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Community-delivered infant–parent psychotherapy improves maternal sensitive caregiving: Evaluation of the Michigan model of infant mental health home visiting

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ABSTRACT

The current study evaluated the effectiveness of a home-based psychotherapeutic Infant Mental Health Home Visiting (IMH-HV) intervention for enhancing parenting sensitivity; a secondary aim was to evaluate whether the use of video feedback was associated with greater treatment response. Participants were $N = 78$ mothers and their children (age at entry ranged from prebirth to 24-month old ($M = 9.8$, $SD = 8.4$), who were initiating IMH-HV services with community mental health-based therapists ($N = 51$). Dyads were assessed during extended home visits via standardized interviews and observational and questionnaire methods within the first month of treatment (baseline), and again 6 and 12 months thereafter. Following each of these extended home visits, study evaluators completed a standard Q-sort to capture observations of maternal sensitivity during the visit. Therapists completed fidelity checklists used to derive the total number of IMH-HV sessions received (i.e., dosage) and frequency with which therapists provided video feedback. Results indicated a dose–response relationship between number of sessions and maternal sensitivity, and that video review with parents independently contributed to improved maternal sensitivity. Discussion focuses on the effectiveness of this community-based psychotherapeutic home visiting model for enhancing parenting, as well as the value of video feedback as a specific therapeutic strategy.

KEYWORDS
parenting, psychotherapy, sensitivity

1 | INTRODUCTION

Toxic stress, parental mental illness, trauma, poverty, and other adverse experiences impact parents, infants, and toddlers at alarmingly high rates, during a time when the young child's developing brain is highly sensitive to experience (Johnson, Riley, Granger, & Riis, 2013; Schore, 2017). The impact of these stressful early experiences is substantial, and can lead to alterations in the course of a child's development (Shonkoff & Garner, 2012). Early interventions that facilitate enriched and nurturing environments, and support the establishment of strong, healthy relationships between parents and their infants, are critical in mitigating the impact of risks and adversities, thus promoting positive outcomes for infants and their families despite life's challenges (Garner, 2013).

Indeed, early parent–child relationships have significant implications for children's behavior and functioning across development, as evidenced by both prior meta-analytic reviews (e.g., Groh, Roisman, van Ijzendoorn, Bakermans-Kranenburg, & Fearon, 2012) and longitudinal research (e.g., Raby, Roisman, Fraley, & Simpson, 2015). Considered an important component of early development, and more broadly, attachment theory, maternal sensitivity is a relational construct that encompasses a caregiver's capacity to support an individual child's needs for security, autonomy, and affiliation (Ainsworth, 1967; Manning, Davies, & Cicchetti, 2014; Mesman, 2013). More specifically, the construct of maternal sensitivity includes dynamic and modifiable processes related to maternal abilities; reciprocity between the mother and child; contingency of maternal responses to child behavior and signals; and maternal qualities such as appropriateness of responses to child cues, emotional expressiveness, and availability (Shin, Park, & Seomun, 2008). Maternal sensitivity may be negatively affected by individual, familial, and systemic stressors; yet sensitive caregivers have a capacity to attend to a child's signals and needs despite competing internal and external demands (Fearon, Groh, Bakermans-Kranenburg, van IJzendoorn, & Roisman, 2016; Kim, Strathearn, & Swain, 2016; Pederson et al., 1990).

Interventions targeting early parent–child relationships, and specifically maternal sensitivity, have increased substantially over the last two decades in response to well-documented relationships between early life experiences and long-term psychological and physical health (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003; Verhage et al., 2016). A large portion of early childhood interventions involve home-based services, which afford opportunities to observe and better support families in their naturalistic environments (Olds, Hill, Robinson, Song, & Little, 2000). Furthermore, home visiting services may be optimal for families with limited resources or systemic disadvantages (Mountain, Cahill, & Thorpe, 2017).

Given the importance of early parenting and parent–child relationships, and indications that maternal sensitivity is open to influence and change (Shin et al., 2008), the current study aimed to (a) explore the impact of the intensive Infant Mental Health-Home Visiting model (IMH-HV; Weatherston & Tableman, 2015) on maternal sensitivity, and (b) as a secondary question given accumulating evidence supporting the use of video feedback techniques, to further examine whether the use of video feedback with parents enhances treatment effectiveness among families participating in this service.

1.1 | The "Michigan model" of IMH-HV

Improving the health and well-being of infants and toddlers remains a pressing public health need, not only in Michigan, but nationally and internationally (Zeanah, 2018). Within Michigan, many families are exposed to economic stress, limited resources, community and interpersonal violence, and mental health problems (Guevara Warren, 2018). The accumulation of such stressors increases the likelihood that children will experience diminished positive parenting, less stimulating learning environments, and greater risk for child maltreatment (Cicchetti & Rizley, 1981). These risks can be transmitted across generations, through compromised early caregiving environments and impaired relational foundations that place infants and toddlers at risk for poor social–emotional and mental health outcomes (Kelly, Slade, & Grienenberger, 2007; Verhage et al., 2016). Yet, Michigan has been recognized as a national and international leader in the development of programs and policies to address infant and early childhood mental health (Cohen, Oser, Quigley, & Stark, 2013). Among existing programs, the IMH-HV intervention model is currently deployed across Michigan to meet the service needs of infants and families at high risk for a variety of concerns, including parent–infant relationship problems, child abuse, neglect, behavioral concerns, developmental issues, parent mental health concerns, and risk for ongoing dependence on the mental health system (Lawler et al., 2017).

