelli, & Odorisio, 2013; Beebe & Lachman, 1994; Brockington, 2011; Crawford et al., 2009; Madigan et al., 2006), and observational studies (Beebe & Lachman, 2002; Beebe et al., 2010; Beebe & Steele, 2013; Biringen et al., 2005; Lyons-Ruth et al., 2004).

Items were also developed based on a review of clinical files on a perinatal and infant inpatient unit. Sixty admission files were scanned for verbatim examples of DMRs yielding 44 phrases (inclusion criteria ensured mothers were over 18 years old, not presenting with history of psychotic symptoms; infants were birth to 1 year old).

Information from all sources of information was brought together, themes identified, and items written which mapped on to those themes. Themes denoted rejection/hostility/negativity towards the infant, anxiety/helplessness about infant mortality

and care for the infant, affect communication errors, ambivalence about self as a competent parent/attachment figure, maternal trauma history, narcissism/role confusion. Given maternal representations include representations of self-as-parent and infant (baby), items were generated to assess both dimensions of the construct. Items referred to *baby* and to behaviours developmentally appropriate for an infant under 12 months of age. Most items (i.e., as many as was possible in the context of negative themes) were worded positively to improve response rates (Goodman, 1997). In addition, items were to be easily understood and responded to.

Other factors that were kept in mind during the construction of the scale pertained to the clinical utility of a screening tool being developed. That is, the scale was to be simple to administer and score by primary health clinicians, taking between 5 and 10 minutes to administer.

STAGE 2 – Selection of items

To select items most prototypical of the DMRs characteristic of high-risk mothers two separate focus groups were conducted evaluating face validity and readability of the items.

Participants. The Health Professional Focus Group. Nine perinatal mental health professionals attended a one-hour focus group during business hours consisting of two psychiatrists, two psychologists, an occupational therapist, a speech pathologist, two psychiatric nurses and a senior social worker (all females; mean years of work experience = 12.5 years, range 2 – 25 years). A brief follow-up consultation was conducted with the same group to discuss changes. However, fewer members attended (n=6). The participant drop-out was largely due to hospital working hours (i.e., 24/7) which made scheduling of the same participants during business hours difficult.

The Patient Focus Group. A group of mothers (n=5) participated in a one-hour focus group to discuss a draft of the 30-item MIRS. Mothers were recruited during their inpatient

stay on the Perinatal and Infant Unit which is a 6-dyad specialist psychiatric unit for women in the postpartum period and their infants. Mothers who were 18 years or older, had an infant aged birth to 1 year, were not presenting with active suicidality and/or infanticide, or history of psychotic illness were eligible to participate. The mothers ranged from 23 to 36 years (M age =29, SD=4.8). Three mothers had borderline personality disorder, one severe anxiety, and one of postnatal depression and bulimia/history of self-harm in remission. All mothers had reported 'bonding' difficulties in the relationship with their babies. Two mothers had at least high school education, two mothers had vocational qualifications, and one mother an undergraduate university degree. All mothers were native English speakers. Their infants ranged from 3 weeks to 9 months (M age = 5.2 months, SD= 2.9).

Procedure. In the health professional focus group, participants were presented with a theoretical model of DMRs (Stern, 1985; Slade, 2005) and asked to indicate on a 0-100 scale how good they thought the MIRS captured DMRs characteristic of high-risk populations. They were then asked to rate the prototypicality of each item separately in terms of its prototypicality as capturing high-risk DMRs on a scale 0 (not at all prototypical) to 7 (most prototypical). The aim was to identify those items that depicted behaviours or experiences that were typical of mothers presenting with 'high-risk' disturbed relationship patterns with their babies. To achieve this, participants were asked to rate items using a partially fixed distribution: only 6 items could receive the maximum score of 7 (denoting highly prototypical items), 10 items could receive the next highest score of 6 (moderately prototypical items), and the rest of the items could receive any score between 0 and 5 (low prototypicality). In addition, the participants were asked to provide comments and suggestions.

In the patient focus groups, participants were presented with the MIRS and asked to rate whether each individual item was acceptable on a 4-point scale in terms of

comprehension (i.e., acceptable, somewhat acceptable, somewhat unacceptable, totally unacceptable). In addition, participants were invited to provide comments. The patient focus group was co-facilitated by a speech therapist and a psychology intern and supervised by a senior clinical psychologist.

