

Primary Care Interventions for Early Childhood Development: A Systematic Review

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abstract

CONTEXT: The pediatric primary care setting offers a platform to promote positive parenting behaviors and the optimal development of young children. Many new interventions have been developed and tested in this setting over the past 2 decades.

OBJECTIVE: To summarize the recent published evidence regarding the impact of primary care-based interventions on parenting behaviors and child development outcomes; to provide recommendations for incorporation of effective interventions into pediatric clinics.

DATA SOURCES: A literature search of PubMed and PsycINFO was conducted from January 1, 1999, to February 14, 2017.

STUDY SELECTION: Publications in which primary care-based interventions and reported outcomes regarding the child's development or parenting behaviors associated with the promotion of optimal child development are described.

DATA EXTRACTION: Forty-eight studies in which 24 interventions were described were included. Levels of evidence and specific outcome measures are reported.

RESULTS: Included interventions were categorized as general developmental support, general behavioral development, or topic-specific interventions. Two interventions resulted in reductions in developmental delay, 4 improved cognitive development scores, and 6 resulted in improved behavioral intensity or reduction in behavioral problems. Interventions used a variety of theory-based behavior change strategies such as modeling, group discussion, role play, homework assignment, coaching, and video-recorded interactions. Three interventions report the cost of the intervention.

LIMITATIONS: Community or home-based interventions were excluded.

CONCLUSIONS: Although several interventions resulted in improved child development outcomes for children aged 0 to 3 years, comparison across studies and interventions is limited by use of different outcome measures, time of evaluation, and variability of results.

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The first 3 years of life are a critical period for child brain growth and development, with the potential to impact later social, economic, and health-related quality of life.¹ Pediatric primary care, which includes health supervision and anticipatory guidance, offers an important entry point for the promotion of optimal child development in the United States because it is a universal service with frequent encounters in the first 3 years of a child's life.^{2,3} In a systematic review by Regalado and Halfon⁴ of publications between 1979 and 1999, the authors summarized developmental assessments, anticipatory guidance, and specific interventions used to promote development of children aged 0 to 3 years in primary care settings. They comment on the efficacy of anticipatory guidance and problem-focused counseling interventions as well as the challenges and barriers to implementing such interventions in practice. Importantly, the authors found that targeted skill-building interventions that were focused on improving parent-child interaction,⁵ or specific parenting behaviors (such as book sharing,⁶ coping with infant colic,⁷ sleep training,⁸ or non-harsh discipline⁹) proved to be the most effective.

New interventions to promote the optimal development of young children continue to be developed and tested. Additionally, in 2012, the American Academy of Pediatrics called for the pediatric community to “catalyze fundamental change in early childhood policy and services.”³ This declaration underscored the need for new, more effective strategies to increase the impact of primary care on promoting optimal development for young children in the United States. Taking this statement along with the rapidly changing landscape of US pediatric primary care systems, including the rise of the medical home model¹⁰

and new models of well-child care delivery,¹¹ a comprehensive and current review of these interventions is needed. The authors of such a review must summarize the impact these interventions have on child development outcomes, building on a previous review focused on positive parenting outcomes.¹² Furthermore, scientists and clinicians could benefit from a synthesis of available evidence-based interventions to inform areas still in need of future study. Therefore, our objective in this systematic review was to examine the interventions implemented in connection with primary care to promote optimal child development for children aged 0 to 3 years from 1999 to 2017 and to summarize the efficacy of these interventions on child and parent level outcomes.

METHODS

Search Strategy

This systematic review was conducted by following the PRISMA guidelines¹³ to identify interventions delivered in connection with primary care setting for the promotion of optimal early development of children aged 0 to 3 years. For the purpose of this review, pediatric primary care or pediatric clinics were defined as family medicine, pediatric, or public health clinics (outside of the United States) providing preventive care to children. Interventions were defined as education, counseling, or other provider-parent engagement beyond screening for developmental delay. Parents could include nonbiological parents, grandparents, or caregivers, but henceforth we refer to these caregivers as parents. Our inclusion criteria required that English, peer-reviewed publications: (1) examined interventions for the promotion of optimal child development for children aged 0 to 3 years, (2) described delivery of the intervention within or associated with a primary care setting, and

(3) reported outcomes regarding the child's development (cognitive, behavior, or social-emotional) or parenting behaviors associated with the promotion of optimal child development (eg, book sharing, positive discipline, or parental sensitivity using validated measures). We excluded review articles and articles that targeted children with developmental diagnoses (eg, autism, attention-deficit/hyperactivity disorder, oppositional defiant disorder) or extreme prematurity (<28 weeks' gestation). We also excluded studies solely of parents with known substance abuse or depression because these mental health illnesses frequently require additional targeted treatment. We excluded studies that only reported outcomes regarding child sleep. Publications were considered from any country if they met the above listed criteria.

PubMed and PsycINFO were searched by E.P.-C. for a selection of articles published from January 1, 1999, through February 14, 2017, using these key words: (“child development” OR “parenting”) AND (“pediatrics” OR “primary care”). In addition, we searched references of included articles and related review articles. The final list of included articles was reviewed with 2 expert child development consultants not affiliated with the study: 1 developmental behavioral pediatrician with more than 30 years of clinical and intervention development experience and a second developmental behavioral pediatrician that has written extensively about child developmental assessments and promotion in clinical settings.