The IMH-HV model in Michigan is a multi-faceted, needs-driven, relationship-focused home visiting intervention serving parents and their infants or toddlers (Lawler et al., 2017; McKelvey et al., 2015; Weatherston & Ribaudo, this issue; Weatherston & Tableman, 2015). Services are delivered to families who have environmental or familial concerns that place their children at risk for developing a variety of emotional, behavioral, social, and cognitive delays. Typically, services are 1–2 hr per week and are provided from pregnancy up to child age 36 months (duration of service varies based on factors including family need). IMH-HV is based on well-established clinical and developmental theories, with refinement based on clinical implementation among thousands of families in Michigan over the past four decades. The

intervention uses a manual (Weatherston & Tableman, 2015) and includes a fidelity monitoring tool (see Huth-Bocks et al., this issue) and a case studies compilation volume (Weatherston & Shirilla, 2002). Clinicians delivering IMH-HV in Michigan are required by the state Department of Health and Human Services to have at least a masters-level degree in social work, psychology, or a related field; be licensed by the State of Michigan to provide psychotherapy services; and achieve endorsement by the Michigan Association for Infant Mental Health in Culturally Sensitive, Relationship-focused Practice Promoting Infant Mental Health® as an Infant Family Specialist, with endorsement as an Infant Mental Health Specialist preferred. Thirty states now offer endorsement, and more details regarding this credentialing are available at the website for the international Alliance for the Advancement of Infant Mental Health (allianceaimh.org).

The IMH-HV model has a long tradition in Michigan, with initial development in the early 1970's by Fraiberg at the University of Michigan (Fraiberg, 1980; see Weatherston & Ribaudo, this issue). IMH-HV services are currently delivered to Medicaid-eligible families through county or regional community mental health service programs (CMHSPs) across Michigan. In 2014, Michigan provided IMH-HV services to more than 1,700 of the state's most vulnerable families, with the goal of ameliorating serious mental health issues during the critical period of infancy and toddlerhood and preventing costly consequences for the individual and society across domains of health care, education, and the justice system.

Although there is acceptance and foundational infrastructure within Michigan to provide IMH-HV services, and several well-established models have grown from the tradition of IMH-HV, including modalities that focus specifically on trauma and more fully address the needs and experiences of preschool-aged children (Lieberman, Ghosh Ippen, & Van Horn, 2015; Lowell, Carter, Godoy, Paulicin, & Briggs-Gowan, 2011), there remains a need for systematic evaluation of the Michigan IMH-HV model. The current study sought to confirm expected associations of the IMH-HV intervention services and parent caregiving sensitivity (Lawler et al., 2017). As a preliminary exploration, a community-based focus was adopted through evaluating existing IMH-HV services delivered in Michigan by CMHSPs, in order to further understand how participation in IMH-HV services is associated with changes in maternal caregiving sensitivity. In addition, given the extant data suggesting that video feedback with parents may convey a unique added benefit for improving parenting (Bakermans-Kranenburg et al., 2003; Balldin, Fisher, & Wirtberg, 2018), a second key focus of this study was to examine whether the use of video review and feedback with parents was associated with enhanced treatment efficacy for improving maternal sensitivity.

1.2 | Maternal sensitivity

Although definitions vary, maternal sensitivity typically refers to a mother's ability to perceive and infer the meaning behind her infant's behavioral cues, and to respond promptly and appropriately. In her seminal work, Mary Ainsworth demonstrated robust links between maternal sensitivity and the development of attachment security in children (Ainsworth, 1967); although maternal sensitivity is not an exclusive predictor of attachment security (De Wolff & van IJzendoorn, 1997), it remains an important caregiving factor to the development of attachment and other childhood outcomes (Belsky & Fearon, 2002; Mesman, 2013).

1.2.1 | Measuring maternal sensitivity

Ainsworth, Bell, and Stayton (1971, 1974) developed observational measures of parenting behaviors, including maternal sensitivity. Although Ainsworth's measures are still used today, there is no standard measure of maternal sensitivity. It is posited that differences in measurement approaches may contribute to equivocal findings within the maternal sensitivity literature (Behrens, Parker, & Kulkofsky, 2014; Mesman, 2013; Nievar & Becker, 2008). One commonly used tool, the Maternal Behavior Q-set (MBQS), was developed as a means of rating maternal sensitivity in a naturalistic and ecologically valid manner (Pederson et al., 1990). Prior research indicates that the MBQS is a valid measure of maternal sensitivity, with consistent links to attachment (Behrens et al., 2014) and greater associations with attachment security compared to other measures of maternal sensitivity (Atkinson et al., 2000; Pederson & Moran, 1996). For instance, three prior meta-analyses examining associations between maternal sensitivity and infant–parent attachment quality reported only small to medium effect sizes (weighted average range from $r = .27$ to $r = .30$; Atkinson et al., 2000; De Wolff & van IJzendoorn,1997; Nievar & Becker, 2008), whereas the effect size for studies specifically utilizing the MBQS has demonstrated greater, albeit moderate, associations ($r = .60$, Pederson & Moran, 1996; $r = .52$, Pederson et al., 1990). For the purpose of the current study, a short version of the MBQS was adopted as an indicator of maternal sensitivity across time.

1.2.2 | Maternal sensitivity and high-risk groups

Several studies examining maternal sensitivity and child outcomes also support differential effects for high-risk groups. In a randomized control group trial, Klein Velderman, Bakermans-Kranenburg, Juffer, and van IJzendoorn (2006) reported that two attachment-based treatment approaches significantly increased maternal sensitive behaviors, but only for mothers with highly reactive children. Similarly, Manning et al. (2014) found that maternal sensitivity was related to child adjustment (i.e., externalizing and prosocial behaviors)

for children exposed to a high level of interpersonal violence, but not for those with low violence exposure. More specifically, among the high interpersonal violence–exposed group, maternal sensitivity buffered the risk of children developing externalizing problems and low prosocial behavior (Manning et al., 2014). Given these associations and the nature of families served by the IMH-HV model in Michigan, the current study explored the effects of IMH-HV on the change in maternal sensitivity among a high-risk, low-income sample.

