ARE POPULAR OBSERVATIONAL MATERNAL SENSITIVITY MEASURES CONSISTENT IN THEIR ASSESSMENT OF MATERNAL SENSITIVITY IN NORTH AMERICA?

YOOKYUNG LEE

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Abstract

This study examined three observational maternal sensitivity measures, Emotional Availability

Scales (EAS; Biringen, Robinson, & Emde, 1998; Biringen, 2008), the Parent Child Interaction –

Nursing Child Assessment Satellite Training Feeding Scale (NCAFS; Barnard 1978; Oxford &

Findlay, 2015), Mini-Maternal Behaviour Q Sort (MBQS; Moran, Pederson & Bento, 2009), to

determine the degree to which they measure sensitivity as defined by Ainsworth (Ainsworth

Maternal Sensitivity Scales (AMSS); 1969). The measures were administered to the same

sample of 50 diversely functional European American mother-infant dyads, including the scales

and subscales of the measures that were deemed to measure sensitivity for analysis. EAS,

NCAFS, and MBQS were significant predictors of Ainsworth's sensitivity (AMSS); however,

the role of socio-economic status varied across the measures. The findings suggest that three of

the most frequently used observational maternal sensitivity measures may not measure identical

features of sensitivity and should perhaps not be used interchangeably.

   Keywords: maternal sensitivity; observational maternal sensitivity measures; mother-
infant interactions

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Patience is bitter but its fruit is sweet – Aristotle

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Introduction

Maternal sensitivity is recognized for its important role in promoting healthy child development. The concept of sensitivity has long attracted the attention of developmental researchers and has been extensively studied in various contexts. Furthermore, a number of measures have been developed in the last decades to allow for the quantification and objective assessment of maternal sensitivity. However, consensus on the characteristics and behaviours that define maternal sensitivity is still sorely lacking. Currently, maternal sensitivity remains a broad concept that is often interchangeably used with other terms, including maternal responsiveness, mother-infant interaction, or maternal competency, without a clear organization of specific maternal caregiving behaviours that are identified to be sensitive (Meins, Fernyhough, Fradley, & Tuckey, 2001; Posada et al., 2016; Shin, Park, Ryu, & Seomun, 2008; van Den Boom, 1997). Given the inconsistencies in definition plaguing the scientific literature, it is worthwhile to question whether popular assessment tools designed to measure maternal sensitivity are indeed achieving this reliably. Moreover, there is a dearth of research or convincing empirical evidence to support the notion that maternal sensitivity takes the same form across diverse cultural groups (Ekmekci et al., 2016; Emmen, Malda, Mesman, Ekmekci, & van IJzendoorn, 2012).

The current study represents the first step of a two-phase inquiry that proposes to investigate both the interchangeability and the cross-cultural validity of popular standardized measures of maternal sensitivity.

The Importance of Maternal Sensitivity in Child Development

The concept of maternal sensitivity, introduced by Ainsworth (Ainsworth, Blehar, Waters, & Wall, 1978) is considered one of the most crucial features of positive parenting, with important implications for healthy child development (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003; Bornstein, 1989; Bornstein, 2002; DeWolff & van IJzendoorn, 1997; Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2012). Maternal sensitivity refers to the mother's ability to notice an infant's signals and subsequently "interpreting them accurately and…responding to them appropriately" (Ainsworth et al., 1978, p.40). Sensitive maternal behaviours promote positive development in infants, as sensitive mothers interpret the infant's actions as meaningful and treat the infant as an intentional active entity (Ainsworth et al.,1978; Meins, 1997).

Maternal sensitivity has been closely tied to the quality of the parent-infant attachment relationship in the developmental literature (Bigelow et al., 2010; Breatherton, 2013; McElwain & Booth-LaForce, 2006). High maternal sensitivity is believed to foster secure attachment development in infants, while lower maternal sensitivity has been linked to insecure attachment (Bigelow et al., 2010; Bretherton, 2013; McElwain & Booth-LaForce, 2006). While links between maternal sensitivity and positive developmental outcomes in infants are supported by empirical evidence, these findings are inconsistent. Maternal sensitivity has been linked to socioemotional development in children (Moran, Pederson, & Tarabulsy, 2011; Stams, Juffer, & van IJzendoorn, 2002), however some studies suggest that maternal sensitivity does not predict socioemotional development in infants (Page, Wilhelm, Gamble, & Card, 2010). Furthermore, maternal sensitivity has been associated with higher levels of language development and academic achievement (Hirsh-Pasek & Burchinal, 2006; Nozadi et al., 2013), but the influence of maternal sensitivity appears to be associated with specific facets of language development

instead of holistic language development (Paavola, Kemppinen, Kumpulainen, Moilanen, & Ebeling, 2006; Vallotton, Mastergeorge, Foster, Decker, & Ayoub, 2016). Some studies report maternal sensitivity to be linked to positive cognitive development (Feldman, Eidelman, & Rotenberg, 2004; Lemelin, Tarabulsy, & Provost, 2006; Roger Mills-Koonce et al., 2015), whereas others suggest that maternal sensitivity does not predict cognitive ability in infants (Page et al., 2010). The inconsistent findings across the studies that report associations between maternal sensitivity and child development raise a concern that it is unclear which maternal caregiving behaviours contribute to the relationship.

Cultural Perspectives on Caregiver Sensitivity[1] Expression

The importance of a healthy early attachment relationship between a caregiver and young child remains relatively undisputed, and is considered universal (Posada et al., 2002). Bowlby (1969), who had posited that mother-infant attachment was central to human development, also proposed that maternal sensitivity might be critical for establishing a secure attachment. Research findings have largely supported Bowlby's theory, showing that quality of attachment is dependent on quality of early care. These findings appear to be consistent across contexts and cultures (Ekmekci et al., 2015; Emmen et al., 2012; Mesman et al., 2012; Posada, 2013). However, most research in this area has been conducted with middle-class samples in industrialized societies. In reality, there is a shortage of studies that explore attachment across various cultural groups in non-Western cultural settings.

According to Bronfenbrenner's Ecological Systems Theory (1979), just as children do not grow up in isolation, parents also do not parent in isolation (Bornstein & Cheah, 2006). This conceptual framework places parent-child relationships at the centre of a network of nested

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[1] Caregiver sensitivity and maternal sensitivity are used interchangeably in this paper.

systems: the microsystem consists of the parents and the child; the *mesosystem* consists of the

connections between the microsystems in which the parents and the child participate, including

daycare, family, neighbourhood, peers, and school; the *exosystem* includes extended family,

health services, mass media, neighbours, and workplace; the *macrosystem* encompasses beliefs,

culture, laws, social class, and values; and the *chronosystem* refers to the developmental changes

of child and parents over time in their environment (Bronfenbrenner, 1979 & 1986).

Comparably, Parental Intuitive Theories (Harkness & Super, 2006) address the

relationship between child development and culture by focusing on parents' cultural belief

systems of their children, their parenting practices, and themselves as parents. Parental intuitive

theories also include parents' long-term goals for their children's development that guide

parents' actions in culturally accepted ways (Bornstein & Cheah, 2006). Thus, culture shapes

mothers' beliefs about their children's development, which influence the mothers' interpretations

of which of their infants' behaviours are meaningful and important. In turn, the expression of

maternal sensitivity is embedded in the mothers' cultural context.

Whether there is cultural variability in the expression of maternal sensitivity, how this

variability is expressed, and what that means for the assessment of sensitivity continues to be

debated in the current literature. A recent systematic review of observational studies of maternal

sensitivity including ethnic minority families with young children suggests that low SES (socio-

economic status) and high family stress may be stronger predictors of sensitivity than either

ethnicity or minority status (Mesman et al, 2012). These authors also concluded, however, that

there is still a lack of research initiatives that examine the role of culture in maternal sensitivity.

Furthermore, comparisons of sensitivity shown by mothers belonging to ethnic majorities versus

mothers belonging to minority groups do not provide enough empirical evidence to disregard the

role of culture in maternal sensitivity because these studies often do not consider within-group

differences in ethnic minority families (Mesman et al., 2012; Posada et al., 2016, Tamis-

LeMonda, Briggs, McClowry, & Snow, 2009).

Given the small number of studies on which many generalizations about sensitivity

across cultures are based, one of the first questions that should be asked in this context is whether

comparable measures were used across these investigations, and whether these measures were

indeed assessing sensitivity as a construct consistently.

Maternal Sensitivity as a Construct

While maternal sensitivity has attracted attention in the literature as one of the most

important features of mother-child relationships, there are outstanding questions about the

consistency of the operational definition of sensitivity (Posada et al., 2016; Shin et al., 2008).

Considering its prominence in the child development literature, and its prevalence in clinical

applications, studies that seek to better understand the legitimacy, specificity, and universality of

maternal sensitivity as a construct are warranted.

Currently, maternal sensitivity remains a broad concept, inclusive of many caregiving

behaviours, characteristics, and attributes (van Den Boom, 1997). Shin et al. (2008) provided a

review of how maternal sensitivity, as a concept, is defined in the literature. Their review shed

light onto the lack of consensus in defining maternal sensitivity. Shin et al. (2008) also highlight

that maternal sensitivity is used interchangeably with other terms, for example maternal

responsiveness (Hoksbergen, Riksen-Walraven, & Kohnstamm, 1997; Raval et al., 2001;

Tharner et al., 2012), mother-infant interaction (Cassibba, Castoro, Costantino, Sette, & van

Ijzendoorn, 2015; Ventura & Pollack Golen, 2016), or maternal competency/efficacy (Gartstein

& Iverson, 2014). Similarly, Meins et al. (2001) suggest that it is unclear which set of maternal

sensitive behaviours specifically are typically taken into account when defining maternal sensitivity as a construct. There is clearly a need to clarify and unify definitions in order to provide a stronger foundation for further research on the relationship between maternal sensitivity and child development in diverse contexts. Such a clarification should include a systematic examination of the validity and reliability of tools that are routinely used to measure maternal sensitivity both in developmental research and in clinical practice.

Popular Observational Measures of Maternal Sensitivity

Many parenting and attachment measures, including self-report questionnaires and observational measures, are available for researchers and clinicians to assess maternal sensitivity (Pritchett et al., 2011). Although self-report measures of parenting and attachment are easier to administer and more cost-efficient compared to observational measures, many parenting and attachment self-report measures have been deemed to lack validity, particularly attachment assessment measures (Pritchett et al., 2011; van IJzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004; Voorthuis et al., 2013). Consequently, research studying mother-infant relationships has typically used observational measures (Pritchett et al., 2011). For this study, the emphasis is placed on examining the reliability and validity of observational maternal sensitivity measures.

There are numerous observational maternal sensitivity measurements currently used in research as evident from recent systematic reviews (Mesman & Emmen, 2013; Tryphonopoulos, Letourneau, & DiTommaso, 2016). There has been an ongoing quest to develop valid observational measures to help quantify sensitivity and measure it accurately. As discussed above however, some of the research that seeks to link sensitivity to attachment and child development has produced ambiguous results (e.g. VanIJzendoorn, 1995; Paavola et al., 2006;

Page et al., 2010), which may call into question the validity and reliability of commonly used measures of sensitivity. Also, there is a lack of uniform definition of maternal sensitivity. In addition, little is known about how these assessment measures perform in various cultural contexts, especially outside the USA and Europe (Mesman & Emmen, 2013). Needless to say, measures that are based on a clear definition, while maintaining good psychometrics, are needed for valid scientific inquiry in the area of maternal sensitivity and its correlates cross-culturally (Bornstein, 2012). Establishing whether the assessment tools most commonly used in current studies do in fact meet those criteria should constitute the first step in an examination of maternal sensitivity and its correlates.

The Current Study

The Emotional Availability Scales (EAS; Biringen, Robinson, & Emde, 1998; Biringen, 2008), the Parent Child Interaction - Nursing Child Assessment Satellite Training Feeding Scale (NCAFS; Barnard, 1978; Sumner & Spietz, 1994; Oxford & Findlay, 2015), and the Maternal Behaviour Q Sort (MBQS; Pederson et al., 1990) are popular observational measures of maternal sensitivity that share conceptual clarity, predictive power, relative objectivity and strict coder training requirements. All are presumably anchored in the original definition of sensitivity as proposed by Ainsworth (Ainsworth Maternal Sensitivity Scales (AMSS); 1969).

The EAS (Biringen et al., 1998; Biringen, 2008) is a well-known caregiver sensitivity measure that has been widely used in the sensitivity literature. A high score on the maternal sensitivity scale suggests a high degree of maternal sensitivity. The maternal sensitivity dimension of Emotional Availability is inspired by Ainsworth's sensitivity conceptualization but is broader than the original maternal sensitivity concept (Mesman & Emmen, 2013). The developer clearly outlines that the EAS differs from attachment theory-based maternal sensitivity

in that EAS integrates attachment theory and an emotional availability perspective (Mesman & Emmen, 2013; Tryphonopoulos et al., 2016). The EAS emphasizes the emotional features of mother-infant interactions, including mother's emotional signaling and understanding of the infant's signaling, in its sensitivity conceptualization. Bornstein et al. (2006) reported that EAS scores did not differ between home and laboratory visits, suggesting that EAS scores exhibit continuity across different contexts. Additionally, Bornstein et al. (2006) explored short-term test-retest reliability of EAS scores for the home visits was .75 and .85 for the laboratory visits.

