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In-the-moment ratings on the Early Relational Health Screen: A pilot study of application in home visiting and primary care

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Abstract

Early infant-parent interaction sets a critical foundation for young children's well-being, and evidence regarding the protective role of secure early relationships has led to increased interest in effective screening and promotion of early relational health in pediatric primary care and home visiting settings. We report findings from two pilot studies conducted in the United States that describe the reliability and validity of a relational health screening tool, the Early Relational Health Screen (ERHS), implemented in two different contexts: an innovative model of relational health promotion in pediatric primary care (Study 1) and an Infant Mental Health Home Visiting (IMH-HV) model (Study 2). Across both studies, a trained clinician rated the ERHS following real-time observation of interaction (i.e., "in-the-moment" ratings). Reliability was assessed by comparing "in-the-moment" ERHS ratings to subsequent coding of the same interaction from video by an independent evaluator. In addition, Study 2 data permitted evaluation of the validity of "in-the-moment" ERHS ratings. Results from both studies indicated reliability of "in-the-moment" ERHS ratings. In addition, Study 2 clinician "in-the-moment" ratings were associated with maternal depression and ratings of child-parent interaction derived from a separate observational task coded by independent evaluators using a different well-validated research-based measure. Discussion highlights the potential of the ERHS as a screening, promotion, and prevention tool that may be feasibly administered by providers across pediatric primary care and home visiting settings.

KEYWORDS
early relational health, home visiting, primary care, screening

1 | INTRODUCTION

Decades of child development research have underscored the importance of the quality of the early infant-parent relationship for optimal outcomes across the lifespan (Belsky & Cassidy, 1994; Thompson, 2000; Zeanah, 2019). Early infant-parent interaction lays a critical foundation for subsequent infant-parent attachment and developmental outcomes across a range of domains (Rosenblum et al., 2019; Willis & Eddy, 2022, this volume). There is accumulating evidence that more optimal early infant-parent interactions significantly contribute to social-emotional, cognitive, and physical health, development, and well-being in the young child, and importantly, may provide a protective buffer to mitigate the impact of adverse early experiences (e.g., Riggs et al., 2021; Rosenblum et al., 2019). The potential protective effect of early relationships has led to an interest in identifying strategies to enhance early relational health, including improving access and opportunities for screening, promotion, prevention, and intervention (Willis & Eddy, 2022, this volume).

Current best practices in pediatrics include the implementation of screening, promotion, prevention, and intervention services that can be delivered within the context of primary care (Hagan et al., 2017). Over the last few decades, child health practices have begun to expand the medical home model to include team-based approaches, and integrated models of care. As a result, pediatric health supervision models have been able to emphasize and foster child social-emotional development by delivering evidence-based approaches that promote positive, effective parenting (Doyle et al., 2019; Johnson & Bruner, 2018; Zuckerman et al., 2004). Similarly, public health approaches through the US Department of Health and Human Services (see https://homvee.acf.hhs.gov/) have similarly emphasized the public health impact of early relationships and healthy social-emotional development, and have promoted home visiting models that include a focus on positive parenting. Taken together, these recommendations underscore the need to develop new tools that can help identify strengths and vulnerabilities in early relational health within the context of pediatric primary care and home visiting, and to disseminate these tools through training and targeted workforce development with an emphasis on promoting strategies that can be effectively delivered by providers across these contexts. In this paper, we report preliminary findings on the reliability and validity of an early relational health screening tool, the Early Relational Health Screen (ERHS; Willis et al., 2022, this volume), with pilot data from its use in both pediatric primary care and home visiting settings (see Table 1).

Routine screening is a core component of both pediatric primary care and home visiting practice, with standard screening tools developed to identify a number of important medical, developmental, and contextual risks that have been shown to be predictive of later adverse outcomes (Committee on Practice and Ambulatory Medicine Bright Futures Periodicity Schedules Workgroup, 2019). Across settings, providers screen for numerous maternal, child and psychosocial risks including maternal postpartum depression, adverse childhood experiences, and autism spectrum disorder (Hagan et al., 2017). Importantly, while many screening tools have been developed to identify factors associated with developmental and behavioral *risk*, there have been fewer screening tools that have been developed to identify factors associated with *resilience*, such as responsive and nurturing early relationships. Relatedly, while a number of high quality, reliable and valid structured research observational tools have been developed

Key Findings/implications

- The Early Relational Health Screen can be reliably implemented in both home and pediatric primary care settings.
- Provider ratings using the Early Relational Health Screen are associated with parental depression and dyadic mutuality assessed via a research-reliable and previously validated assessment of parent-child interaction.
- Early Relational Health Screening and corresponding video review can be implemented in pediatric primary care as part of an integrated screening and health promotion and prevention strategy.

Statement of relevance to infant and early childhood mental health

Responsive and nurturing early relationships provide a critical buffer for infants in families facing adversity. The current study offers preliminary evidence supporting the reliability and validity of a brief observation-based early relational health screening tool, and corresponding health promotion strategy utilizing video review with parents, implemented in home and pediatric primary care settings. Early relational health screening may provide a viable option for detecting risk and universal relational health promotion for infants and their families.

