Healthy Infants: Fostering Responsive Caregiving via Tiered Mentoring for High-Risk Teen Mothers and Infants

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Abstract

Research implications of cumulative poverty, adverse childhood events, and toxic stress on the development and overall future health of young children and families make clear that promotion and prevention programs are necessary. Early Head Start (EHS) is the seminal prevention program for high-risk infants/toddlers and parents. This pilot study explored the elements and impacts of the *Healthy Infants* (HI) promotion and prevention tiered mentoring model of face-to-face and virtual strategies for infant-parent-teacher triads. The HI model strives to promote the acquisition of protective developmental competencies for resiliency and the precursors for early school success, and to prevent and disrupt the early cumulative developmental effects of adverse childhood events (ACEs) and toxic stress in the lives of high-risk infants/toddlers and parents by targeting: a) responsive parenting, b) caregiving competencies, and c) use of best practices by EHS teachers. Overall, the HI promotion and prevention mentoring model was associated with statistically significant increases in responsive parenting and other caregiving competencies (e.g., affection, encouragement, and teaching). Additional positive outcomes were obtained and are discussed.

Key Words: high-risk, infants, parents, mentoring, promotion, prevention

Numerous research studies highlight the insidious negative impact of cumulative ACEs and associated "toxic stress," particularly the effects of poverty, on overall child development, school success,

adult physical health, and successful adaptation in life (Blair & Raver, 2012; Shonkoff, Richter, Vander Gaag, & Bhutta, 2012; Yoshikawa, Aber, & Beardslee, 2012). These cumulative ACEs include: lack of emotional attachments to caregiver; changes in caregivers; recurrent family crisis incidents; homelessness; hunger and malnutrition; physical, sexual, and emotional abuse; divorce and/or domestic violence; chronic unemployment; single-teen-parent head of household; lack of parental education; poor role models for temperament and self-regulatory behavior; illness or chronic medical conditions in family members; drug/alcohol abuse; community violence; and parent incarceration. The more chronic and recurrent the adverse events in a child's life, the higher the risk for "toxic stress" and future neurodevelopmental, behavioral, learning, and chronic medical problems (Felitti, Anda, & Nordenberf, 1998).

Risk Profiles for Teen Mothers and Infants

Teen parents are a unique risk factor for infants/toddlers. Teen parents are often single parents with limited resources. They often have fewer protective factors such as supportive adult relationships and role models (McDonald et al., 2009). Young parents can lack maturity and parenting skills, and typically have greater economic disadvantages (Smith, Gilmer, Salge, Dickerson, & Wilson, 2013). Many teen parents have unrealistic expectations of their children's development, and are less responsive in their interactions with their infants (Holub et al., 2007). Children of teenage parents are at higher risk of showing social-emotional and behavioral disorders, cognitive delays, and lower educational attainment (Holub et al., 2007; McDonald et al., 2009). As these children grow older, they continue to exhibit disparities, compared to same-age peers, in cognitive, behavioral, and health outcomes. Throughout elementary school and into adolescence, teen parents' children continue to fall farther behind their same-aged peers (Mollborn, Lawrence, James-Hawkins, & Fomby, 2014).

The Promise of Tiered Intervention Approaches: Impact on Risk and Resiliency

The risks infants of teen parents face underscore the need to identify and provide appropriate intervention and programmatic support (Holub et al., 2007). Recognizing interventions with teenage parents and their infants/toddlers can play a vital role in preventing negative cycles, and there has been a call to expand the number of services to this group (Mayers, Hager-Budny, & Buckner, 2008). Acknowledging early childhood as an ideal time for interventions that will then improve later life conditions for infants and families, researchers and policymakers have responded with guidance on focusing in the early developmental period (Mollborn et al., 2014).

Recommendations from the National Research Council and the Institute on Medicine [NRCIM], (2000) advocate for designing graduated prevention-oriented programs and individualized interventions to promote caregiving and child development so as to blunt the impact of adverse events and toxic stress in addition to the effects of poverty and lack of positive opportunities in high-risk children and families. Prevention science studies emphasize the ameliorative effect of these models when the focus is on providing nurturing experiences to increase resiliency and coping skills for young children and families (Biglan, Flay, Empty, & Sandler, 2012; Shonkoff & Garner, 2011).

The use of tiered models of promotion and prevention supports are known as Response-to-Intervention (RTI) models and are justified by federal regulations in the IDEA amendments (Office of Special Education Programs [OSEP], 2010). Although most studies on tiered promotion and prevention models have been conducted on school-age students, researchers have begun to validate such tiered models for preschool children (Lehman, Salaway, Bagnato, Grom, & Willard, 2010). To capitalize on the success of the school aged RTI process, and make needed accommodations for younger children, there have been several field validation studies. For example, the *Pyramid*

Model, where supports are provided at different levels of intensity ranging from classroom-wide to individual support was conducted by Hemmeter, Snyder, Fox, and Algina (2016), and Lehman et al., (2010). Bagnato, Salaway, and Suen (2009), and later, Gilliam, Maupin, and Reyes (2016) considered the role of improving teacher skills. Crusto et al. (2013) implemented universal classroom and child-specific strategies and added parent support and education, and home-based intensive interventions. Ocasio, Alst, Koivunen, Huang, and Allegra, (2015) considered the effect of a sequenced curriculum to address listening, focusing attention, self-talk, assertiveness, empathy, emotional management, friendship skills, and problem solving to all children in the classrooms. These authors also embed mental health clinicians in the classrooms, and provide play therapy for children in need of individualized services.