The NCAFS (Barnard 1978; Sumner & Spietz, 1994; Oxford & Findlay, 2015) is another very commonly used maternal sensitivity measure, which has been found to be one of the most valid and user-friendly measures of mother-infant interactions (Byrne & Keefe, 2003; Tryphonopoulos et al., 2016). The NCAFS was developed to measure mother-infant interaction and how it influences later child cognitive development (Sumner & Spietz, 1994). A high total caregiver score suggests a high degree of maternal sensitivity. The NCAFS has also been used to predict positive child development, children's behaviour, and attachment quality. The NCAFS demonstrates predictive validity with the Bayley II Scales of Infant Development ($r = .72$), the Preschool Behavior Questionnaire ($r = .79$), and the Home Observation for Measurement of the Environment (HOME; $r = .76$) (Badr, Bookheimer, Purdy, & Deeb, 2009). The 3-month NCAFS score was a significant predictor of security of attachment in the Ainsworth Strange Situation at 1 year ($r = .19$) (Britton, Britton, & Gronwaldt, 2006).

The MBQS (Pederson et al., 1990) is a maternal sensitivity assessment tool that is also used often in the mother-infant relationship and attachment literatures. Theoretically, the MBQS is rooted in Ainsworth's maternal behaviour descriptions and her Maternal Sensitivity Scales, which describe a mother's acceptance, accessibility, cooperation, and sensitivity, providing a

conceptual framework for measuring maternal sensitivity. A high MBQS global maternal

sensitivity score suggests a high degree of maternal sensitivity. There are multiple versions of

MBQS; for this study, the Mini-MBQS-VR was used because it is more suitable for coding

filmed interactions, compared to earlier versions of the MBQS (Tarabulsy et al., 2009).

According to Tarabulsy et al. (2009), the mini-MBQS-VR is moderately associated with the

Original MBQS-90 completed at 6 months ($r = .35$), and with the Attachment Q-Sort index of

attachment security ($r = .34$). A systematic review by Mesman & Emmen (2013) reports that the

MBQS maternal sensitivity score is related to maternal attachment state of mind (Bailey, Moran,

Pederson, & Bento, 2007; Lindhiem, Bernard, & Dozier, 2011; Whipple, Bernier, & Mageau,

2011), associated with infant attachment security (Atkinson et al., 2000), and sensitive to

improvements in parenting quality post intervention (Moss et al., 2011).

The AMSS (Ainsworth, 1969) constitute a prototypical naturalistic observation measure.

Ainsworth's scales have provided the foundation for research in mother-infant sensitivity and its

link to attachment style. Ainsworth's pioneering maternal sensitivity construct is often

referenced when defining maternal sensitivity in the attachment literature (e.g. EAS, MBQS).

Rating maternal behaviour with the AMSS when their infants were 9 to 12 months old was

strongly related to attachment security in the Strange Situation (concurrent validity; $r = .78$)

(Ainsworth, Bell, & Stayton, 1971; Ainsworth, Blehar, Waters, & Wall, 1978; Pederson, Bailey,

Tarabulsy, Bento, & Moran, 2014). These observations led Ainsworth and her colleagues to

conclude that maternal sensitivity plays a central role in attachment theory. Results from meta-

analytic reviews of maternal sensitivity and attachment security support Ainsworth's maternal

sensitivity hypothesis, but with smaller effect sizes ($r = .24 - .32$) (Goldsmith & Alasnky, 1987;

DeWolff, & van IJzendoorn, 1997). A reason for this notable difference in effect sizes could be

that the lengths of the observation periods in the replication studies are much shorter than the observation periods in the original study (Pederson et al., 2014).

Goals of the Present Study

In this set of studies, we selected EAS, NCAFS, and MBQS to be compared to AMSS for the purpose of determining if these tools are interchangeable when administered to the same group of mother-infant dyads. In other words, we wanted to determine whether these popular measures all access the same relationship processes that were originally proposed by Ainsworth as forming the core of the concept of sensitivity. This study is the first step in a two-phase research initiative, which proposes to establish whether popular measures of maternal sensitivity show adequate validity across diverse cultural groups.

The primary goal of the current study is to compare and contrast the sensitivity ratings obtained when videotaped interactions of the same ethnically homogeneous, but socioeconomically diverse sample of mother-infant dyads are coded with AMSS, EAS, NCAFS, and MBQS.

Second, this study will explore the role of SES in the expression of maternal sensitivity in an ethnically homogeneous sample. That analysis will help set the stage for future directions in cross-cultural sensitivity research by addressing the problem of SES as a confounding variable in the examination of sensitivity in diverse groups of mothers.

To our knowledge, this study is the first to systematically compare popular maternal sensitivity measures and examine whether these assess similar constructs and should therefore be considered interchangeable. Thus, no specific predictions were made.

The results of this study may inform how reviews of the literature on maternal sensitivity should be interpreted, in particular when studies that use different assessment tools are used to

draw conclusions about the predictive value of sensitivity across cultures. The study is also the first to examine multiple popular observational measures of sensitivity in the context of SES. Results may potentially inform the selection of such assessment tools when attempting to differentiate between the effects of SES and the effects of cultural factors when measuring sensitivity.

Methods

Participants

The sample consists of 50 European American mother-infant dyads (50% daughters). Mothers were recruited via mailing lists of recent births in the Washington DC metropolitan area, with a letter describing the study and an invitation to contact the researchers if mothers were interested in learning more about the study and/or participating. Infant age averaged 163.78 days ($SD = 7.02$ days) and weight were averaged at 467.45 g ($SD = 444.66$ g) at birth. 98.0% of the infants were term; non-term infants were healthy and not outliers and were therefore retained in the sample. Mothers averaged 27.48 years of age ($SD = 6.92$ years). Mothers varied in educational achievement (18% had not completed high school, 16% completed high school, 20% partially completed college, 26% completed college or university, and 20% completed university graduate programs), and families varied in socioeconomic status (SES; Hollingshead, 1975; $M = 48.39$, $SD = 13.93$) across a range from 19-66. Hollingshead SES is a four-factor index, which includes education, occupation, sex, and marital status, ranging from 8 (*minimum score*) to 66 (*maximum score*) (Hollingshead, 1975), and has been used widely in research (Adams & Weakliem, 2011). The sample is socioeconomically diverse, but ethnically homogeneous to enable the examination of cross-measure reliability without ethnicity as a confounding variable (Bornstein, Jager, & Putnick, 2013). Demographic statistics of the sample

are presented in Table 1.

Procedures

 Home visits. In the two weeks prior to each home visit, mothers completed a demographic questionnaire asking for background information about the infant, mother, and family. Each mother-infant dyad was visited in the home by a single observer to film a 1-hour video of naturalistic mother and infant behaviour. All home visits took place when the infant was 5 1/2 months of age. Before filming began, mothers reviewed and signed informed consent forms. A female filmer stated that the she was interested in the infant's usual activities and asked the mothers to carry on as they normally would if she were not present. The filmer refrained from making eye contact with, or interacting with the mother and the infant.

 Coding. All coders were blind to hypotheses and purposes of the study and to additional information about the dyads. All scales were coded independently by coders who had attained reliability in the respective coding system. All coders were first trained on the coding system to obtain satisfactory interrater reliability with one of the authors of the system and with one another. All coders attained high interrater reliability, assessed using average absolute agreement intra-class correlation coefficients (*ICC*) in a two-way random effects model (McGraw & Wong, 1996; Shrout & Fleiss, 1979).

Measures

 The Emotional Availability Scales (EAS; Biringen et al., 1998; Biringen, 2008**).** The EAS capture six dimensions of mother-child interaction. These scales are divided into maternal EAS and child EAS (the latter of which were not used in this study). Maternal EAS consists of four scales. The Sensitivity scale assesses the mother's responsiveness to the infant's communications, affect, regulation, and creativity in play from 1 (*highly insensitive*) to 9 (*highly*

sensitive). The Structuring scale assesses the mother's ability to appropriately facilitate, scaffold, or organize the infant's play, exploration, or routine by providing rules without compromising the infant's autonomy from 1 (*non optimal*) to 5 (*optimal*). The Non-intrusiveness scale assesses the mother's ability to support the infant's play, exploration, or routine by appropriately initiating interactions, without interrupting by being overly directive, overstimulating, overprotective, or interfering from 1 (*intrusive*) to 5 (*nonintrusive*). The Non-hostility scale assesses the mother's ability to interact with the infant by being patient, pleasant, and harmonious and not rejecting, abrasive, impatient, or antagonistic from 1 (*markedly hostile*) to 5 (*non hostile*). Biringen (2000) provides empirical evidence for interrater reliability for the EAS: ICC >.80 (Robinson & Speaker, 1996; Ziv, Sagi, Gini, Karie-Koren, & Joels, 1996). For the purpose of the current study, only the Sensitivity scale was included because this is the scale that is anchored in Ainsworth's sensitivity construct, as described by the developers (Biringen & Robinson, 1991). All EAS were coded in ½ points. The ICC, computed on 22% of the coded mother-infant interactions, was 0.84 for the Sensitivity scale. The EAS were coded to provide scores for 15-min intervals of the filmed interaction and for the total hour of the interaction. To stay aligned as much as possible with other sensitivity measures' coding protocols, the EAS scores of the first 15 min of the interactions were used for this study. There was a strong, positive correlation between the first 15 min and the total hour of the EAS scores, $r(46) = .86$, $p < .001$.

The Nursing Child Assessment Feeding Scale (NCAFS; Barnard 1978; Sumner & Spietz, 1994; Oxford & Findlay, 2015). The NCAFS includes 76 binary (*yes/no*) items, which describe the caregiver-infant dyadic relationship and which are organized into six subscales. Four subscales focus on caregiver behaviour: 1) Sensitivity to Cues; 2) Response to Distress; 3)

Social-Emotional Growth Fostering; and 4) Cognitive Growth Fostering (Barnard, 1978). Scores in the four caregiver subscales are added to provide a total caregiver score. The Sensitivity to Cues scale assesses the mother's ability to recognize and respond to the infant's cues. The maximum possible score for this scale is 16. The Response to Distress scale assesses the mother's ability to soothe or quiet a distressed child. The maximum possible score for this scale is 11. The Social-Emotional Growth Fostering scale assesses the mother's affect and ability to communicate a positive feeling tone. The maximum possible score for this scale is 14. The Cognitive Growth Fostering scale assesses the mother's ability to make learning experiences available to the infant. The maximum possible score for this scale is 9. Two additional scales describe the infant's contribution to the interaction; they were not considered in the present study. For the purpose of this study, the Sensitivity to Cues subscale, Response to Distress subscale, and the Total Caregiver scores were included because they were deemed to measure maternal sensitivity by the developers, and as showcased by previous research (Oxford & Findlay, 2015). The NCAFS demonstrates good internal consistency at 0.85 (Cronbach's alphas) for the mother's total scores (Oxford & Findlay, 2015). More specifically, internal consistency reliability estimates (Cronbach's alphas) are 0.60 for Sensitivity to cues, 0.70 for Response to Distress, 0.68 for Social-Emotional Growth Fostering, and 0.71 for Cognitive Growth Fostering scales. The ICCs, computed on 24% of the coded mother-infant interactions, were 0.74 for Sensitivity to Cues, 0.75 for Response to Distress, and 0.77 for Mother Total scales. The average duration of the feeding episodes was 7 min 26 sec (SD = 3 min 0 sec). NCAFS allows caregivers to choose their preferred method of feeding, including breastfeeding, bottle-feeding, and solid food feeding (Sumner & Spietz, 1994; Oxford & Findlay, 2015). 74% of the NCAFS coding segments overlapped with the segments used for either or both of EAS and MBQS.

Mini Maternal Behaviour Q-Sort-VR (Mini MBQS-VR; Moran, Pederson & Bento, 2009**).** The MBQS[2] generates a global maternal sensitivity score. The Mini MBQS-VR is a shorter form of the original 90-item MBQS card set, consisting of 25 items (Tarabulsy et al., 2009). The MBQS focuses on specific sensitive maternal behaviours in relation to the infant, including "Monitors baby's activities during visit", "Speaks to baby directly", and "Praises baby", assessing the quality of maternal behaviour during mother-infant interactions in the home. The items are sorted into five groups, with five items per group. Items are designated as most like (+2), like (+1), neutral (0), unlike (-1), or most unlike (-2) the behaviours observed in the mother. The total score obtained for a given mother is then correlated with the developers' criterion sort for the prototypically sensitive mother, generating a global maternal sensitivity score. Scores vary from -1.0 (*least like the prototypically sensitive mother)* to 1.0 (*most like the prototypically sensitive mother*). The global sensitivity score can be obtained through an unforced or a forced sort. The difference between an unforced and a forced sort is that for an unforced sort, the coder is permitted to assign the quality of maternal behaviour to the groups, without being restricted by the maximum number of items that are allowed per group. On the contrary, when obtaining a forced sort, the coder is restricted by the maximum number of items that are allowed per group. Since there is a very large overlap between an unforced score and a forced score, for the purpose of this study, we used forced scores for data analysis in order to more accurately compare results from past studies that have used forced scores. The ICC, computed on 22% of the coded mother-infant interactions was 0.98 for forced sorts. The first 20 min of the interactions were coded with MBQS to ensure that the MBQS would be able to capture at least 10 min of direct mother-infant interaction, which is required for arriving at the

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[2] Mini-MBQS-VR will be referred to as MBQS.

global sensitivity score (Tarabulsy et al., 2009).

