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Maternal Sensitivity: Within-Person Variability and the Utility of Multiple Assessments

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Abstract

In this study, we examined within-person variability in maternal sensitivity among a culturally diverse sample of high-risk mother–infant dyads ($N = 25$). We also examined incremental increases in effect sizes between maternal sensitivity and two related variables, attachment state of mind and child removal from the home, as a function of increasing observations of maternal sensitivity. The dyads were videotaped during 10 1-hour-long home visits and maternal sensitivity was coded using the abbreviated (25-item) version of the Maternal Behavior Q–Sort (MBQS). Attachment state of mind was assessed using the Adult Attachment Interview (AAI). Within-person variability in maternal sensitivity was greater for nonautonomous mothers compared to autonomous mothers. Mothers who were relatively low in maternal sensitivity were more likely to be nonautonomous and also more likely to have their child removed from their home by child protective services. Results from data sampling trials showed incremental increases in these effect sizes as the number of observations of maternal sensitivity increased. Fewer observations of maternal sensitivity resulted in systematic underestimates of effect sizes between maternal sensitivity and related variables. We discuss the implications for maltreatment researchers and interventionists.

Keywords

attachment; maternal sensitivity; within-person variability; measurement

The construct of maternal sensitivity (i.e., appropriate, timely, and consistent responses to children's signals and needs) is central to attachment theory (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969/1982). Maternal sensitivity is also central to understanding and treating maltreating parents, as it is both a risk factor for maltreatment (e.g., Cicchetti, Rogosch, & Toth, 2006; Lyons-Ruth, Connell, Zoll, & Stahl, 1987) and modifiable through intervention (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003). However, meta-

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[1]Initial studies of attachment stability using the Strange Situation procedure reported high levels of stability from 12 months to 18 months among subjects from middle-class families (Waters, 1978). Later studies of subjects from lower economic backgrounds reported lower levels of stability (Vaughn, Egeland, Sroufe, & Waters, 1979). However, discontinuity in attachment was found to be associated with stressful events in the lives of caregivers. This led to theorizing about "lawful discontinuity." Numerous subsequent studies, demonstrating both stability and instability (e.g. Moss, Cyr, Bureau, Tarabulsey, & Dubois-Comtois, 2005; Thompson, Lamb, & Estes, 1982; Weinfield, Sroufe, & Egeland, 2000), have led to the suggestion that continuity in attachment during infancy and childhood may be due to stability in maternal behavior and family environment (Bar-Haim, Sutton, Fox, & Marvin, 2000).

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analytic reviews indicate that maternal sensitivity is generally an underperforming variable in the empirical literature. Specifically, effect sizes between maternal sensitivity and related constructs have been more modest than would be expected from attachment theory (e.g., De Wolff & van IJzendoorn, 1997; van IJzendoorn, 1995). A plausible reason for this is inadequate measurement of maternal sensitivity (Cassidy et al., 2005; Pederson, Gleason, Moran, & Bento, 1998). There continues to be great variability in a number of parameters related to the measurement of maternal sensitivity including definitions, measures, setting, context, duration, and frequency of assessment (Isabella, 1998; De Wolff & van IJzendoorn, 1997). In the current study, we investigated the role of one of these parameters, frequency of assessment, by examining whether more frequent observations of maternal sensitivity leads to incremental increases in effect sizes between maternal sensitivity and two related constructs, parent attachment state of mind and child removal from the home, in a high-risk sample.

Relevance to Child Maltreatment Research

Maternal sensitivity and related measurement issues have particular relevance to child maltreatment research. Maltreating mothers evidence low levels of maternal sensitivity even when compared to nonmaltreating high-risk mothers and low-income comparison groups (Cicchetti et al., 2006; Lyons-Ruth et al., 1987). Belsky (1980) has outlined a framework for organizing risk factors for child maltreatment into four levels, namely the microsystem (i.e., family and immediate context), the exosystem (i.e., neighborhoods, communities, and social networks), the macrosystem (i.e., cultural values and systems), and ontogenic development (i.e., individual characteristics and experiences of the parent). Within this framework, maternal sensitivity can be classified as a risk factor on the level of ontogenic development. Although no single risk factor has been identified as both a necessary and sufficient cause of child maltreatment (see Belsky, 1980, 1993), it seems particularly important to examine maternal sensitivity in a sample of mothers at risk for maltreating their children, given that maternal sensitivity can be enhanced through intervention (Bakermans-Kranenburg et al., 2003).

Numerous early interventions have been developed to target maternal sensitivity, including interventions tailored specifically to maltreating families (e.g. Cicchetti et al., 2006; Tarabulsy et al., 2008). Among attachment-based interventions, maternal sensitivity is the most commonly evaluated outcome, followed by infant attachment security. In a meta-analysis of 88 attachment-based interventions, 81 assessed effects on sensitivity and 29 assessed effects on infant attachment security (Bakermans-Kranenburg et al., 2003). In terms of efficacy, findings from this meta-analysis indicated that attachment-based interventions are effective in enhancing maternal sensitivity ($d = 0.33$) and promoting secure infant attachment behaviors ($d = 0.20$). Furthermore, interventions that had the largest effect on maternal sensitivity ($d > 0.40$) also had the largest effect on infant attachment behaviors ($d = 0.35$), supporting the active role in maternal sensitivity in promoting secure infant attachment behaviors.