STAGE 3 – Psychometric properties: Reliability and Validity

In the final stage of the study, reliability (internal consistency and test-retest reliability), and validity (construct and convergent) of the MIRS were examined.

Participants. The total sample consisted of 164 mothers of infants who ranged in age between 0-12 months. Women with indications of impairments in mother-infant interaction (clinical sample) were patients at a metropolitan hospital in Melbourne, Australia with an inpatient and outpatient specialist service for parents who are at-risk of harming their children (e.g., maltreatment, neglect) in the context of mental illness and/or significant psychosocial risk (n=78). The service is linked to the community via multiple referral pathways including maternal and child health, child protection services, and self-referral.

Exclusion criteria for participation in the study included active risk of suicide, infanticide, and (history of) psychotic symptoms. Decisions on eligibility to participate were made in weekly clinical case review meetings supervised by a consultant psychiatrist. For inpatients, in-person recruitment during the first week of hospital stay was used (average length of stay was 24 days). Outpatients were recruited via telephone during the first month of treatment as long-term mother-infant psychotherapy has been suggested to shift DMRs (Lieberman & Van Horn, 2008).

In terms of clinical diagnoses 38 (48%) mothers had an existing diagnosis of BPD, 10 mothers (12%) had a diagnosis of postnatal depression, 5 mothers (6.4%) had a diagnosis of depression/anxiety, 2 mothers (3.6%) had a diagnosis of PTSD, 22 mothers (28%) did not report a formal diagnosis at the time of recruitment for the study. In terms of social risk,

(10%) of families had current involvement with Child Protection Services, and 34 mothers (43%) had substance abuse history. In this sample, 100% of the mothers had reported difficulties in their relationship with their babies.

The non-clinical sample (n=86) consisted of women with no psychiatric history and no current concerns with their relationship with their babies. They were recruited via advertisements at community Maternal and Child Health Centres in the same region as the clinical sample.

Procedure. Ethics approval for the study was granted from the Human Research Ethics Committee. Informed consent was provided by the mothers.

The full study protocol involved filling out a survey, taking part in an interview (PDI; Aber et al., 1985) and a video-recorded mother-infant interaction (EAS; Biringen, 2008). Participants were given options to complete the study survey only (no reimbursement), or the full study protocol including the interview and the video for which a reimbursement was provided due to substantial time commitment required.

Mothers in the clinical sample who were inpatients completed the study protocol in the hospital unit during their stay. Outpatients completed the study protocol in person during a hospital visit before their psychotherapy session.

Mothers in the non-clinical sample completed the survey either on-line or in paper form. Those mothers in the non-clinical sample who indicated they were interested in participating in the full study protocol were interviewed and videoed interacting with their babies at the psychology training clinic. The interview and video procedure were consistent between groups.

To evaluate test-retest reliability the MIRS was mailed to both groups of participants 2 weeks after they completed the initial questionnaire. They were to be returned no longer than 4 weeks from the initial date of completing the initial MIRS.

Measures. A family background questionnaire was developed to obtain relevant demographic information about the mothers, infants, and their families and was completed by all participants. The questions collected information on ethnicity, languages spoken at home, education, occupation/employment, medical and mental health conditions, and postcode of the suburb where they lived to evaluate sociodemographic status. Education was divided into 3 categories where low indicated attended some secondary school level of education, medium indicated completed secondary school and vocational training, and high indicated completed tertiary education. Questions regarding the infants concerned age, developmental delay, and medical/neurological conditions. Information about families regarded marital/relationship status, family income, government benefits, and perceived financial stability (i.e., *Do you have enough money to meet your needs?*). Income was asked at the family level and divided into categories where low indicated below the year 2017 minimum national wage of AU\$40 000, medium from \$40-80 000, and high >\$80 000 per annum.