1.2.3 | Interventions to enhance maternal sensitivity

In a meta-analysis of early childhood interventions targeting maternal sensitivity, Bakermans-Kranenburg et al. (2003) reported moderate effects ($d = .33$) of interventions on maternal sensitivity among 51 randomized controlled trials. Interventions were more successful if they specifically targeted sensitivity (e.g., compared to sensitivity and support), used video feedback, and included fewer than 16 sessions; the authors therefore argued for a behaviorally focused, "less-is-more" approach to early intervention services aimed at altering maternal sensitivity (Bakermans-Kranenburg et al., 2003). In an updated meta-analysis, Mountain et al. (2017) further substantiated results supporting effects of early intervention services on maternal sensitivity. Interestingly, however, the authors found mixed results with regard to dosage, wherein there was some empirical support for significant effects of intensive interventions (i.e., duration of 6 months or longer) on maternal sensitivity. Overall, Mountain et al. (2017) concluded that there is a need for additional empirical attention to questions regarding the dosage and duration of maternal sensitivity interventions.

1.3 | Video feedback

Video feedback approaches to infant mental health interventions have existed for several decades. McDonough and colleagues (2012), through their development of a brief strengths-based video review intervention, first highlighted the benefits of video feedback for high-risk families with infants and young children. Technological improvements in the ease of implementation for video recording and feedback, coupled with the aforementioned meta-analytic findings suggesting efficacy of video review for enhancing maternal sensitivity (Bakermans-Kranenburg et al., 2003), have prompted an increase in the number of interventions adopting a video feedback approach (Balldin et al., 2018). In the most recent revision of the IMH-HV manual (Weatherston & Tableman, 2015), the use of video was incorporated and recommended, though not required. As a result, evaluation of the impact of video review with caregivers is warranted to identify the potential value added through incorporation of this approach into the IMH-HV service.

1.4 | Current study

The current study was undertaken to examine whether the IMH-HV intervention, as a community based, Medicaid-funded service delivered by CMHSPs, improves sensitivity among a group of mothers receiving home-based IMH-HV services in Michigan. A secondary aim of the current study was to evaluate the use of video feedback–enhanced treatment effectiveness. We hypothesized that higher dosing of IMH-HV (i.e., more treatment sessions) would be associated with greater improvements in maternal sensitivity, and that the use of video feedback with caregivers would further add to the treatment effect.

2 | METHOD

The current study was an open trial, pre–post design of a community-delivered, Medicaid-funded IMH-HV. The study was approved by the University of Michigan Review Board (ID no. HUM00096040).

2.1 | Participants

Participants in the current study included parents and their infants or toddlers, as well as clinicians delivering the service. Twelve CMHSPs that were providers of IMH-HV were identified and partnered with this study; IMH-HV clinicians at each of the agencies recruited parents or caregivers and their children from their caseload to take part in the study. Eligible participants were pregnant women or parents or caregivers of children ages 0–24 months who had recently initiated IMH-HV services ($M = 9.8$, $SD = 8.4$; modal period since initiation = 4 weeks). Of the 123 caregivers approached by clinicians to determine their interest, 116 were eligible for study enrollment. Of these, 91 (79 mothers and 12 fathers) and their 80 children (11 children had two parents or caregivers enrolled in the study) were enrolled. Caregivers included biological or foster mothers and fathers, and all children enrolled were Medicaid recipients (i.e., eligible for health insurance for low-income persons). Parents or caregivers were incentivized for their participation in data collection and could receive up to $280 USD over the course of the study. All participants were volunteers, and all parents or caregivers and clinicians provided written informed consent. Data from one parent participant and her child were not analyzed due to voluntary withdrawal from the study. Given the small number of fathers enrolled in the study ($n = 12$), coupled with the fact that all but one of the children of enrolled fathers also had a mother enrolled in the study, we included data only from mothers. Six of the mothers were pregnant with the target child at baseline and consequently did not have a baseline evaluation of caregiver sensitivity; these mothers were excluded from the current analyses. Therefore, the final sample for the current

TABLE 1 Timeline for collection of measures completed by participants, evaluators, and clinicians

Measure	Baseline	6 months	12 months	Biweekly
Participant rated measures				
Demographics (child & mother)	x			
Interpersonal violence screener	x			
Adverse childhood experiences (ACE)	x			
Evaluator rated measures				
Maternal sensitivity Q-sort *(in-home)*	x	x	x	
Clinician rated measures				
Overall family health	x			
Clinician recorded video				
Free play video (with optional feedback)				x

analyses was $N = 72$ mothers (69 biological and three foster) and their children.

All IMH-HV clinicians ($N = 51$) also provided informed written consent for their participation in the study; no incentives were provided for data collection by participants. IMH-HV clinicians attended a brief training on data collection and study procedures. As other evidence-based treatment models have been developed from the IMH-HV model (Lieberman et al., 2015; Lowell et al., 2011), clinicians were asked to indicate if they had prior training in other related intervention models. At the time of the study, five clinicians indicated that they had received any training in Child–Parent Psychotherapy (Lieberman et al., 2015), the most prominent intervention model related to IMH-HV.

2.2 | Procedure

Mothers completed a variety of measures and tasks at five time points (see Table 1): baseline (corresponding to entry into the study), then again at 3-, 6-, 9-, and 12-months after baseline. Assessments included self-report questionnaires designed to assess domains such as parent or caregiver mental health, child social–emotional wellbeing, parenting, life events, and demographics; an attachment-based representational interview; and a video-recorded parent–child interaction procedure. All assessment procedures at baseline, 6-, and 12-months were conducted by trained research staff and occurred in the home of the participating parent; these visits lasted approximately 2–2.5 hours. An abbreviated set of self-report questionnaires was administered to the parent in the home or over the phone at the 3- and 9-month time points. During baseline, 6-, and 12- month visits, self-report questionnaires were verbally administered to the parent or caregiver and took about 45–90 min to complete. Parent interviews were audio recorded and lasted approximately 30–60 min. The video-recorded parent–child interaction procedure was conducted with a standard set of age-appropriate toys brought into the home by the research team. During this procedure, the parent or caregiver was instructed to complete a set of tasks with their child (i.e., free play, clean up, and two child age-dependent teaching tasks); this procedure took approximately 15 min to complete. As needed, the order of the home visit activities varied given the duration of the assessments and in order to account for parent or caregiver comfort, infant or toddler needs or sleep patterns, and other factors that might impact the home environment.