Measurement of Maternal Sensitivity

Whereas infant attachment security and adult attachment state of mind have well validated, standard measures of assessment (i.e., the Strange Situation procedure and Adult Attachment Interview [AAI], respectively), there remains no “gold-standard” measure of maternal sensitivity. Mary Ainsworth’s original definition of maternal sensitivity involved mothers’ awareness of infant signals, accurate interpretation of these signals, and appropriate responses (Ainsworth, Bell, & Stayton, 1971, 1974). In her original study of infants in Baltimore, Ainsworth measured maternal sensitivity painstakingly during 4-hr-

long home visits every 3 weeks during the first year of life (Ainsworth et al., 1978). Since these early studies, however, definitions and measures of maternal sensitivity have differed considerably across studies (De Wolf & van IJzendoorn, 1997). Although maternal sensitivity is commonly measured globally using Likert rating scales (e.g., Lohaus, Keller, Ball, Voelker, & Elben, 2004; Moore et al., 2009), there remains variability in the tools and procedures in its assessment, including q-sort methodologies (e.g., Pederson et al., 1998).

In addition to issues of definitions and measures, there are several additional parameters that vary across studies including assessment setting (home vs. lab), context (free play vs. structured tasks), length, and frequency. Some studies rely exclusively on close interactions between mothers and their infants, such as feeding and play situations (e.g., Oyen, Landy, & Hilburn-Cobb, 2000; Pianta, Sroufe, & Egeland, 1989). Others rely on observations of situations that place competing demands on the mother's attention, such as completing a questionnaire while in an empty room with her child (e.g., Atkinson et al., 2005; Pederson et al., 1990). More recently, maternal sensitivity has been assessed in the context of maternal responsiveness to nighttime waking and crying (Higley & Dozier, 2009). In terms of duration of assessment, some recent studies have based the assessment of maternal sensitivity on as little as a single 10-min observation (e.g. Moore et al., 2009). In the current study we were concerned with the frequency of assessment and its implications.

Frequency of Assessment

As noted above, Ainsworth and her colleagues assessed maternal sensitivity across approximately eighteen 4-hr-long home visits in her original Baltimore study (Ainsworth et al., 1978). Since this time, numerous studies have assessed maternal sensitivity based on a single observation (e.g., Lyons-Ruth et al., 1987; Moore et al., 2009). There are notable exceptions including Cassidy and colleagues who have recently assessed maternal sensitivity over the course of three 30-min home visits and a 60-min lab visit (Cassidy et al., 2005). Besides measurement error, assessment at a single time point would not be problematic, provided maternal sensitivity is a stable construct. If so, the assessment of maternal sensitivity on a given day would reflect a mother's "true" level of maternal sensitivity (plus measurement error). However, unlike infant attachment security and adult attachment state of mind which are theoretically stable and therefore generally assessed only once,1 maternal sensitivity is associated with a greater degree of temporal variability (Ainsworth et al., 1978). Maternal sensitivity is not only a *static trait* (i.e., global or "average" sensitivity) but also *fluid state* that fluctuates from one assessment to the next.

In other words, a single assessment of maternal sensitivity reflects a snapshot of maternal sensitivity during a given observation (plus measurement error). This snapshot of maternal sensitivity, in turn, is a function of both global or average sensitivity (trait) plus actual temporal variability (state). Furthermore, caregivers likely differ from each other not only in their global or average sensitivity but also in within-person variability in sensitivity (see Bolger, Davis, & Rafaeli, 2003). By very definition, maternal sensitivity relates to how *consistent* a caregiver is in responding to her infant's signals (Ainsworth et al., 1978). We might expect, therefore, that some caregivers show more variability in maternal sensitivity over time than others, limiting the reliability of single time point assessments. Whereas caregivers with high overall sensitivity are likely able to attend to their children's cues in predictable and stable ways, caregivers with lower overall sensitivity are likely to respond to their children's cues sporadically and inconsistently. We would expect that this inconsistency will be manifest in a lesser degree of temporal stability, as evidenced by greater within-person variability from one assessment to the next. Therefore, we would expect that caregivers with low global sensitivity would evidence greater within-person

variability in sensitivity. If this is indeed the case, the implication would be that single time point assessments are particularly problematic for high-risk and maltreating samples.

There is very limited research into whether frequency of observation of maternal sensitivity influences the strength of associations with related variables. In one study, the mean of three observations of maternal sensitivity was a better predictor in infant attachment behaviors than the individual observations (Isabella, 1998). It is also important to note that Ainsworth's original Baltimore study reported a very strong correlation (r = .78) between maternal sensitivity (assessed multiple times) and infant attachment behaviors (Ainsworth et al., 1978). Although an effect size of this magnitude has not been replicated, subsequent studies have not relied on the same degree of methodological rigor as the Baltimore study. Ainsworth's original study remains a statistical outlier and has, therefore, been excluded from meta-analytic estimates of effect sizes on statistical grounds (De Wolff & van IJzendoorn, 1997). However, it must be noted that this robust association was reported in the context of detailed and frequent observations of mother–infant interactions.