TABLE 1 Summary overview of the Early Relational Health Screen (ERHS) pilot studies described in this paper

	Study 1:"Thrive with Your Baby Clinic"	Study 2"Thriving Together"
Setting	Pediatric primary care	Home visiting
Study purpose	Proof of concept quality improvement project to assess the feasibility, acceptability, and perceived helpfulness of relational health screening and a corresponding video review promotion and prevention strategy in pediatric primary care	Pilot randomized controlled trial testing the efficacy of Infant Mental Health Home Visiting for improving outcomes across a range of domains including parenting, parent mental health, child health and development, economic self-sufficiency, and child maltreatment
Child age	Infants presenting for a 6-month-old well-child visit	Range 6- to 24-months ($M = 12.6$, $SD = 5.4$)
Eligibility criteria	Any infant presenting for a 6-month well-child visit at a university-based pediatric primary care satellite clinic	Community-based sample of mothers and their infants from pregnancy through child age 24 months at study entry who met at least two of four criteria including: low income, parent mental health concern, infant behavioral or developmental concern, elevated parenting stress
Sample size	$N = 16$	$N = 26$
ERHS administration timing and setting	Immediately prior to or following the 6-month well-child visit; in the clinic	Within first four home visiting sessions; in the home
Economic demographics of population served	35% of children served by the clinic have Medicaid	60% of families in study received a form of financial public assistance (e.g., Medicaid, WIC)
Race/ethnicity of sample	Infants identified in medical record as Black, Indigenous, or person of color (44%) or White (56%)	Mothers self-identified race as Black (15%), White (84%), or American Indian/Alaskan Native (1%)
Provider qualifications	ERHS trained MSW-prepared clinician	ERHS trained MSW-prepared clinician
Evaluator ratings of the ERHS and qualifications	Based on coding video recording of ERHS infant-parent play observation from the pediatric clinic; trained graduate-level research assistants	Based on coding home visitor's video recording of ERHS infant-parent play observation; trained graduate-level research assistants

to assess the quality of parent-infant interaction (e.g., the NCAST Scales, Barnard et al., 1989; the Emotional Availability Scales, Biringen & Easterbrooks, 2012; and the Parent Child Early Relationship Assessment, Clark, 1999; the Ainsworth Sensitivity Scales, Posada et al., 1999), many of these reflect more *comprehensive assessments* and are not designed specifically for *screening*, and have not necessarily been designed for use in primary care or home visiting settings.

Furthermore, although many of these tools are designed to capture relational qualities, specific dimensions or scales rated using extant measures often emphasize rating the parent and child behavior separately rather than scales that rate qualities of mutual dyadic interaction that capture the likely dynamic and interactive parent and child contributions to individual-focused codes (e.g., Biringen & Easterbrooks, 2012; Posada et al., 1999). Finally, requirements for administration for many of these tools may constrain clinical utility and serve as barriers for implementation in the clinical setting, for example, relatively lengthy periods of observation (e.g., the Crowell procedure, (Crowell & Feldman, 1988), "artificial" interactive protocols such as the Still Face (Weinberg & Tronick, 1994) or Strange Situation Paradigm (Ainsworth et al., 1978), or post-session coding based on repeated videotape review (e.g., Biringen & Easterbrooks, 2012; Clark, 1999; Fagan et al., 2019). These pose significant hurdles to use in everyday practice and thus may limit the utility of these tools for wide-scale screening and surveillance in "real-world" settings.

The ERHS (Willis et al., 2022, this volume) was developed to address the limitations of current assessment tools, and to provide an alternative that could be used as an instrument for screening across clinical and non-clinical settings. The ERHS has evolved, through practice, to include two component activities: (1) a "*screening component*" that involves brief observation of parent-infant interaction followed by trained clinician (or non-clinician) rating of specific dyadic relational qualities, and (2) a "*promotion component*" described elsewhere in this special section (see Willis et al., 2022, this volume) that involves ERH conversation and video review that can be completed with the parent(s) or caregiver(s). The screening

TABLE 2 Brief Description of the Early Relational Health Screen (ERHS) subscales

ERHS subscale	Description	Scoring for age
Overarching affect	Global rating on a five-point scale reflecting the affective tone of dyadic interaction. Scores range from clearly positive to clearly not positive; scores reflecting uncertain, not positive, or clearly not positive overarching affect impose a constraint on the maximum score that can be assigned on all other scales	Scored at all ages
Mutual engagement	Clear involvement, interaction, and responsiveness toward one another with sense of ease/comfort/familiarity	4, 6, 12, 18, 24 months
Mutual enjoyment	Clear demonstration of shared pleasure in the interaction, evidenced by smiles, talking, relaxed postures	6, 12, 18, 24 months
Mutual responsiveness	Evidence of "back and forth" interaction with responsiveness to action, affect, and vocalizations	6, 12, 18, 24 months
Mutual pacing	Recognition and responsiveness to rhythm and timing of play; natural pauses observed	6, 12, 18, 24 months
Mutual attention	Reciprocal inclusion of the other in one's attention, evidenced by listening and looking at one another	6, 12, 18, 24 months
Mutual initiation	Use of gestures, sounds, or touch to begin an interaction	12, 18, 24 months
Mutual imitation	Demonstrated ability to copy each other's behaviors, evidenced by actions, gestures, words. Can be combined to evidence complex imitation	12, 18, 24 months
ERHS subscale	**Description**	**Scoring for age**
Shared goal/objective	Having a common theme in play, engaging interactively toward a shared goal, theme, or objective	18, 24 months
Mutual cooperation	Demonstrated ability to share interests and change behaviors and activities led by the other	18, 24 months
Recognition of affect state	Demonstrated awareness and sensitivity to multiple emotional expressions of the other	18, 24 months
Mutual response to challenge	Shared re-establishment of positive interaction around new activity after being given signal to change to new activity	18, 24 months
Shared pretend play	Demonstrated shared pretend play involving imaginative interactions with objects. Must involve shared interaction and not just parental observation of play	24 months
Complex communication	Communication using joint complex communication, evidenced via use of words, gestures, facial expressions during play	24 months

Note: When overarching affect is rated "positive" or "clearly positive," scores on each subscale range from 0 to 2 (not observed – sometimes observed – observed); when overarching affect is rated as "neutral" or "not positive" or "clearly not positive", scores on each subscale range from 0 to 1 (not observed – sometimes observed). Specific scoring criteria differs based on developmental age of the child, and corresponding scoring criteria.

component may be completed immediately following a brief observation of interaction, while the corresponding video review component is a relational health promotion and prevention strategy designed to support parental observation and reflection.