        Ainsworth Maternal Sensitivity Scales (AMSS; Ainsworth, 1969**).** The AMSS consist of four scales, including 1) Sensitivity vs. Insensitivity to the baby's signals (Sensitivity), 2) Cooperation vs. Interference with baby's ongoing behaviour (Cooperation), 3) Physical and Psychological Availability vs. Ignoring and Neglecting (Availability), and 4) Acceptance vs. Rejection of the baby's needs (Acceptance). The Sensitivity scale assesses the mother's capacity to be aware of the infant's signals, to interpret, and to respond appropriately and promptly. The scores range from 1 (*highly insensitive*) to 9 (*highly sensitive*). The Cooperation scale assesses the mother's degree of physical interference of the infant's activity and the frequency of these interruptions. The scores range from 1 (*highly interfering*) to 9 (*conspicuously cooperative*). The Availability scale assesses the mother's accessibility in terms of responsiveness to the infant. The scores range from 1 (*highly inaccessible, ignoring or neglecting*) to 9 (*highly accessible*). The Acceptance scale assesses the mother's balance of positive and negative feelings about the infant. The scores range from 1 (*highly rejecting*) to 9 (*highly accepting*). These scales were developed to assist in constructing a comprehensive narrative of the mother-infant interactions. For the purpose of this study, we focused on the Sensitivity scale rather than including all four scales of the AMSS, as the Sensitivity scale captures Ainsworth's sensitivity construct, whereas the rest of the AMSS scales were developed for differentiating between mothers of avoidant and ambivalent infants in the Strange Situation (Mesamn & Emmen, 2013). The ICCs, computed on 22% of the coded mother-infant interactions, were 0.93 for Sensitivity. The first 20 min of the interactions were coded with the AMSS.

Analyses

Prior to formal analysis, univariate distributions of the maternal sensitivity scales and covariates were assessed to explore normality and outliers. As the scales did not have normal distributions, with the exception of EAS Sensitivity scale mothers' age, and SES, bootstrapping was performed to address the non-normality of the distributions.

Two sociodemographic variables were considered as covariates: mothers' age in years and SES at the time of the home visits. Mothers' age was considered to be a covariate due to prior empirical evidence suggesting that adult mothers demonstrate more mother sensitivity than adolescent mothers (Lounds, Borkowksi, Whitman, Maxwell, & Weed, 2005; Secco & Moffatt, 2003). Additionally, lower SES has been related to lower maternal sensitivity (Mesman et al., 2012). Regression analyses were performed to assess the unique relations of mothers' age and SES with maternal sensitivity scores in predicting Ainsworth's sensitivity. Partial correlations between maternal sensitivity scores of EAS, NCAFS, MBQS, and AMSS were obtained, controlling for covariates. Further, bivariate correlation comparisons were completed using Fisher's *r*-to-*z* transformation to evaluate whether reported correlation coefficients differ significantly from each other.

Results

An alpha level of .05 was used for all statistical tests.

Preliminary Analysis

Frequency distributions of the maternal sensitivity scales, mothers' age, and SES were examined for normality and outliers.

EAS. The distribution of the Sensitivity scale suggested a minimal skew (see Figure 1). The skewness value was -0.22 and kurtosis value was -0.88.

NCAFS. Distributions of the Sensitivity to Cues and Response to Distress subscales, and

the Total Caregiver scores of the NCAFS were significantly skewed (see Figure 2, 3, and 4). For the distribution of the Sensitivity to Cues scale, the skewness value was -1.15 and kurtosis value was 1.36. For the distribution of the Response to Distress scale, the skewness value was -1.02 and kurtosis value was 0.16. For the distribution of the Total Caregiver scores the skewness value was -0.63 and kurtosis value was -0.03.

MBQS. A distribution of the forced scores of the MBQS was positively skewed ($p <$ .05) (see Figure 5). The skewness value was 0.49 and kurtosis value was -1.35. Furthermore, the MBQS scores distribution was bimodal (see Figure 5).

AMSS. The distribution of the Sensitivity scale was positively skewed, $p < .05$ (see Figure 6). The skewness value was 0.46 and kurtosis value was -1.09. The Sensitivity scores distribution was bimodal (see Figure 6).

Mothers' age. The distribution of the mothers' age suggested a minimal negative skew (see Figure 7). The skewness value was -0.10 and kurtosis value was -0.95.

SES. The distribution of the SES suggested a minimal negative skew (see Figure 8). The skewness value was -0.34 and kurtosis value was -0.99.

Descriptive Statistics

The means, standard deviations, and score ranges of AMSS Sensitivity, EAS Sensitivity, NCAFS Sensitivity to Cues, NCAFS Response to Distress, NCAFS Caregiver Total, and MBQS are reported in Table 2. All scales showed nearly the full range of scores, suggesting that there was substantial variance of sensitivity in this sample of mother-infant dyads.

Simple and Multiple Regressions

Before conducting one-tailed simple and multiple linear regression analyses, regression assumptions were investigated and were met. One-tailed tests were conducted because positive

correlations were expected among the scales. Firstly, simple regression analyses were conducted

on each scale of the EAS, NCAFS, and MBQS to evaluate how well each predicted Ainsworth's

sensitivity construct (AMSS Sensitivity). Then, multiple regression analyses were performed

with each scale of the maternal sensitivity measures (EAS, NCAFS, and MBQS) entered

simultaneously with the covariates in order to evaluate the unique relations of mothers' age and

SES with EAS, NCAFS, and MBQS, in regards to how well they predicted AMSS Sensitivity.

2000 bootstrap replications were performed to address the non-normality of the distributions.

EAS. The simple linear regression results indicate that the EAS Sensitivity significantly

predicted AMSS Sensitivity, as shown in Table 3. EAS Sensitivity explained 36.4% of the

variance of AMSS (R^2 = 0.36, F(1, 48) = 12.35, p < .001). The estimated regression slope is β =

0.60, t(48) = 5.24, p < .001, 95% CI [0.53, 1.20], indicating that for each one point increase in

the EAS Sensitivity, there is a 0.60 point increase in the predicted AMSS Sensitivity.

The multiple linear regression results indicated that the EAS Sensitivity and the

covariates (mothers' age and SES) explained 44.6% of the variance in AMSS (R^2 = 0.45, F(3,

46) = 12.35, p < .001), as shown in Table 3. The estimated partial regression slope for EAS

Sensitivity is β = 0.49, t(46) = 4.09, p < .001, 95% CI [0.36, 1.06], indicating that holding the

covariates constant, for each one point increase in EAS Sensitivity, there is a 0.49 point increase

in the predicted AMSS Sensitivity. However, holding the EAS Sensitivity and SES constant,

mothers' age does not significantly predict AMSS Sensitivity (β = 0.15, t(46) = 0.84, p = .20,

95% CI [-0.07, 0.17]). Furthermore, holding the EAS Sensitivity and mothers' age constant,

SES does not significantly predict AMSS Sensitivity (β = 0.18, t(46) = 0.03, p = .15, 95% CI [-

0.03, 0.09]). EAS Sensitivity is a significant predictor of AMSS Sensitivity over and above the

mothers' age and SES.

NCAFS.

NCAFS Sensitivity to Cues. The simple linear regression results show that the NCAFS Sensitivity to Cues significantly predicted AMSS Sensitivity, as shown in Table 4. EAS Sensitivity explained 29.9% of the variance in AMSS ($R^2 = 0.30$, $F(1, 47) = 20.01$, $p < .001$). The estimated regression slope is $\beta = 0.55$, $t(47) = 4.47$, $p < .001$, 95% CI [0.39, 1.03], indicating that for each point increase in the NCAFS Sensitivity to Cues, there is a 0.55 point increase in the predicted AMSS Sensitivity.

The multiple linear regression results indicated that the NCAFS Sensitivity to Cues and the covariates (mothers' age and SES) explained 30.3% of the variance of AMSS ($R^2 = 0.30$, $F(3, 46) = 6.66$, $p < .001$), as shown in Table 4. The estimated partial regression slope for NCAFS Sensitivity to Cues is $\beta = 0.26$, $t(46) = 1.97$, $p = .03$, 95% CI [-0.01, 0.64]), indicating that holding the covariates constant, for each point increase in the NCAFS Sensitivity to Cues, there is a 0.26 increase in the predicted AMSS Sensitivity. However, holding the NCAFS Sensitivity to Cues and SES constant, mothers' age does not significantly predict AMSS Sensitivity ($\beta = 0.27$, $t(46) = 1.36$, $p = .09$, 95% CI [-0.05, 0.23]). Furthermore, holding the NCAFS Sensitivity to Cues and mothers' age constant, SES does not significantly predict AMSS Sensitivity ($\beta = 0.15$, $t(46) = 0.79$, $p = .22$, 95% CI [-0.04, 0.09]). NCAFS Sensitivity to Cues is a significant predictor of AMSS Sensitivity over and above the mothers' age and SES.

NCAFS Response to Distress. The simple linear regression results show that the NCAFS Response to Distress significantly predicted AMSS Sensitivity, as shown in Table 5. The results showed that NCAFS Response to Distress explained 18.5% of the variance of AMSS ($R^2 = 0.19$, $F(1, 48) = 10.88$, $p = .001$). The estimated regression slope is $\beta = 0.43$, $t(48) = 3.30$, $p = .001$, 95% CI [0.29, 1.21], indicating that for each one point increase in the NCAFS Response to

Distress, there is a 0.43 point increase in the predicted AMSS Sensitivity.

The multiple linear regression results indicated that the NCAFS Responsiveness to Distress and the covariates (mothers' age and SES) explained 30.3% of the variance in AMSS ($R^2 = 0.30$, $F(3, 46) = 6.68$, $p < .001$), as shown in Table 5. The estimated partial regression slope for NCAFS Response to Distress is $\beta = 0.28$, $t(46) = 1.98$, $p = .03$, 95% CI [-0.01, 0.96], indicating that holding the covariates constant, for each one point increase in NCAFS Response to Distress, there is a 0.28 increase in the predicted AMSS Sensitivity. In addition, the estimated partial regression slope for mother's age is ($\beta = 0.35$, $t(46) = 1.82$, $p = .04$, 95% CI [-0.01, 0.25], holding the NCAFS Response to Distress and SES constant, for every increased year in mothers' age, there is a 0.35 increase in the predicted AMSS Sensitivity. However, holding the NCAFS Response to Distress and mothers' age constant, SES does not significantly predict AMSS Sensitivity ($\beta = 0.04$, $t(46) = 0.20$, $p = .42$, 95% CI [-0.06, 0.07]). NCAFS Response to Distress is a significant predictor of AMSS Sensitivity over and above SES.

NCAFS Caregiver Total. The simple linear regression results indicate that the NCAFS Caregiver Total significantly predicted AMSS Sensitivity, as shown in Table 6. NCAFS Caregiver Total explained 17.9% of the variance of AMSS ($R^2 = 0.18$, $F(1, 48) = 10.44$, $p = .001$). The estimated regression slope is $\beta = 0.42$, $t(48) = 3.23$, $p = .001$, 95% CI [0.07, 0.29], indicating that for each one point increase in the NCAFS Caregiver Total, there is a 0.43 point increase in the predicted AMSS Sensitivity.

The multiple linear regression results indicated that the NCAFS Caregiver Total and the covariates (mothers' age and SES) explained 22.8% of the variance in AMSS ($R^2 = 0.23$, $F(3, 46) = 5.83$, $p = .002$), as shown in Table 6. Holding the covariates constant, NCAFS Caregiver Total does not significantly predict AMSS Sensitivity ($\beta = 0.21$, $t(46) = 1.41$, $p = .08$, 95% CI [-

0.04, 0.22]. In addition, holding the NCAFS Caregiver Total and SES constant, mothers' age does not significantly predict AMSS Sensitivity ($\beta = 0.28$, $t(46) = 1.35$, $p = .09$, 95% CI [-0.05, 0.24]). Furthermore, holding the NCAFS Caregiver Total and mothers' age constant, SES does not significantly predict AMSS Sensitivity ($\beta = 0.11$, $t(46) = 0.58$, $p = .28$, 95% CI [-0.05, 0.09]). NCAFS Caregiver Total is not a significant predictor of AMSS Sensitivity over and above the mothers' age and SES.

MBQS. The simple linear regression results show that the MBQS significantly predicted AMSS Sensitivity, as shown in Table 7. NCAFS Caregiver Total explained 92.7% of the variance in AMSS ($R^2 = 0.93$, $F(1, 48) = 613.74$, $p < .001$). The estimated regression slope is $\beta = 0.96$, $t(48) = 24.77$, $p < .001$, 95% CI [3.48, 4.09], indicating that for each one point increase in the MBQS, there is a 0.96 point increase in the predicted AMSS Sensitivity.

The multiple linear regression results indicated that the MBQS and the covariates (mothers' age and SES) explained 93.2% of the variance in AMS ($R^2 = 0.93$, $F(3, 46) = 84.31$, $p < .001$), as shown in Table 7. The estimated partial regression slope for MBQS is $\beta = 0.93$, $t(46) = 21.57$, $p < .001$, 95% CI [3.31, 3.99], indicating that holding the covariates constant, for each one point increase in the MBQS, there is a 0.93 point increase in the predicted AMSS Sensitivity. However, holding the MBQS and SES constant, mothers' age does not significantly predict AMSS Sensitivity ($\beta = 0.05$, $t(46) = 0.87$, $p = .19$, 95% CI [-0.02, 0.06]). Furthermore, holding the MBQS and mothers' age constant, SES does not significantly predict AMSS Sensitivity ($\beta = 0.03$, $t(46) = 0.44$, $p = .33$, 95% CI [-0.02, 0.03]). MBQS is a significant predictor of AMSS Sensitivity over and above the mothers' age and SES.