Attachment State of Mind and Maternal Sensitivity

"State of mind" with regard to attachment refers to how adults process, reflect on, and value attachment-related experiences (George et al., 1985). Adults classified as having an "autonomous" state of mind are open and reflective regarding both positive and negative attachment-related experiences. Autonomous adults remain coherent and contained in their descriptions of attachment-related memories. Adults classified as having a "nonautonomous" state of mind, on the other hand, tend to devalue the significance of their attachment-related experiences, evidenced by idealization of their parents, denial of specific memories, or by becoming overly emotional and angry during discussions of attachment-related experiences. Adult attachment state of mind is associated with the ability to respond in sensitive ways to an infant's cues (George et al., 1985; van IJzendoorn, 1995). Whereas mothers with autonomous states of mind tend to interpret and respond to their children's signals appropriately, mothers with nonautonomous states of mind may reject their children's bids for comfort, respond excessively and intrusively, or be frightening toward their children. Meta-analytic findings indicate a moderate association (r = .34) between adult attachment state of mind and global sensitivity (van IJzendoorn, 1995). Although few studies have examined the association between attachment state of mind and maternal sensitivity across multiple assessments, we would expect autonomous mothers to demonstrate higher consistency, and thus lower variability, in their ability to respond to their children's signals. Contrarily, nonautonomous mothers whose own attachment-related histories are likely to interfere with their accurate interpretation of, and response to, their children's cues are more likely to respond in inconsistent and therefore less reliable ways.

Maternal Sensitivity and Child Removal From the Home

In order to ground this study in the "real-world" context of the child welfare system, we also examined the association between maternal sensitivity and removal of the child from his or her home. These analyses extend the research base on parent-level variables associated with re-referrals to child protective services. A recent study examining predictors of re-referrals to child protective services among maltreated infants found that demographic variables were better predictors than parent-level variables (Thompson & Wiley, 2009). In the study, several parent-level variables were examined including parent psychopathology, substance use, and harsh parenting behaviors, none of which were associated with re-referrals. Understanding associations between maternal sensitivity and re-referrals to child protective services may inform prevention and intervention efforts targeted for these families.

Current Study

Given that maternal sensitivity is central to attachment theory, a risk factor for child maltreatment, and a key outcome for many early interventions, it is critical to understand measurement issues that might affect its assessment. We had two objectives in the current study. The first was to examine within-person variability in maternal sensitivity across observations. We expected that nonautonomous mothers would not only evidence lower global (average) maternal sensitivity but also greater within-person variability in their sensitivity scores across observations, relative to autonomous mothers. Our second objective was to examine whether multiple observations of maternal sensitivity leads to more robust associations with theoretically related variables, namely adult attachment state of mind and subsequent removal of the child from the home. We expected that increasing the number of observations of maternal sensitivity would lead to more robust associations (stronger effect sizes) with these related constructs.

Method

Participants

Participants in this study were 25 high-risk mother–infant dyads assigned to the treatment control group of a randomized clinical trial of an early intervention (Dozier, 2006). All caregivers were referred by social service agencies due to substantiated cases of neglecting their infants. The most common concerns noted on the referral forms included one or more of the following: neglect, housing conditions, substance abuse (mother), parenting skills, mental health issues (mother), and domestic violence. Only control group participants were included in this sample because the control intervention, unlike the experimental intervention, was not intended to have any effect on maternal sensitivity. The first 25 control subjects to complete 10 1-hour-long home visits were included in this sample. In all, 14 (56%) of the mothers were African American, 6 (24%) were European American, and 5 (20%) were Hispanic; 14 (56%) of the infants were African American, 3 (12%) were European American, 5 (20%) were Hispanic, and 3 (12%) were Biracial. The mothers ranged in age from 17 to 41 years (M = 25.9; SD = 7.0). The infants ranged in age from 3 to 20 months (M = 11.9 months; SD = 5.7 months) at the beginning of the study. Only 4 infants were under 6 months of age. Annual income ranged from less than $4,000 to $30,000 ($M$ = $13,669; SD = $10,643). Maternal education ranged from 8 to 12 years (M = 10.0; SD = 1.3).

Measures

Maternal sensitivity—An abbreviated (25-item) version of the Maternal Behavior Q–Sort (MBQS; Pederson & Moran, 1995; Pederson, Moran, & Bento, 1998) was used to assess maternal sensitivity. MBQS items included descriptions of various aspects of maternal behavior related to sensitivity, such as response to distress, monitoring of infant's behavior, attentiveness to infant cues, and appropriateness of maternal affect. After observing each videotaped home visit, coders sorted MBQS items into 5 piles of 5 items each (Category 1 = *most unlike the mother's behavior*; Category 5 = *most like the mother's behavior*). In order to determine a mother's sensitivity score, each coder's sort was correlated with the criterion sort of a prototypically sensitive mother. Scores can range from −1.0 to 1.0, with higher scores indicating higher sensitivity. The short version of the MBQS has established reliability and predictive validity (Tarabulsy et al., 2009). The coders consisted of a team of undergraduate research assistants who were trained to use the MBQS by the first author. Only coders who were able to sort to criterion (r = .80) were included in the coding team. Coding assignments were made carefully to ensure that there were no systematic biases to the coding procedures. Sessions were not coded in order, and each coder coded several

videotapes of each mother–infant dyad and each session number. As a result, there were no systematic associations between coders, session numbers, or mother–infant dyads. Coders were blind to all other information including attachment state of mind classifications of the mothers. To maximize reliability, each videotaped session was q-sorted by at least two coders and the scores were averaged. The Spearman-Brown coefficient, calculated as a measure of inter-rater reliability, was high (r = .84).