Not surprisingly, pyramid models for young children (age 3-5 years) incorporate several of the key elements identified in research by the NRCIM (2011), and align with developmentally-appropriate practices for effective prevention and promotion. Many of these studies also indicate the elements of the prevention and promotion model elements or tiers that have been shown to increase resiliency and coping skills for young children and families (Biglan et al., 2012; Shonkoff & Garner, 2011). The following list summarizes some of the elements which have shown protective and positive neurodevelopmental effects: longer program participation, responsive caregiver-child attachments, parent engagement, direct child teaching and interventions, emphasis on social-emotional and early literacy competencies, individualization, high program quality, standards-driven best professional practices mentored and modeled for teachers and parents, community-based leadership driving innovative interagency supports, public/private partnerships, and preschool-school linkages (Ramey & Ramey, 1998; Shonkoff et al., 2012).

Findings from these studies demonstrate that early childhood intervention programs and support in natural community settings,

which encompass specific programmatic features and elements, can have substantial benefits for young children and families. Adding to this positive literature on prevention programs, Bagnato, Suen, Brantley, Smith-Jones, & Dettore, (2002) conducted ground-breaking longitudinal studies across Pennsylvania for over 15,000 high-risk preschool children (0-6 years of age) in high-poverty and high ACE risk in rural and urban school district-community partnerships to demonstrate the positive developmental and behavioral impact and parent engagement for high quality preschool programs (Bagnato et al., 2009).

Taken altogether, it is clear that in the era of public health initiatives, interagency and interdisciplinary supports involving physical and behavioral health, and family support must be integrated into traditional EHS programs in order to promote the coping, resiliency, and progress of the most vulnerable families. Likewise, the integration of tiered supports in EHS programs can strengthen the competencies of parents and teachers. To date, although tiered models have been implemented and proven effective for children age three to school-age, no tiered promotion and prevention model synthesizes the most efficacious elements from prior studies for application to high-risk infants/toddlers, parents, and EHS teachers.

Purpose of this Pilot Study

The purpose of this pilot study was to explore the elements and impact of the HI promotion and prevention mentoring model for high-risk infants/toddlers, parents, and EHS teachers in the metropolitan city of Pittsburgh, Pennsylvania. The essential objective of this study was to determine if the HI model is associated with the enhancement of responsive parenting and caregiving competencies by parents with their infants/toddlers, and the increased use of best practices by EHS teachers. The central questions of this program evaluation research were:

- Did high-risk parents who received HI model supports over an 8-month period demonstrate a significant enhancement in their responsive parenting and caregiving competencies (e.g., affection, encouragement, and teaching)?
- Did high-risk infants/toddlers of parents who received HI model supports demonstrate reductions in the scope of their atypical development (e.g., improved social and self-regulatory behaviors and decreases in extremes of temperament?
- Did EHS teachers who received HI model supports demonstrate an increase in their use of best practices (e.g., nurturing and responsive relationships, supportive environments, targeted social emotional strategies, and individualized interventions) and in the quality of their classroom's climate (e.g. developmentally-appropriate practices)?

Methods

This study was conducted in the metropolitan area of Pittsburgh, Pennsylvania. Several urban areas have been affected by chronic socio-economic distress and poverty, poor nutrition, unsafe housing, inadequate drinking water, and limited medical resources, as well as high unemployment, inadequate infrastructure, and lack of social service and health care opportunities which impact the health of this population (Healthy People, 2010). The percentage of children in poverty ranges from 23% to 38%, another 19.7% are in families between 100% and 199% of the federal poverty level, and 18.3% have special health care needs as compared to a national rate of 13.9%, (Centers for Disease Control [CDC], 2008); ACE score risk levels exceed four, placing individuals for negative health and mental health outcomes across their lifetime.

Participants

Participants (infants/toddlers, parents, and teachers) were recruited from an EHS program. At the time of this data collection, 48 infants/toddlers had parents and teachers participating in tiers 1-3 of the HI model whereas 21 had completed all five tiers of the pyramid model. Of the 21 completed, two parents withdrew and two aged-out of the EHS program, leaving a total of 17 parents. Ultimately, 13 of the participating parents provided various pieces of information for analysis; one parent had two infant/toddlers participating. Demographic information was collected on all infants/toddlers, parents, and teachers. Outcome measures were collected only on parents, infants/toddlers, and teachers receiving services in tiers four or five.

Parent participants. Table 1 provides an overview of parent data, including where information was omitted. For this reason, the number of participants in each parent level analysis below varies. Table 2 describes parent demographic information ($n = 10$).

Infant/toddlers. Table 3 provides data on infants/toddlers.

Teacher participants. Eight teachers (lead and assistants) from four EHS classrooms, participated in the HI model. One classroom was located in an Early Childhood Center and three classrooms were located in high schools. The EHS coordinator, family support specialist, education coach, early interventionists, and related service providers were also often participants; however, they were not part of the outcome analysis. See Table 4 for teacher demographic information.