The Emotional Availability Scales 4th edition (EAS; Biringen,2008). The EAS is an observational measure that assesses quality of observed mother-infant interactions along six dimensions of emotional availability: four parent scales (sensitivity, structuring, non-intrusiveness, and non-hostility) and two child scales (responsiveness and involvement). The administration involves a video of the mother-infant interaction whereby a mother is invited to play with her baby for 8 minutes as she would at home. A rug, two soft toys, blocks, small rattle and a truck were provided. Interactions are rated by independent and reliable coders on the appropriateness of mothers' responses to their child's cues, display of appropriate and authentic affect and structuring their child's activities, while the children are rated on their response to their mother's interaction both overtly and affectively and their ability to engage their mother. Specifically, sensitivity is a global construct that considers qualitative factors such as affect, timing, flexibility, acceptance, conflict negotiation, and mother's awareness of

child cues as well as appropriate responsiveness. Structuring refers to mother's ability to structure and scaffold the child's environment and play. Non-intrusiveness refers to the degree to which the mother can be available however without interfering with the child's autonomy and space. Non-hostility refers to maternal behaviours that are free of impatience, malice, or harshness. Child responsiveness indicates how well the child responds to parental bids and expressions. Child involvement refers to the degree that the child invites or includes the parent in play. Each of the subscales is coded on a Likert scale, from 1 to 7; 1 indicating low or problematic, and 7 indicating high emotional availability. Reliability and validity of the EAS are well established (Biringen, 2005). In terms of internal consistency, intercorrelations of EAS dimensions range from .48 to .88, with the lowest correlations for the non-intrusiveness dimension. In terms of inter-rater reliability, Kappas between two independent coders (VB and MT) for 20% of cases was .95. In this study the EA subscales were used to assess convergent validity.

The Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden & Sagovsky, 1987). The EPDS is a self-report screen of depression symptoms after childbirth. It excludes somatic dimensions of depression such as fatigue and appetite variations which are normal during the ante- and postnatal periods. Each item is rated on a 4-point scale with a minimum total score of 0 indicating low depression and a maximum of 30 indicating severe depression. The EPDS has been shown to be valid (for a review see Gibson, McKenzie-McHarg, Shakespeare, Price, & Gray, 2009) and reliable screen for depression, correctly identifying 90.7% of mothers with depression (test-retest $ICC=.92$) (Kernot, Olds, Lewis & Maher, 2015). In this study, EPDS was used to identify mothers in the non-clinical sample who were experiencing significant postnatal depressive symptoms (cut-off scores above 14) and were therefore not eligible to participate in the study.

The Parent Development Interview (PDI; Aber et al., 1985). The PDI is a 45-item semi-structured clinical interview intended to examine parental reflective function (PRF); a parents' representations of their children, themselves as parents, and their relationship with their children. The interview assesses internal representations of relationships by tapping into the mother's understanding of infant's behaviour, thoughts and feelings by asking her to provide real life examples of affectively charged interpersonal situations e.g., "Describe a time in the last week when you and your child really clicked" or "didn't click". The questions provide a means to evaluate a mother's understanding of her own and her child's internal experience at challenging times. The PDI is coded across four dimensions: (1) awareness of the nature of mental states, (2) the explicit effort to tease out mental states underlying behaviour; (3) recognition of the developmental aspects of mental states; and (4) mental states in relation to the interviewer. Scores on the PDI vary from -1 to 9, with very low scores indicative of efforts to avoid, deny or downplay emotional experience, indicating disruptive and intense levels of emotion. High scores indicate capacity to think about and tolerate mental states in self and other. The PDI was audiotaped, transcribed, and then coded by a person (LN) trained to reliable standard, who was blind to study group membership. The PDI has high interrater reliability (.80-.95) and adequate to good internal consistency (alpha coefficients ranging from .68-.82) (Aber, Belsky, Slade & Crnic, 1999).

Statistical methods and analyses. Given MIRS scores were distributed symmetrically, parametric methods were used. Item level analyses were conducted to select items for the inclusion in the final version of the MIRS. Cronbach's alpha was used to examine internal consistency. Test-retest reliability was assessed using Intraclass Correlation Coefficients (ICC). To evaluate construct validity of the MIRS, exploratory factor analyses were performed. A principal components extraction using Promax with Kaiser Normalisation rotation method was completed, after which the number of factors was determined by

assessing the scree plot, with Eigenvalues >1 (Hills, 2011). Convergent validity was evaluated using Pearson Correlation Coefficients. All data were analysed using SPSS 22.0 (2015).

Results

STAGE 1 – Measure development: Generating the items

Items were organised to form a 30-item scale. The format was designed to facilitate easy reading, scoring and interpretation keeping in mind its purpose to be used by primary health clinicians with varying degrees of skill and expertise. The response set consisted of a 4-point Likert scale where each item is scored from *never* (0) to *always* (3) using an overall format of equally weighted items. An even-response option was chosen to prevent participants from making a neutral response.