Study Selection

Initial search terms were intentionally broad; therefore, 1 investigator (E.P.-C.) screened the initial list of titles to exclude clearly irrelevant studies. Two investigators

independently screened abstracts of all potentially relevant titles (E.P.-C. and K.I.) using inclusion and exclusion criteria listed above to identify studies for full text review. The investigators resolved disagreements by consensus, reviewing full-text articles and involving a third investigator as needed.

Data Abstraction and Levels of Evidence

Data were abstracted from full-text articles by K.I. by using a structured form that included information on intervention delivery (content, frequency, duration, person implementing, location, specific developmental focus, and cost), study design, child age, sample size, study population, outcome measures (child or parent outcomes), and findings. Abstracted data were verified and checked for consistency by a separate abstractor (E.P.-C.). Two reviewers (E.P.-C. and K.I.) independently assessed the levels of evidence of the studies using a clinically relevant quality rating scheme modified from the Oxford Centre for Evidence-Based Medicine Levels of Evidence.¹⁴ Levels of evidence are classified as follows: level 1, properly powered and conducted randomized clinical trials; level 2, well-designed controlled trial without randomization, prospective comparative cohort trial; level 3, case-control studies, retrospective cohort studies; level 4, case series with or without intervention, cross-sectional study. Disagreements regarding level of evidence scores were resolved through discussion and consensus.

RESULTS

Description of Study Selection

Initial searches yielded 7605 titles from all search engines. Of these, 528 abstracts (411 from PubMed and 117 from PsychInfo) were retained, with an additional 40 abstracts

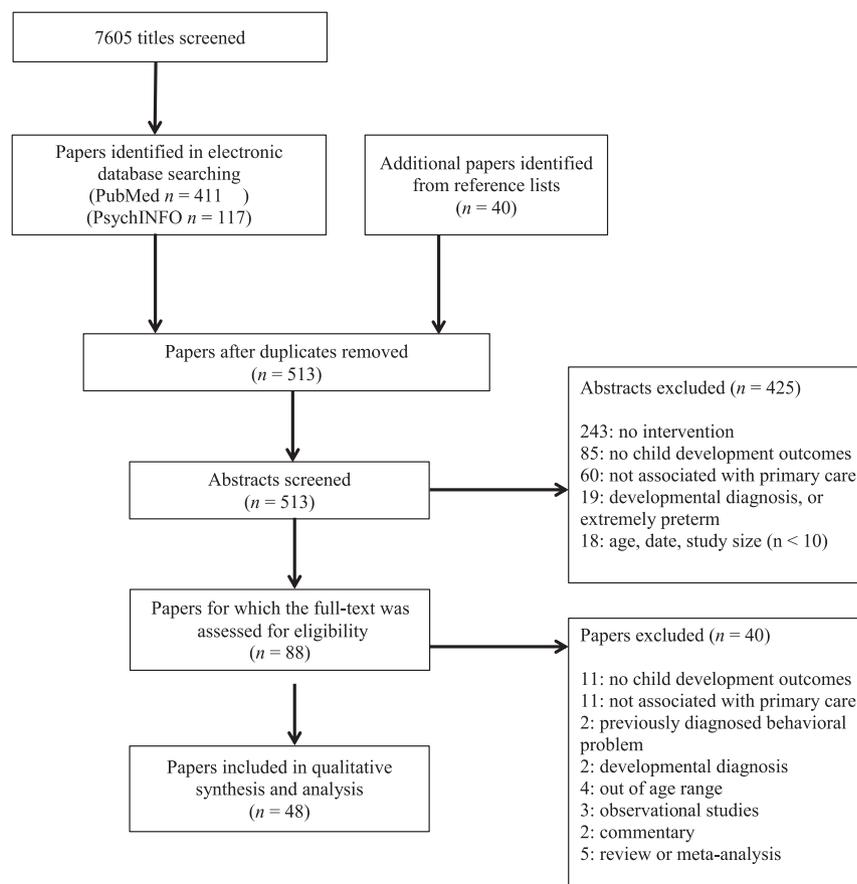


FIGURE 1

Flowchart for search results through February 14, 2017.

identified from reference lists. After the removal of 55 duplicate articles, 513 abstracts were reviewed for inclusion and/or exclusion criteria (Fig 1). Four-hundred and twenty-five articles were excluded during abstract review, resulting in the full-text review of 88 articles. Forty articles were excluded on full-text review, yielding 48 articles in which 24 interventions were described that met all inclusion and exclusion criteria.

Intervention Description

Interventions were conducted in 12 different countries: United States, Australia, China, Holland, Canada, Norway, Turkey, Chile, Jamaica, Antigua, St. Lucia, and Iran. Interventions identified in this review could be grouped in 3 broad categories on the basis of the described intervention “focus” as

summarized in Tables 1 through 3: (1) general developmental support, such as language, social, gross and fine motor development (9 interventions, 20 studies); (2) general behavioral development, such as managing negative child behaviors through developing positive disciplinary strategies (8 interventions, 19 studies); and (3) specific developmental topics (topic specific), including infant colic and reading aloud to children (7 interventions, 9 studies). Descriptions of interventions are found in Tables 1, 2, and 3, which include the intervention components, the “dose” of the intervention, the developmental focus of the intervention, who administered the intervention, the cost when available, and the connection to primary care.