HI Model Implementation

Implementation team. Five trained specialists (early interventionist, developmental school psychologist, developmental healthcare consultants, and a consulting pediatric nurse practitioner) acted as mentors to the teachers delivering the intervention in this study. HI mentors were masters or doctoral-level staff working

Table 1:
Number of Participants Responding to Each Outcome Measure

Measure	Responded	Omitted
Parent demographic information	10	3
Child demographic information	11	3
Caregiver ACES	9	4
Child ACES	11	3
PICCOLO	12	2
TABS	7	7

Note: PICCOLO = Parenting Interactions with Children: Checklist of Observations Linked to Outcomes; TABS = The Temperament and Atypical Behavior Scale.

Table 2:
Parent and Family Demographic Characteristics

Characteristic	N	Characteristic	N
Age		**Number of children**	
19 or younger	7	1	7
20 or older	3	2	2
Sex		3	1
Female	9	**Housing**	
Male	1	Rent	3
Ethnicity		Share	5
African American	7	Transitional	2
Biracial	1	**Disability***	
Caucasian	1	Disabled	3
Hispanic	1	Non-Disabled	6
Marital Status		**Social serviced involvement**	
Single	9	Current	4
Married	1	Past	1
		Never	5

**Note: One parent omitted this item*

Table 3:
Child (Total N = 11) Demographic Characteristics

Characteristic	N
Birth year	
2014	4
2013	1
2012	3
2011	3
Sex	
Female	4
Male	7
Ethnicity	
African American	8
Biracial	3

Table 4:
Teacher (N = 6) Demographic Information

Title	N
Lead teacher	3
Teaching assistant	3
Sex	
Female	6
Male	0
Ethnicity	
Caucasian	3
African American	3
Teaching Experience (in years)	
5 or less	2
5-10	2
10 or more	2
Degree Level	
Bachelor's Degree	6

at the University of Pittsburgh Office of Child Development, or student interns completing a master's degree in psychology, special education, or social work.

Implementation process. HI mentors were trained to have knowledge in infant and toddler development, adult learning, collaborative consultation and problem solving, mentoring, motivational interviewing, evidence-based observation and promotion-prevention-intervention strategies, and HI model elements, processes, and procedures. In addition to the mentoring role, specialists were also trained as teacher, parent, and child assessors with structured observational tools (The Pyramid Infant-Toddler Observation Scale [TPITOS], Parenting Interactions with Children Checklist of Observations Linked to Outocmes [PICCOLO]), rating scales (Temperament and Atypical Behavior Scale [TABS]), and surveys (demographic and ACES).

At the start of the study, HI mentors introduced the HI model, goals, benefits, and responsibilities in participation and overall processes to parents and EHS teachers. HI mentoring was provided equally to a lead teacher and an assistant teacher. The HI team also met weekly to share professional knowledge and provide interdisciplinary perspectives.

Previous federal research on teacher mentoring in Head Start (Bagnato, Seo, Salaway, & Kim, 2016) demonstrated that mentoring of seven hours per week (28 hours per month) resulted in significant improvements in a teacher's use of best practice as indicated on the norm-referenced observational measures. HI mentors provided seven hours per week of face-to-face and virtual mentoring to teachers and parents in delivering the HI model. HI mentors implemented the following five HI model elements, which have been identified as promising effective elements in other studies, with the participants for 1-2 years depending on their point of entry.

Element 1: Tiered promotion and prevention services and supports. The HI model incorporated the foundational features of the field-validated *Teaching Pyramid from the Center for Social-*

Emotional Foundations of Early Learning (CSEFEL; Fox, Carta, Strain, Dunlap, & Hemmeter, 2010) as a framework for implementing the remaining four elements. CSEFEL's Pyramid model includes 1) effective workforce, 2) nurturing and responsive relationships, 3) high quality supportive environments, 4) targeted social emotional supports, and 5) intensive interventions. These components served as the foundation and organizing framework for HI's tiered promotion and prevention services and supports. Table 5 illustrates the HI model elements implemented across tiers.

Element 2: Transagency teamwork. HI mentors worked in partnership with EHS program's education coaches, family support specialists, and supervisors to mentor parent-infant-teacher triads via a mobile transagency interdisciplinary team. The transagency team had representatives from the HI team (generalists and specialists including a masters-level developmental healthcare consultant, an applied developmental psychologist, and a consulting pediatric nurse practitioner), and the EHS program (e.g., education coach, family support specialist, education supervisor). The HI mentor offered the specific mentoring, developmental/behavioral health consultation, and promotion-prevention-intervention strategies that enabled teachers to build their use of best practice and responsive caregiving competencies, and improve the overall climate of their EHS classroom. The education supervisor represented the organizational commitment for linking HI mentoring with supervisory and programmatic support to teachers within EHS regulations. The transagency team worked together to support infants/toddlers, parents, and each other while addressing individual, group, and program needs.