Ratings on the ERHS are made on a set of scales reflecting developmentally relevant indices of the quality of dyadic interaction. For all dyads, the initial rating is focused on the *overarching affect* of the observed interaction, with ratings on a five-point continuum from "clearly not positive" to "clearly positive." Subsequent ratings depend on child age, and specific relational qualities are assessed (see Table 2). For example, scoring at 6 months of age involves assigning ratings along the dimensions of *mutual engagement*, *enjoyment*, *responsiveness*, *pacing*, and *attention*. For toddlers, given expanding developmental capacities, dyads are additionally scored in the areas of *mutual initiation* and *simple mutual imitation*, *complex mutual imitation*, *shared goals/objectives*, *mutual cooperation, recognition of affective states, and a mutual response to a challenge*. Finally, dyads with children around 24 months old are additionally rated along the domains of *shared pretend play and mutual-complex communication*. Clinicians who utilize the ERHS are trained prior to its use by someone reliable in coding the screener. Clinicians are introduced to the coding system, and receive training on recording, coding, and reviewing the interaction. Previously recorded parent-infant/toddler interactions are

utilized to introduce the measure to clinicians, who practice scoring the interaction using the ERHS coding scheme. After initial guided practice, clinicians are supported in their use of the measure, which includes periodic review of ERHS recording and coding, as well as support provided when encountering difficult to rate interactions.

In this paper, we focus on the screening component of the ERHS, describing the implementation of the ERHS as a screening instrument in primary care, and reporting on the preliminary reliability and validity of clinical "in-the-moment" ratings in both primary care and home-based settings.

1.1 | Screening and early relational health in primary care

The pediatric office is a site of universal access and intervention (Garner & Yogman, 2021). Pediatric providers, because of their regular contact over time with infants, toddlers, and their families, are well-positioned to observe the nuances of the early care-giving relationship, and are one resource to provide support, guidance, and intervention in the context of "behavioral health surveillance," within the pediatric health supervision visit (Shah et al., 2011). In this context, given the clear long-term developmental and health outcomes of the quality of early relationships, the quality of the early dyadic relationship may be considered as a critical pediatric "vital sign," and as such, is in need of surveillance, screening and monitoring (Willis et al., 2022, this volume). Failure to detect and treat "relational-risk" conditions during infancy and early childhood can undermine later development, just as the promotion of these foundational relationships provide unique opportunities to foster resilience.

There are a number of psychosocial, practical, and systemic barriers that disproportionately impede full access to quality child health care for young children. However, when well-child visits are available for families during these earliest months, child health providers have a unique opportunity to not only reinforce and support observed strengths, but also to detect and address risks that can disrupt the early caregiving environment. Despite frequent visits to primary care during the first 2 years of life (e.g., 10 Bright Futures visits), and newly expanded recommendations for quality standards of formal screening on a number of developmental, family, and social risk markers, most infants and toddlers do not receive routine formal screening for specific indices of early relational health, nor are there agreed-upon indicators or tools for that purpose (Willis & Eddy, 2022).

In recent years several models have been developed that offer opportunities within pediatric primary care to support and enhance positive parenting and early relational health not only for individual children but also for the family relationships within which their development depends. To illustrate, the Healthy Steps Model, supported by ZERO TO THREE (see http://www.healthysteps.org) and the Michigan Child Collaborative Care Pediatrics program (MC3 for Kids, Marcus et al., 2017), and led by faculty at the University of Michigan Department of Child and Adolescent Psychiatry, delivers behavioral health services for infants, toddlers and young children within the pediatric primary care setting. Healthy Steps is an evidence-based, team-based pediatric primary care program that promotes the health, well-being and school readiness of babies and toddlers, with an emphasis on families living in low-income communities. MC3 is a telehealth consultation service that delivers mental health consultation by university-based child and adolescent mental health specialists to pediatric primary care providers across the state, with a special focus on effective screening, assessment, and referral to community-based resources. Both Healthy Steps and MC3 encourage universal screening and surveillance strategies for infants and young children to identify a range of risk and protective factors for children and families and to deliver (or refer to) appropriate services when risks are identified. In addition, strategies for supporting early relationships in primary care have included the use of video feedback with parents to promote responsive parenting; for example, the Video Interaction Project incorporates video feedback with parents during primary care visits, and evaluation of this program has demonstrated significant and lasting effects on parent and child outcomes (Cates et al., 2016; Mendelsohn et al., 2018).

Evaluation data indicate that these models can have a significant positive impact in detection, connection to care, and outcomes (e.g., Briggs et al., 2014; Marcus et al., 2017; Minkovitz et al., 2007). However, despite growing availability of integrated or co-located behavioral health care providers in primary care settings, and despite guidelines for screening across a range of critical domains during well child visits, there remains an unmet need for reliable, valid strategies for screening early relational health (see Willis et al., 2022, this volume). We sought to address this gap in the science and have conducted formative work to develop and pilot test the feasibility and acceptability of a brief screening and video feedback promotion and preventive intervention model for use in primary care settings. The *Thrive with Your Baby Clinic* (TWYB) model has been implemented at several satellite clinics during routine 4-, 6-, 9-, and 12-month-old well-child visits, and was designed to deliver early relational health screening with a corresponding promotion and prevention activity using video review with parents. As part of this clinic, the ERHS is administered by a trained social worker. Data collection to

assess outcomes associated with this brief service is ongoing. In the current paper, we report on a pilot study to determine the reliability of the ERHS screening data collected as part of this clinic implementation, comparing "in-the-moment" clinician ratings to ratings generated by independent observers coding the same interaction from video observation. Reliability of "in-the-moment" ratings—that is, those ratings made by a provider in the context of a visit with the family and therefore not dependent on post-encounter video review—were of particular interest given the positive implications for feasibility, implementation and scaling in practice-based settings.