Adult attachment state of mind—Adult attachment state of mind was assessed using the AAI (George et al., 1985). The AAI is a semistructured interview that includes questions regarding early experiences with attachment figures, experiences of abuse and loss, and other traumatic experiences. During the interview, the parent is also asked to talk about the effects of these experiences on her adult personality and caregiving behaviors. All interviews were audio-recorded, transcribed, and then coded by a professional coder using Main and Goldwyn's (1998) coding system. The training involves a 2-week workshop, followed by a reliability test consisting of 36 transcripts. For the purposes of the current study, transcripts were classified as autonomous or nonautomomous. The reliability and discriminant validity of the AAI is well established (Bakermans-Kranenburg & van IJzendoorn, 1993; van IJzendoorn, 1995). The AAI also has predictive validity for infant attachment security (d = 1.06) and caregiver sensitivity (d = .72; van IJzendoorn, 1995).

Child removal from the home—Data regarding children's removal from their homes were obtained from the referring social service agencies. These removals all took place sometime after the dyads had completed their last home visits. It is important to note that the decision to remove a child from his or her home was not based on any data from the current study. Rather, each decision was made independently by the respective social service agency without any access to confidential study data.

Procedure

Data collection—AAIs were conducted at an initial home visit. The interviews were recorded onto a digital voice recorder for transcription. Mothers were paid $25 after completing this initial visit. Next, mothers and infants were videotaped in their homes for 1 hr/week for 10 weeks as part of the control intervention. The 10 sessions covered topics such as colors, shapes and sizes, and animals. The observations were intended to be as naturalistic as possible, within the context of home visits (i.e., divided attention between infant and visitor). As such, mothers were not given any specific instructions regarding their interactions with their infant. During each home visit, parent trainers discussed general information related to children's language, cognitive, and/or motor development. Mothers participated in activities intended to support children's development that corresponded to the session's theme (e.g., colors). Parent trainers did not direct the mothers' interactive behavior with their infants during these activities; rather, they provided toys and described activities that could be used to promote children's skill development. During most home visits, there were opportunities to observe the mothers' behaviors when their attention was divided (e.g., engaged in discussion with the parent trainer), when their children were upset or frustrated, during play interactions, and other daily tasks (e.g., feeding). Each of these home visits was q-sorted to assess maternal sensitivity. Coders attended to maternal behavior throughout the entire visit. Mothers received $100 after all 10 home visits were completed.

Data sampling trials—In order to examine whether increasing observations of maternal sensitivity leads to larger effect sizes with theoretically related constructs, we used a data sampling methodology to create random samples consisting of increasing numbers of observations of maternal sensitivity. Specifically, we used a resampling method (e.g., Good, 1999) know as bootstrapping (e.g., Chernick, 1999; Efron & Tibshirani, 1993). As noted

above, our data set consisted of maternal sensitivity scores from 10 time points (T1–T10) for each of 25 mothers (M1–M25). A program was created using Microsoft Excel to randomly sample maternal sensitivity scores from the data set for which the number of observations to be sampled for each mother could be selected. For example, when the number of observations to be sampled was set at "3," the program randomly sampled 3 maternal sensitivity scores for each of the 25 mothers. The three scores were then averaged and effect sizes (*r*) calculated between the resulting scores and adult attachment state of mind classifications (autonomous [1] vs. nonautonomous [0]) and a variable indicating whether the infant was later removed from his or her home by a social service agency (removed [0] vs. not removed [1]). The first time the program was run, one maternal sensitivity score for each mother was randomly selected from the data set and effect sizes were calculated. Each program run consisted of 500 trials (the maximum allowed by the program), resulting in 500 random samples each consisting of one maternal sensitivity score for each of the 25 mothers. Each time the program was run, the number of observations of maternal sensitivity sampled for each of the 25 mothers was increased. In the second run, for example, two maternal sensitivity scores for each mother were randomly selected by the program and effect sizes were calculated between the averages of these two scores and adult attachment state of mind classifications and whether the infant was removed from the home. Every program run, therefore, resulted in 500 sets of effect sizes, based on increasing observations of maternal sensitivity.

Results

Missing Data

Out of a possible 250 videotaped home observations (10 for each of the 25 dyads), 219 (87.6%) were able to be coded. The remaining 31 observations (12.4%) could not be coded, usually because the infant was asleep during the home visit. Every dyad had at least seven observations that could be coded for maternal sensitivity ($M = 8.8$; $SD = 1.0$). We conducted analyses to explore for any patterns of missing data. The number of missing sessions per caregiver was not associated with maternal sensitivity ($r = .11$, $p = .60$) or any other variable measured in the study. Transcribed and coded AAIs were available for 23 (92%) of the mothers. A missing data variable was created by coding each AAI as "missing" (1) or "not missing" (0). Missing AAI data were not associated with any other variable.

Descriptive Statisics and Preliminary Analyses

Maternal sensitivity—Table 1 presents descriptive statistics for maternal sensitivity scores for each of the 10 sessions. Across the 10 sessions, maternal sensitivity scores for any given assessment ranged from −0.05 to 0.88 ($M = 0.65$; $SD = 0.18$). For each caregiver, we calculated an average sensitivity score across the 10 sessions. These average maternal sensitivity scores for each caregiver ranged from 0.20 to 0.77 ($M = 0.65$; $SD = 0.12$). Minimum sensitivity scores for each caregiver ranged from −0.05 to 0.67 ($M = 0.43$; $SD = 0.18$). Maximum sensitivity scores for each caregiver ranged from 0.62 to 0.88 ($M = 0.82$; $SD = 0.06$). Figure 1 shows a scatter plot of sensitivity scores across the 10 sessions. Overall, maternal sensitivity scores were moderately stable from one home observation to the next, $r = .49$; $p < .001$. Sensitivity scores did not change systematically with repeated visits, $F(9, 209) = 0.286$, $p > .05$. Sensitivity scores were also not associated with infant age, $r(25) = -.16$, $p > .05$.