TABLE 1 Summary and Description of General Developmental Support Interventions (*n* = 9)

Intervention	Brief Description	Focus	Delivery
VIP	Videotaping and covieing parent-child interaction followed by discussion, developmentally age appropriate toy, and written material	Discussion of developmental concerns, review of video to identify strengths and potential areas of improvement, provide age-appropriate learning material	12 sessions, 30–45 min Delivered by: child development specialist Primary care Cost: \$150–240 per child per year Primary care: delivered in the primary care clinic during well-child visits
BB	Age-specific newsletter mailed once per mo with developmentally age-appropriate toy and parent-completed developmental questionnaires	Support of verbal interactions in the context of pretend play, shared reading, and daily routines	Delivered by: not applicable, materials only Cost: \$75 per child per year Primary care: materials sent to patients by the primary care clinic and contacted family if questionnaires suggested possible delay
HS	Meeting with developmental specialist, phone lines for questions; written material, parenting groups	Developmental, behavioral, and psychosocial aspects of care	9 enhanced well-child visits and 6 home visits in the first 3 y Delivered by: child development specialist Cost: \$400–\$933 per child Primary care: delivered in the primary care clinic during well-child visits
HS + PP	Meeting with developmental specialist, phone support, and screening for risk factors (smoking, depression, domestic violence)	Education and preparation for changes in pregnancy and newborn period, identify risk in pregnant mothers	3 home visits during pregnancy and HS Delivered by: child development specialist Primary care: HS components delivered in the primary care clinic during well-child visits
CFD	Structured interview and counseling during an acute health visit and 1 wk follow-up visit ¹⁵ Discussion based on counseling guidelines, modeling, practice with feedback, and written material ¹⁶	Enhancement of caregiver-child interactions and home environment in resource-limited settings, introducing forms of play, communication, homemade toys, and reading aloud	2 sessions, 30 min ¹⁵ 2 sessions, 30–60 min ¹⁶ Delivered by: physician or other health professional Primary care: delivered in clinics or by health professionals
Touchpoints	Sessions with a parent coach, phone support, Ages and Stages Questionnaire activity-based system, video vignettes, and modeling child interactions	Strengthening of parent-health provider relationship, educate about nonharsh parent-child interactions, and increase use of community resources	Clinic and home visits from birth to 18 mo Delivered by: “parent coach” (bilingual college-educated in child development) Primary care: mentoring by social worker and nurse from the primary care office
POC	Group sessions (15 dyads per group), home visits, and in-depth interviews for parents of children aged 0–4 y	Strengthening positive caregiver-child interaction in learning activities and play; promote comprehensive socioemotional, motor, language, and cognitive development; enhance parenting skills and knowledge; and foster networks among caregivers	Weekly group sessions, 2.5 h Delivered by: “community monitors” with support from physicians, psychologists, and teachers Primary care: sessions held in health center, support from physicians, psychologists
Parenting intervention	Shown short videos (9 modules, 3 min each), discussed and encouraged mother to practice activity shown in video (~16 min), health provider reinforced messages, gave written materials, a book, and a puzzle	Illustration of mothers doing parenting behaviors considered central to promoting child development	5 brief sessions in waiting rooms Delivered by: community health worker and nurse Primary care: delivered in the primary care clinic during routine health maintenance visits
SDP	Modeling for parents how a toy can facilitate talking or playing with their child. Parents observed and feedback provided on their interaction introducing the new toy.	Informed by social cognitive theory, promoting observational learning, resources to engage in behaviors, and concrete strategies in addition to knowledge provision	8 sessions from 2–24 mo of age, 10–15 min in waiting room Delivered by: existing clinical staff, nonprofessionals, or volunteers Primary care: delivered in the primary care clinic waiting room

General developmental interventions included the Video Interaction Project (VIP),^{17–23} Building Blocks (BB),^{19–21,23} Healthy Steps (HS),^{24–28} HS plus PrePare (PP),^{15,29} Care For Development (CFD) Intervention,^{16,30} Touchpoints,³¹ Play with

Our Children (POC),³² Parenting Intervention,³³ and Sit Down and Play (SDP).³⁴ VIP and HS were the 2 most intensive interventions involving additional meetings with child development specialists at each well-child visit from birth to age 3 years.