Partial Correlations of the Sensitivity Measures

Controlling for covariates, 1-tailed Pearson's partial correlations between all included

maternal sensitivity scores were obtained, as shown in Table 8. 2000 bootstrap replications were

performed to address the non-normality of the distributions. EAS Sensitivity was positively

correlated with NCAFS Response to Distress ($r(46) = .30$, $p = .02$), and MBQS ($r(46) = .41$, $p =$

$.002$), but not with NCAFS Caregiver Total ($r(46) = .18$, $p = .11$). NCAFS Sensitivity to Cues

was positively correlated with EAS Sensitivity ($r(46) = .27$, $p = .03$) and NCAFS Caregiver

Total ($r(46) = .75$, $p < .001$), but not with NCAFS Response to Distress ($r(46) = .10$, $p = .24$) and

MBQS ($r(46) = .23$, $p = .06$). Additionally, NCAFS Response to Distress was positively

correlated with NCAFS Caregiver Total ($r(46) = .39$, $p = .004$) and MBQS ($r(46) = .27$, $p = .03$).

NCAFS Caregiver Total was not positively correlated with MBQS ($r(46) = .19$, $p = .10$).

Bivariate Correlation Coefficient Comparisons

Pearson's partial correlations between all included maternal sensitivity scales were

compared to evaluate whether there were significant differences between the partial correlations,

using Fisher's r to z transformation (2-tailed). 2-tailed tests were conducted because the

directions of the correlation coefficient comparisons could not be predicted.

The comparisons of correlation coefficients between AMSS, EAS, NCAFS, and MBQS

scales are shown in Table 9.

Correlation coefficient comparisons between AMSS Sensitivity and EAS Sensitivity,

and others. The correlation coefficient of AMSS Sensitivity and EAS Sensitivity significantly

stronger than the correlation coefficients of EAS Sensitivity and NCAFS Caregiver Total ($z =$

2.06, $p = .04$), EAS Sensitivity and MBQS ($z = 2.92$, $p = .004$), and NCAFS Caregiver Total and

MBQS ($z = 1.98$, $p = .05$). On the contrary, the correlation coefficient of AMSS Sensitivity and

EAS Sensitivity was significantly weaker than the correlation coefficients of AMSS Sensitivity

and MBQS ($z = 7.00$, $p < .001$) and NCAFS Sensitivity to Cues and NCAFS Caregiver Total ($z = 2.02$, $p = .04$). However, the correlation coefficient of AMSS Sensitivity and EAS Sensitivity was not significantly different from the correlation coefficients of AMSS Sensitivity and NCAFS Sensitivity to Cues ($z = 1.57$, $p = .12$), AMSS Sensitivity and NCAFS Response to Distress ($z = 1.90$, $p = .06$), EAS Sensitivity and NCAFS Sensitivity to Cues ($z = 1.62$, $p = .14$), EAS Sensitivity and NCAFS Response to Distress ($z = 1.42$, $p = .16$), NCAFS Sensitivity to Cues and NCAFS Response to Distress ($z = 1.87$, $p = .06$), NCAFS Sensitivity to Cues and MBQS ($z = 1.85$, $p = .06$), NCAFS Response to Distress and NCAFS Caregiver Total ($z = 0.82$, $p = .41$), and NCAFS Response to Distress and MBQS ($z = 1.63$, $p = .10$).

Correlation coefficient comparisons between AMSS Sensitivity and NCAFS Sensitivity to Cues, and others. The correlation coefficient of AMSS Sensitivity and NCAFS Sensitivity to Cues was significantly weaker than the correlation coefficients of AMSS Sensitivity and MBQS ($z = 8.11$, $p < .001$), and NCAFS Sensitivity to Cues and NCAFS Caregiver Total ($z = 3.56$, $p < .001$). However, the correlation coefficient of AMSS Sensitivity and NCAFS Sensitivity to Cues was not significantly different from the correlation coefficients of AMSS Sensitivity and NCAFS Response to Distress ($z = 0.01$, $p = .99$), AMSS Sensitivity and NCAFS Caregiver Total ($z = 0.45$, $p = .45$), EAS Sensitivity and NCAFS Sensitivity ($z = 0.07$, $p = .94$), EAS Sensitivity and NCAFS Response to Distress ($z = 0.13$, $p = .90$), EAS Sensitivity and NCAFS Caregiver Total ($z = 0.63$, $p = .53$), EAS Sensitivity and MBQS ($z = 0.78$, $p = .44$), NCAFS Sensitivity and NCAFS Response to Distress ($z = 1.03$, $p = .31$), NCAFS Sensitivity to Cues and MBQS ($z = 1.17$, $p = .24$), NCAFS Response to Distress and NCAFS Caregiver Total ($z = 0.67$, $p = .50$), NCAFS Response to Distress and MBQS ($z = 0.04$, $p = .97$), and NCAFS Caregiver Total and MBQS ($z = 0.84$, $p = .40$).

Correlation coefficient comparisons of AMSS Sensitivity and NCAFS Response to Distress, and others. The correlation coefficient of AMSS Sensitivity and NCAFS Response to Distress was significantly weaker than the correlation coefficients of AMSS Sensitivity and MBQS ($z = 8.28$, $p < .001$), and NCAFS Sensitivity to Cues and NCAFS Caregiver Total ($z = 3.56$, $p < .001$). However, the correlation coefficient of AMSS Sensitivity and NCAFS Response to Distress was not significantly different from the correlation coefficients of AMSS Sensitivity and NCAFS Caregiver total ($z = 0.49$, $p = .62$), EAS Sensitivity and NCAFS Sensitivity to Cues ($z = 0.07$, $p = .95$), EAS Sensitivity and NCAFS Response to Distress ($z = 0.16$, $p = .87$), EAS Sensitivity and NCAFS Caregiver Total ($z = 0.56$, $p = .57$), EAS Sensitivity and MBQS ($z = 0.78$, $p = .43$), NCAFS Sensitivity to cues and NCAFS Response to Distress ($z = 1.04$, $p = .30$), NCAFS Sensitivity to Cues and MBQS ($z = 0.28$, $p = .78$), NCAFS Response to Distress and NCAFS Total ($z = 0.63$, $p = .53$), NCAFS Response to Distress and MBQS ($z = 0.21$, $p = .83$), and NCAFS Caregiver Total and MBQS ($z = 0.57$, $p = .57$).

Correlation coefficient comparisons of AMSS Sensitivity and NCAFS Caregiver Total, and others. The correlation coefficient of AMSS Sensitivity and NCAFS Caregiver Total was significantly weaker than the correlation coefficients of AMSS Sensitivity and MBQS ($z = 7.96$, $p < .001$) and NCAFS Sensitivity to Cues and NCAFs Caregiver Total ($z = 4.21$, $p < .001$). However, the correlation coefficient of AMSS Sensitivity and NCAFS Caregiver Total was not significantly different from the correlation coefficients of EAS Sensitivity and NCAFS Sensitivity to Cues ($z = 0.41$, $p = .68$), EAS Sensitivity and NCAFS Response to Distress ($z = 0.56$, $p = .57$), EAS Sensitivity and NCAFS Caregiver Total ($z = 0.16$, $p = .87$), EAS Sensitivity and MBQS ($z = 1.16$, $p = .25$), NCAFS Sensitivity to Cues and NCAFS Response to Distress ($z = 0.57$, $p = .57$), NCAFS Sensitivity to Cues and MBQS ($z = 0.22$, $p = .82$), NCAFS Response to

Distress and NCAFS Caregiver Total ($z = 1.12$, $p = .26$), NCAFS Response to Distress and

MBQS ($z = 0.43$, $p = .67$), and NCAFS Caregiver Total and MBQS ($z = 0.32$, $p = .75$).

   Correlation coefficient comparisons of AMSS Sensitivity and MBQS to others. The

correlation coefficient of AMSS Sensitivity and MBQS was significantly stronger than the

correlation coefficients of EAS Sensitivity and NCAFS Sensitivity to Cues ($z = 7.94$, $p < .001$),

EAS Sensitivity and NCAFS Response to Distress ($z = 7.74$, $p < .001$), EAS Sensitivity and

NCAFS Caregiver Total ($z = 8.49$, $p < .001$), EAS Sensitivity and MBQS ($z = 8.81$, $p < .001$),

NCAFS Sensitivity to Cues and NCAFS Response to Distress ($z = 8.86$, $p < .001$), NCAFS

Sensitivity to Cues and NCAFS Caregiver Total ($z = 4.40$, $p < .001$), NCAFS Sensitivity to Cues

and MBQS ($z = 8.76$, $p < .001$), NCAFS Response to Distress and NCAFS Caregiver Total ($z =

7.25$, $p < .001$), NCAFS Responsiveness to Distress and MBQS ($z = 8.40$, $p < .001$), and NCAFS

Caregiver Total and MBQS ($z = 8.66$, $p < .001$).

   Correlation coefficient comparisons between EAS, NCAFS, and MBQS Scales. The

correlation coefficients comparisons between EAS, NCAFS, and MBQS Scales are shown in

Table 10. The correlation coefficient of EAS Sensitivity and NCAFS Sensitivity to Cues was

significantly weaker than the correlation coefficient of NCAFS Sensitivity to Cues and NCAFS

Caregiver Total ($z = 3.58$, $p < .001$), but was not significantly different from the correlation

coefficients of EAS Sensitivity and NCAFS Response to Distress ($z = 0.19$, $p = .85$), EAS

Sensitivity and NCAFS Caregiver Total ($z = 0.88$, $p = .38$), EAS Sensitivity and MBQS ($z =

0.83$, $p = .41$), NCAFS Sensitivity to Cues and NCAFS Response to Distress ($z = 0.98$, $p = .33$),

NCAFS Sensitivity and MBQS ($z = 0.26$, $p = .79$), NCAFS Response to Distress and NCAFS

Caregiver Total ($z = 0.74$, $p = .46$), NCAFS Response to Distress and MBQS ($z = 0.02$, $p = .99$),

and NCAFS Caregiver Total and MBQS ($z = 0.47$, $p = .64$). The correlation coefficient of EAS

Sensitivity and NCAFS Response to Distress was significantly weaker than the correlation coefficient of NCAFS Sensitivity and NCAFS Caregiver Total ($z = 3.49$, $p < .001$), but was not significantly different from the correlation coefficients of EAS Sensitivity and NCAFS Caregiver Total ($z = 0.78$, $p = .43$), EAS Sensitivity and MBQS ($z = 0.64$, $p = .52$), NCAFS Sensitivity to Cues and NCAFS Response to Distress ($z = 1.43$, $p = .15$), NCAFS Sensitivity to Cues and MBQS ($z = 0.26$, $p = .69$), NCAFS Response to Distress and NCAFS Caregiver Total ($z = 0.58$, $p = .56$), NCAFS Response to Distress and MBQS ($z = 0.02$, $p = .99$), and NCAFS Caregiver Total & MBQS ($z = 0.63$, $p = .53$). The correlation coefficient of EAS Sensitivity and NCAFS Caregiver Total was significantly weaker than the correlation coefficient of NCAFS Sensitivity to Cues and NCAFS Caregiver Total ($z = 4.34$, $p < .001$), but was not significantly different from the correlation coefficients of EAS Sensitivity and MBQS ($z = 1.30$, $p = .43$), NCAFS Sensitivity to Cues and NCAFS Response to Distress ($z = 0.44$, $p = .67$), NCAFS Sensitivity to Cues and MBQS ($z = 0.28$, $p = .78$), NCAFS Response to Distress and NCAFS Caregiver Total ($z = 1.28$, $p = .21$), NCAFS Response to Distress and MBQS ($z = 0.50$, $p = .62$), and NCAFS Caregiver Total and MBQS ($z = 0.06$, $p = .95$). The correlation coefficient of EAS Sensitivity and MBQS was significantly weaker than the correlation coefficient of NCAFS Sensitivity to Cues and NCAFS Caregiver Total ($z = 2.73$, $p = .006$), but was not significantly different from the correlation coefficients of NCAFS Sensitivity to Cues and NCAFS Response to Distress ($z = 1.14$, $p = .25$), NCAFS Sensitivity to Cues and MBQS ($z = 1.09$, $p = .28$), NCAFS Response to Distress and NCAFS Caregiver Total ($z = 0.11$, $p = .92$), NCAFS Response to Distress and MBQS ($z = 0.85$, $p = .79$), and NCAFS Caregiver Total and MBQS ($z = 1.24$, $p = .21$). The correlation coefficient of NCAFS Sensitivity to Cues and NCAFS Response to Distress was significantly weaker than the correlation coefficients of NCAFS Sensitivity and NCAFS

Caregiver Total ($z = 4.66$, $p < .001$), and NCAFS Response to Distress and NCAFS Caregiver

Total ($z = 2.92$, $p = .001$), but was not significantly different from the correlation coefficients of

NCAFS Sensitivity and MBQS ($z = 0.72$, $p = .47$), NCAFS Response to Distress and MBQS ($z =$

0.95, $p = .34$), and NCAFS Caregiver Total and MBQS ($z = 0.48$, $p = .63$). The correlation

coefficient of NCAFS Sensitivity to Cues and NCAFS Caregiver Total was significantly stronger

than the correlation coefficient of NCAFS Sensitivity to Cues and MBQS ($z = 3.84$, $p < .001$),

NCAFS Responsiveness to Distress and NCAFS Caregiver Total ($z = 2.74$, $p = .001$), NCAFS

Response to Distress and MBQS ($z = 3.59$, $p < .001$), and NCAFS Caregiver Total and MBQS (z

$= 4.17$, $p < .001$). The correlation coefficient of NCAFS Sensitivity to Cues and MBQS was not

significantly different from the correlation coefficients of NCAFS Response to Distress and

NCAFS Caregiver Total ($z = 0.95$, $p = .34$), NCAFS Response to Distress and MBQS ($z = 0.23$,

$p = .82$), and NCAFS Caregiver Total ($z = 0.38$, $p = .70$). The correlation coefficient of NCAFS

Response to Distress and NCAFS Caregiver Total was not significantly different from the

correlation coefficients of NCAFS Response to Distress and MBQS ($z = 0.68$, $p = .50$), and

NCAFS Caregiver Total and MBQS ($z = 1.20$, $p = .23$). The correlation coefficient of NCAFS

Response to Distress and MBQS was not significantly different from the correlation coefficient

of NCAFS Caregiver Total and MBQS ($z = 0.52$, $p = .60$).