Following completion of the evaluation home visit, study team evaluators completed measures regarding their observations, including the standard Q-sort methodology to capture their observations of maternal sensitivity across the duration of the home visit; these measures were not completed for pregnant women. Finally, in addition to the measures completed by the parents and evaluators, the IMH-HV clinicians completed a treatment fidelity tool after each session with their client(s), and two additional components of data collection on a biweekly basis: a brief video recording of 5-min free play between the mother and child, and a brief maternal speech sample during which mothers described their children's personality. These videos and fidelity forms were submitted by clinicians to the university-based study team.

2.3 | Measures

2.3.1 | Demographics

The demographics form asked parents to indicate their own and their child's gender and race and ethnicity, the highest level of education they completed, marital or committed relationship status, and total household income.

2.3.2 | Clinician rating of family health

As part of the baseline assessment, clinicians were asked four questions designed to capture their impressions of their clients' overall mental and physical health. Specifically, clinicians were asked how they would rate the overall mental health of parent or caregiver and of child (separately), and also

how they would rate the overall physical health of the parent or caregiver and of the child (separately). Ratings were on a 5-point scale from 1 = *very poor* to 5 *very good*. Ratings across these four scales were averaged to provide an "overall family health" score.

2.3.3 | Traumatic experiences

Parents completed two measures designed to index exposure to commonly occurring adverse or traumatic experiences. These included the Adverse Childhood Experiences Questionnaire (ACEs; Felitti et al., 1998) and the Intimate Partner Violence Screener (Rosenblum & Muzik, 2012). The ACEs Questionnaire is a well-validated and widely employed measure designed to index exposure to stressful experiences in childhood. For this measure, one point is assigned for report of each of the 10 following indicators of adversity: psychological abuse, physical abuse, sexual abuse, physical neglect, emotional neglect, parental divorce, family member mental illness, substance abuse by a family member, incarceration of a family member, and domestic violence. The Intimate Partner Violence Screener asked parents to respond to the question: "In the last year, have you been scared, threatened, or hurt by anything a romantic partner did or said to you?" This was coded as "0" for no and "1" for yes. If parents responded yes, they were asked a follow-up question regarding the recency of this type of event.

2.3.4 | IMH-HV dosage

IMH-HV clinicians held sessions as they typically would through the 12-month duration of family participation in the study. Fidelity forms were completed by each clinician following every session with their client(s). These forms were used to derive the number of sessions held per quarter (i.e., between baseline to 3 months, 4–6 months, 7–9 months, and 10–12 months), as well as the total number of sessions held across the 12-month study.

2.3.5 | Dosage of use of video and video review with parents

Use of video is included in the IMH-HV manual as a strategy for supporting parents and the parent–infant relationship during sessions (Weatherston & Tableman, 2015). Although the research project protocol asked clinicians to complete biweekly videos, the use of video review was not required and was left to the purview of the clinician. Instructions for recording the video segment that was part of the study protocol were simply to record parent and child in free play for 5 min; parents were instructed to "play or spend time with their baby as they usually would while (the clinician) makes a movie." No instructions were given regarding the location in the home or regarding the use of toys, and no study-specific instructions were provided regarding how to conduct the video review. The IMH-HV fidelity form completed after each session asked clinicians to indicate if they had (a) made a video with the parent and baby (coded "0" for "no video" and "1" for "yes video completed"), and (b) reviewed the video with the parent during the session (coded "0" for "no video review or feedback" and "1" for "yes video review or feedback").

2.3.6 | Maternal sensitivity

To assess maternal sensitivity, study team evaluators completed the short version of the well-established and validated MBQS (Bailey, Bisceglia, Roche, Jenkins, & Moran, 2009; Pederson & Moran, 1995; Tarabulsy et al., 2009) at three separate time points: immediately following completion of the baseline, 6-, and 12-month assessment home visits. The MBQS focuses on a mother's ability to perceive and respond promptly and appropriately to her young child's behavioral signals. The original 90-item MQBS version (Pederson & Moran, 1995) was designed to assess maternal behaviors toward an infant in the home setting over the course of several hours of naturalistic observations. Trained coders sort 90 descriptors of maternal behaviors into nine piles with an even distribution of 10 items per pile. Sorts are then converted to a maternal sensitivity dimensional score based on a correlation with the profile of a prototypically sensitive mother. The MBQS has repeatedly shown strong correlations with other measures of maternal behaviors and mother–infant attachment security. A 25-item shortened version of the MBQS has been developed (Bailey et al., 2009; Tarabulsy et al., 2009). Evidence for validity of the shortened version has been demonstrated through significant associations with the full MBQS ($r = .35$), cognitive functioning ($r = .48$), and attachment security ($r = .34$; Tarabulsy et al., 2009).

The evaluator completing this task used observations from across the duration of the home visit to sort items from the short version of the MBQS. Prior to conducting the MBQS, all evaluators completed training on the short MBQS administration and subsequently demonstrated adequate reliability in these ratings (ICC $\geq .80$) based on six video-taped home visit observations of maternal behavior sensitivity from a previous research study.

2.4 | Data analysis plan

A linear mixed model was used to estimate the effects of quantity of IMH-HV treatment (i.e., dosage) and use of video feedback on caregiver sensitivity across time. Linear mixed models provide greater flexibility than repeated measures ANOVA. For example, if a subject is missing data at any time point, they will be eliminated from the analysis in ANOVA, but can be retained in a mixed model so all participant data are used. In addition, it is possible to include time-varying covariates in a mixed model. We took advantage of this capability

to model the amount of time in treatment as a time-varying predictor of caregiver sensitivity. Linear mixed modeling also allows for testing different assumptions about the structure of the variance–covariance matrix, thus increasing model fit to the data.