STAGE 2 - Selection of items

Results showed that the health professionals (n=9) thought that the items captured the DMRs quite well as indicated by a median score of 90/100 ranging from 80/100 to 95/100. Only 3 items received scores under 5 (i.e., low prototypicality) by one respondent and were thus retained. All other items were rated as highly (score of 7) to moderately (score of 6) prototypical. Moderately prototypical items were included to distinguish between socially desirable response patterns and accurate representations and were thus retained in the analysis.

In addition, the expert consultation led to the identification of several concerns, including (a) the fact that some items might be difficult to comprehend for mothers with low reading capabilities, (b) that although some high-risk mothers may hold DMRs, they may not be motivated to endorse these items during a hospital admission due to potential implications for child protection, (c) social desirability of some of the items. Based on these concerns, several items were reformulated to ensure easier reading and comprehension, and some were

reverse coded to address comments regarding social desirability (e.g., Item 12 was changed from '*I feel that my baby does not like me*' to '*I feel that my baby likes me*'), leading to a set of 30 items which together constitute the MIRS. The items were reviewed again by the same group of health professionals (n=6) and rendered improved.

Following the health professional focus group, the 30-item MIRS was presented to the patient focus group. All items were deemed readable and comprehensible. Four items were identified as 'somewhat unacceptable' due to their potentially distressing effect on the patients (items 15. '*I feel rejected by my baby*', 19. '*I feel that my baby wants to upset or hurt me*', 20. '*I feel worried that I will repeat bad relationship patterns with my baby*', and 22. '*I feel worried that my baby might experience abuse*'). However, due to the low frequencies of responses and because the scale was specifically designed to screen for disturbances in mother-infant interaction in high-risk populations, these items were retained.

Out of a total of 30 items, 10 items were positively worded/reverse coded. All items were rated on a 4-point Likert scale from *never* (0) to *always* (3) with a possible minimum score of 30 and maximum score of 60. Lower scores indicate low risk, and higher scores high risk of disturbance in mother-infant interaction at the level of maternal representation.

Finally, readability of the items was assessed using the Flesch-Kincaid test (Bond & Fox, 2007; Pallant & Tennant, 2007). Appropriate readability index (87.7) and a reading grade level (3.6) were determined which means that the MIRS could be completed by a wide range of the population. The items are provided in Table 1.

Insert Table 1 about here

STAGE 3- Psychometric Properties: Reliability and Validity

To evaluate the psychometric properties of the measure, the 30-item MIRS was distributed as part of the study protocol among clinical and non-clinical mothers.

Sample Characteristics. There were no significant differences in age between mothers in the clinical ($M=30.4$ years, $SD= 6.5$) and the non-clinical sample ($M=32.5$ years, $SD= 4.9$); $t(129)=1.69, p =.094$. However, the mean age of infants in the clinical sample was significantly lower ($M= 5.2$ months, $SD= 2.9$) than of those in the non-clinical sample ($M=7$ months, $SD=2.9$). All infants were full-term and had no developmental delay or known neurological impairment. Other descriptive data on sociodemographic characteristics of the sample are presented in Table 2 highlighting several differences between the groups.

Insert Table 2 about here

Reliability. Several types of reliability of the MIRS were examined. Firstly, the internal consistency of the MIRS was calculated using Cronbach's alpha and was found to be excellent in the clinical (.91) and acceptable in the non-clinical sample (.78) (Cicchetti, 1994).

To evaluate the test-retest reliability of the MIRS intraclass correlation coefficient (ICCs) were calculated for the sample of 30 mothers (11 from the clinical and 19 from the non-clinical sample) who completed the MIRS twice. Only responses received within the required 4-week period since the initial questionnaire was completed were included in this analysis. Response times ranged from 2 to 4 weeks ($M= 21.4$ days, $SD= 3.8$). Excellent

(Cicchetti, 1994) test-retest reliability was indicated by a strong positive correlation between the two mean MIRS item scores ($ICC=.81$).

Construct validity. Given the preliminary nature of the study and limited sample size, we examined the construct validity of the MIRS using Principal Component Analysis (PCA) in the total sample, followed by the clinical and non-clinical samples.

First, correlations between items were examined. Of the total sample, three items on the MIRS (Items 18, 21, and 28) did not correlate with any other items ($r < .3$) and were thus removed from the analysis.