Element 3: Curriculum-guided responsive caregiving. HI tiered mentoring focused upon the 29 critical parenting competencies of the PICCOLO (Roggman, Cook, Innocenti, Jump, & Christiansen, 2013) which best predict positive infant-parent outcomes have been field-validated in the EHS Family and Child Experiences Survey (FACES; Xue et al., 2014), in developmental research during standardization

(Cook & Roggman, 2009), and supported by the NRCIM (2000) *Neurons to Neighborhoods* report on the importance of responsive caregiving relationships and social-emotional competencies. HI mentors nurtured relationships between parent-infant-teacher triads using such varied strategies as face-face modeling, parent group peer-mentoring and cell-phone and iPad video feedback. The HI mentor structures the mentoring process to focus on critical and measurable changes in relationships and the use of "best practices" with high-risk infants/toddlers and families. HI mentors focused on individual, small group, and peer mentoring of parents and EHS teachers during developmental activities and teaching routines in the natural center environment following the mentoring methodology from previous field-validation research (Bagnato et al., 2016).

Element 4: Mobile technology & telemedicine consultation. Capitalizing on the integral use of text-messaging among teenagers and young adults, HI mentors utilized text messages as another support mechanism in disseminating information and supporting young parents both within and outside of the face-to-face mentoring sessions. Text-messaging between the HI mentor and parent or EHS teacher is critical for immediate reinforcement of mentored practices. HI mentors used snap videos focusing upon "positive" parent-infant-teacher interactions to support and supplement face-to-face mentoring. The videos highlighted responsive interactions and provided powerful visual images of status and change in caregiving during mentoring.

Distance technology is also important to engage interdisciplinary partners on the team and provided a vehicle and opportunity for formal and episodic consultation between other professionals such as early intervention specialists, health specialists, and human service representatives. HI mentors utilized the Health Insurance Portability and Accountability Act (HIPPA)-compliant software to provide tele-medicine consultation from a certified pediatric nurse practitioner and psychologist and Skype

and FaceTime were used to enable HI mentors to answer EHS teacher questions about particular individual infant/toddler or parent needs as well as to conduct short tutorials on critical professional development topics such as nutrition, relationships with primary care physicians, medical conditions, management of atypical self-regulatory behaviors, and identifying risk and delay.

Element 5: University-community partnerships for interdisciplinary education. HI mentors provided training to EHS teachers who received professional development and continuing education credits for their engagement in various HI promotion and prevention supports: face-face and virtual mentoring, formal workshops, webinars, and telemedicine consultation. University mentors provided participants with education and training which aligned with Pennsylvania state-documented Pennsylvania Quality Assurance System (PQAS) and Act 48 education credits.

Measures

PICCOLO. *The PICCOLO* (Roggman et al., 2013) is a norm-referenced checklist of 29 observable developmentally supportive parenting behaviors, which is field-validated nationally for the use of assessing and planning for goals to promote responsive parenting (Bagnato, Neisworth, & Pretti-Frontczak, 2010; Xue et al., 2014). The PICCOLO includes measures of parental affection (e.g., "parent speaks in a warm tone of voice"), parental responsiveness (e.g. "parent responds to child's emotions"), parental encouragement (e.g., "parent supports child in making choices"), and teaching interactions (e.g., "parent engages in pretend play with child"). Together, these factors are thought to contribute to positive parent-child relationships.

TABS. *The TABS* Screener is a norm-referenced, nationally standardized, 15-item rating scale designed to identify temperament and self-regulation problems that can indicate that a child is developing atypically or is at risk for atypical development (Bagnato, Neisworth, & Salvia, 1999; Neisworth,

Bagnato, & Hunt, 1999). The TABS is commonly used for early screening and intervention programs in the United States and is one of only four instruments recommended for use with infants and young children by the American Academy of Pediatrics (AAP; Bagnato et al., 1999). A TABS rating of 1-2 indicates a strong risk for atypical development. A rating of three or more indicates a 95% chance that the infant/toddler will demonstrate temperament and self-regulation problems on the full 55-item TABS.

TPITOS. TPITOS is an assessment instrument designed to measure the fidelity of implementation of practices associated with the Pyramid Model in infant/toddler care settings (Hemmeter, 2009). The TPITOS provides a classroom snapshot of adult behaviors and classroom environment variables that are associated with supporting and promoting the social-emotional development of infants/toddlers. The TPITOS is completed based on a two-hour observation conducted in infant/toddler classrooms (birth to age three), followed by an interview with the teacher. TPITOS data may be used to support professional development in the following ways: 1) identifying and making explicit the specific competencies that promote social-emotional development; 2) providing team and individual teacher feedback to reinforce teacher strengths; 3) guiding individual and team targeted goal-setting to strengthen teacher competencies; and 4) monitoring growth relevant to professional development competencies.

ACES. *The Adverse Childhood Events Survey* (Felitti et al., 1998) measures three areas of adverse childhood events: abuse, neglect, and household dysfunction. More specifically, the survey asks if the parent or child has been physically, emotionally or sexually abused, physically or emotionally neglected, or if mental health, domestic violence, divorce, incarceration, or substance abuse is present within the household. According to the ACEs study a higher ACE score indicates the higher likelihood of various health problems later in life (Felitti et al., 1998).