1.2 | Early relational health in home visiting

The focus on relational health within home visiting programs is well established, beginning with Selma Fraiberg's "kitchen table therapy" (Fraiberg, 1980) to current-day models that emphasize relational health, including but not limited to Healthy Families America (e.g., Caldera et al., 2007), Nurse-Family Partnership (e.g., Olds et al., 1994), and the Infant Mental Health Home Visiting (IMH-HV) model (e.g., Weatherston & Ribaudo, 2020). Evidence from home visiting models confirms the potential for a strong positive impact across a number of domains, including child development, parent mental health, and positive parenting.

The IMH-HV model is a psychotherapeutic, multi-component, needs-driven, Medicaid-funded home-based intervention delivered through community mental health service provider agencies to parents and infants from pregnancy through child-age of 36 months. Core components of IMH-HV include developmental guidance, case management, emotional support, and infant-parent psychotherapy, with the use of video and video feedback strongly encouraged. Recent evaluation of the IMH-HV model in community practice has demonstrated efficacy of the intervention for improving maternal sensitivity and indicated that clinician use of video review with families was associated with greater improvement in outcomes (Rosenblum et al., 2020). The current manuscript utilizes ERHS data collected by clinicians as part of a university-based randomized controlled trial (RCT) of IMH-HV (the "Thriving Together" study). In this study clinicians used the ERHS during the early stage of home-based IMH-HV treatment with families; recordings from these ERHS interactions were subsequently coded from video by an independent coder. Data generated through this study also provide an opportunity for validation of clinician ERHS "in-the-moment" ratings against another more commonly employed and validated research-based measure of dyadic interaction.

1.3 | Pilot studies: Analyses and hypotheses

The current paper reports on the preliminary reliability of the ERHS implemented across two settings: in primary care, as part of the TWYB Clinic pilot (Study 1), and in-home visiting, as part of the *Thriving Together* study (Study 2). In each setting, a trained clinician implemented the ERHS and rated the quality of early relational health within the ERHS age-relevant dimensions following real-time observation of interaction (i.e., "in-the-moment" ratings). Although these two studies were not designed a priori to assess the reliability of clinician ratings, we capitalized on data previously collected and had independent, reliable coders, blind to information about the dyads, rate the videos to determine the reliability of the initial clinician ratings. In addition, available home visiting study data also permitted a preliminary examination of the validity of clinician "in-the-moment" ERHS ratings compared to another well-validated measure of dyadic interaction developed by the NICHD Early Child Care Research Network (1999). We report on methods and results from each of these studies separately in the sections that follow.

In Study 1: TWYB Clinic (primary care pilot), we report on the interrater reliability between clinician "in-the-moment" ERHS ratings collected during a 6-month-old well-child visit, and ratings derived from an independent evaluator coding the same interaction from videotape, using intraclass correlation coefficients to examine reliability in subscale ratings and kappa coefficients to assess agreement on dichotomous indicators of affective tone and age-specific cutoffs indicating need for follow-up. Our hypothesis was that clinician "in-the-moment" ratings would be highly correlated with ratings of the same interaction assigned by an independent coder using videotape for observation and scoring.

In Study 2: *Thriving Together* study (home visiting pilot), we again examine the reliability of clinician "in-the-moment" ERHS ratings assigned during a home visit early in treatment with ratings assigned by an independent coder based on observation of the same interaction recorded on video. In contrast to Study 1, the age of children varied from 6- to 24-months of age. Given the relatively small sample size for each age group, we report only on the reliability of those subscales that were coded for all children, that is, the subset of five subscales appropriate for children 6 months and older. Interrater reliability was assessed using intraclass correlation coefficients. In

addition, with this sample, we further examine the validity of clinician "in-the-moment" ERHS ratings via correlational analyses and *t*-tests to determine associations between clinician ERHS ratings and (a) maternal self-reported depression as an indicator of construct validity and (b) ratings of parent-child behavior and dyadic interaction based on coding a separate observational task using the NICHD Early Child Research Network (1999) interaction coding system as an indicator of criterion validity. Our hypotheses were that a summary score reflecting clinician "in-the-moment" ratings on the ERHS subscales would be: (1) correlated with ratings of the same interaction assigned by an independent coder observing a video recording of the interaction (i.e., same observation, same rating scale, different raters), and (2) significantly associated with ratings assigned by independent evaluators scoring a separate dyadic interactive observational task using the NICHD scales system (i.e., same parent-child dyad, different observation, different scales, and different raters).

2 | METHOD AND RESULTS

2.1 | Study 1: The Early relational health screen in pediatric primary care

The TWYB Clinic has been piloted at several pediatric satellite clinics connected to a large academic medical center in a medium-sized city in the midwestern United States; data reported here are part of a quality improvement project (University of Michigan IRB # 00169400).