VIP sessions included videotaping the parent and child during a play interaction followed by review and coaching of the interaction with the specialist at a cost of \$150 to \$240 per child per year. BB provided a monthly newsletter and age-specific

TABLE 2 Summary and Description of General Behavioral Development Interventions (*n* = 8)

Intervention	Brief Description	Focus	Delivery
IY	Group sessions (8–12 parents, group discussions after video vignettes, modeling, role play, and parent homework)	Nurture parenting through play, praise, rewards, limit setting, managing misbehavior	6–10 weekly group sessions, 2 h Delivered by: clinical psychologist and 1 pediatric staff (RN, MD, LCSW, NP) Primary care: delivered at primary care clinics or public health centers
Triple P	Level 1: universal parent information strategy that provides all interested parents with access to useful information via pamphlets and electronic media Level 2: 2 sessions in clinic, early anticipatory developmental guidance, video, and pamphlets Level 3: 4 sessions in clinic, 30 min, for children with mild to moderate behavioral difficulties Level 4: 8–10 sessions, 2 h, individual, group, or self-directed parent training program for children with more severe behavioral difficulties Level 5: 12 sessions, 1–2 h, enhanced behavioral family intervention program when behavior is complicated by other sources of family distress	(1) enhance parental knowledge and resourcefulness; (2) promote nurturing, low-conflict environments for children; (3) promote children’s social, emotional, and intellectual competencies through positive parenting practices	Delivered by: child development specialist, psychologist, or physician Primary care: delivered in primary care clinics or health centers
PCIT	Compared group sessions (2–4 dyads) and homework reinforcing skills versus providing the same information in written packets	Praise for positive behavior and not giving any attention to negative behavior	4 weekly group sessions, 1.5 h Delivered by: PCIT-trained therapist and the children with research assistant Primary care: delivered in primary care clinic waiting room after hours
Universal parenting program/toddlers without tears	Individual sessions with health care provider, handouts describing normal child development	Education regarding unreasonable expectations, harsh discipline, and nurturing parenting	3 sessions, 2 h Delivered by: health care provider and a parenting expert Primary care: delivered by physician separate from usual clinic visits
Webster-Stratton	Group sessions (10 parents per group), videos, group discussion, role play, homework	Improvement of parent-child interactions, limit setting, ignoring undesired behavior, praise, reward, follow through on discipline plans	10 weekly group sessions, 2 h Delivered by: trained health visitors or nurses Primary care: delivered at health centers
Family Foundations	Group psycho-educational sessions (5 prenatal, 4 postnatal, 8–12 couples per group)	Coparental conflict resolution, problem solving, and communication	9 group sessions, 2–3 h Delivered by: trained male and female facilitators Primary care: delivered at health center
eZParent	Modules on an android tablet, adapted from the Chicago parent program group sessions, includes video vignettes, knowledge questions, and interactive games	Evidence-based strategies to encourage good behavior and decrease misbehavior in children aged 2–5 y	6 modules, 1 h Delivered by: electronic device Primary care: delivered in large urban primary care pediatric clinic
PriCARE	Weekly group sessions (6–8 parents), includes role-play and homework	Trauma-informed positive parenting, prosocial behaviors, giving effective commands. Informed by attachment and social learning theories and based in PCIT techniques	6 weekly group sessions, 1.5 h Delivered by: 2 licensed mental health professionals Primary care: delivered in conference room at primary care clinic

LCSW, Licensed Clinical Social Worker; MD, Doctor of Medicine; NP, Nurse practitioner; RN, registered nurse.

toy to families at a lower cost (\$75) and was studied as part of a 3-arm randomized controlled trial (RCT) with VIP. HS clinic sessions offered parents an opportunity to discuss developmental concerns with a child development specialist as well as

home visits, phone support, written material, and parenting groups. PP was an addition to HS providing 3 home visits during pregnancy. HS cost between \$400 and \$933 for 11 well-child visits and 2 home visits over 2.5 years. Touchpoints included

similar services (clinic and home visits, phone support) delivered from birth to 18 months of age by a “parent coach” with college-level education in child development. CFD, developed by the World Health Organization and the United Nations

TABLE 3 Summary and Description of Specific Developmental Topic Interventions (*n* = 7)

Intervention	Brief Description	Focus	Delivery
Family-centered treatment (colic)	Individual sessions, developed IFTP	Identification of potential causes of and responses to infant colic, develop coping mechanisms to deal with crying	3 sessions within 6 wk Delivered by: pediatrician and mental health specialist Primary care: delivered in the primary care clinic
BBP (colic)	Booklets and video mailed to parents, optional phone call and group parenting session	Development of a tailored management plan to address infant crying	25 min video, 1 group session 1.5 h Delivered by: maternal child health nurses Cost: \$60 Primary care: overseen by pediatrician at respective health centers
THB (colic)	Video for parents describing the best way to calm their infant on the basis of a step-wise approach beginning with feeding, then holding, changing, swaddling, side-laying, swaying, exposing to white noise, and then pacifier	Strategies to soothe crying infant	30 min video Delivered by: multimedia video Primary care: delivered in community hospitals on the newborn nursery, assume cared provided by general pediatricians
Infant massage (colic)	Mothers learned to administer infant massage during 1 session, then massaged infants once during the day and once at night before sleeping. Control group was rocked gently for 5–25 min	Infant massage for soothing	1 session, daily massage 15–20 min Delivered by: training by expert in infant massage, massage administered by mothers Primary care: training provided in clinic
Literacy promoting intervention (reading)	Families given an age appropriate book and written handout explaining benefits of reading to children	Child literacy and parent-child interactions	Each well-child visit from 6–18 mo Delivered by: pediatric providers Primary care: delivered in the primary care clinic during well-child visits
ROR (reading)	Reading demonstrations of age-appropriate books, anticipatory guidance, written material, and age-appropriate book written in English	Child literacy and parent-child interactions	Each well-child visit from 6 mo to 6 y Delivered by: volunteer (demonstration) and physician (anticipatory guidance) Primary care: delivered in the primary care clinic waiting rooms
ROR + M	Modeling how parents could use a developmentally appropriate book to engage the child in mathematics activities around specific concepts (discriminating small numbers of objects, counting, simple arithmetic, geometry, spatial thinking) by using mathematical language and written handout focused on each concept	Child literacy, parent-child interactions, and promotion of basic math skills	1 session at a well-child visit Delivered by: pediatric residents Primary care: delivered in the primary care clinic