Table 5:
Specific HI Elements and Strategies Across Tiers

Tier & % coverage	Elements and common strategies	Teacher-infant	Parent-infant
Tiers 1-3: Professional development mentoring to promote best practices, responsive caregiving and quality classrooms **100% Coverage** Universal-entire program	•On-site and virtual interdisciplinary education and mentoring to enhance use of best practices, quality classrooms and responsive relationships	x	x
	•Interdisciplinary and transagency team-building activities	x	
	•Assessment of "best practices", quality of classroom environment and teacher-parent and teacher-infant interactions	x	
	•Assessment of infant/toddler's social-emotional development	x	x
	•Assessment of family needs and risk factors		x
	•On-site demonstrating and modeling	x	
Tier 4: Mentoring with small groups of parents and teachers on strategies to promote the acquisition of caregiving competencies and positive social-emotional development **50% Coverage** Selected need groups	•On-site and virtual interdisciplinary education and mentoring to enhance targeted social emotional supports	x	x
	•Collaborative development of classroom goals and plans based on assessment	x	
	•On-site demonstrating and modeling to enhance targeted social emotional supports	x	x
Tier 5: Mentoring individual parents and teachers on strategies to prevent developmental disabilities and support the most complex needs. **10-15% Coverage** Individual needs Parent-infant-teacher triads	•On-site and virtual interdisciplinary education and mentoring on individual interventions	x	x
	•Additional assessment of parent-infant-teacher interactions, family strengths & needs, infant's development	x	x
	•Collaborative development of individual parent-infant-teacher plans to enhance responsive caregiving	x	x
	•On-site individual mentoring, demonstrating and modeling of individualized interventions	x	x
	•Use of teacher-infant and parent-infant interaction video for feedback as a behavior change strategy	x	x
	•Interdisciplinary and interagency teaming; linkages to additional services	x	x
	•Individual parent-infant-teacher consultation from pediatric nurse practitioner or psychologist	x	x

Research Design

HI utilized a repeated-measures, pre-test, post-test single group design (Cook & Campbell, 1979) to evaluate the effectiveness of improving parent-child interactions, teacher-child competencies, and reducing child risk for atypical development. Prior to HI program implementation, parents were observed and rated using the PICCOLO to evaluate the quality of mother-infant/toddler interactions. Teachers were observed by trained HI personnel, and

their teaching interactions were rated with the TPITOS. Children's behaviors were rated using the TABS screener to evaluate their current risk for atypical development. These measures provided baseline ratings of parent, teacher, and child behavior, and were administered at the completion of the program to evaluate the effects of HI on parent, child, and teacher variables. Individual participants within the study thus acted as their own control.

HI mentors examined the formative results of the above pre-intervention measures to identify the strengths and needs of participants, and to initiate tiered mentoring based on their analysis and observations. Mentoring services extended from September to June of two school years. Mentors and teaching teams or parents collaboratively set individualized goals. During the mentoring process, mentors encouraged teachers' and parents' reflection on their current practices and their experimentation with newly learned techniques. Post-test data were collected on teachers' and parents' practices after mentoring at the end of the study using the TPITOS and PICCOLO.

Results

ACES

Nine caregivers in the program reported on their personal traumatic life experiences using the ACES. According to the Adverse Childhood Experiences Study a higher ACE score indicates the higher likelihood of various health problems later in life (Felitti et al., 1998). Within this cohort, all but one caregiver reported experiencing multiple traumas, with a median of six different types of traumatic experiences reported (min = 1, max = 8). The high-risk cutoff in national research is at 2-3 for later medical and mental health diagnoses. Table 6 shows parent ACES endorsements. Caregivers also reported on the traumatic experiences of their young children (N = 11). Within the cohort, all but one child had experienced multiple types of traumatic experiences, with a mean of four different types of experiences reported (min = 1, max = 8).

The high-risk cut-off in national research is at 2-3 for later medical and mental health diagnoses. See Table 7 for infant/toddler ACES endorsements.

HI Outcomes

Infant outcomes. The self-regulatory behaviors of infants/toddlers were evaluated with the TABS screener (Bagnato et al., 1999). On the TABS screener, endorsement of at least two behaviors indicates that the child is at risk for atypical development and self-regulatory behavior. Endorsement of three or more indicates that the infant/toddler's temperament and self-regulatory behaviors are likely atypical for his or her age. Of the seven infants/toddlers who were evaluated, six had a reduction in maladaptive behaviors after participation by the parent in HI. One infant/toddler had a drastic increase (+6) in maladaptive behaviors, and represented a significant outlier in the group. Before HI tiered mentoring, a median of 3.5 maladaptive behaviors were reported, indicating significant signs of atypical temperament and self-regulation. After HI tiered mentoring, maladaptive behaviors were reduced to a median of 0.5, indicating a reduction to minimal risk of atypicality (See Figure 1). Reduction of maladaptive behaviors below the threshold of three indicates that children in the HI program experienced a reduced risk for atypical development.

Parent outcomes. HI used the PICCOLO to record and rate the parent's level of responsive parenting and caregiving behaviors with their infants/toddlers. In total, 13 parents and their infant/toddlers had their interactions observed and rated using the PICCOLO at entry to the program. Only 12 parents-infant dyads were evaluated using the PICCOLO after HI tiered mentoring was completed. One parent-infant pair experienced a large reduction in positive interactions in every domain of the PICCOLO for unknown reasons (See Figure 2). This represented an extreme outlier of the group, and was thus eliminated from analysis leaving a total of 11 repeated measures cases for analysis.