Attachment state of mind—Eleven mothers (47.8%) were classified as autonomous and 12 (52.2%) were classified as nonautonomous on the AAI. (Of those classified as nonautonomous, nine had a primary classification of Dismissing and three had a primary classification of Unresolved.) Sensitivity scores did not change systematically with repeated

visits for autonomous mothers, $F(9, 90) = 1.298$, $p > .05$, or nonautonomous mothers, $F(9, 91) = 0.113$, $p > .05$. See Figure 1 for a graphical presentation of the data. Mothers who were autonomous with regard to attachment state of mind had higher average sensitivity scores ($M = 0.72$; $SD = 0.03$) than nonautonomous mothers ($M = 0.58$; $SD = 0.15$), $F(1, 21) = 8.89$, $p < .01$. This association is equivalent to an effect size of $r = .55$. Autonomous mothers also had higher minimum sensitivity scores ($M = 0.54$; $SD = 0.08$) than non-autonomous mothers ($M = 0.32$; $SD = 0.19$), $F(1, 21) = 12.66$, $p < .01$. This is equivalent to an effect size of $r = .61$. However, autonomous mothers did not have significantly higher maximum sensitivity scores than non-autonomous mothers, $F(1, 21) = 2.51$, $p > .05$.

Child removal from the home—No infants were removed from their home during the active phase of the control-intervention (i.e., during the period of the 10 home visits). However, a small minority (20%; $N = 5$) of the infants were removed from their home by child protective agencies in the first year subsequent to their completion of the last home visit. Removal from the home was associated with overall (average) maternal sensitivity ($r = .57$, $p < .01$). Specifically, mothers who had their infants removed from their home evidenced lower overall maternal sensitivity ($M = 0.51$; $SD = 0.20$) compared to mothers who did not have their infants removed ($M = 0.68$; $SD = 0.07$), $F(1, 23) = 10.80$, $p < .01$.

Within-Person Variability in Maternal Sensitivity

To examine within-person variability in maternal sensitivity, we calculated standard deviations of maternal sensitivity scores across the 10 observations for each of the 25 mothers. Each mother's variability in maternal sensitivity scores ranged from 0.06 to 0.24 ($M = 0.13$; $SD = 0.06$). Consistent with our first hypothesis, mothers who were nonautonomous with regard to attachment state of mind evidenced greater within-person variability in their sensitivity scores compared to autonomous mothers, $F(1, 21) = 11.35$, $p < .01$. This association is equivalent to an effect size of $r = .59$. Mothers who had their infant removed from their home also evidenced greater within-person variability in their sensitivity scores compared to mothers who did not have their infant removed, $F(1, 23) = 9.20$, $p < .01$. This association is equivalent to an effect size of $r = .54$.

Data Sampling Trials

Finally, we examined whether effect sizes between maternal sensitivity and two theoretically related variables, attachment state of mind and child removal from the home, increased as the number of assessments of maternal sensitivity increased. Data sampling trials were conducted as described in the Method section. We only sampled up to seven observations of maternal sensitivity as this was the maximum number of observations that were available for all 25 dyads. The results of the data sampling trials are summarized in Table 2. Consistent with out second hypothesis, the results showed incremental increases in effect sizes between maternal sensitivity and adult attachment state of mind ($r = .37$ to $r = .54$) and child removal from the home ($r = .37$ to $r = .56$) with increasing observations of maternal sensitivity. As would be expected, variability in mean effect sizes also decreased with increasing observations.

The results are visually depicted in Figure 2. The curves suggested an inverse function, which we confirmed using the curve estimation function in SPSS, $Fs(1, 3498) = 1764.68$ and 1309.60, $ps < .001$. The curve for attachment state of mind can be modeled with the following equation: effect size (r) = $.561 - .191/x$, where x represents the number of observations of maternal sensitivity. The constant (.561) is the asymptote for the curve, representing the mean effect size between maternal sensitivity and attachment state of mind, given an infinite number of observations of maternal sensitivity. The coefficient (.191) represents the average bias (underestimate) of the effect size between maternal sensitivity

and attachment state of mind when *x* is 1 (a single observation of maternal sensitivity). The curve for child removal from the home can be modeled with the following equation: effect size (r) = .579 − .214/x, where x represents the number of observations of maternal sensitivity. The constant (.579) is the asymptote for the curve, representing the mean effect size between maternal sensitivity and child removal from the home given an infinite number of observations of maternal sensitivity. The coefficient (.214) represents the average bias (underestimate) of the effect size between maternal sensitivity and child removal from the home when *x* is 1 (a single observation of maternal sensitivity).

Discussion

Our two hypotheses were supported by the results of the study. First, we found that within-person variability in maternal sensitivity was greater for mothers who were nonautonomous compared to mothers who were autonomous with regard to attachment state of mind. Within-person variability in maternal sensitivity was also greater for mothers who subsequently had their infant removed from their home compared to mothers who did not have their infant removed from their care. Second, the results from our data sampling trials showed incremental increases in effect sizes between maternal sensitivity and theoretically related constructs with increasing observations of maternal sensitivity. We discuss each of these findings in turn.