BBP, Baby Business Program; IFTP, Individualized Family Treatment Plan; THB, The Happiest Baby.

Children’s Fund and officially called the Care for Child Development intervention, provided a picture card and guides for clinicians to share with parents to discuss the importance of developmentally appropriate play, home-made toys, communication, and reading. POC offered group sessions by “community monitors” as well as home visits and in-depth interviews from birth to age 4 years. The Parenting Intervention and SDP were 2 brief interventions delivered in waiting rooms for 10 to 15 minutes by community health workers or paraprofessional volunteers.

General behavioral interventions included Incredible Years (IY),^{35,36} Positive Parenting Program (Triple P),^{37–45} Parent-Child Interaction Therapy (PCIT),⁴⁶ Universal Parenting Program (also called Toddlers without Tears),^{47,48} Webster-Stratton,^{49,50} Family Foundations,⁵¹ ezParent,⁵² and PriCARE.⁵³ Triple P was the most widely disseminated and studied program, which included 9 publications from 4 different countries. Triple P had 5 levels of intervention intensity designed to match the severity of the child’s behavioral problems (Table 2).

With increasing Triple P levels, the total number of sessions as well as length of sessions increased. The Webster-Stratton intervention, IY, and PriCARE were among the more intensive group-based parenting programs involving ~10 parents in 6 to 10 sessions delivered by child psychologists or pediatric staff, including role play, homework, and group discussion. PriCARE adapted a trauma-informed program called Child-Adult Relationship Enhancement⁵⁴ on the basis of principles and techniques derived from PCIT for the primary care setting. PCIT and the Universal

Parenting Program required fewer sessions (3–4) ranging from 1.5 to 2.5 hours. Family Foundations included psycho-education for coparents to resolve conflicts between parents beginning prenatally. EzParent was the only behavioral intervention that was entirely delivered via an electronic device, adapting a parenting group curriculum into 6 multimedia interactive modules.

The topic-specific interventions included 4 interventions for colic (Family-Centered Treatment,⁵⁵ Baby Business Program,⁵⁶ The Happiest Baby,⁵⁷ and Infant Massage⁵⁸) and 3 interventions to promote reading aloud (Literacy Promotion Intervention,⁵⁹ Reach Out and Read [ROR],^{6,60,61} and Reach Out and Read plus Mathematics [ROR + M]⁶²). The 4 colic interventions varied greatly in intensity from development of individualized family treatment plans designed by a pediatrician and mental health specialist (Family-Centered Treatment) to multimedia videos with optional discussion (Baby Business Program and The Happiest Baby) as well as infant massage. ROR is a well-studied program to promote child literacy during well-child visits, also previously described in Regalado and Halfon's⁴ review. The authors of 2 additional studies completed after 1999 evaluated the intervention through a quality improvement evaluation across 10 states in the United States.^{6,60} The authors of a third study modified the intervention to teach specific math topics.⁶² A literacy intervention similar to ROR evaluated the impact of reading aloud on receptive and expressive language development.⁵⁹

Sample Composition

The authors of the studies included in this review recruited participants from varying socioeconomic backgrounds, ethnicities, and nationalities. VIP involved primarily low-income and Spanish-speaking participants in the United States,

a large proportion of which did not receive education beyond the seventh grade. HS studies included 15 primary care sites across the United States.^{25–27} Three interventions (CFD, POC, and the Parenting Intervention) were studied solely in low- or middle-income countries. In contrast to the general developmental interventions, behavioral interventions tended to target participants on the basis of behavioral concerns rather than demographic factors. The researchers for IY,^{35,36} Webster-Stratton,^{49,50} and PriCARE⁵³ studies enrolled children that scored above a certain threshold on behavioral assessments or whose parents reported concerns regarding their child's behavior. Triple P tailored the intervention intensity on the basis of the severity of the child's behavioral problems.

Levels of Evidence

General developmental interventions were primarily conducted as quasi-experimental study designs, with the exception of the VIP and the Parenting Intervention studies in which RCTs were employed (Table 4). Sample sizes ranged from 50 at a single site³¹ to >3000 study participants in 10 sites.^{25,26} All of the general behavioral interventions were evaluated by at least 1 RCT (Table 5). For topic-specific studies, RCT study design was employed in colic interventions, whereas observational cohorts or cross-sectional comparisons with historical controls were used in the literacy studies (Table 6). All Levels of Evidence scores are reported in Tables 4 through 6.