Table 6:
Parent (Total possible N = 9) ACES Endorsements and Tally of ACES experiences

Experience	N
Physical abuse	5
Emotional abuse	7
Sexual abuse	0
Drug and alcohol abuse in home	5
Caregiver incarceration	5
Family mental health concern	9
Domestic violence	3
Absent caregiver	7
Physical neglect	4
Emotional neglect	4
Total Number of Experiences	
1 or less	1
2-5	2
6 or more	6

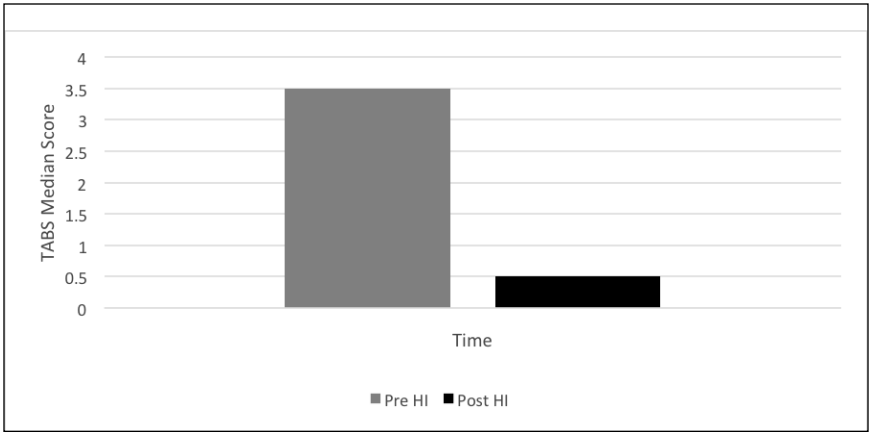
Table 7:
Infant/toddler (Total possible N = 11) ACES Endorsements and Tally of ACES Experiences

Experience	N
Physical abuse	0
Emotional abuse	2
Sexual abuse	0
Drug and alcohol abuse in home	6
Caregiver incarceration	9
Family mental health concern	8
Domestic violence	3
Absent caregiver	6
Physical neglect	5
Emotional neglect	5
Total Number of Experiences	
1 or less	1
2-5	7
6 or more	3

Due to the use of a repeated measures design, a paired-samples t-test was conducted to analyze the effects of HI on positive parent-infant/toddler interactions as measured by the PICCOLO (Roggman et al., 2013). On average, parents engaged in more positive and responsive interactions with their infants/toddlers after participation in HI tiered mentoring (M = 32.09; SD = 8.32) than before (M = 20.82; SD = 9.24). This difference, 11.27, 95% Confidence Interval [5.49, 17.06], was significant t (10) = 4.34, p < .005, and represented a moderate effect r = .65 (See Table 8 and Figure 2).

HI tiered mentoring had a significant, small effect on parents responsiveness to their infants/toddlers (Mean difference = 4.18, 95% CI [2.48-5.88], t (10) = 5.50, p < .001, r = .28), a significant, large effect on their encouraging interactions (Mean difference = 2.63, 95% CI [.42-4.85], t (10) = 2.65, p < .05, r = .75, and a significant, large effect on their teaching interactions (Mean difference = 1.91, 95% CI [.77-3.05], t (10) = 3.72, p < .005, r = .58). HI did not have a significant effect on parental affection toward their infants/toddlers, p = .075.

Figure 1:
TABS median scores before and after HI model implementation



Using descriptive statistics on PICCOLO scores, teen parents (age 19 or younger) demonstrated greater improvement in positive and responsive parent-infant interactions (Mean difference = 11.5) than non-teen parents (Mean difference = 6.7) when comparing pre:post HI group means by caregiver age. This underscores the importance of early intervention for at-risk parent-infant dyads. When comparing pre:post HI group means by parent ACES tally, parents who experienced less than the cohort median of six types of traumatic experiences benefited the most from HI, as per composite PICCOLO scores (Mean difference = 27). Parents with more than six types of traumatic experiences saw less of an improvement in positive parent-infant interactions (Mean difference = 7.5). While only two caregivers who completed the PICCOLO experienced less than six traumatic experiences, the large difference in PICCOLO improvement between groups can still point to the cumulative effects of trauma on parent-infant interactions.