Within-Person Variability in Maternal Sensitivity

Our results indicated moderate temporal stability in maternal sensitivity over time. As expected, we also found individual differences in within-person variability in maternal sensitivity. These findings suggest that caregivers differ from each other not only in their global levels of maternal sensitivity but also in within-person variability over time. In addition, we found that nonautonomous mothers showed more within-person variability in maternal sensitivity compared to autonomous mothers. This lawful association suggests that variability in maternal sensitivity over time is due to more than measurement error. Rather, within-person variability seems to be a theoretically important construct that is a critical part of maternal sensitivity. It is also consistent with Ainsworth's original definition of sensitivity. By definition, a sensitive caregiver is *consistent* in responding to her infant's signals (Ainsworth et al., 1978). We found that nonautonomous mothers do not only have lower global sensitivity than autonomous mothers but also greater within-person variability from one assessment to another. In other words, consistent with Ainsworth's definition, less sensitive mothers sometimes respond to their infant's cues but do so inconsistently and unpredictably.

The Utility of Multiple Assessments

The results from our data sampling trials showed incremental increases in effect sizes between maternal sensitivity and theoretically related constructs with increasing observations of maternal sensitivity. Multiple observations of maternal sensitivity allow for not only a means to assess within-person variability but also a more reliable measure of overall global sensitivity. Although it may seem obvious that assessing maternal sensitivity on multiple occasions yields a more reliable and accurate measurement, our results suggest that this may be especially true for mothers who are nonautonomous with regard to attachment state of mind and other high-risk populations for whom a greater degree of within-person variability in maternal sensitivity might be expected. Our findings also provide *empirical* evidence for the utility in assessing maternal sensitivity over multiple observations, which is not routine practice.

Moreover, not only did multiple observations of maternal sensitivity lead to reduced standard errors of measurement for effect sizes with related constructs but also systematic increases in estimates of effect sizes. On average, fewer observations of maternal sensitivity resulted in *systematic underestimates* of effect sizes with related constructs. The mean effect size of the association between attachment state of mind and a single observation of maternal sensitivity from our data sampling trials (r = .37) is close to the effect size between attachment state of mind and maternal sensitivity reported in the van IJzendoorn (1995) meta-analysis (r = .34). Our results suggest that measurement issues (i.e., frequency of assessment) related to maternal sensitivity are likely contributing factors to the underperformance of maternal sensitivity in much of the empirical literature, especially when compared to the early pioneering attachment studies in which maternal sensitivity was assessed frequently (e.g., Ainsworth et al., 1978).

Limitations

A clear limitation of the study is the small sample size. However, this problem was mitigated by the within-person design of the study. Although there were only 25 participants in the sample, maternal sensitivity was assessed over the course of 10 home visits. As a result, the sample size was sufficient to address the main aims of the study, namely to examine within-person variability in maternal sensitivity and the utility of multiple assessments. It should also be noted that we cannot rule out the possibility that greater within-person variability in maternal sensitivity for nonautonomous mothers relative to autonomous mothers is due, in part, to a ceiling effect in our measure of sensitivity. However, our cumulative results seem more consistent with the interpretation that less sensitive mothers indeed demonstrate more variability over time than more sensitive mothers. This interpretation is also consistent with a theoretical understanding of maternal sensitivity and the results from our data sampling trials.

We were also surprised by the seemingly high rates of autonomous attachment classifications and levels of sensitivity for a high-risk sample. Although the rate of autonomous mothers (48%) was higher than the larger sample (41%; N = 150) and other high-risk samples (e.g., 30%; N = 1,368; Bakermans-Kranenburg & van IJzendoorn, 2009), this difference is not statistically significant. In other words, the apparently high rate of autonomous mothers is within a reasonable margin of error, given the small sample size. With regard to seemingly high levels of sensitivity, it is critical to note that scores on the MBQS have not been standardized. As such, in the absence of standardized norms it is not meaningful to interpret a score of 0.65, for example, as “high” or “low.” In addition, it is worth noting that scores from the MBQS typically have a negative skew (means above zero) across samples (e.g., Tarabulsy et al., 2003; Tarabulsy et al., 2009). We caution readers, therefore, not to generalize rates of autonomous attachment classifications or levels of sensitivity from this very small sample to other high-risk populations. Rather, the conclusions drawn from the current study must be limited to the topics it was intended to address, namely within-person variability in maternal sensitivity and the utility of multiple assessments.

Finally, our results do not provide a definitive answer to the question of how many times to assess maternal sensitivity. Whereas more is better than less, our results are also consistent with the “law of diminishing returns.” There are certainly financial and opportunity costs associated with assessing maternal sensitivity, and the added statistical benefit decreases for each additional assessment. As such, it is not possible to suggest a definitive guideline for the optimal frequency of assessment. However, at least two assessments are necessary to estimate within-person variability in maternal sensitivity. More than three assessments, while still providing incremental benefit, might not always justify the additional time and resources. Such decisions will depend on the aims of individual studies and the resulting

degree of precision required in the measurement of maternal sensitivity. Ultimately, it will be up to researchers to weigh the relative costs and benefits associated with multiple assessments of maternal sensitivity.

Implications for Child Maltreatment Researchers and Practitioners

Our results have important implications for child maltreatment researchers, including developmental psychopathologists and interventionists. Accurate measurement is critical in studying the antecedents, correlates, and sequelae of maternal sensitivity, especially for the estimation of effect sizes. As noted above, maternal sensitivity is a risk factor for child maltreatment and a specific target of many interventions. Poor measurement of maternal sensitivity will inevitably indicate its relative unimportance in terms of predictive utility and malleability to intervention. Given the results of our study, it would not be surprising if meta-analytic indices of the effectiveness of early interventions in enhancing maternal sensitivity (e.g., Bakermans-Kranenburg et al., 2003) are conservative estimates.