For the linear mixed models, SAS PROC MIXED with maximum likelihood estimation was used. We tested fit of different models with changes in deviance (–2 log likelihood) for nested models, as well as Akaike and Bayesian Information Criteria (AIC and BIC), which are valid for nonnested models. For all model fit statistics, a smaller value is indicative of better fit. We first estimated an unconditional linear growth model and then compared this model with a quadratic model. Demographic covariates with and without interactions with time were then tested. Covariates that were related at $p < 0.1$ when tested individually were retained in the model. To test the effect of IMH-HV treatment dosage on sensitivity, summary scores were created for the number of visits between baseline and 6 months of treatment and between 6 and 12 months of treatment. We tested the effect of number of sessions within these time periods as time-varying predictors of sensitivity and used correlations to examine whether baseline caregiver differences were related to the length of time in treatment. To illustrate the outcome of the linear mixed model, the sample was split into quartiles, based on total number of visits over the year, and trajectories of caregiver sensitivity were plotted for each quartile.

3 | RESULTS

3.1 | Participant characteristics

At study entry, mothers were on average 27 years old ($M = 27.1$, $SD = 6.9$) and many were at risk due to socioeconomic status; 28.1% reported an education level less than high school, only 5.1% completed a bachelor's degree, and 66.7% reported an annual household income under $20,000. Sixty-nine percent were never married, and 22% were married at study entry. Child age at study entry averaged 9 months ($M = 9.8$, $SD = 8.4$). With regard to race and ethnicity, over half of the mothers identified as White (55%), 45% identified as Black or African American, 4% as American Indian or Alaskan Native, 5% as Hispanic or Latina, and 1% as Native Hawaiian or Pacific Islander (percentages adding to more than 100% because participants were able to select as many as applied). In terms of trauma and adversity exposures, the average number of ACES was 4.5 ($SD = 3.0$), and 24.4% of the sample indicated that they had been "scared, threatened, or hurt by anything a romantic partner did or said" in the past year. The average of clinician ratings on the overall family health scale indicated that 33.3% of families were rated as demonstrating "fair" overall health, whereas 60.2% were rated "good."

3.1.1 | Dosage of IMH-HV services and changes in caregiver sensitivity

The number of IMH-HV treatment visits for each family over the course of the study-year ranged between 1 and 67, with a mean of 32.0 ($SD = 17.4$). Twenty-five percent of the sample received 19 or fewer visits, 15% received 48 or more visits, whereas the remainder (60%) received 20–47 visits. There was an average of 19.7 visits in the first 6 months and 12.2 in the second half of the year. The correlation between baseline caregiver sensitivity and the ultimate number of treatment sessions was not significant ($r = –.11$, $p = .35$), indicating that caregivers did not differentially discontinue treatment based on baseline parenting sensitivity. At baseline, caregiver sensitivity was correlated with child age, ($r\,(72) = -–.31$), such that caregivers with older children were less sensitive. However, child age was no longer correlated with maternal sensitivity at 6 months ($r = .06$, $p > .6$) or 12 months ($r = –.15$, $p > .2$).

To examine changes in maternal sensitivity, unconditional growth models, using a linear mixed model, were estimated first. Results showed a positive fixed effect of time (0.017, $p = .0012$) and yielded a model fit deviance of 206.7 (AIC = 216.7, BIC = 228.5). The significant positive effect of time confirms the positive slope (i.e., increase) of caregiver sensitivity across the study year (see Figure 1a). In the linear mixed model, the covariance between random intercept and random slope ($\tau_{0,1}$) was low and not significantly different from zero (.00015, $p = .93$), which allowed us to increase the fit of the model by setting the $\tau_{0,1}$ to zero. This resulted in a better fitting model, according to the AIC (214.7; lower is better) and BIC (224.2; lower is better). The quadratic model of changes in maternal sensitivity was examined next. Although visual inspection indicated some individual trajectories demonstrated curvilinear properties, the comparison of the unconditional linear growth model to the quadratic growth model did not result in a better fit (AIC = 216, BIC = 228); therefore, the linear model was used for all subsequent analyses.

Using the linear model, we tested child age at baseline and several baseline caregiver characteristics as potential covariates: caregiver education, income, adverse childhood experiences, intimate partner violence, and relationship status. Covariates that were significant at $p < 0.1$ were retained in the model. Table 2 shows the fixed effects of the model with covariates (model fit deviance = 191.0, AIC = 207.0, BIC = 225.9). Results of this analysis indicated that education was positively related to intercept and negatively related to the slope of sensitivity, suggesting that education was positively related to baseline maternal sensitivity and growth or improvement in sensitivity was greater for mothers with less education. Follow-up analysis showed that those with higher levels of education had slightly higher levels of sensitivity at baseline (H.S. or lower $M = .24$, Above H.S. $M = .31$,