Factor structure of the MIRS. The scree test indicated a three-factor solution. Eigenvalues of the first three factors were 8.5, 2.8, and 1.7 respectively, together explaining 62% of variance. The three factors consisted of twelve (Items 19, 17, 16, 15, 14, 11, 10, 26, 13, 6, 22), seven (Items 5, 8, 12, 23, 24, 25, 27), and seven items respectively (Items 2, 4, 7, 9, 20, 29, 30). Promax and Varimax solutions of the three factors were similar. Solutions of more than three factors were difficult to interpret because of the small number of items comprising the fourth, fifth, and sixth factors.

The content of these three factors was readily interpretable and closely aligned with the theoretical descriptions of key features of DMRs. Factor 1 was labelled (1) Hostility/Rejection as the items captured hostility, rejection, withdrawal, and negativity towards the infant. Although it is possible that the items that elicit maternal withdrawal could comprise an independent factor in a larger sample resulting in a more even distribution of items across factors, in this sample the model provided a better fit when the items were merged together. Second factor captured items reflecting a mother's capacity to identify as a nurturing and a competent attachment figure/parent and to having confidence in reading

infant cues and was thus labelled (2) Parenting/Attachment. All items in this factor were positively worded, that is, reverse scored for scoring. The third factor consisted of items related to (3) Helplessness/Anxiety about the care for the infant and its safety.

However, several items emerged as complex. For example, Item 22 *'I feel worried that my baby might experience abuse'* negatively loaded onto factor 1 where the rest of the items in that factor loaded positively. Since it is not appropriate to reverse score already coded items, this item was removed (Hair, Black, Babin & Anderson, 2010). Items 4 and 30 loaded onto multiple factors possibly due to ambiguous sentence composition. For example, Item 4 *'I feel that I am not enjoying my baby as much as I should'* simultaneously incorporates a negative feeling state and a prescribed mental state. Due to a range of possible interpretations this item was deemed not useful. Therefore, items 4 and 30 were removed. Similarly, items 1, 3, and 5 loaded onto multiple factors and were removed.

The final model consisting of 19-items and its factor loadings are presented in Table 3. This version of the MIRS has a maximum score of 42 and minimum score of 15.

Insert Table 3 about here

Finally, the total sample was split to evaluate the PCA in the clinical and non-clinical samples separately. A similar pattern of loadings emerged in the clinical sample suggesting validity of construct.

However, in the non-clinical sample items loaded with slight variations. It appears that the mothers in the non-clinical sample view negative feelings e.g., frustration and anger (e.g., Items 9 and 11) as relatively normal aspects of parenting together with recognition that they may at times worry about past relationship patterns and ways in which those patterns

could influence parenting (e.g., Item 20). Similarly, items that refer to feelings of connection, rejection and interpersonal reciprocity (Items 13, 15, 16) are viewed as related to items that refer to confidence in attachment/relationships (e.g., Item 25). However, the items that assign hostile and particularly malevolent or bizarre mental states to the infant, for example, '*I feel that my baby is manipulative*'/ '*wants to hurt me*'/and '*need to withdraw from baby*' are viewed as a separate category altogether. This finding, although preliminary, suggests that DMRs are clinical phenomena. In general, the structure of components that emerged was the same, but with slightly different loadings between samples.

Concurrent Validity. To assess the concurrent validity of the 19-item MIRS, Pearson correlations were calculated between the total scores of the MIRS and measures of clinically relevant constructs, namely the PDI, a representational measure, and the subscales of the EAS, an observational measure. Correlations from the clinical sample are presented in Table 4 (insufficient data were available from the non-clinical sample). The strong positive significant correlation between the MIRS and the PDI (.529, $p < .01$) suggests the two measures tap into a similar construct (Cohen, 1988). Moderate negative correlations between the MIRS and EAS subscales (structuring -.508, $p < .01$; non-intrusiveness -.345; $p < .01$; non-hostility -.536; $p < .01$, child responsiveness -.248 $p < 0.5$; and involvement – .324, $p < .05$) suggest that DMRs are associated with low or problematic emotional availability i.e., disturbance in mother-infant interaction.