Discussion

This study aimed to verify if three observational assessment tools that are widely used in

research and practice to assess maternal sensitivity do in fact capture the same construct.

Maternal sensitivity in infancy is widely studied and recognized as an important facet of

parenting that is predictive of later child development. However, it is unclear whether the most

common tools used in research to measure sensitivity show enough overlap to be deemed

interchangeable.

I examined the extent to which the Emotional Availability Scales (EAS), the Parent Child Interaction - Nursing Child Assessment Satellite Training Feeding Scale (NCAFS), and Mini Maternal Behaviour Q-Sort-VR (MBQS) assess maternal sensitivity, as originally measured by Ainsworth (Ainsworth Maternal Sensitivity Scales; AMSS) in an ethnically homogenous sample of mothers. Additionally, I examined the role of SES in the expression of maternal sensitivity in that sample. Addressing the question of shared variance in popular measures that presumably are equally adept at assessing an important factor of parenting is necessary and important. Indeed, maternal sensitivity is understood to be fundamental and crucial to positive parenting and child development (Bernier, Carlson, & Whipple, 2010; Hirsh-Pasek & Burchinal, 2006; Feldman, Eidelman, & Rotenberg, 2004; Lemelin, Tarabulsy, & Provost, 2006), yet has been proven inconsistent in the prediction of child development across studies (Paavola et al., 2006; Page et al., 2010; Pillhofer et al., 2015; Tamis-LeMonda et al., 2009). This is not surprising given that, despite the established importance of the role of maternal sensitivity, there is a lack of empirical evidence showing that the most commonly used maternal sensitivity measures indeed assess a similar maternal sensitivity construct. Indeed, in this study I established that there are significant differences in how closely three of the aforementioned measures map onto Ainsworth's original sensitivity measure (AMSS), and how closely these measures overlap with each other. Furthermore, we also showed that the role of SES in the expression of maternal sensitivity varied across the EAS, NCAFS, MBQS, and AMSS.

How Adept are Commonly Used Maternal Sensitivity Measures at Capturing Ainsworth's Original Sensitivity Construct?

Inspections of the maternal sensitivity measures' score distribution revealed some marked

differences between the AMSS, EAS, NCAFS, and MBQS. Ratings based on the NCAFS tended to characterize the mothers in this sample as overall more sensitive than EAS, MBQS or AMSS ratings, for example. As well, while ratings based on EAS and NCAFS resulted in a continuum of maternal sensitivity scores, MBQS and AMSS showed bi-modal distributions resulting in a more distinctive division between lower and higher maternal sensitivity scores. These trends suggest that MBQS and AMSS may differentiate more categorically between mothers who are highly sensitive versus mothers that show low sensitivity.

When mothers' age and SES were not taken into consideration as factors that may influence the expression of maternal sensitivity in the linear regression models, the total scales and subscales of all the examined measures (EAS, NCAFS, and MBQS) did significantly predict Ainsworth's sensitivity construct. However, when mothers' age and SES were controlled, EAS Sensitivity, NCAFS Sensitivity to Cues, and MBQS were significant predictors of Ainsworth's sensitivity over and above mothers' age and SES, while NCAFS Response to Distress was a significant predictor of Ainsworth's sensitivity over and above SES. Notably, the relationship between maternal sensitivity as measured by the MBQS and maternal sensitivity as measured by the AMSS was significantly stronger than any of the other relationships in this study. This finding was not surprising given that MBQS is explicitly linked, conceptually, to Ainsworth's definition of maternal sensitivity.

NCAFS Caregiver Total was not a significant predictor of Ainsworth's sensitivity over and above mothers' age and SES. A possible explanation for this finding is that two additional subscales of NCAFS Caregiver Total (which were not included in the current analysis), Socio-Emotional Growth Fostering scale and Cognitive Growth Fostering scale, may be confounding, and may be negatively affecting the predictive power of the NCAFS Caregiver Total scale when

it comes to measuring maternal sensitivity. Indeed, NCAFS Socio-Emotional Growth Fostering and Cognitive Growth Fostering scales have been deemed to be less directly linked to maternal sensitivity than the other subscales by the NCAFS developers (Oxford & Findlay, 2015). Not surprisingly, NCAFS Sensitivity to Cues and NCAFS Caregiver Total demonstrated a stronger relationship than when compared to the relationships of NCAFS Sensitivity to Cues with AMSS Sensitivity, EAS Sensitivity, NCAFS Sensitivity to Cues, NCAFS Response to Distress, and NCAFS Caregiver Total, and MBQS, given that NCAFS Sensitivity to Cues is one of four subscales that make up the NCAFS Caregiver Total.

In this study I found that EAS Sensitivity and MBQS were more closely aligned with Ainsworth's sensitivity measure than were the NCAFS scales. This finding is in line with the theoretical bases of EAS and MBQS (Tryphonopoulos et al., 2016). Both EAS and MBQS descriptions include explicit references to Ainsworth's maternal sensitivity construct (Mesman & Emmen, 2013).

It should also be noted that, except in the context of NCAFS Response to Distress and NCAFS Caregiver Total, SES was not a significant predictor of maternal sensitivity as defined by Ainsworth. Furthermore, mothers' age was not a significant predictor of Ainsworth's concept of maternal sensitivity in this study, except in the context of NCAFS Caregiver Total. These results suggest that with the exception of NCAFS Response to Distress and NCAFS Caregiver Total, all other total and subscales (EAS Sensitivity, NCAFS Sensitivity to Cues, and MBQS) apparently capture a construct of maternal sensitivity that is separate from mothers' age and SES. It is noteworthy that NCAFS subscales differentially predict maternal sensitivity, as measured by AMSS. In practice, the NCAFS offers clinicians and researchers the choice of using the Caregiver Total scale, the Caregiver-Infant Total scale, or select subscales. While NCAFS

Sensitivity to Cues was a significant (and the best of all NCAFS scales) predictor of maternal

sensitivity as measured by AMSS, over and above SES and mothers' age, this scale however

demonstrates lower internal consistency reliability estimates (at 0.60 in comparison to the rest of

the NCAFS subscales and the total scales, which reach 0.69 – 0.88). Thus, NCAFS Sensitivity

to Cues, NCAFS Response to Distress, and NCAFS Caregiver Total should be used with caution,

and none as a standalone for measuring maternal sensitivity.

Validity of EAS, NCAFS, and MBQS

The partial correlation values reported here support the notion that EAS Sensitivity,

NCAFS Response to Distress, and MBQS capture a similar construct of maternal sensitivity.

However, there appear to be some significant differences in the degree of to which these scales

and subscales are related to each other and to the concept as originally advanced by Ainsworth,

and captured through the AMSS. NCAFS Sensitivity to Cues was found to be related to EAS

Sensitivity, but less so to MBQS. As expected, NCAFS Sensitivity to Cues and NCAFS

Response to Distress were strongly related to NCAFS Caregiver Total, to which these subscales

contribute. However, NCAFS Sensitivity to Cues and NCAFS Response to Distress were less

predictive of one another, and thus may capture different versions of sensitivity. Again, this

finding highlights the variance within NCAFS subscales that have been supported by the

aforementioned findings in this study.

Implications for Maternal Sensitivity Research and Its Predictive Validity in Child

Development

Since Ainsworth (Ainsworth et al., 1978) first developed her conceptualization of

maternal sensitivity, several observational measures have been developed for the purpose of

assessing maternal sensitivity. Although Ainsworth developed and implemented AMSS, it may

not be feasible to use AMSS in modern child development research or clinical practice due to its time-intensiveness (Mesman & Emmen, 2013). The current study's findings suggest that, while three commonly used maternal sensitivity assessment tools measure maternal sensitivity as originally conceived by Ainsworth, the apparent conceptual overlap between these tools is weaker than expected. This finding is aligned with the fact that there is still little consensus in the literature on the caregiving behaviours that define sensitivity (Posada et al., 2016). Our findings are also in agreement with the meta-analytic conclusions of De Wolff and van IJzendoorn (1997) that there is indeed a large unexplained variance in observational sensitivity measures. In their meta-analytic study, DeWolff and van IJzendoorn found a moderate combined correlation of $r = .22$ ($N = 1666$) for the studies using AMSS and other observational, self-report, and interview sensitivity measures, examining the relationship between maternal sensitivity and attachment security development. Additionally, a moderate combined correlation of $r = .24$ ($N = 837$) was found between the AMSS and attachment. Many empirical studies using observational measures of sensitivity have not been able to replicate Ainsworth's original findings as robustly (Beebe & Steele, 2013; DeWolff & van IJzendoorn, 1997; Posada et al., 2016). The meta-analytic study by DeWolff and van IJzendoorn included studies that used AMSS, MBQS, and other observational and self-report sensitivity measures but did not have studies that used EAS and NCAFS in their meta-analysis for calculating the relationship between sensitivity and attachment. Furthermore, although the current study used the same sample and compared and contrasted some of the observational sensitivity measures, there is a shared conclusion that there is a large unexplained variance across observational sensitivity measures. The lack of consistency in the definitions of maternal sensitivity may partially explain the often conflicting empirical evidence related to the predictive power of maternal sensitivity when it

comes to developmental outcomes in children (Paavola et al., 2006; Pillhofer et al., 2015).

Furthermore, the findings regarding the role of SES in the expression of maternal sensitivity as measured by several tools show that the impact of SES varied across these measures. SES has at times been described as confounding analyses related to ethnicity, which can further be confounded with immigration stress, language difficulties, acculturation stress, and perceived discrimination (Berry, 1997; Ekmekci et al., 2016; Emmen et al., 2013; Mesman et al., 2012). In an attempt to set the stage for, in future, disentangling ethnic minority status from SES in its impact on the expression of maternal sensitivity, this study examined the role of SES in maternal sensitivity in an ethnically homogeneous sample. We found that, even in an ethnically homogeneous sample, the impact of SES on sensitivity differed by specific assessment scale and subscale, suggesting that SES deserves close attention and consideration when measuring maternal sensitivity with particular tools. The family stress model (Conger & Donnellan, 2007) addresses some of the mechanisms whereby low SES predicts less sensitive parenting (Bakermans-Kranenburg, van IJzendoorn, & Kroonenberg, 2004; Dotterer, Iruka, & Pungello, 2012; Raviv, Kessenich, & Morrison, 2004), including the effect of the inordinate stress and parenting stress that low SES is often linked to. The current study's findings about the differential role of SES in the expression of maternal sensitivity, depending on which tool was used to assess the latter, adds another level of complexity to examinations of the impact of SES on child developmental outcomes.

The fact that ratings of caregiver sensitivity can change significantly depending on which common observational tool is used (even though these tools are presumed to be interchangeable) raises questions about the theoretical and conceptual bases of these measures. A recent review of caregiver-infant interaction observational assessment tools (Tryphonopoulos et al., 2016)

explains that AMSS, EAS, NCAFS, MBQS, and several other measures are all built on a similar foundation of "sensitive and consistent caregiving behaviours" (p. 128), crucial for enhancing and promoting optimal caregiver-infant relationship, secure attachment, and, in turn, positive developmental outcomes in children. Additionally, all these observational measures are rooted in Bowlby's attachment theory (1988), which is conceptually related to Ainsworth's theory of maternal sensitivity (Ainsworth et al., 1978). Based on their shared theoretical frameworks, there should be a large degree of overlap in these tools' operationalization of maternal sensitivity. As has been shown here, this is not necessarily the case.

Due to the shared theoretical bases of the AMSS and its derived observational sensitivity measures, EAS, NCAFS, and MBQS are more likely to accurately represent maternal sensitivity than self-report sensitivity measures. Indeed, observational sensitivity measures are strongly preferred and used more commonly in assessing caregiver-infant interactions (Pritchett et al., 2011; Van IJzendoorn et al., 2004; Voorthuis et al., 2013). Given the large unexplained variance across the observational sensitivity measures, it is unclear how much more accurately observational sensitivity measures assess sensitivity as defined by Ainsworth (Ainsworth et al., 1978) than self-report observational sensitivity measures do.

It is helpful to review and contrast the development of the AMSS, EAS, NCAFS, and MBQS respectively. AMSS and MBQS were designed to explicitly measure maternal sensitivity, whereas EAS and NCAFS were developed with the goal of capturing multiple components of mother-infant interactions, including sensitivity, through corresponding subscales. However, both EAS and NCAFS are used routinely in studies to examine and report on maternal sensitivity (e.g. Bohr & BinNoon, 2014; Cassibba et al., 2015; Golen & Ventura, 2015; Mielke et al., 2016; Oyen, Landy, & Hilburn-Cobb, 2000; Speltz, Goodell, Endriga, &

Clarren, 1994; van Doesum, Hosman, Riksen-Walraven, & Hoefnagels, 2007; Ventura & Pollack Golen, 2015). In addition, there is much variability in the way in which NCAFS scales are used. Some studies that have used NCAFS to measure maternal sensitivity focused on results obtained with the Sensitivity to Cues scale only (Golen & Ventura, 2015; Speltz et al., 1994), the Sensitivity to Cues and Response to Distress scales (Ventura & Pollack Golen, 2016), or all of the NCAFS subscales and total scales (Bohr & BinNoon, 2014). Given the current study's findings about the variance and inconsistent relationships within the NCAFS Sensitivity to Cues, Response to Distress, and Caregiver Total scales, choosing a particular subscale, total scale or a set of subscales to report on maternal sensitivity should be approached carefully. This consideration should not be unique to the NCAFS. Indeed, similarly to the latter, the trend of selecting a particular scale or using all scales provided is also found in studies that use EAS to measure maternal sensitivity. Some studies have used the EAS Sensitivity scale on its own (Mielke et al., 2016; Oyen et al., 2000; van Doesum, 2007), while others have aggregated all of the available scales to create an overall EAS score to be used to assess maternal sensitivity (Cassiba et al., 2015). Given the variability in the methods used to assess and report on maternal sensitivity, even using well-established standardized measures, caution should be exercised when interpreting the results.