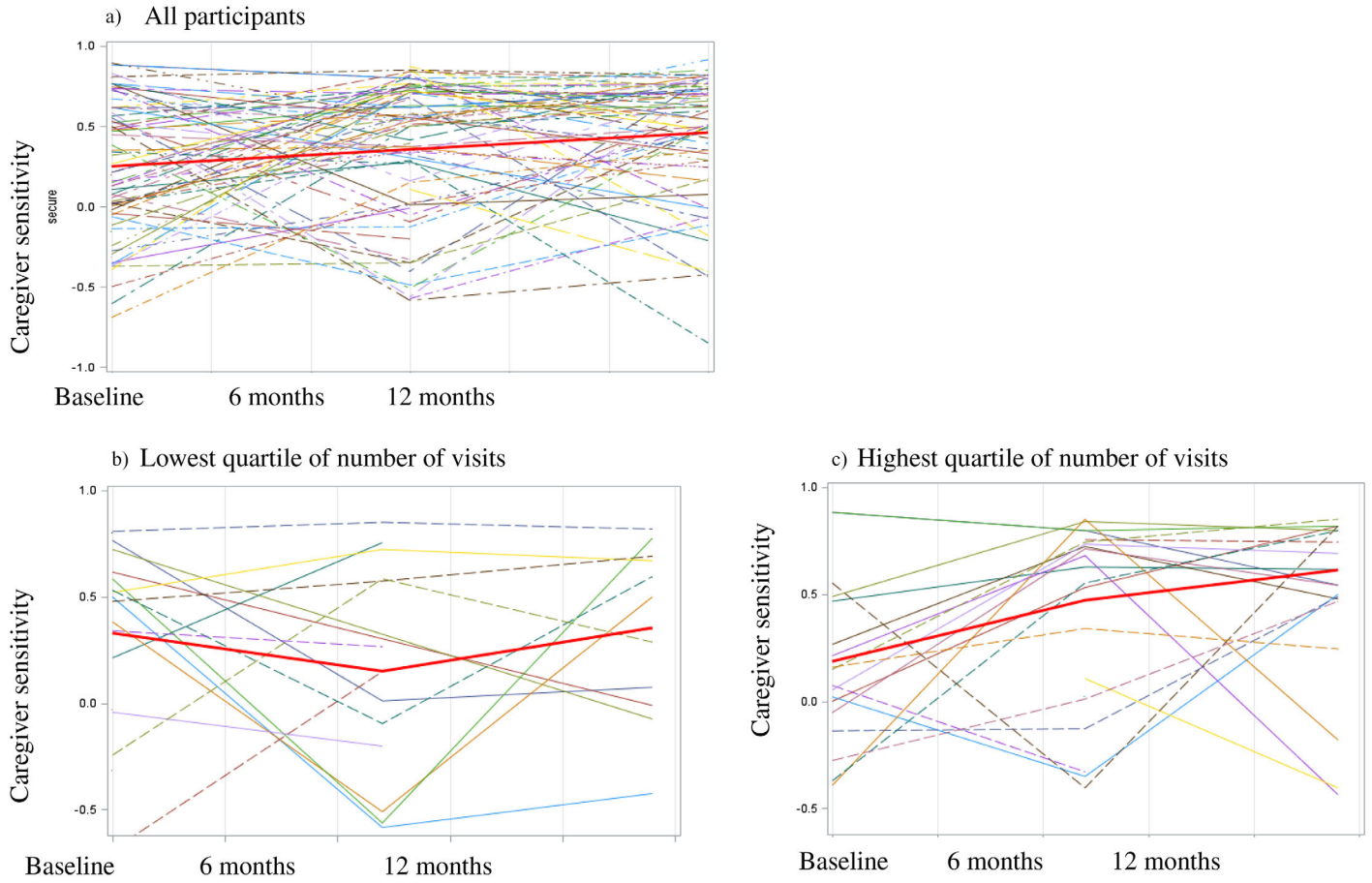

FIGURE 1 Trajectory of Q-sort caregiver sensitivity ratings over time for (a) all participants, (b) participants in the the lowest quartile for number of IMH-HV sessions, and (c) participants in highest quartile for number of IMH-HV sessions. Bold line is loess curve fitting the 3 points

TABLE 2 Fixed effects of the model with covariates

Effect	Estimate (*SE*)	*t*-Value	$p > \|t\|$
Intercept	−.33 (.24)	−1.4	.17
Time	.037 (.01)	3.3	<.01
Child age at baseline	−.004 (.004)	−1.1	.28
Education	.10 (.03)	3.0	<.01
Time × education	−.01 (.004)	−2.1	.04
Family health	.11 (.06)	1.7	.09

Note. AIC = 206.9
BIC = 228.0

TABLE 3 Growth model of caregiver sensitivity, showing the effect of covariates

Effect	Estimate (*SE*)	*t*-Value	$p > \|t\|$
Intercept	−.47 (.22)	−2.12	.04
Time	.03 (.01)	2.69	<.01
Education	.09 (.03)	2.77	<.01
Time × education	−.01 (.004)	−2.14	.03
Family health	.14 (.06)	2.17	.03
Number of IMH visits	.01 (.002)	2.39	.02

Note. AIC = 201.4
BIC = 220.3

$t = .81$, n.s.), but by 12 months those with lower levels of education had "caught up" and were now slightly (not significantly) higher in maternal sensitivity (H.S. or lower $M = .31$, above H.S. $M = .23$, $t = .81$, n.s.). Higher clinician ratings of overall family health at baseline were related to a higher intercept of sensitivity, suggesting that those mothers with greater sensitivity at baseline had more positive clinician ratings of family health.

To test the effect of IMH-HV dosage, we added the time-varying predictor of number of visits to the model. At baseline, this predictor is zero, at 6 months it equals the number of home visits from baseline to 6 months, and at 12 months it equals the total number of visits between 6 and 12 months. Table 3 shows that the time-varying predictor of number of visits was a significant predictor of caregiver sensitivity over the entire year, while controlling for baseline covariates. On the addition of the time-varying predictor, all model fit indices demonstrated improvement (deviance = 185.4, AIC = 201.4, BIC = 220.3). We tested a random effects model for number of visits (i.e., the effect of number of visits varied across participants) and a model where the effect of number of visits varied over time (i.e., with the strength of the effect and the value of the number of visits both varying across time). Neither of these approaches increased the model fit (for random effects, delta deviance = 0.5, 1 *df*, $p = 0.48$ for effects varying across time, delta deviance = 0.3, 1 *df*, $p > 0.1$).