Insert Table 4 about here

Discussion

This paper describes the development of the Mother-Infant Relationship Scale (MIRS), a new screening measure of disturbance in mother-infant interaction at the level of distorted maternal representations (DMRs). Results from the study evaluating its psychometric properties suggest the MIRS is a reliable measure that is consistent internally and over time. Further, the results suggest the scale parsimoniously measures the DMRs construct concurrent with other representational and observational measures of mother-infant interaction and may be used as a clinical screener or for research purposes.

The detailed process of scale development and final item selection, including both health professional and patient focus groups, ensured the measure consisted of appropriate items capturing DMRs with good face validity. The MIRS was found to have excellent to adequate internal consistency and test re-test reliability.

Regarding construct validity of the MIRS, initial testing of the original pool of 30 items resulted in a reduction to 19 items. The factors were labelled (1) Hostility/Rejection, (2) Attachment/Parenting, and (3) Anxiety/Helplessness as these were the closest depictions of the DMRs elicited by the items. Factor structure and the meaning of items were essentially the same in the total and clinical samples, with some variation of loadings in the non-clinical sample. Items that referred to particularly hostile i.e., bizarre/persecutory mental states in the infant (e.g., *'my baby is manipulative'*) were seen in a different way to other items that more simply referred to negative feeling states (e.g., *'I feel sad when I think about my baby'*). The non-clinical sample responses differed from the clinical sample in intensity as well as the level of the interpretation. This result could mean that an 'ordinary mother' (Winnicott, 1971) may at times experience her infant as demanding, however, without drawing the conclusion that this is because the infant wants to hurt or upset her. This is consistent with previous research and theory that argues that negative emotional experiences such as frustration, guilt

and anger are common in early parenting and are in healthy relationships integrated with feelings of connection with the baby and experience of oneself as an attachment figure (e.g., George & Solomon, 1996; Ogden, 1979; Slade, 2005; Vreeswijk, Maas, & Van Bakel, 2012). Although more research is required, this finding suggests DMRs are on a continuum and differ in the intensity and the level of interpretation between clinical and non-clinical groups.

Findings are also consistent with previous research with high-risk samples that found mothers with histories of attachment-related trauma and features of borderline personality experience challenges in integrating negative and positive aspects of parenting. Using the Hostile/Helpless coding system of the Adult Attachment Interview (George et al., 1985) several studies have shown that mental processes of denial and projection are characteristic of populations with chronic trauma (Lyons- Ruth et al., 2004, 2005). These mothers tend to split off the negative aspects of the parenting experience and project them onto the baby (congruent with factor (1) Hostility/Rejection), or unduly assign negative affective states to parts of the self as a ‘bad mother’ (congruent with factor (2) Attachment/Parenting). Previous research has also highlighted that rejection of positive aspects of parenting such as a sense of getting to know one’s child or feeling liked by one’s child may be indicators of risk of disturbance in interaction including severe anxiety about infant care and mortality (congruent with factor (3) Helplessness/Anxiety) (Brockington et al., 2006; George & Solomon, 2011). However, compared to these other assessment measures which require lengthy interview processes, the MIRS briefly screens for DMRs and indicates risk of disturbance.

Further, the results indicate the MIRS has good concurrent validity with the PDI (a representational measure) and with the EAS (an observational measure) that tap into disturbance in the mother-infant interaction. Since DMRs are typically elicited using discursive interviews such as the PDI, and since observational measures are considered the ‘gold standard’ in the study of disturbed mother-infant interactions (Brockington et al., 2006)

it was important to evaluate the concurrent validity of the MIRS with both types of measures.

The correlations between the MIRS and these two measures indicate that the MIRS taps into disturbance in interaction at the level of representation.

Associations between the MIRS and the PDI suggest the underlying constructs, distorted maternal representations (i.e., DMRs) and parental reflective function (PRF), are related. Both constructs encompass attributes of maternal representations, hence, the risk of disturbance in interaction and therapeutic change could be evaluated using either measure. However, where the PRF is a dynamic, relatively global construct evaluated from interview data largely utilised in research with low-risk samples; DMRs as measured by the MIRS capture more basic distortions of cognitions associated with disturbed mother-infant relationship patterns in high-risk populations elicited via self-report.