2.1.1 | Participants

Participants were parents ($N = 16$; 15 mothers and one father) and their infants presenting to pediatric primary care for a 6-month well-child visit. Recruitment strategies included distribution of promotional material (e.g., flyers and a promotional video) in the waiting room, phone calls to parents to invite their participation in the clinic during an upcoming well-baby visit, and/or scheduling a voluntary TWYB Clinic session during check-out from a prior pediatric visit as an add-on to an upcoming well-child visit. Based on medical chart review, the race/ethnicity of the infants was as follows: White ($n = 9$; 56%), Black/African American ($n = 1$; 6%), Asian American ($n = 3$; 19%), Latino ($n = 2$; 13%), or data missing ($n = 1$; 6%). As documentation within the medical record varied, other data available regarding participant demographics were inconsistent. Specifically, income data were not consistently collected, yet we note this was an economically diverse pediatric practice, and that 35% of children served by this clinic have Medicaid insurance. Of the subset of mothers that had recent postpartum depression screens available in their medical record ($n = 10$), 50% met screening criteria for depression risk scoring at or above cutoffs of 10 on the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) or nine on the Edinburgh Postpartum Depression Questionnaire (EPDS; Cox et al., 1987).

2.1.2 | Procedures

The TWYB Clinic was offered as an opt-in adjunctive service connected to the 6-month well-child visit. The service was delivered by a master's level trained social worker. At the start of the TWYB session, the clinician invited the parent "to play with your baby" for 5 min using a standard set of developmentally appropriate toys. This interaction was videotaped using a tablet and instructions were nominal ("Interact with your baby as you normally would"). The clinician held the camera and observed unobtrusively, taking mental note of indicators for ERHS scoring (ERHS described in greater detail below). This mental "in-the-moment" scoring was the basis for risk detection and for selection of segments for video review. The clinician documented "in-the-moment" ERHS ratings either during the TWYB visit or immediately following based on these observations.

Following the interactive play episode, and not the focus of the current manuscript, the clinician played back video segments and engaged in a process of collaborative observation, reflection, and dialogue ("video review"). The stance of the clinician across the video recording and review was one of curiosity, interest and promotion of the parents' own insights and observations to enhance their reflective capacity, provide an empowering experience, and offer developmental guidance and emotional support as appropriate. Based on this collaborative review process, a follow-up plan was generated based on ERHS score, family request, or general clinician concern. For low-risk scores, and where there was also low family and clinician concern, a note was placed in the electronic medical record (EMR) indicating family participation in the TWYBC as a universal early relational health promotion service. For families with scores indicating heightened risk (i.e., scores below the standard cutoff), or for families with identified needs for additional resources and support, parents were either: (a) invited to return with their baby for at least one and up to four more TWYB video sessions with the clinician, or (b) provided with a tailored referral for other relevant and desired services (e.g., treatment for postpartum depression, community playgroups, early intervention services, infant-parent psychotherapy). Care was taken to ensure that the process of determining a

follow-up plan was made in a collaborative, strengths-promoting manner, with the provider using a process of reflective inquiry to support parents' own insights and identification of needs, and a responsive and inviting stance, offering parents the possibility of additional support or services based on their interests and wishes. A note was entered into the EMR documenting and alerting the pediatrician to potential family needs, as well as any referrals or follow-up planning.

Following the TWYB Clinic visit, a trained research evaluator also rated the parent-child interaction from the video recording of the free play episode, again using the same ERHS scales. The evaluator was blind to the clinician "in-the-moment" ratings and to any other information about the family.

2.1.3 | Measures

The ERHS (Willis et al., 2022, this volume) is a video-based tool used to support observation and screening of infant-caregiver interactions. Prior research (Siqveland et al., 2022, this volume) has demonstrated the feasibility and reliability of the ERHS for coding parent-child interaction from video recording. The scoring system first asks the rater to assess the "Overarching Affect" of the interaction on a five-point scale ranging from "clearly not positive" to "clearly positive." As the affective tone contextualizes the meaning and experience of all other interactive behaviors, scores of "uncertain," "not positive," or "clearly not positive" constrained the maximum rating allowed on all other ERHS scales, and were, therefore, a strong indicator of potential risk. Following rating affective tone, ratings (0–2) were made on a number of specific indicators of relational health (see Table 2), indicating whether each indicator was "not observed" (= 0), "sometimes observed" (= 1), or "observed" (= 2). If the affective tone was "uncertain," "not positive," or "clearly not positive" the maximum score on each scale was set at 1. Thus, affective tone constrains the total score and higher scores on the individual scales indicate that the rater has observed more of the specified dyadic behavior. For current Study 1 analyses we report on scores for the standard set of 6-month-old ERHS scales (see Table 2 for a description of each of these dimensions). In addition, the 6-month standard ERHS scales were used to derive three additional ERHS variables. First, we created a "Dyadic Affect" variable distinguishing ratings of overarching affect that were "positive" or "clearly positive" (Dyadic Affect = 1) from those that were rated "uncertain," "not positive," or "clearly not positive" (Dyadic Affect = 0). Second, we computed the standard "ERHS Summary Scale" as the sum total of ratings across all five standard ERHS subscales (possible range = 0–10). Third, "ERHS Risk" variable was computed using the ERHS Summary Score and the ERHS-designated 6-month cutoffs; "no follow up indicated" was assigned for scores of 8 or greater, and "unclear or follow-up indicated" was assigned for scores < = 7.

TABLE 3 Intraclass correlations to assess reliability for primary-care based Thrive with Your Baby clinician "in-the-moment" ratings and evaluator ratings from videotape

	Evaluator × Clinician
Overall affect	.65
Engagement	.80
Enjoyment	.92
Responsiveness	.85
Pacing	.77
Attention	.87
ERHS summary score	.95

Note: All reported intraclass correlation coefficients are two-way mixed, absolute. All ICCs were significant at $p < .05$.