Figures 1b and 1c provide a graphical depiction of the linear mixed model with regard to the dose response relationship between IMH-HV sessions and maternal sensitivity. Quartiles of the sample were created based on number of treatment visits for the entire year. The average number of visits was 8.4, 24.7, 39.8, and 54.9 for the quartiles, respectively. To illustrate the differences in the trajectories of caregiver sensitivity over time, we plotted trajectories based on number of visits. Figures 1b and 1c show caregiver sensitivity over time for participants in the lowest ($M = 8.4$ sessions) and highest ($M = 54.9$ sessions) dosage quartiles. The bolded line represents the loess curve and illustrates the overall change for the group (Cleveland, 1979). For those with the lowest number of visits, there was a slight decrease in sensitivity from baseline to 6 months, and a slight increase from 6 to 12 months, with an overall result of little change from baseline to 12 months. In comparison, those in the highest quartile displayed an increase in sensitivity from baseline to 6 months, as well as from 6 months to 12 months. This graph supports the results of the mixed model, wherein participants who received more IMH-HV sessions demonstrated increases in observed maternal sensitivity over the year of data collection.

3.1.2 | Frequency of video feedback and changes in caregiver sensitivity

We subsequently addressed the question of whether clinician use of video review with parents would predict improvement in maternal sensitivity above and beyond the total number of visits attended. Analysis of clinician reports on the IMH-HV fidelity form revealed that clinicians completed video recordings of parent–infant interaction in 33.5% of all of the sessions held; the mean number of times clinicians made videos of parent–child interaction with a specific family was 10.4 ($SD = 6.8$). Of note, however, only 51% of clinicians ever provided video review with parents (video review was not part of the study protocol, but instead, left up to clinicians to use for clinical purposes). Furthermore, video review occurred with relatively low frequency, reported for only 6.1% of the total number of sessions with participating mothers. The average number of video review sessions clinicians had with families was 2.0 ($SD = 3.3$). Given variability in clinicians' use of video review with families, the effect of clinician-led video review with caregivers on changes in maternal sensitivity over time was tested. Table 4 shows results of the multivariate analysis indicating that any use of video review was related to higher levels of caregiver sensitivity, while controlling for baseline covariates and number of IMH-HV sessions.

4 | DISCUSSION

The present open trial study was designed to examine the effectiveness of a community-based implementation of IMH-HV in Michigan, delivered through the publicly funded mental health system by CMHSPs. We were specifically interested in exploring whether both the dosing of IMH-HV

TABLE 4 Growth model of caregiver sensitivity, showing the effect of number of IMH treatment visits and video feedback while controlling for baseline covariates

Effect	Estimate (*SE*)	*t*-Value	$p > \|t\|$
Intercept	−.47 (.22)	−2.12	.037
Time	.03 (.01)	2.69	<.01
Education	.09 (.03)	2.77	<.01
Time × education	−.01 (.004)	−2.14	.046
Family health	.11 (.06)	1.87	.067
Number of IMH visits	.01 (.002)	2.04	.045
Video feedback	.15 (.06)	2.59	.015

Note. AIC = 199.4
BIC = 222.9

and the addition of video feedback from clinicians were related to improvements in maternal sensitivity among high-risk families served with IMH-HV. Results indicated improvements in maternal sensitivity over time for the total sample, with a dose–response relationship suggesting that improvements in sensitivity were greater for those who received a higher number of IMH-HV sessions and for those who received video feedback review. Given that these improvements were not associated with baseline differences in maternal sensitivity, these findings suggest that sustained participation in IMH-HV is associated with enhanced parenting sensitivity, a key target of the intervention.

The present work contributes to the existing literature on intervention and maternal sensitivity in several key ways. First, this is one of the first outcome studies to demonstrate effectiveness of the IMH-HV intervention currently implemented across the state of Michigan, by identifying a dose–response relationship between IMH-HV treatment and enhanced caregiver sensitivity. Although mothers who received the lowest number of sessions (i.e., the lowest quartile) did not show meaningful change in parenting sensitivity from the baseline to 12-month assessment, those who received the most sessions (i.e., the top quartile) showed the greatest improvement. These differences emerged despite finding no differences in ratings of maternal sensitivity between these two groups at treatment onset. Baseline characteristics of the mothers were also largely unrelated to changes in maternal sensitivity, with one notable exception; maternal education was positively related to the intercept and negatively related to the slope of maternal sensitivity, suggesting that mothers with more education demonstrated higher levels of sensitivity at baseline, and growth or improvement in sensitivity was greater for mothers with less education.

Second, the current evaluation examines changes in sensitivity associated with an IMH-HV intervention using a high-risk, treatment-seeking, community mental health sample of mother–child dyads, who were not initially engaged in services through research. Providers delivering the IMH-HV service were community mental health clinicians and were not employed by the study, and all families participating in this project had initiated engagement in IMH-HV just prior to enrolling in the study. This is important as it permits identification of the treatment effect in a community context, not selected for or initially recruited to engage in a research study. The children served were also all low-income, Medicaid recipients.

Third, the study employed a robust indicator of maternal sensitivity, the short version of the MBQS (Pederson & Moran, 1995; Tarabulsy et al., 2009). Q-sort ratings are correlations with the "ideal" sort; for maternal sensitivity, the measure reflects how highly correlated the maternal behavior is with an ideally sensitive caregiver. Several of the Q-sort findings contribute uniquely to the literature. First, at baseline, caregiver sensitivity was correlated with child age, such that caregivers with older children were less sensitive; at later assessments, child age was no longer correlated with maternal sensitivity. It is possible that the inverse association between sensitivity and child age reflects the ways that mothers may have been better able to respond to young infants' needs, and struggle more to respond sensitively to the autonomy demands of a toddler. It is also possible that the absence of correlation at later time points may reflect the impact of treatment, thus dissociating parental capacity for sensitive responsiveness from child age and the associated developmental demands. These hypotheses clearly warrant continued study focused on the interplay between child age and sensitivity as reflected in the MBQS. Second, although the MBQS has repeatedly demonstrated reliability and validity as noted in the literature review, the current study further demonstrated the utility of the short version of the MBQS for capturing change associated with treatment in a very high-risk, community-based sample. Of note, at baseline the Q-sort correlation for those in the highest dosage quartile was <.3, whereas at the 12-month assessment the correlation was >.5, representing substantial change in maternal sensitivity; this magnitude of change for those who received the high dose of treatment suggests a likely clinically meaningful effect.