Concerns About the Assessment of Maternal Sensitivity with Diverse Cultural Groups

As noted earlier, the current study was designed to serve as the first step of a two-phase inquiry that aims to investigate the interchangeability and the cross-cultural validity of commonly used standardized observational maternal sensitivity measures. We will thus offer a short discussion of the implications of the current study's findings for the assessment of maternal sensitivity across diverse cultural groups.

Considering the well-established role of maternal sensitivity as an influential factor in promoting optimal child development, relatively few studies have examined the clarity of the construct of maternal sensitivity, particularly in the context of diverse cultures. Furthermore, what little empirical evidence exists suggests inconsistent findings about the role of culture in the *expression* of maternal sensitivity. A systematic review of observational studies of maternal sensitivity (Mesman et al., 2012) found that in those studies ethnic minority parents demonstrate lower sensitivity levels than ethnic majority parents in the U.S. and the Netherlands. However, these differences either diminished or substantially decreased when SES was taken into consideration, and there was a relationship between ethnic minority status and lower SES, both predicting lower parental sensitivity (Mesman et al., 2012; Emmen et al, 2013). Likewise, Mesman et al., (2015) found similar trends in a sample including 26 cultural groups from 15 countries.

More recently, Ekmekci and colleagues (2016) reported that ethnic majority mothers scored higher on maternal sensitivity beliefs and behaviours than ethnic minority parents and that sensitivity beliefs were not related to sensitivity behaviours in either group. In that study, ethnicity and SES did not moderate the relationship between sensitivity beliefs and sensitivity behaviours. Given that observational tools are considered the gold standard when assessing maternal sensitivity, it is crucial to be mindful of the fact that, during observation, judgment calls are made as coders are observing and rating maternal sensitivity (Cheung & Elliott, 2016). Certified coders have to undergo rigorous training to satisfy inter-rater reliability criteria set by the developers of standardized tools to deliver objectivity. However, each coder's own cultural background, juxtaposed to the observed caregiver's culture, as well as the coder's understanding of the observed caregiver's cultural background, clearly contributes to subjectivity that cannot be

entirely eliminated. If a coder is native or very familiar with the observed mothers' culture, the coder may be more attuned to the nuances of the observed mother's sensitivity toward her infant and more accurate in assessing it (Cheung & Elliott, 2016). However, as suggested above, before studying culturally determined distinctions in the expression of sensitivity, we should be very clear about what we are studying in the first place, and confident that the measure we are using to do so are reliable, valid and, if used interchangeably, do in fact capture the same construct.

Unexplained Variance Across Measures of Caregiver Sensitivity That are Currently Used Interchangeably

Another noteworthy conclusion deriving from the current analysis relates to the relative lack of overlap between measures that are often used interchangeably in the scientific child development literature. As noted, our findings show that there are significant relationships between the examined popular maternal sensitivity measures, which indicates that these scales indeed assess similar concepts of maternal sensitivity. However, what is striking is the *relative weakness of the associations* between these measures. The R^2 results demonstrate that when attempting to predict the same mother's results using AMSS by relying on their results using a second scale (a scale that presumably assesses that same sensitivity), one can expect little convergent validity. Indeed, large portions of variability in AMSS are unaccounted for by the measures when predicting maternal sensitivity using alternate measures.

It is notable that compared to other maternal sensitivity measures in this study, MBQS demonstrated a very strong association with Ainsworth's sensitivity measure with a large R^2. This could be due to the very explicit conceptual relationship between the MBQS and AMSS (Mesman & Emmen, 2013; Moran et al., 2009). Furthermore, NCAFS Caregiver Sensitivity to

Cues exhibited a strong relationship with NCAFS Caregiver Total, with a relatively small

proportion of its relationship unaccounted for by the measure, mothers' age and SES, whereas

NCAFS Response to Distress exhibited a weaker relationship with NCAFS Caregiver Total, with

a large proportion of this relationship unaccounted for. NCAFS Sensitivity to Cues seems to

assess a more similar maternal sensitivity construct than NCAFS Caregiver Total. This finding

suggests that, counter-intuitively, using NCAFS Response to Distress assessments may not be a

good proxy for attachment-related caregiver sensitivity, as a weaker association was recorded

between this scale and sensitivity as originally conceived by AMSS, as compared to NCAFS

Sensitivity to Cues and NCAFS Caregiver Total.

Clinical Implications

This study provides meaningful additions to fill some gaps in the extant literature

regarding the definition and measurement of maternal sensitivity. Our study suggests that three

of the most frequently used observational assessment tools for maternal sensitivity may not

measure identical features of dyadic relationships and should perhaps not be used

interchangeably. In addition, the current results raise questions about the consistency and

stability of the measurement of sensitivity as applied in research and practice, and the

repercussions for its predictive value in child development (Nozadi et al., 2013; Vallotton et al.,

2016; Vandell, Belsky, Burchinal, Steinberg, & Vandergrift, 2010).

This study thus offers several implications for how maternal sensitivity measures are

utilized in clinical practice. For instance, when interpreting maternal sensitivity scores in clinical

settings, it is imperative that clinicians consider a specific measure's idiosyncracies in assessing

maternal sensitivity. For instance, clinicians should be aware of the fact that, depending on

which scale they choose, their sensitivity rating for a particular mother's rating may result in

quite different conclusions, with one tool describing a mother as more responsive to her child than another tool might. Clinicians should be aware of the possibility that currently no one tool provides a definitive assessment of sensitivity. On the other hand, should the findings of the current study be replicated, and should they adhere in their clinical work to a definition of sensitivity as originally advanced by Ainsworth (Ainsworth et al., 1978), clinicians should be encouraged to select the assessment tool that best matches that definition conceptually.

Limitations and Future Directions

While this study's sample consisted of participants with a wide range of educational achievement, SES, and mothers' age, the ethnic homogeneity of the current sample limits the generalizability of the findings. Given the overall suggestion in this study that mothers' age and SES were not significant predictors of maternal sensitivity when using three of the four tools described here, the next step would be to investigate whether similar trends can be identified in a multicultural sample. Thus, the current study sets the stage for future studies to further explore the consistency of commonly used maternal sensitivity measures' ability in assessing maternal sensitivity.

Another potential limitation of the analyses completed for this study is that there were a number of correlational analyses conducted simultaneously, meaning that there is an increased chance that some significance testing results may have been found spuriously. Therefore, the results should be interpreted with caution when reviewing the relationships between measures of sensitivity.

Additionally, it is important to be mindful of the differences between the criteria for the types of interactions required by EAS, NCAFS, MBQS, and AMSS for coding the dyadic interactions optimally. EAS and AMSS call for naturalistic observations of mother-infant

interactions, while NCAFS requires a feeding episode to take place in the mother-infant interactions. Moreover, MBQS is the most suitable for coding play interactions. Since the purpose of this study was to compare and contrast observational sensitivity measures coded in a same sample of mother-infant dyads, and the respective required protocols were adhered to as much as possible, the interactions were not set up to be assessed most optimally by NCAFS and MBQS in particular.

In order to compare and contrast the AMSS, EAS, NCAFS, and MBQS in an optimal manner, we chose the total scales or subscales of each measure that most closely aligned with Ainsworth's (Ainsworth et al., 1978) maternal sensitivity construct, leaving some subscales out of the analyses. AMSS and MBQS are deemed to be measurements that assess caregiver behaviour, whereas the EAS and NCAFS are described as measurements that assess dyadic behaviour. For the purpose of this study, we excluded the subscales and total scales that assessed infant behaviour to fairly compare and contrast the scales of the AMSS, EAS, NCAFS, and MBQS that are relevant to caregiver behavior, thus potentially forfeiting additional helpful information about the quality of dyadic interaction.

Given the frequent assumption that all available maternal sensitivity measures capture a common construct, clinicians tend to select maternal sensitivity measures that are well known, user-friendly and highly accessible, assuming that all tools are interchangeable. The measures included in this study are but three of the observational maternal sensitivity measures available for practitioner use. Future studies are warranted to investigate additional measures, to ascertain that these do indeed tap into the essential core of the construct of maternal sensitivity. Next steps should involve an examination of common core concepts in a larger sample of popular measures of caregiver sensitivity, and perhaps a discussion and re-thinking of what exactly we measure

when we assess sensitivity. A comprehensive study of the predictive validity of the scales examined in the current study, as well as of additional commonly used measures in both ethnically homogeneous and culturally diverse samples is also recommended.

Conclusion

The current literature provides ample but inconsistent empirical evidence that maternal sensitivity plays an important role in many aspects of positive child development. However, there continues to be a lack of consensus as to what it truly means for caregivers to be sensitive and how sensitivity is operationalized across diverse groups of caregivers. By showing that three widely used assessment tools, used with identical mother-child dyads, share relatively little variance when it comes to capturing maternal sensitivity, the current study confirmed that there is in fact much work left to be done in standardizing and harmonizing the definition, operationalization, and by extension assessment of this construct. If the current findings can be replicated, it would follow that these measures should not be used interchangeably, and that results deriving from research initiatives based on one or the other of these tools should probably not be pooled to contribute to a larger body of research on sensitivity. In that case, there would also be implications for the assessment of maternal sensitivity in cross-cultural research.

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Appendix A

Table 1.

Sample Demographics Statistics

Variable	*M*	*SD*
n	50	
Mother age	27.48	6.92
Mother education	18% not completed high school	
	16% completed high school	
	20% completed college partially	
	26% completed college/university	
	20% completed university graduate programs	
Infant age	163.78	7.02
Infant birth weight	3467.45	444.66
Infant gender (% female)	50	
SES	48.39	13.93

Table 2.

Descriptive Statistics for Sensitivity Measures (n = 50)

Variables	*M*	*SD*	Range
AMSS Sensitivity	3.76	2.35	1 – 8
EAS Sensitivity	5.68	1.64	2 – 8.5
NCAFS Sensitivity to Cues	13.60	1.95	8 – 16
NCAFS Response to Distress	9.88	1.35	6 – 11
NCAFS Caregiver Total	39.66	5.62	10 – 15
MBQS	.24	.59	-0.90 – 0.80

Table 3.

Summary of Simple and Multiple Regression Analyses for EAS Sensitivity Predicting AMSS (n =

50)

	Model 1			Model 2		
Variable	β	t	95% CI	β	t	95% CI
EAS Sensitivity	0.60	5.24*	[0.53, 1.20]	0.49	4.09*	[0.36, 1.06]
Mothers' age				0.15	0.84	[-0.07, 0.17]
SES				0.18	0.03	[-0.03, 0.09]
R^2		0.36			0.45	
F		27.46*			12.35*	

*p < .05 (1-tailed).

Table 4.

Summary of Simple and Multiple Regression Analyses for NCAFS Sensitivity to Cues Predicting

AMSS (n = 50)

	Model 1			Model 2		
Variable	β	t	95% CI	β	t	95% CI
NCAFS Sensitivity to Cues	0.55	4.47*	[0.39, 1.03]	0.26	1.97*	[-0.01, 0.64]
Mothers' age				0.27	1.36	[-0.05, 0.23]
SES				0.15	0.79	[-0.04, 0.09]
R^2		0.30			0.30	
F		20.01*			6.66*	

*$p < .05$ (1-tailed).

Table 5.

Summary of Simple and Multiple Regression Analyses for NCAFS Response to Distress

Predicting AMSS (n = 50)

	Model 1			Model 2		
Variable	β	t	95% CI	β	t	95% CI
NCAFS Response to Distress	0.43	3.30*	[0.29, 1.21]	0.28	1.98*	[-0.01, 0.96]
Mothers' age				0.35	1.82*	[-0.01, 0.25]
SES				0.04	0.20	[-0.06, 0.07]
R^2		0.19			0.30	
F		10.88*			6.66*	

*$p < .05$ (1-tailed).

Table 6.

Summary of Simple and Multiple Regression Analyses for NCAFS Caregiver Total Predicting

AMSS (n = 50)

	Model 1			Model 2		
Variable	β	t	95% CI	β	t	95% CI
NCAFS Caregiver Total	0.42	3.23*	[0.07, 0.29]	0.21	1.41	[-0.04, 0.22]
Mothers' age				0.28	1.35	[-0.05, 0.24]
SES				0.11	0.58	[-0.05, 0.09]
R^2		0.18			0.23	
F		10.44*			5.83*	

*$p < .05$ (1-tailed).

Table 7.

Summary of Simple and Multiple Regression Analyses for MBQS Predicting AMSS (n = 50)

	Model 1			Model 2		
Variable	β	t	95% CI	β	t	95% CI
MBQS	0.96	24.77*	[3.48, 4.09]	0.93	21.57*	[3.31, 3.99]
Mothers' age				0.05	0.87	[-0.02, 0.06]
SES				0.03	0.44	[-0.02, 0.03]
R^2		0.93			0.93	
F		613.74*			84.31*	

*$p < .05$ (1-tailed).

Table 8.