2.1.4 | Results

Reliability of clinician "in-the-moment" scores on ERHS scales were examined in relation to independent evaluator ERHS scoring derived from watching the same video recordings of the interaction. Intraclass correlation coefficients for each of the ERHS 6-month-old subscales indicated significant agreement between clinician and evaluator ratings. Table 3 details the intraclass correlation coefficients across these independent raters for each of the 6-month subscales (range ICCs .65 to .92), as well as for the total "Summary Score" (ICC = .95). In this pilot sample, and expected given the universal health promotion strategy that included participation of families regardless of risk status, most dyads were rated by the clinician (88%) and evaluator (81%) as having "positive" or "clearly positive" interactions; agreement between the ERHS clinician and evaluator for the dichotomous Dyadic Affect rating was high ($\kappa = .76$, $p < .01$). Similarly, only 19% of dyads scored in the ERHS Risk variable range indicating a need for follow up. Of note, there was perfect agreement ($\kappa = 1.00$) between clinician and evaluator regarding scores meeting criteria for follow up ($\kappa = 1.00$).

2.1.5 | Summary

Results of Study 1 provide preliminary feasibility and reliability data regarding the ERHS in primary care, indicating that the ERHS tool can be administered in the primary care setting, and that ERHS ratings assigned by a

clinician during a 6-month well-child visit are consistent with those assigned by an independent evaluator coding the same interaction subsequently from videotape. Limitations to Study 1 include the small sample size, the restricted infant age range, and the absence of validity data, issues that are addressed in our second pilot study as follows.

2.2 | Study 2: The early relational health screen in home visiting

The pilot study of ERHS in home visiting, Study 2, offered an opportunity to begin to address several of the limitations of Study 1, including examination of interrater reliability between clinician "in-the-moment" and independent evaluator ratings with additional families, inclusion of a broader infant age range, and an opportunity to examine validity of the clinician "in-the-moment" ERHS ratings by examining these ERHS ratings in relation to maternal mental health and ratings of interaction in another context using a different well-validated coding system. The data used for Study 2 were from an RCT of IMH-HV (Rosenblum et al., 2020; Weatherston & Ribaudo, 2020), the Thriving Together Study. The study was approved by the University of Michigan Institutional Review Board [#00124224 and is registered with Clinicaltrials.gov [# NCT03175796].

2.2.1 | Participants

Participants in the current study ($N = 26$) were all mother-infant dyads randomized into the treatment (home visiting) arm of the RCT whose infants were at least 6-months-old when the ERHS was administered by the home visiting clinician. Sixty percent of these families were eligible for some form of public assistance, including but not limited to Medicaid and food assistance through the Women, Infants, and Children (WIC) program. At the baseline assessment mothers were on average 32.5 years old ($SD = 5.7$) and infants were on average 12.6 months of age ($SD = 5.4$). In regards to race and ethnicity, 84% mothers identified their own race as White ($n = 22$), 15% Black/African American ($n = 4$), and 1% American Indian/Alaskan Native ($n = 1$). In addition, four parents also self-identified as Latino/Hispanic and one as Arab American.

2.2.2 | Procedures

The Thriving Together study retained core IMH-HV components but did not require families to be Medicaid eligible (though a majority of families were eligible for public assistance), and services were delivered by clinicians employed through the university. All families in the study completed a baseline evaluation visit prior to randomization, during which an evaluator recorded a parent-infant free play interaction using a standard age-appropriate set of toys. While this was a different set of toys than those used for the ERHS, in both situations toys selected were developmentally appropriate and designed to support or facilitate, and not interfere, with interaction (e.g., no electronic toys). These videos were subsequently coded by independent coders blind to family intervention status and, when applicable, to clinician ERHS ratings. For families assigned to the treatment arm, the clinician] administered the ERHS during the second home visit session with families. Consistent with procedures described in Study 1, home visiting clinicians made a video of the infant-parent interaction and generated "in-the-moment" ERHS scores. Subsequently, an independent coder scored the ERHS from observation of the same video recording; this coder was blind to clinician ratings. In the current analyses, we examined the interrater reliability of the ERHS using the ERHS Summary Scale derived from both clinician and independent coder ratings on the six ERHS subscales. In addition, we assessed the validity of the clinician "in-the-moment" ratings by examining associations with ratings assigned to a separate parent-child interaction task coded by independent raters using a different set of standard, well-validated items of research scales used to assess parent and child behavior and dyadic mutuality.

2.2.3 | Measures

ERHS. The ERHS was employed and scored as described previously for Study 1. Given the broad infant age range represented in this sample, sample size was small for any particular age, and thus for the current analyses we only report on the set of five ERHS subscales that are standardly rated as part of the 6-month screen (i.e., manual engagement, mutual enjoyment, mutual responsiveness, mutual pacing, and mutual attention), as this set of subscales are also rated for older children, and were therefore applicable to all infants and toddlers included in this sample. These 6-month subscales were the same as those employed in Study 1.

Patient Health Questionnaire *(PHQ-9;* Kroenke et al., 2001*)*. Self-reported depression symptoms were measured at baseline using the PHQ-9 which comprises nine items scored on a three-point scale with range of scores from 0 (no depression symptoms) to 27 (high level of depression symptoms). Prior research indicates that scores of 10 or greater are an indicator of probable depression.