Our finding of greater within-person variability in maternal sensitivity among nonautonomous mothers compared to autonomous mothers has several implications for practitioners who work with maltreating and otherwise high-risk families. First, it is important for practitioners to be mindful of variability in mothers' sensitivity and to continuously observe mothers' behavior during sessions or visits. Identifying specific times when mothers attend to their children's cues as well as specific times when mothers fail to attend to their children's cues is likely a critical step to effective intervention. A number of attachment-based interventions highlight mothers' strengths (i.e., appropriate responses) and weaknesses (i.e., missed opportunities to respond) by providing feedback either at the moment or through video (Dozier, Bernard, & Bick, 2009; Juffer, Bakermans-Kranenburg, & van IJzendoorn, 2008). By praising parents when they attend sensitively to their children's cues, even if this happens briefly in a lengthy series of insensitive interactions, practitioners can capitalize on and reinforce the positive aspects of the mothers' behavior. Second, given the association between attachment state of mind and maternal sensitivity, it is important for practitioners to be mindful of how mothers' own attachment-related experiences influence their parenting. Several interventions specifically address this aim by helping parents identify experiences from their own childhood that make it difficult to respond to their infants in consistent, nurturing ways (e.g., Dozier, Higley, Albus, & Nutter, 2002; Tarabulsy et al., 2008). In working with parents who devalue attachment-related experiences, it is perhaps especially important to address past experiences that are interfering with current caregiving behaviors. We are not suggesting that it is practical or even necessary to change mothers' attachment state of mind in order to change maternal sensitivity. However, we do suggest that it may be important to help mothers become aware of how their own childhood experiences may interfere with their ability to consistently respond to their children's cues. By supporting mothers in exploring these associations, practitioners can further encourage and empower mothers to provide their children with the sensitive parenting that they might not have received themselves.

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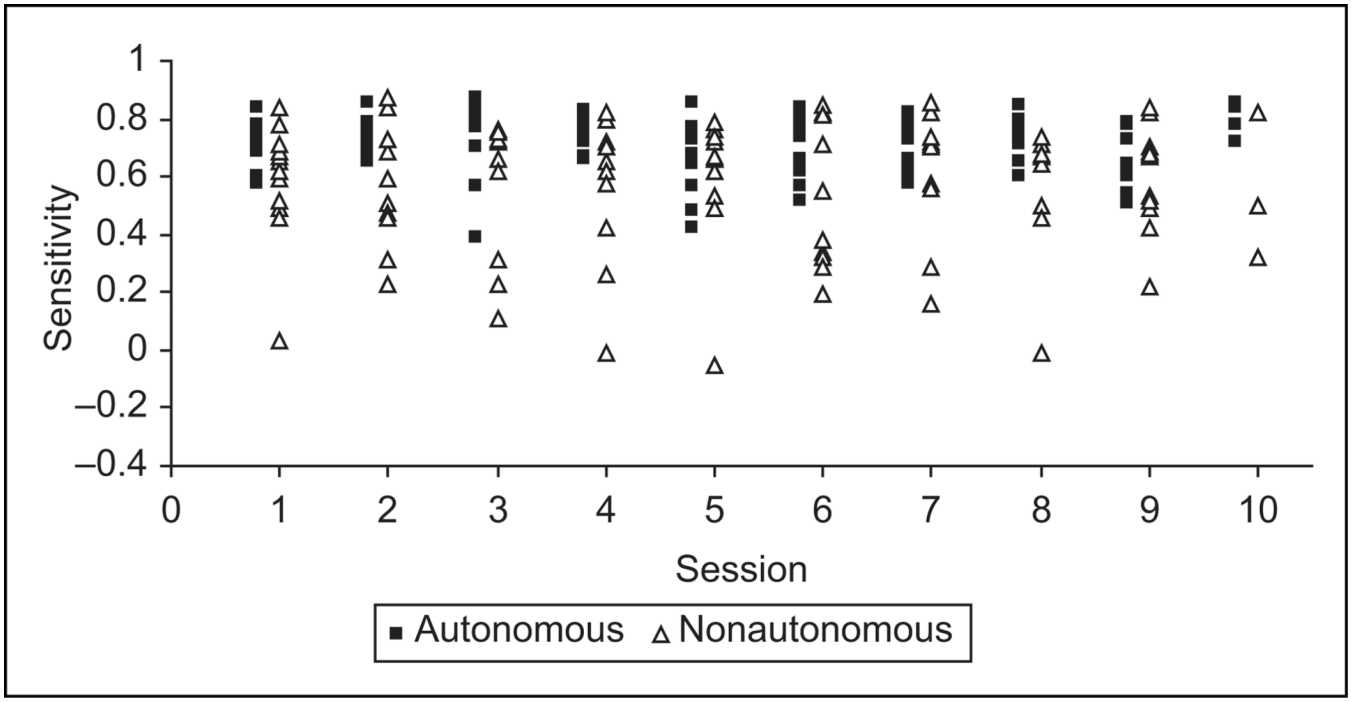

Figure 1.
Maternal sensitivity scores across the 10 sessions.