Finally, our results are consistent with prior meta-analyses and indicate that video review holds potential for uniquely adding to intervention efficacy. Of note, in the current study and as described by Huth-Bocks and colleagues (this issue), the video review was conducted relatively infrequently, suggesting that this component of treatment, even when delivered intermittently, can convey beneficial effects above and beyond total number of treatment sessions. Although we did not observe or measure the method employed by clinicians in reviewing video with families, others have described the potential for video to provide important opportunities to support parental observation skills and reflection, and to engage collaboratively in identifying strengths and moments of connection, to explore parents' attributions, and to offer

alternative explanations and support around challenging behaviors, feelings, or experiences (e.g., McDonough, 2012; Schechter et al., 2015).

Of note, although many models of home visiting incorporate infant mental health principles and practice, the IMH-HV model in Michigan is a psychotherapeutic model of home visiting that incorporates infant–parent psychotherapy as a core component (see Huth-Bocks et al., this issue). In contrast to many nationally implemented home visiting models that are delivered by paraprofessionals and educators, the IMH-HV service is specifically a psychotherapeutic service, and thus requires delivery by clinicians who have specialized training in infant mental health. However, there is a close correspondence between IMH-HV and several other intensive, evidence-based, psychotherapy models with roots in Fraiberg's model of IMH-HV, most notably Child–Parent Psychotherapy (CPP; Lieberman et al., 2015) and the Child First model (Lowell et al., 2011). Indeed, these models incorporate and retain many of the key components of the IMH-HV model. For example, CPP is an evidence-based, widely implemented trauma-specific treatment for families with young children, with a well-established standardized training, manual, and fidelity process (Lieberman et al., 2015); clinicians in the Child First model are also routinely trained in CPP. IMH-HV as a model also incorporates attention to trauma, including a strong focus on parental "ghosts in the nursery" and the intergenerational transmission of risk (Fraiberg, 1980); however, the treatment is not exclusively trauma focused, and families participating in the intervention present for a range of concerns. Nevertheless, given the shared foundation in infant mental health and roots in Fraiberg and colleagues' early work, it is likely that results of the current study have relevance for these other models as well.

Although a broad array of interventions currently exists for parents of infants, there is increased attention toward ensuring that models not only demonstrate efficacy in clinical trials, but also have the potential for clinical implementation and effectiveness in community-based settings and sustainability beyond grant-funding periods. A particular strength of this study is an evaluation of the IMH-HV model that is fully scaled and implemented across the state of Michigan through the publicly funded community mental health system, with demonstrated sustainability. It is our hope that these empirical data on IMH-HV dosage and use of video feedback will help inform clinical practice of IMH-HV and other related early childhood treatment modalities, not only within the state of Michigan, but nationally and internationally.

4.1 | Limitations

Although the current findings are promising and suggestive of the effectiveness of the IMH-HV intervention, this study has several key limitations.

First, because participants in this study were seeking treatment through their CMHSPs, and because IMH-HV is the primary service delivered to Medicaid eligible infants or toddlers through Michigan's community mental health system, randomization to treatment or control for these families was not possible. Although the primary advantage of this "open trial" design is the opportunity to test the community-based delivery of the intervention, the lack of random assignment clearly limits its conclusions regarding causality. As such, randomized controlled studies of the IMH-HV intervention, delivered outside the public health system, would contribute significantly to our understanding of causality. In addition, a randomized controlled trial would have controlled for any possible confound that might explain why some parents completed a higher dose of treatment. To address the possibility of confounds in retention, future analyses should explore factors, including clinician and participant characteristics, that might predict treatment retention. Nevertheless, the current dose–response findings—and particularly the finding that dosage was not associated with baseline differences in maternal sensitivity—lend compelling support to the likely efficacy of the IMH-HV intervention for promoting improvement in this key parenting domain.

Second, relatedly, the open trial design meant that evaluators were not blind to assessment time point (and therefore potential amount of treatment received) when completing the Q-sort. Although this is a potential threat to the validity of study findings, it is important to point out that evaluators were unaware of the total dose of treatment sessions, and furthermore, specific evaluators assigned to collect data varied over time for each family. Thus, although the evaluators were aware of the assessment time point (e.g., baseline vs. 6-month visit), they were not aware of the dose of treatment received, as all families completed each assessment regardless of treatment status (i.e., treatment continuing vs. discontinued) or dosage (i.e., total number of sessions received).

Third, although the study afforded a unique opportunity to examine the contribution of video review, the delivery of video review was not standardized as part of the intervention service nor was it required per study protocol; in fact, it was used infrequently. Our results are consistent with other findings underscoring the power of video review with parents (Balldin et al., 2018). Future studies should examine how video review is conducted within the practice of IMH-HV. This would permit better understanding of the likely process and mechanisms associated with change as a result of video review, and could possibly allow for incorporation of randomized assignment to video review or no video review conditions to ensure that differences are not due to an unmeasured variable that may have led only some clinicians and parents to engage in this process together.

Fourth, given the very limited number of fathers enrolled in the current study, the current set of analyses focused on

mothers only. Future studies should aim to oversample for fathers participating in the IMH-HV service to determine factors related to treatment effectiveness for this population. Fifth, and relatedly, the sample size even for mothers was relatively modest. Yet, the inclusion of multiple points of assessment for each individual was a strength of the study design, permitting valuable analysis of change in sensitivity over time.

Taken together, the current study findings lend support to the conclusion that receipt of IMH-HV can enhance caregiving sensitivity even among a very high-risk, vulnerable sample of parents and their infants and toddlers. Future work should additionally aim to incorporate a randomized controlled design, include child outcomes, and identify potential behavioral and biological pathways for treatment change.

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