Moreover, associations between the MIRS and EAS suggest concurrent validity with an observational measure. The patterns of negative associations are in line with previous EAS research with high-risk samples which highlights that this group of women is more likely to be less sensitive, less structuring, more intrusive and more hostile in interaction with their infants; and their infants are in turn less likely to be responsive and less likely to engage their mother in interaction than their nonclinical counterparts (Newman, Stevenson, Bergman, & Boyce 2007). Although the EAS was not specifically developed for use in high-risk samples it is a well-established tool that can be used with very young infants (Biringen, 2000), measuring both mother and infant's relational behaviours, and which continues to prove reliable in identifying early problematic relationships. The concurrent validity between the MIRS and the EAS provides evidence that they capture related phenomena, and that the MIRS could thus be used as a screening tool for risk of relational disturbance.

Although the negative moderate association between the MIRS and the EAS suggests both measure distortions in the mother-infant relationship, it is important to note that the

MIRS captures distortions at the level of representation (i.e., self-report) whereas the EAS captures (clinician) observed disturbances at the level of behaviour. In other words, there are differences between the constructs at the level of expression and measurement. Furthermore, given both representational and behavioural manifestations of disturbances in the mother-infant interaction can be subtle (e.g., maternal withdrawal), it would be very important to utilise both types of measures in the assessment of the relationship quality. Where the MIRS could be used for screening purposes by primary health clinicians as a preliminary indicator of risk, clinical observational skills together with available observational measures should be utilised for a secondary level and more nuanced assessment of the interaction between the mother and her infant.

Limitations

Despite the strengths of the present study, such as the test of the initial validity in a high-risk sample and the use of both interview-based and observational measures to test the concurrent validity rather than only use of self-report, the present findings should be interpreted in the light of some limitations. First, while the current study provides preliminary evidence of a valid factor structure in the clinical sample, more research is required to confirm the three-factor structure of the MIRS in other samples such as adolescent mothers, or mothers from culturally and linguistically diverse backgrounds. Second, the present study did not consider the role of the father or paternal representations in the parent-infant relationship. The use of the word parent in the MIRS will allow for validation of the scale in both mothers and fathers in future studies. Third, while it is possible that a self-report instrument such as the MIRS containing direct statements pertaining to common distortions typical of high-risk cases e.g., “*my baby doesn't like me*” would produce defensive responding, it is also likely that mothers seeking relational help would endorse those items.

Indeed, many clinical risk screening tools regarding, for example, aggression, suicide, importantly include targeted questions about intent and mental state.

Clinical implications

In view of its brevity, affordability, and relatively easy administration, the MIRS is a promising screening tool of disturbance in the mother-infant interaction at the level of representation that could also be used in research. Because parenting disturbance in high-risk cases may have lifelong and intergenerational consequences on the individual, social and economic levels, it is important to continue to advance early screening processes in routine clinical practice in order to improve outcomes (Lieberman, Chu, Van Horn, & Harris, 2011). Whilst the MIRS could be used as a screening tool across the interdisciplinary infant mental health field, it does not replace the ‘gold standard’ observation for clinical decision-making purposes. Nevertheless, identifying dyads at-risk of relational disturbance by means of a brief, self-report screening tool available to a wide range of practitioners may provide a targeted opportunity for secondary level clinical assessment involving the observational and interview expertise, followed by early intervention when required. Routine application of this process could therefore potentially prevent the more severe and persistent manifestations of child maltreatment and neglect.

Conclusion

The MIRS is a promising screening tool of DMRs. Further evaluation studies are required to provide additional support for its psychometric properties in a range of different clinical settings (e.g., CALD mothers) and with different caregivers (e.g., fathers, foster carers) and to determine its long-term predictive validity in terms of infant developmental outcomes. Furthermore, DMRs is a complex construct from an assessment point of view and includes a variety of many different aspects of relationships such as relationship to self, to other (i.e., infant, own parents), past and present (Stern, 1985; Sloed & Fonagy, 2010).

Observable disturbance in mother-infant interaction is equally complex to assess and to our knowledge, there are currently limited valid diagnostic and screening tools of this process. Thus, refining measures of maternal states of mind in relation to her pre-verbal infant, and its disturbance, that have clinical utility, remains a research challenge.