Partial Correlations of Sensitivity Scales, Controlled for Mother's Age and SES (n = 50)

Variables	1	2	3	4	5	6
1. AMSS Sensitivity	_					
2. EAS Sensitivity	.52*	_				
3. NCAFS Sensitivity to Cues	.28*	.27*	_			
4. NCAFS Response to Distress	.28*	.30*	.10	_		
5. NCAFS Caregiver Total	.20	.18	.75*	.39*	_	
6. MBQS	.95*	.41*	.23	.27*	.19	_

*p < .05 (1-tailed).

Table 9.

Comparisons of Correlation Coefficients Between AMSS, EAS, NCAFS, and MBQS Scales

(Absolute Values of Z Scores)

Correlation Coefficients	r_{12}	r_{13}	r_{14}	r_{15}	r_{16}
r_{12}	–	–	–	–	–
r_{13}	1.55	–	–	–	–
r_{14}	1.57	0.01	–	–	–
r_{15}	1.90	0.45	0.49	–	–
r_{16}	7.00*	8.11*	8.28*	7.96*	–
r_{23}	1.62	0.07	0.07	0.41	7.94*
r_{24}	1.42	0.13	0.16	0.56	7.74*
r_{25}	2.06*	0.63	0.56	0.16	8.49*
r_{26}	2.92*	0.78	0.78	1.16	8.81*
r_{34}	1.87	1.03	1.04	0.57	8.86*
r_{35}	2.02*	3.56*	3.60*	4.21*	4.40*
r_{36}	1.85	1.17	0.28	0.22	8.76*
r_{45}	0.82	0.67	0.63	1.12	7.25*
r_{46}	1.63	0.04	0.21	0.43	8.40*
r_{56}	1.98*	0.84	0.57	0.32	8.66*

*$p < .05$ (2-tailed).
1. AMSS Sensitivity
2. EAS Sensitivity
3. NCAFS Sensitivity to Cues
4. NCAFS Response to Distress
5. NCAFS Caregiver Total
6. MBQS

Table 10.

Comparisons of Correlation Coefficients Between EAS, NCAFS, and MBQS Scales (Absolute Values of Z Scores)

Correlation Coefficients	r_{23}	r_{24}	r_{25}	r_{26}	r_{34}	r_{35}	r_{36}	r_{45}	r_{46}
r_{24}	0.19	—	—	—	—	—	—	—	—
r_{25}	0.88	0.78	—	—	—	—	—	—	—
r_{26}	0.83	0.64	1.30	—	—	—	—	—	—
r_{34}	0.98	1.43	0.44	1.14	—	—	—	—	—
r_{35}	3.58*	3.49*	4.34*	2.73*	4.66*	—	—	—	—
r_{36}	0.26	0.40	0.28	1.09	0.72	3.84*	—	—	—
r_{45}	0.74	0.58	1.28	0.11	2.92*	2.74*	0.95	—	—
r_{46}	0.02	0.21	0.50	0.85	0.95	3.59*	0.23	0.68	—
r_{56}	0.47	0.63	0.06	1.24	0.48	4.17*	0.38	1.20	0.52

*$p < .05$ (2-tailed).
2. EAS Sensitivity
3. NCAFS Sensitivity to Cues
4. NCAFS Response to Distress
5. NCAFS Caregiver Total
6. MBQS

Appendix B

Figure 1. A frequency distribution of EAS Sensitivity scale scores.
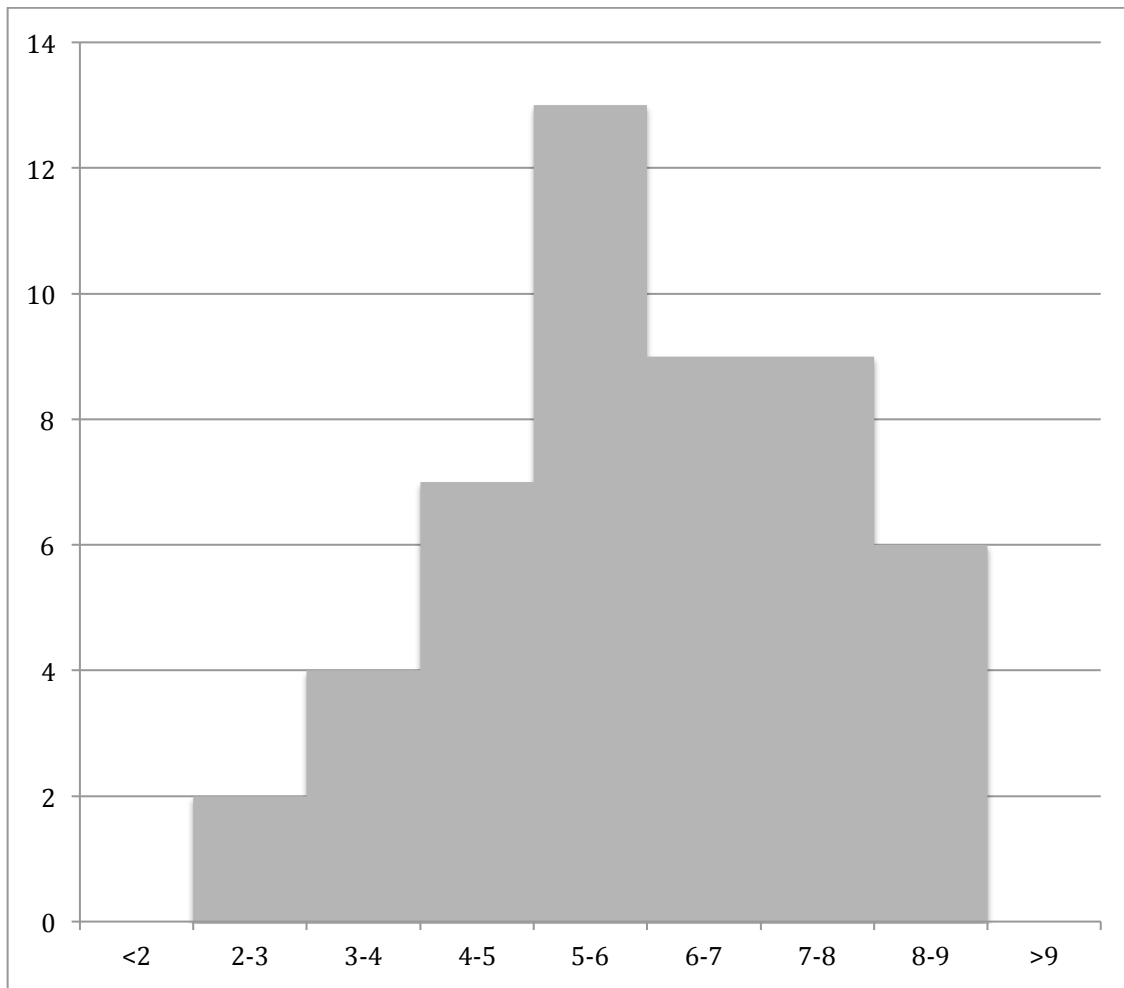
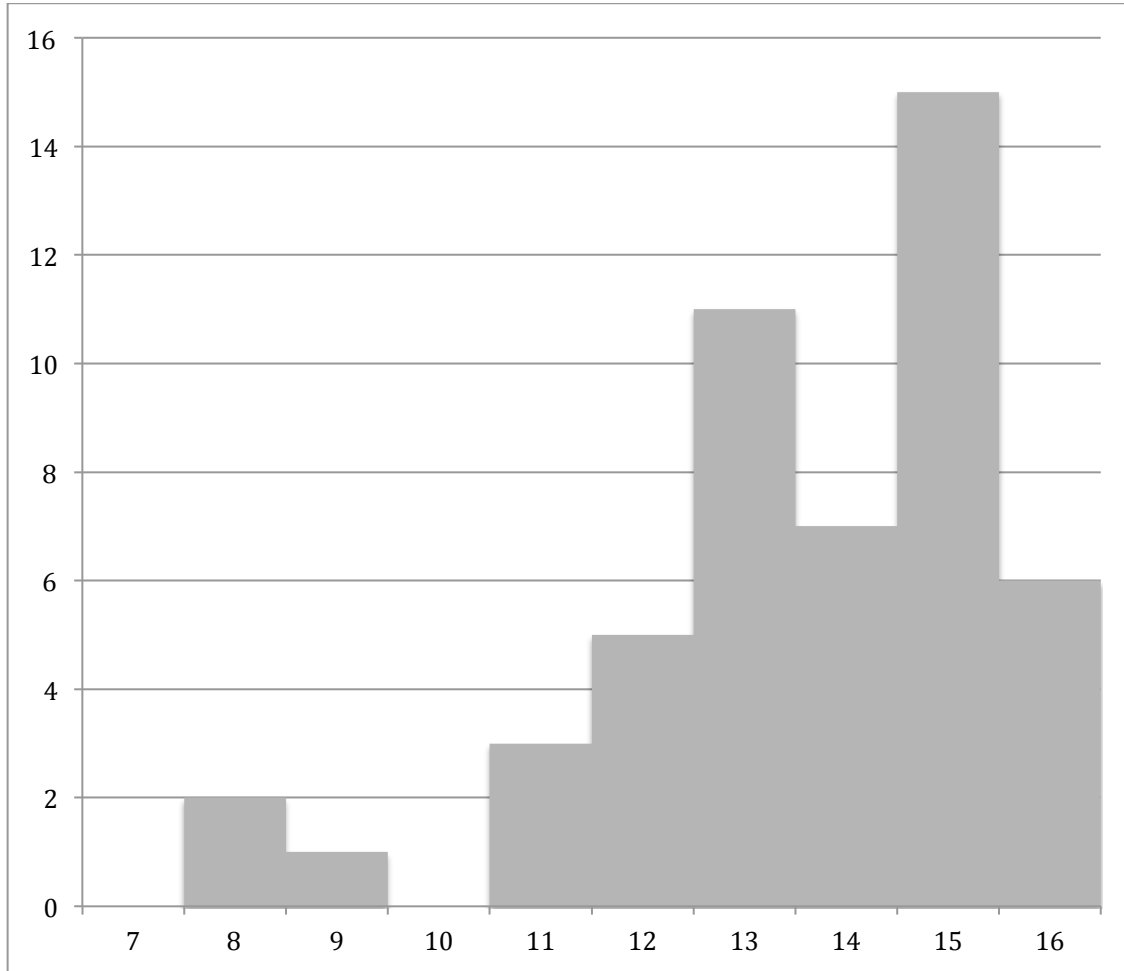*Figure 2*. A frequency distribution of NCAFS Sensitivity to Cues scale scores.