Outcomes

General Developmental Support

Among the general developmental interventions, cohorts enrolled in HS and VIP experienced fewer cases of developmental delay compared with control groups at 12 months²⁸ and 3 years, respectively.^{17,18} The effects

of VIP on child development were more pronounced among children of mothers with seventh to 11th grade educations in 1 study^{17,18} and for mothers with a literacy level of ninth grade or higher in a second study.¹⁹ VIP also resulted in decreased hyperactivity and externalizing behaviors.²³ HS and PP resulted in a reduction in child aggressive behavior at 30 months of age measured by the Child Behavior Checklist (CBCL).^{15,29} No difference in child behavior was detected with HS alone. CFD resulted in improved adaptive, language, and social development 6 months postintervention.³⁰ Touchpoints was associated with significant improvement in child language development (expressive and receptive) measured by the MacArthur Communicative Development Inventories at 16 months of age.³¹ The Parenting Intervention was associated with significantly improved cognitive development (Griffith Mental Development Scale), but not specifically language development.³³

Multiple studies reported significant changes in both parenting behaviors and psychological well-being. Parents enrolled in the VIP,¹⁹ BB,¹⁹ HS,^{25,26} CFD,¹⁶ and SDP³⁴ interventions engaged in educational activities (such as reading) at significantly higher levels compared with control groups. The overall quality of the home environment improved among families enrolled in VIP and BB at 6 months of age.¹⁹ HS,²⁴ Touchpoints,³¹ and POC³² were associated with greater parental sensitivity and higher quality parent-child interactions. Parents enrolled in VIP reported significantly reduced stress and depressive symptoms compared with controls.²² One study in which HS and PP were evaluated revealed an increase in parental depressive symptoms and a decrease in parenting satisfaction among the intervention group at 30 months.^{15,29}

TABLE 4 General Developmental Support Interventions: Results and Levels of Evidence

Intervention Reference	Study Design	Sample Size, Location	Age, Specific Population	Levels of Evidence	Effect	Child Outcomes	Parent Outcomes
VIP, Mendelsohn et al ^{17,18}	RCT	N = 99, New York, NY	Birth to 36 mo low income families, mostly Hispanic	1	Significantly fewer cases of developmental delay (BSID). No change in language (PLS-3) or behavior (CBCL) at 21 and 33 mo of age.	Significantly reduced parenting stress (PSI-SF) and improved parental teaching (PIDA), no change in depression (GES-D) or the home environment (StimQI) at 33 mo of age	
VIP	3-arm RCT	N = 410, New York, NY	Birth to 36 mo low income families, mostly Hispanic	1	Improved attention at 24 mo, decreased hyperactivity and externalizing behaviors at 36 mo of age	Improved quality of the home environment (StimQI) and increased time spent reading (reading diary) at 6 mo of age	
Mendelsohn et al ¹⁹ Berkule et al ²⁰						Reduction in mild and moderate depressive symptoms (PHQ-9) at 6 mo of age Decreased parenting stress (PSI-SF) At 6, 24, and 36 mo	
Canfield et al ²¹ Cates et al, ²² Weisleder et al ²³						Less harsh discipline at 24 mo of age Improved quality of the home environment (StimQI) at 6 mo of age	
BB, Mendelsohn et al, ¹⁹ Berkule et al ²⁰	3-arm RCT	N = 410, New York, NY	Birth to 36 mo low income families, mostly Hispanic	1	No difference in attention or imitation play at 24 mo	Increased no. reading instances per day (reading diary) Reduction in mild depressive symptoms (PHQ-9) at 6 mo of age No change in harsh discipline at 24 mo Greater parental sensitivity (NCAST), less harsh discipline, and higher quality parenting interactions (P/GIS) at 34–37 mo. No difference in the home environment (HOME) Less severe discipline and greater reported reading activities with child at 62 mo. Greater ignoring child misbehavior at 36 mo, but not at 62 mo	
Canfield et al, ²¹ Weisleder et al ²³						None reported	
HS, Caughy et al ²⁴	RCT	N = 378, Southeast and Southwest, United States	Birth to 36 mo	1	No differences in behavior (OBCL) at 34–37 mo of age	None reported	
HS	RCT 6 sites, quasi-experimental 9 sites	N = 3165, United States	Birth to 36 mo	2	No significant difference in aggressive or anxious behavior (CBCL)	None reported	
Minkovitz et al ^{25,26} Zuckerman et al ²⁷ HS, Niederman et al ²⁸	Cohort	N = 363, Chicago, IL	Birth to 36 mo	3	At 36 mo of age Significantly fewer cases of developmental delay (chart review) at 12 mo postintervention	None reported	