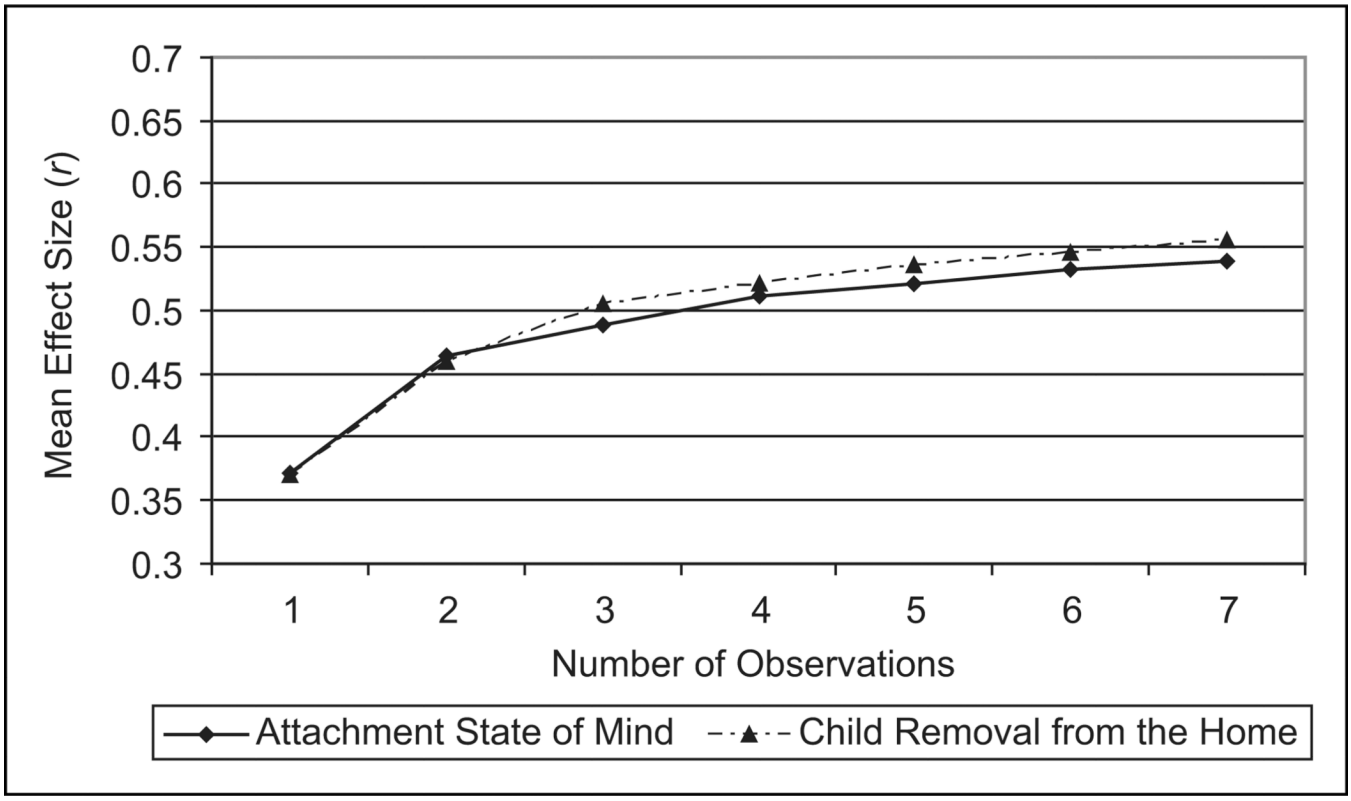

Figure 2.
Incremental increases in mean (500 trials) effect sizes (*r*) between maternal sensitivity and adult attachment state of mind (*r* = .37 to *r* = .54) and child removal from the home (*r* = .37 to *r* = .56) as a function of number of observations of maternal sensitivity.

Table 1

Descriptive Statistics for Maternal Sensitivity

Maternal Behavior Q–Sort	Min.	Max.	Mean	*SD*
Session 1 sensitivity	0.03	0.84	0.66	0.17
Session 2 sensitivity	0.23	0.87	0.65	0.18
Session 3 sensitivity	0.11	0.87	0.64	0.21
Session 4 sensitivity	−0.01	0.83	0.65	0.20
Session 5 sensitivity	−0.05	0.86	0.62	0.19
Session 6 sensitivity	0.19	0.85	0.63	0.21
Session 7 sensitivity	0.16	0.86	0.65	0.20
Session 8 sensitivity	−0.01	0.85	0.68	0.18
Session 9 sensitivity	0.22	0.84	0.64	0.15
Session 10 sensitivity	0.32	0.88	0.72	0.20
Minimum sensitivity	−0.05	0.67	0.43	0.18
Maximum sensitivity	0.62	0.88	0.82	0.06
Average sensitivity	0.20	0.77	0.65	0.12
Variability in sensitivity	0.06	0.24	0.13	0.05

Table 2

Correlations With Maternal Sensitivity

	Min.	Max.	Mean	*SD*
Attachment state of mind				
1 Observation	−0.08	0.72	0.37	0.12
2 Observations	0.09	0.72	0.46	0.10
3 Observations	0.25	0.73	0.49	0.08
4 Observations	0.30	0.69	0.51	0.07
5 Observations	0.36	0.68	0.52	0.05
6 Observations	0.41	0.64	0.53	0.04
7 Observations	0.43	0.61	0.54	0.03
Child removal from home				
1 Observation	−0.10	0.80	0.37	0.17
2 Observations	0.05	0.74	0.46	0.13
3 Observations	0.17	0.77	0.50	0.10
4 Observations	0.28	0.71	0.52	0.08
5 Observations	0.37	0.69	0.54	0.07
6 Observations	0.41	0.66	0.55	0.05
7 Observations	0.46	0.64	0.56	0.03