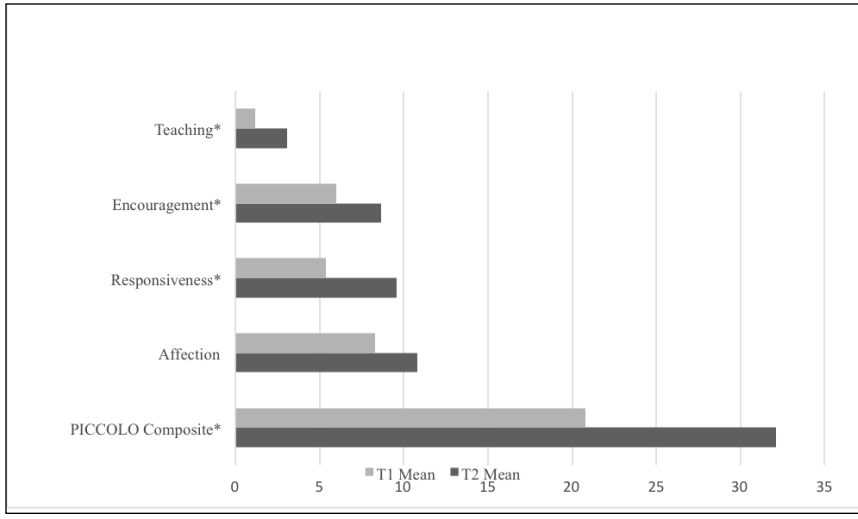
Program/provider outcomes. In order to measure the quality and climate of the classroom's social and physical environment and the competencies of teachers in areas of social emotional development, HI utilized the TPITOS observation scale on three of the four classrooms. The TPITOS evaluates the developmental appropriateness of the EHS classroom climate and physical and social environment, using Likert Scale items with possible scores ranging from 1-4. In total, three EHS classrooms provided an instructional environment to the infants/toddlers enrolled in HI; 55% of the participating children attended school A, 18% were enrolled in school B, and 9% were enrolled in school C. The remaining (18%) of children in the study were in a classroom that was not observed using the TPITOS. In the three participating schools, lead teachers established environments approaching ideal levels of best practice, as indicated by average TPITOS pre-intervention ratings between "emerging" and "exemplary" ($M = 3.67$; $SD = .208$) prior to HI tiered mentoring. After HI tiered mentoring,

Table 8:
Pairwise comparison results (PICCOLO T1 vs. PICCOLO T2)

Domain	Mean difference	Std. dev	95% CI	t	Sig. (2-tailed)	Effect size correlation
PICCOLO composite	11.27273	8.61500	5.4859-17.06036	4.340	.001*	.653
Affection	2.54545	4.25120	-.31054-5.40145	1.986	.075	-
Responsiveness	4.18182	2.52262	2.48710-5.87654	5.498	.000*	.282
Encouragement	2.63636	3.29462	.42301-4.84972	2.654	.024*	.751
Teaching	1.90909	1.70027	.77684-3.051	3.724	.004*	.581

Note: Significant results, defined by p < .05, are marked with an asterisk (*). CI = confidence interval; Std. dev = standard deviation.

Figure 2:
PICCOLO median scores before and after HI model implementation



Note: Significant results, defined by p < .05, are marked with an asterisk (*).

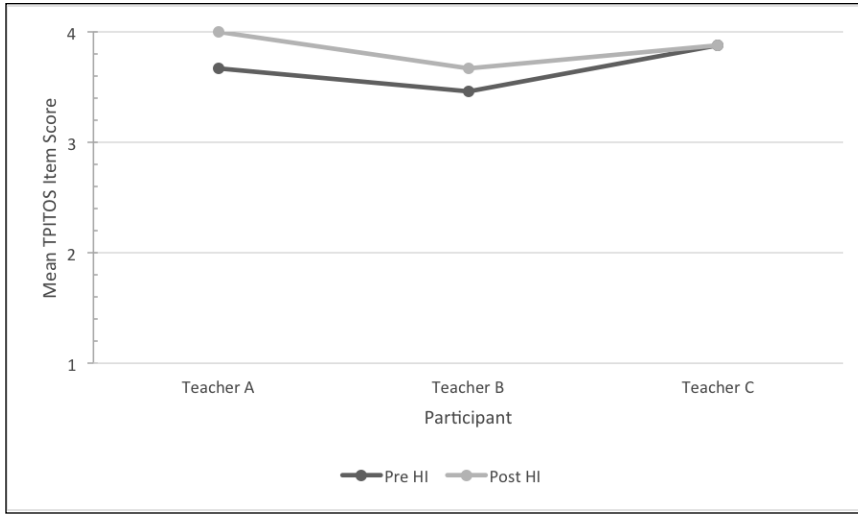
teachers on average improved their interactions with children and their classroom environment, as indicated by an increase in the average observational item score on the TPITOS (M = 3.84; SD = .17). See Figure 3 for average item score for each teacher before and after HI implementation. This equates to an average 4.3-point increase on the overall TPITOS measure, and an overall improvement in the developmental appropriateness of the EHS classroom. Prior to HI tiered mentoring, teachers scored a total score of 88 out of a possible 96 points on the TPITOS (91.6%); This is notable due to the limited room for positive growth created by the maximum score obtainable on the measure. An increase to a total score of 92.3 (96.2%) on the TPITOS, with a reduction in standard deviation, indicates that the quality of the EHS classroom improved and the EHS teachers were able to more closely approach ideal levels of support. This change suggests that HI tiered mentoring helped to create EHS classrooms that were more developmentally-appropriate and supportive, and worked to bring all classrooms to comparable levels of quality.