TABLE 4 Continued

Intervention Reference	Study Design	Sample Size, Location	Age-Specific Population	Levels of Evidence	Effect	Child Outcomes	Parent Outcomes
HS + PP, Johnston et al ^{15,29}	3-arm quasi-experimental	N = 439, Pacific Northwest, United States	Birth to 36 mo mostly higher income families	2	Reduced aggressive behavior (CBCL) at 30 mo postintervention	Reduced aggressive behavior (CBCL) at 30 mo postintervention	Reduced maternal depression symptom scores (CES-D) at 3 mo but higher depression scores and lower parent satisfaction (PSOC) among intervention group at 30 mo
CFD, Ertem et al ¹⁶	Sequentially conducted control trial	N = 233, Ankara, Turkey	Birth to 23 mo low to middle income families	2	None reported	No difference in language development (MCDI) or anxious behavior (CBCL) at 3 or 30 mo postintervention	No difference in nurturing interactions, parent self-efficacy (PSOC)
CFD, Jin et al ⁵⁰	Quasi-experimental	N = 100, Anhui, China	Birth to 24 mo low income families, rural	2	Improved adaptive, language and social development (GS) 6 mo postintervention	Improved adaptive, language and social development (GS) 6 mo postintervention	Increased no. of family made toys, RR = 4.0 (2.3, 7.1), and reading to child, RR = 5.6 (2.0, 15.8), at 1 mo postintervention. No difference in quality of the home learning environment (HOME)
Touchpoints, Farber ³¹	Quasi-experimental	N = 50, Washington, DC	Birth to 18 mo low income families	2	No difference in motor development	Improved receptive and expressive language development (MCDI) at exit (average age 16 mo)	Greater positive parenting (AAP) and resilience scores (RAS) at exit (average age 16 mo)
P0C, Brahm et al ³²	Quasi-experimental	N = 102, Santiago, Chile	2–23 mo low income families	2	None reported	None reported	Decreased maternal stress (PSI-SF) for children <12 mo of age, increased maternal sensitivity (Q-Sort) for children aged 12–23 mo. No difference in maternal depression (PHQ-9) immediately after intervention
Parenting intervention, Chang et al ⁵³	Cluster RCT	N = 501, Jamaica, Antigua, St. Lucia	3–18 mo	1	Improvement in cognitive development score (GMDS) at 18 mo of age	Improvement in cognitive development score (GMDS) at 18 mo of age	Improved parenting knowledge, no change in parenting behaviors (HOME) at 18 mo of age. No change in maternal depressive symptoms (CES-D) at 18 mo of age
SDP, Shah et al ³⁴	Prospective cohort study	N = 30, Chicago, IL	6–12 mo low income families, African American or Hispanic	2	None reported	No difference in language development (GDI) at 18 mo of age	Improved parental verbal responsiveness, and parental involvement (StimQ) at 4 wk postintervention

AAP, Adult-Adolescent Parenting Inventory; BSID, Bayley Scales of Infant Development; CDI, Communicative Development Inventory; CES-D, Center for Epidemiologic Studies-Depression Scale; GMDS, Griffith Mental Development Scale; GS, Gesell Scale; HOME, Home Observation for Measurement of the Environment; MCDI, MacArthur Communicative Development Inventories; NCAST, Nursing Child Assessment by Satellite Training; P/CIS, Parent/Caregiver Involvement Scale; PHQ-9, Patient Health Questionnaire-9; PIDA, Parental Involvement in Developmental Advancement; PLS-3, Preschool Language Scale-3; PSI-SF, Parenting Stress Index-Short Form; PSOC, Parenting Sense of Competence Scale; RAS, Resiliency Attitude Scale; RR, relative risk; StimQ, a validated interview-based instrument for measurement of a family's cognitive home environment; StimQI, StimQI Infant; StimQT, StimQ Toddler.

TABLE 5 General Behavioral Development Interventions: Results and Levels of Evidence

Intervention, Reference	Study Design	Sample Size, Location	Age, Specific Population	Levels of Evidence	Effect	Child Outcomes	Parent Outcomes
IY, Reedtz et al ³⁵	RCT	N = 186, Tromsø, Norway	2–8 y Mean age: 3.9 y High behavioral intensity	1	Decrease in behavior intensity (ECBHS) immediately after intervention, no difference at 12 mo postintervention	Reduced use of harsh discipline (PP), improved positive parenting (PP), parent satisfaction at 12 mo postintervention	No difference in parenting self-efficacy (PSOC)
IY, Perrin et al ³⁶	RCT and direct assignment	N = 173, Greater Boston area, United States	2–4 y	1	Reduced behavior problems and intensity (ECBHS) at 6 and 12 mo postintervention	Reduced observed negative parent-child interaction—supportiveness/nurturing (DPICS-R) and reduced self-reported negative parenting (PS) at 12 mo	Reduced observed negative parenting (PSOC)
Triple P level 2 & 3, McConnell et al ³⁷	Quasi-experimental	N = 923, Alberta, Canada	Birth–11 y, mean age: 2.8 y	2	None reported	No difference in observed disruptive behavior (DPICS-R)	No difference in observed negative parenting—parent negativity/hostility (DPICS-R) at 12 mo postintervention
Triple P level 3, Turner and Sanders ³⁸	RCT	N = 30, Brisbane, Australia	2–6 y, mean age: 3.3 y Family requesting advice	1	Reduced behavior problems (PDR, ECBI-PS, HCPO), intensity (ECBHS) at 6 mo postintervention No difference in child disruptive behavior (FOS)	Reduced behavior problems (PDR, ECBI-PS, HCPO), intensity (ECBHS) at 6 mo postintervention No difference in child disruptive behavior (FOS)	No significant difference in personal distress or child rearing distress (PSI-SF), or family functioning (NLSY) at 8–12 wk postintervention Improved discipline style (PS) and satisfaction (PSOC) at 6 mo postintervention No difference in parent self-efficacy (PCOS), positive parenting (FOS), maternal depression, anxiety, or stress (DASS)
Triple P level 3, McCormick et al ³⁹	RCT	N = 101, Seattle, WA	1.5–12 y	1	No difference in child behavior (CBCL) at 3 mo postintervention.	No difference in child behavior	No difference in discipline (GDS), parent satisfaction or self-efficacy (PCOS) at 3 mo postintervention
Triple P level 4, Leung et al ⁴⁰	RCT	N = 69, Hong Kong, China	Mean age: 4.8 y 3–7 y Mean age: 4.2 y	1	Improved behavior problems (PDR, ECBI-PS), intensity (ECBHS), conduct, emotion, hyperactivity, and peer interactions (SDQ) immediately after intervention	Improved behavior problems (PDR, ECBI-PS), intensity (ECBHS), conduct, emotion, hyperactivity, and peer interactions (SDQ) immediately after intervention	Improved self-reported discipline style (PS), parent satisfaction, self-efficacy (PCOS), and marital health (RQ) immediately after intervention