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Table 1 *Set of Items Generated and Selected in the Development of the Mother-Infant Relationship Scale*

The Mother-Infant Relationship Scale – 30 item version

1. I feel that I am a good parent (RC)
 2. I feel anxious about how my baby will develop
 3. I feel I am confident as a parent (RC)
 4. I feel that I am not enjoying my baby as much as I should
 5. I feel I am the best parent I can be (RC)
 6. I feel sad when I think about my baby
 7. I feel worried about my baby's future
 8. I feel that I can work out what my baby is communicating (RC)
 9. I feel frustrated being a parent
 10. I feel that my baby is too demanding
-

11. I find I have angry feelings towards my baby
12. I feel that my baby likes me (RC)
13. I feel I can't connect with my baby
14. I feel that my baby wants too much from me
15. I feel rejected by my baby
16. I feel like my baby should give a lot back to me
17. I feel that my baby is manipulative
18. I feel that I respond to my baby's needs (RC)
19. I feel that my baby wants to upset or hurt me
20. I feel worried that I will repeat bad relationship patterns with my baby
21. I feel that my baby reminds me of my own childhood
22. I feel worried that my baby might experience abuse
23. I feel that my baby has inherited some good characteristic (RC)
24. I feel that being a parent has changed me in a good way (RC)
25. I feel that I make my baby feel safe and secure (RC)
26. I feel I need to withdraw from my baby
27. I feel that I am getting to know my baby (RC)
28. I feel that my baby reacts to my emotions (RC)
29. I feel it is hard to cut off when my baby is upset
30. I feel I need time away from my baby

Note: RC= reverse coded items

Table 2 *Sample Characteristics*

	Clinical sample	Non-clinical sample
	n=78	n=86
English as first language	96.9% (n ^a =75)	100%
Marital Status		
Married	26.3%	68.6%
Cohabiting	14.1%	29.1%
Single	17.2%	0%
Government benefits	46.5 %	35.4%
Education		
Low	22%	3.5%
Medium	17.4%	21.2%
High	18.2%	67.4%
Current employment	20.2 %	45.3%
Family Income (per annum)		
<minimum wage	21%	7.9%
\$40,000 – 80,000	25.7%	36.69%
>\$ 80,000	28.5%	47.1%
Perceived financial stability	19. 2%	28%

Note: n^a= Number of study participants for whom responses were available.

Table 3

Factor Loadings of Measured MIRS Items in the PCA

Factor	Total sample (N= 164)	Clinical sample (n=78)	Non-clinical sample (n=86)
1 Hostility/Rejection (α coefficient: .91)			
19. I feel that my baby wants to upset or hurt me	.977	.984	.776***
17. I feel that my baby is manipulative	.931	.957	.649***
16. I feel like my baby should give a lot back to me	.857	.946	.655*
15. I feel rejected by my baby	.856	.917	.516*
14. I feel that my baby wants too much from me	.705	.838	.394**
11. I find I have angry feelings towards my baby	.666	.776	.775**
10. I feel that my baby is too demanding	.577	.765	.705**
26. I feel I need to withdraw from my baby	.665	.710	-.443***
13. I feel I can't connect with my baby	.482	.543	.699*
6. I feel sad when I think about my baby	.481	.485	.355**
2 Parenting/ Attachment (α coefficient:.77)			
12. I feel that my baby likes me	.820	.864	.739*
27. I feel that I am getting to know my baby	.812	.806	.748*

THE MOTHER-INFANT RELATIONSHIP SCALE (MIRS)

23. I feel that my baby has inherited some good characteristic	.719	.794	.616*
25. I feel that I make my baby feel safe and secure	.656	.629	.714*
8. I feel that I can work out what my baby is communicating	.521	.522	.449*
<hr/>			
3 Helplessness/Anxiety (α coefficient: .62)			
<hr/>			
29. I feel it is hard to cut off when my baby is upset	.800	.934	.396**
20. I feel worried that I will repeat bad relationship patterns with my baby	.672	.675	.584**
7. I feel worried about my baby's future	.608	.651	.527**
9. I feel frustrated being a parent	.549	.589	.604**

Note: * Refers to Factor 1, ** Factor 2, and *** Factor 3 for the variation of loadings in the non-clinical sample compared to the total and clinical samples.

Table 4

Pearson Correlation Coefficients Between the 19-item MIRS, PDI, and EA subscales scores

	Correlation coefficients (n)
PDI	.529* (55)
EAS subscales	
Sensitivity	-.238 (55)
Structuring	-.508** (55)
Non-intrusiveness	-.345** (55)
Non-hostility	-.536** (55)
Child Responsiveness	-.248* (55)
Child Involvement	-.324* (55)

n= Number of study participants for whom responses were available. ** $p < .01$. * $p < .05$.

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