Discussion

The pilot study investigated the impact of the HI tiered mentoring model on enhancing high-risk parent's responsive parenting and caregiving competencies, reducing atypical self-regulatory behaviors in their high-risk infants/toddlers, and improving overall EHS classroom quality and climate. This is the first pilot study of HI as a tiered mentoring model for promotion and prevention. Overall, the HI tiered mentoring model was associated with statistically significant increases in responsive parenting and caregiving competencies. In addition, high-risk infants/toddlers whose parents were involved in HI showed reductions in atypical behaviors; teachers who received HI mentoring showed improvements in their competencies and the quality of EHS classrooms improved.

Parents in this study engaged in more positive and responsive interactions with their infants/toddlers after participation in HI tiered mentoring. On average, parents showed significant increases in positive and responsive interactions with their children (going from $M = 32.09$ down to $M = 20.82$). While inferential comparisons could not be made due to study limitations, the apparent effect of HI as indicated by mean-difference scores on the PICCOLO paired with a reduction in maladaptive infant/toddler behaviors as measured by the TABS (six of the seven infants/toddlers evaluated showed a reduction in maladaptive behaviors, from a median of 3.5 to a median of .5) indicates that HI tiered mentoring has the likely effect of mitigating risk for atypical development and problematic self-regulatory behaviors in high-risk populations. Prior to HI tiered mentoring, infants/toddlers in the study displayed significant signs of atypical extremes of temperament and self-regulatory behaviors. After HI tiered mentoring, these behaviors were reduced, minimizing the risk of atypical development. Additionally, parents

Figure 3:
Lead teacher TPITOS ratings before and after HI implementation



with five or fewer types of adverse experiences benefited the most from HI, while parents with more than five improved less. This is in-line with research about how adverse events and toxic stress hinder a parent's capacity to provide responsive caregiving.

EHS teachers participating in HI tiered mentoring entered the program as already high-quality, highly-trained educators. This is exemplified by the high mean pre-intervention ratings on the TPITOS. These teachers were responsive to HI tiered mentoring and demonstrated improvements in their competencies and classroom quality which began at nearly ideal levels of quality, which are defined by a score of four (M = 3.67 increased to M = 3.84). Considering the high average scores of teachers before the intervention and the limited room for upward growth, the reduction of the variance between pre and post-test TPITOS scores of the teachers shows that the intervention succeeded in its mission to improve EHS classroom quality. With only three teachers evaluated, inferential comparisons were not possible. However, should HI be replicated and implemented on a larger cohort of teachers, infants/toddlers and parents, it is hypothesized that HI would have a similar positive effect.

Adverse life events clearly put infants/toddlers at high risk for developmental, behavioral, learning, and medical problems. Children living below the federal poverty level experience substantial adverse life events associated with poverty, putting them at high risk for atypical development. All infants/toddlers and their parents fell below the federal poverty level as indicated by their eligibility and enrollment in EHS. As such, these infants/toddlers have accumulated risk for atypical development related to barriers to quality health care, mental health care, and education, and increased risk for exposure to trauma, and effects of other cumulative adverse live events. These adverse experiences were quantified in this study for participants, and were endorsed at levels indicative of a high-risk for future developmental, behavioral, learning, and health problems.

Limitations of the Study

The HI tiered mentoring model was implemented in an EHS program with a high turnover rate for families. The beginning cohort of 22 families was diminished over time, leaving only 10 parent-infant dyads that could be used for analysis. Much of the data gathered on the parents, infants/toddlers represented a particular population; that of impoverished families. As such, many parents reported similar rates of personal trauma experiences leaving little variance in the sample. The skewedness of the data may appear to be a limitation; however, this skew could also typify the population being studied. The cycle of poverty resists regression to the mean. Despite the small sample size, parent interactions as rated on the PICCOLO significantly improved after participation in HI tiered mentoring, and represented a moderate effect. This is promising considering the size of the sample and the strength of the association between HI and the outcome measure. It is hypothesized that if applied to a larger, more heterogeneous sample that the effects would remain and likely show similar associations.

Many participants in the study omitted items in the demographics survey, leaving missing data. There was also a consistent pattern in the data omitted - namely, items that asked about abuse experiences of their infants/toddlers. Many parents also omitted sensitive items for themselves. This is a common difficulty when asking participants about sensitive topics, and is a barrier to correlating parental adverse experiences to child outcomes.

Future Directions

Despite the limitations, the present findings have important initial implications for practice and policy. HI appears to be a promising promotion and prevention mentoring model for enhancing high-risk parent's responsive parenting and caregiving

competencies, reducing atypical self-regulatory behaviors in high-risk infants/toddlers, and improving overall EHS classroom quality. This study helps to fill the gap of research for promotion and prevention models with high-risk infants/toddlers, parents, and providers, as most research has been conducted on preschool and school-age students. The HI model needs more rigorous study, but provides hope for reducing disparities between impoverished children and their peers. This pilot study indicates the potential for success of the HI's promotion and prevention model, under "to-scale" expansions, at improving parent-infant interactions, reducing signs of atypical development in infants/toddlers, and improving the quality of EHS classrooms and teacher's caregiving practices. Given that there is limited research on the use of promotion and prevention models with high-risk parents and their infants/toddlers, further research is warranted. It would be crucial and beneficial to conduct a wider and more rigorous study using a group-randomized trial with a larger sample to further explore the benefits of promotion and prevention models, such as HI.

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