Figure 3. A frequency distribution of NCAFS Response to Distress scale scores.
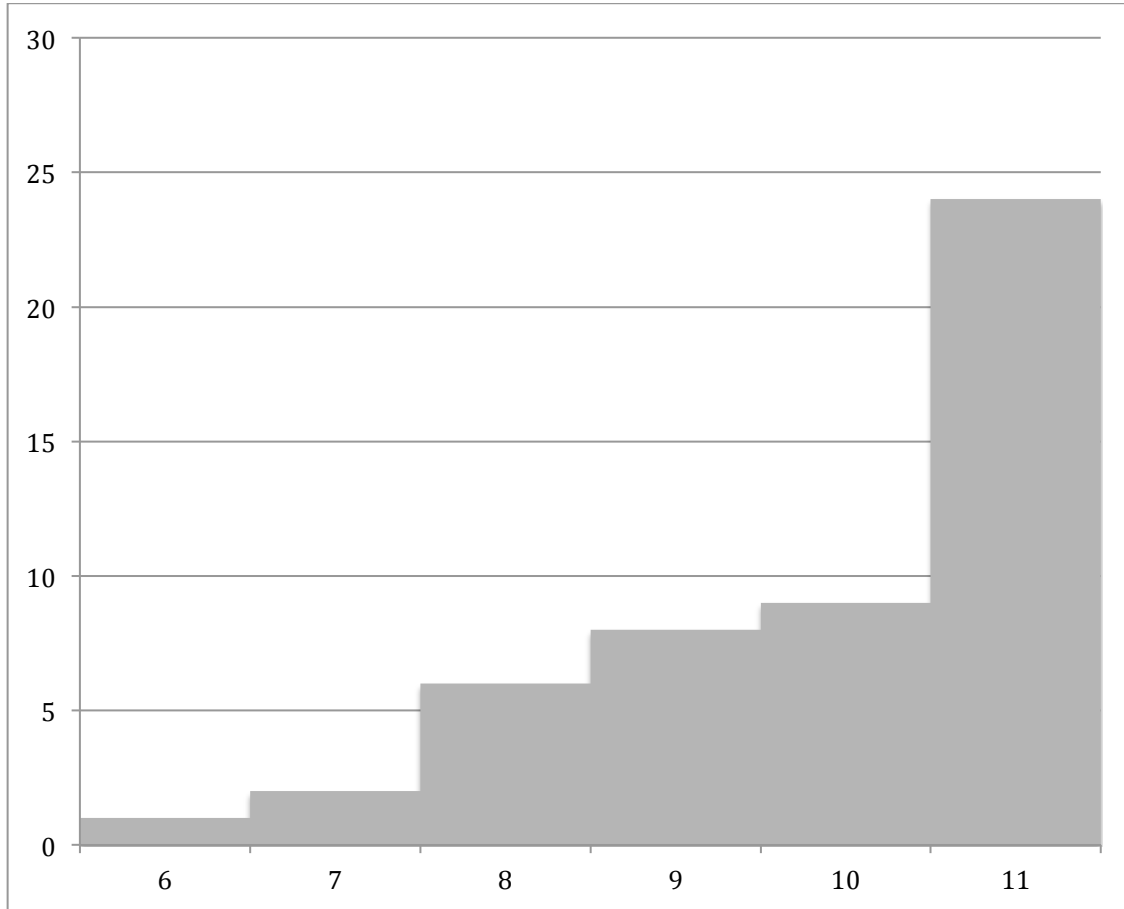
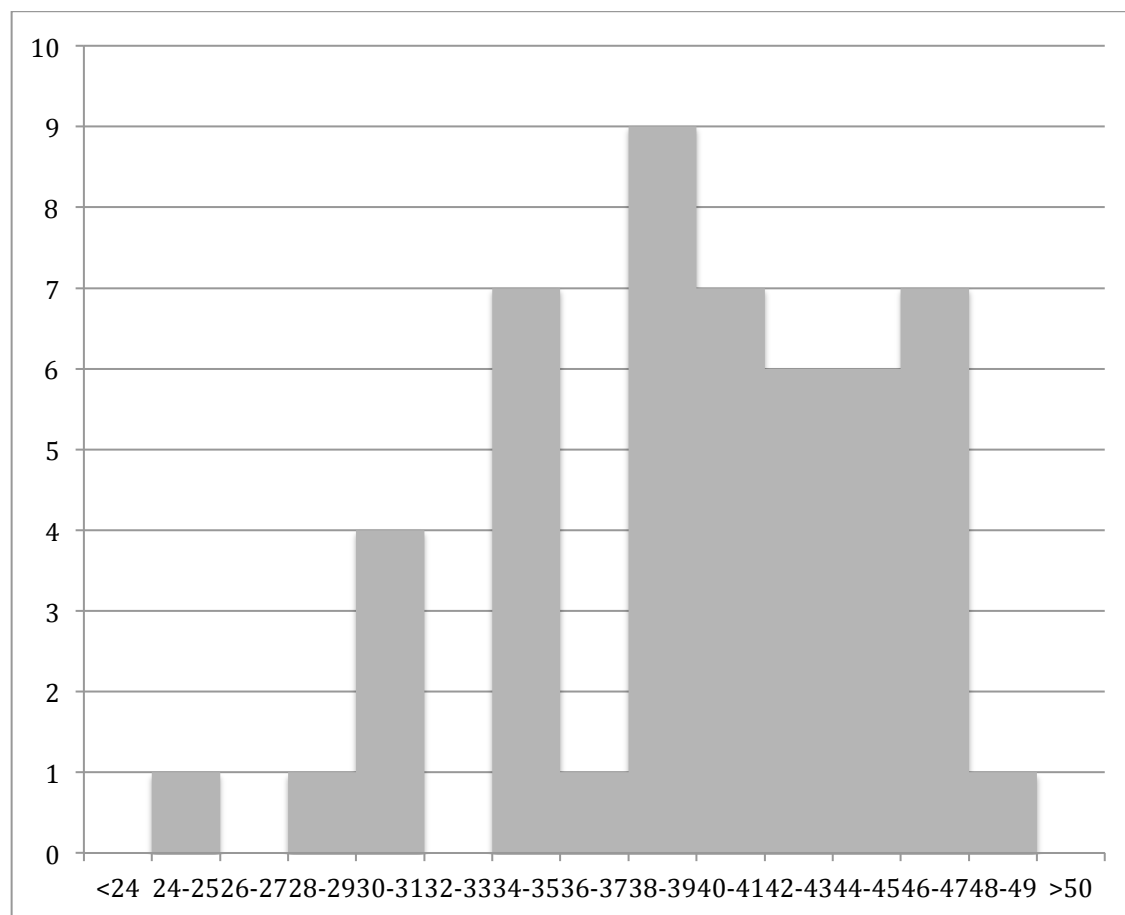*Figure 4*. A frequency distribution of NCAFS Caregiver Total scale scores.

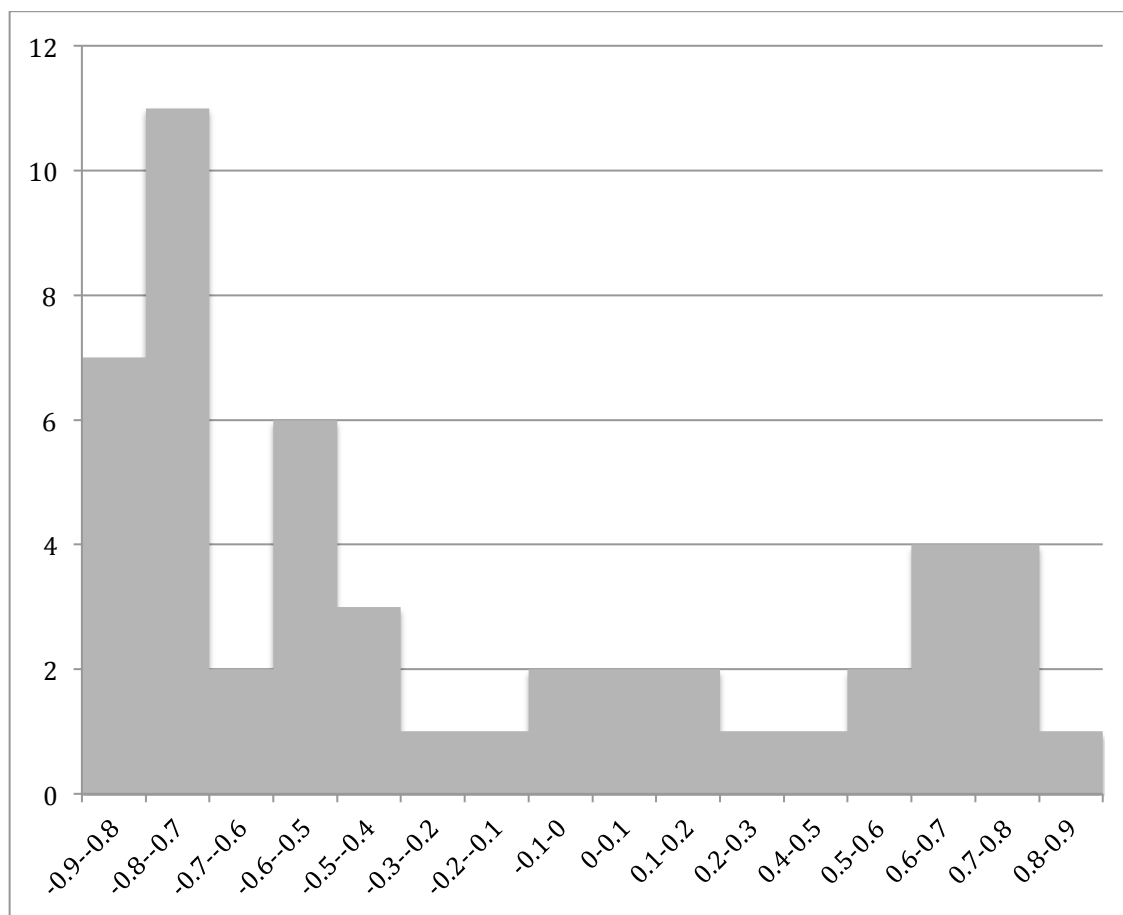*Figure 5*. A frequency distribution of MBQS scores.

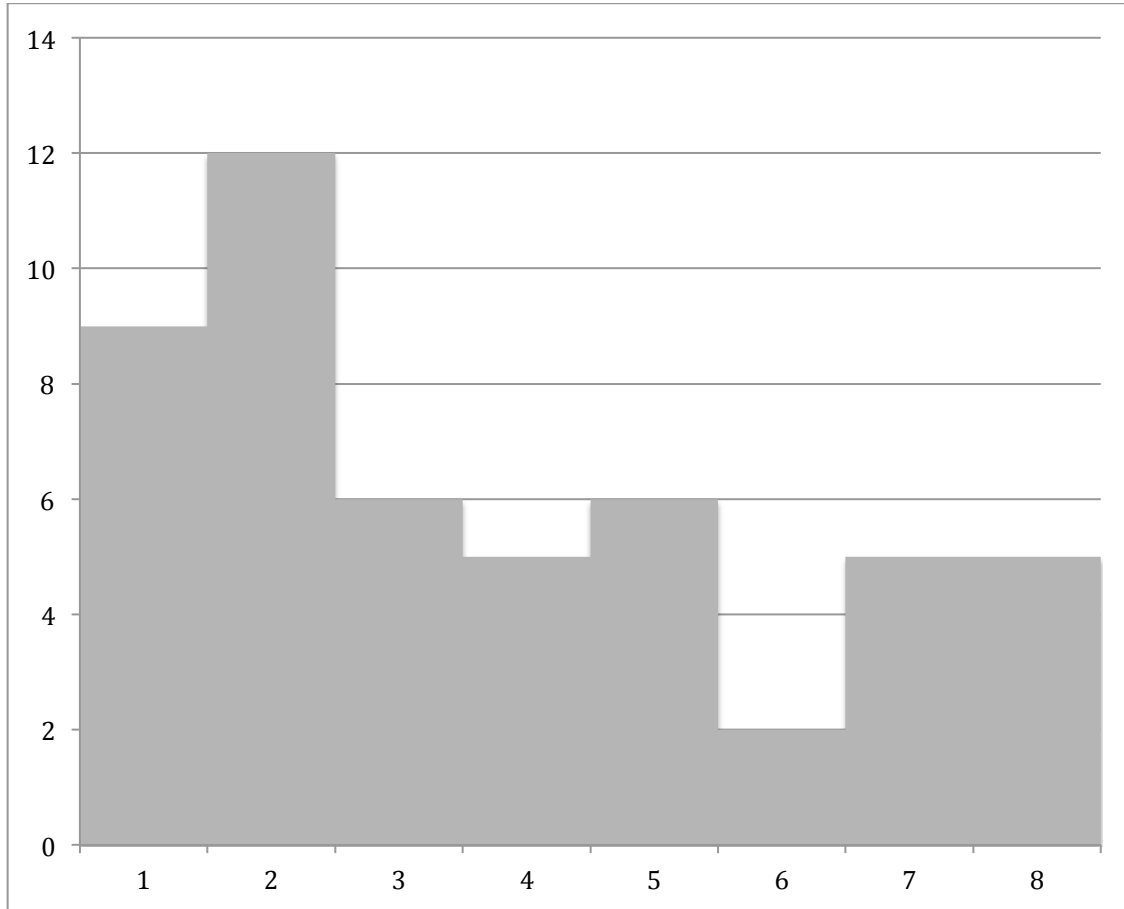*Figure 6*. A frequency distribution of AMSS Sensitivity scale scores.
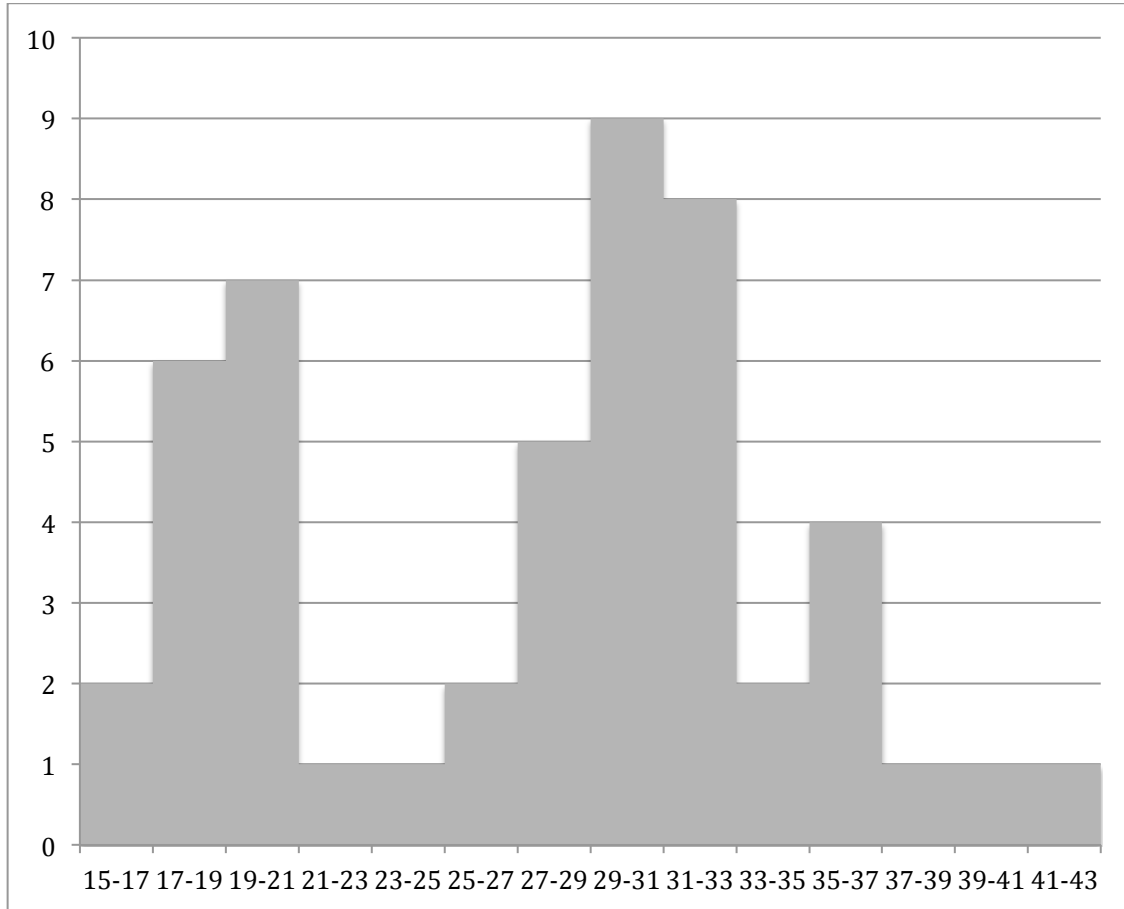
Figure 7. A frequency distribution of mothers' age.

Figure 8. A frequency distribution of SES.