NICHD Early Child Care Scales (NICHD Early Child Care Research Network, 1999*)*. During study baseline

assessment visits, and prior to family randomization into the treatment or control condition, mothers and infants were video recorded engaging in an 8-min free play interaction at home using a standard set of age-relevant toys (Crowell & Feldman, 1988). This interaction was coded by a group of independent trained, reliable coders blind to family treatment condition and ERHS scores, along with a number of dimensions using a well-validated system developed by the National Institute of Child Health and Human Development Early Child Care Research Network (NICHD Early Child Care Research Network, 1999). These scales have been described elsewhere (e.g., Else-Quest et al., 2011), and include six focused on maternal behavior (sensitivity, intrusiveness, detachment, cognitive stimulation, positive regard, negative regard), two focused on child behavior (positive affect, negative affect) and one focused on dyadic mutuality. Given the conceptual overlap with the ERHS the Dyadic Mutuality scale was of particular interest, as it is comparably designed to assess the synchrony of interaction, including reciprocity in play, communication, and shared enjoyment, thus reflecting interaction that is mutually regulated by maternal and infant contributions. Prior work has validated this measure (e.g., Else-Quest et al., 2011; Fagan et al., 2019). Interrater reliability in coding the NICHD scales was established by two independent raters (not overlapping with the coders who scored the ERHS); these NICHD scale raters double-coded a set of 15 parent-child interaction videos, and interrater agreement was strong (all ICCs > = .70, range .76–.91).

2.2.4 | Results

Initial analyses examined the reliability of ERHS scores using intraclass correlations to assess the interrater reliability of ERHS Summary Score derived from clinician "in-the-moment" ratings and subsequent independent evaluator video-based ratings; results indicated high levels of agreement (ICC = .74, $p < .001$). Next, we examined the validity of clinician "in-the-moment" ratings, first in relation to material risk (depression) as an indicator of construct validity and subsequently in relation to parent-child interaction risk (NICHD scale ratings) as an indicator of criterion validity. In regards to maternal risk, eleven (42%) of the mothers exceeded PHQ-9 cutoffs for probable depression. Results indicated that the group of depressed mothers received lower clinician ERHS "in-the-moment" ratings as indexed by the ERHS Summary Score ($M = 5.55$, $SD = 2.5$) than non-depressed mothers ($M = 7.27$, $SD = 1.71$), $t(24) = 2.09$, $p < .05$. For parent-child interaction risk, Table 4 provides results of bivariate correlations between clinician ERHS Summary Score ratings and ratings of the separate free play coded using the NICHD scales.

TABLE 4 Bivariate correlation coefficients for home visiting clinician-rated ERHS Summary Scores by evaluator-rated NICHD Early Child Care scale scores assigned during a separate observational task

NICHD scales	ERHS summary scale	*p*-Value
Sensitivity to non-distress	.31	.13
Intrusiveness	.08	.69
Detachment	−.40	.04*
Cognitive stimulation	.22	.28
Mother positive regard	.10	.65
Mother negative regard	−.01	.97
Child positive affect	.42	.03*
Child negative affect	−.27	.19
Dyadic mutuality	.54	.005**

*$p < .05$, **$p < .01$.

Higher clinician "in-the-moment" ERHS Summary Scale scores were associated with ratings of lower detachment, more child positive affect, and greater dyadic mutuality on the NICHD scales; of note, the association was strongest for the conceptually similar NICHD Dyadic Mutuality scale.

2.2.5 | Summary

Consistent with findings from Study 1, results suggest that clinician "in-the-moment" ERHS ratings (as indexed by the computed ERHS Summary Score) rating are reliable, and further, that these ratings are associated meaningfully with other well-validated measures of maternal and parent-child interaction risk. Limitations include the small sample size, which constrained the number of infants in each age category for the ERHS. Thus, while infant age in this sample varied, only scales that were appropriate for all infants in the sample (i.e., the subset appropriate for infants as young as 6 months of age) were included in the ERHS Summary Score for these analyses.

3 | DISCUSSION

In the current study, we examined the reliability and validity of clinician "in-the-moment" ratings of parent-child interaction using the ERHS in pilot studies conducted in both primary care and a home visiting setting. Results indicated that the EHRS can be scored in "real time" evidenced by high interrater reliability between clinician ratings assigned during or immediately following visits with families and ratings of the same interaction by an independent evaluator scored from a video recording.

Reliability of clinician "in-the-moment" ratings of interaction was observed for scores assigned both in the primary care and home visit contexts. Data from the home visiting study indicated the ERHS also holds validity as a screening tool to identify risk, as evidenced by concordance between clinician ratings on the ERHS and mothers' concurrent self-reported depression symptoms, and more specific criterion validity as dedespitemonstrated by agreement with ratings of the same dyad interacting in a separate observational task coded using the well-validated, research reliable NICHD Early Child Care Research Network scales.

Results suggesting reliability of clinician "in-the-moment" ratings have important implications for the potential utility of the ERHS measure across settings, with the added potential for widespread use and scalability. Many providers, across both the primary care and home visiting settings, rely on parent-report measures of infant social-emotional adjustment to assess early attachment and/or relationship quality, including the frequently employed Ages & Stages Questionnaire (Squires et al., 2002), but many of these measures are constrained by the lack of observational data, a potential bias of parent report, and the focus on infant behavior instead of parent behavior or parent-child dyadic qualities (McCrae & Brown, 2017). Similarly, as noted previously, while a number of research-based observational scales have been developed to assess parent-child interaction, most require extensive time for administration and coding, which limit their utility in clinical and home visiting settings. As a screening tool, the ERHS provides a brief tool to rate observations of interactions, and while not diagnostic per se, can assist the provider in making determinations regarding follow up or need for additional referrals. As a tool that yields both categorical and dimensional scores, the ERHS offers all providers an opportunity to use the ratings on individual scales to hone observations on important indices of relational health. In addition, the dimensional scoring may be particularly useful for home visitors or others who might be interested in repeated application to see change in dimensional ratings over time, while the cutoffs may be particularly useful in pediatric practice or in others situations where it is helpful to have a tool that can be used to identify dyads that may benefit from additional support or follow-up. In addition, most observational measures of interaction focus on rating either parent or child behavior separately, without rating the dyadic quality of interaction. This "observational omission" may occlude capturing specific qualities of the dynamic interactive nature of parent-child relational qualities, and more importantly, may fail to detect vulnerabilities that can serve as a potential focus of intervention. These data, therefore, make an important contribution to the infant research field in demonstrating the reliability and validity of a measure that can be used to drive "in-the-moment" ratings of dyadic interaction between parents and infants in the home and primary care settings. Critically, these naturalistic "snapshots" of dyadic interactions can help identify potential areas of concern and areas of strength and resilience in the early parent-child relationship that can guide and inform the care provided to families.

With regards to the validity of the ERHS measure, associations were observed for both maternal and parent-child interaction risk. While associations with the ERHS were observed for several of the NICHD scales, the strongest association obtained was for the Dyadic Mutuality scale. The strength of this association was notable given that the Dyadic Mutuality scale ratings were based on a separate parent-child interaction observation conducted on a different day and coded by independent raters who were blind to any information about the family. The high level of consistency of dyadic-specific ratings across separate observations conducted at different times, in the presence of different observers, and with different toys, raises the intriguing possibility that there is something more robust about capturing variability in relationship dynamics that is less dependent on displays of particular behaviors on the part of either partner. That is, the dyadic mutuality and the summary ERHS scale may capture more general qualities of stable relationship patterns that are less variable or context-dependent than indicators of specific behaviors such as parent positive affect. This finding in particular, though preliminary, also provides evidence for the convergent validity of the ERHS, as both the ERHS and the Dyadic Mutuality scale focus on relational and dyadic qualities that may be distinct from the contributions of either partner alone to the interaction. Importantly, our work provides some suggestion that, contrary to measures used in primary care and home visiting settings that focus solely on ratings of parent or infant behavior, the ERHS captures information about the dyad that can help identify foci of risk and opportunities to promote resilience.

In addition, results from the home visiting study suggest that while ERHS ratings and maternal depression symptoms are significantly correlated, they are not entirely redundant. Not all mothers with depression scores that exceed cutoffs had low ERHS scores, suggesting that these are not redundant indicators of risk, but rather highlight potentially overlapping but distinct domains that may appropriately lead the provider to offer different strategies and resources for support and intervention (Lovejoy et al., 2000). This finding is consistent with prior work that suggests that treating maternal depression alone may not be sufficient for promoting positive parenting and child outcomes (Cooper et al., 2003; Forman et al., 2007; Murray et al., 2003). Our findings suggest the possibility that screening for both maternal depression and early

relational health may help identify unique patterns of vulnerability that may lead to more appropriate, tailored, interventions that include a focus on the dyad and the developing relationship.

Taken together, findings from these two pilot studies support our hypothesis that clinician "in-the-moment" ratings on the ERHS can be both reliable and valid, and thus provide support for the real-world application and potential scaling of this screening approach. Other papers in this special issue also provide strong reliability and validity data for the ERHS in a research application, that is, when administered in a standard research setting context and coded by highly trained research staff from video recording. To our knowledge, these are the first set of studies to suggest reliability and validity of clinician observation and screening using "in-the-moment" ratings on the ERHS. Together with findings from the larger research studies, these data offer support for the practical utility of the ERHS approach for both the home visiting and pediatric settings, and potential scalability for public health surveillance for relational health. This is important as many other measures of relational health have similarly demonstrated research study-based reliability and validity—i.e., coding interaction from video recordings—but have not demonstrated reliability and validity of clinician "in-the-moment" ratings on the same instrument. Thus, these findings may be an early relational health measurement breakthrough, providing preliminary evidence suggesting the possibility of scalability and dissemination.

3.1 | Limitations

There are a number of limitations to the current studies, including the small sample sizes and the need for more diverse samples, including more broad representation of parent risk status, child age, and other demographic characteristics, including family race and ethnicity. Furthermore, as described separately for each study, only those scales that are coded for 6-month-olds were included in analyses, leaving the possibility that reliability may be different for ERHS scales used for children at older time points. In addition, the ERHS was developed, in part, to address the absence of other gold standard relationship-focused screening tools. Yet the lack of an obvious gold standard, dichotomous criterion to demonstrate criterion validity represents a significant challenge for demonstrating sensitivity and specificity analyses. Despite these problems, it is notable that the reliability data were consistent across these two observational settings, and that the findings for the ERHS in relation to the NICHD scales indicated greatest convergence with the scale most closely approximating the ERHS relational and dyadic focus. Future research should aim to replicate these findings in both settings with larger and more diverse samples, with a broader array of measures in order to more fully test convergent and divergent validity of the ERHS ratings in both contexts.

3.2 | Final thoughts

Although data presented in the current paper reflect only the screening portion of the ERHS, as part of the TWYB Clinic application in pediatric primary care settings, and consistent with the work described by Condon et al. (2022), the ERHS was delivered as an integrated promotion and prevention strategy. Our data suggest that the ERHS can be used to support an approach that integrates observation and screening within a larger promotion-prevention effort to detect strengths and risks and to promote early relational health as an integrated process. Given accumulating data suggesting that relational health in these early, foundational relationships can provide a critical buffer for infants within families facing adversity, optimizing health and developmental outcomes, early relational health can and should be seen as another significant "vital sign" to attend to in pediatric primary care, and the ERHS appears to provide a promising tool for work in this direction.

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CONFLICTS OF INTEREST

We have no known conflicts of interest to disclose.

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