TABLE 5 Continued

Intervention, Reference	Study Design	Sample Size, Location	Age, Specific Population	Levels of Evidence	Effect	Parent Outcomes
Triple P level 4, Leung et al ⁴¹	Cohort study	N = 480, Hong Kong, China	3 y old low income families, child behavior problem	3	Improved behavioral intensity (ECBI) immediately postintervention	Improved parental satisfaction, self-efficacy (PSOC), decreased parenting stress (PSI) and depression, anxiety or stress symptoms (DASS) immediately postintervention
Triple P level 4, Zubrick et al ⁴²	Quasi-experimental	N = 1610, Western Australia	36–48 mo	2	Improved behavior intensity (ECBI-IS) at 12 and 24 mo postintervention	Improved self-reported discipline style (PS), mental health (DASS), parental conflict due to parenting (PPC), and marital health (ADAS) at 12 and 24 mo postintervention
Triple P level 4 and 5, Sanders et al ^{43,44}	4 arm RCT No control beyond 15 wk	N = 305, Brisbane, Australia	Mean age: 45 mo 36–48 mo	2	Improved disruptive behavior (PDR) and behavioral intensity (ECBI) at 12 mo and 3 y postintervention. No difference between treatment groups	Improved parent competence (PCOS), discipline (PS), and marital conflict at 3 y. No difference at 12 mo postintervention
Triple P level 4 and 5, Cann et al ⁴⁵	Cohort study	N = 589, Melbourne, Australia	Mean age: 41 mo Low income families, high behavioral intensity	3	Improved behavioral intensity and reduced behavior problems (ECBI) immediately postintervention.	No difference in depression, anxiety, or stress (DASS) for mothers or fathers at 12 mo postintervention
Parent-child interaction theory, Berkovits et al ⁴⁶	RCT	N = 30, Gainesville, FL	1–15 y, mean age: 4.5 y 3–6 y	1	Improved behavior intensity (ECBI-IS) at 6 mo postintervention	Reduction in dysfunctional parental styles (PS), improved parental satisfaction and self-efficacy (PCOS), improved depression, anxiety, and stress symptoms (DASS) immediately postintervention
Universal parenting program/toddlers without tears, Hiscock et al, ⁴⁷ Bayer et al ⁴⁸	Cluster RCT	N = 733, Melbourne, Australia	8 mo	1	No difference in externalizing or internalizing behaviors (CBCL) at 10, 16, or 28 mo of age	Improved self-reported confidence (PLOC-SF) and discipline style (PS) at 6 mo postintervention. Decreased unreasonable expectations (PBC) at 16 and 28 mo. Decreased harsh discipline (PBC) at 16 mo, but not at 28 mo of age
Webster-Stratton, Patterson et al, ⁴⁹ Stewart-Brown et al ⁵⁰	RCT	N = 116, Oxford, England	2–8 y Mean age: 4.6 y	1	Decreased behavior and conduct problems (SDQ) at 6 mo, but not at 12 mo postintervention. No difference in behavior intensity (ECBI-IS), emotion, hyperactivity, or peer interaction	No difference in nurturing behaviors (PBC), maternal depression, anxiety, or stress (DASS) Reduction in depressive symptoms (GHQ) at 12 mo postintervention

TABLE 5 Continued

Intervention, Reference	Study Design	Sample Size, Location	Age, Specific Population	Levels of Evidence	Effect	Parent Outcomes
Family Foundation, Feinberg et al ⁵¹	RCT	N = 399, United States	Child behavior problem Birth to 10 mo middle class, mostly white	1	Improved parent reported soothing, decreased night waking at 10 mo of age	No difference in total mental health scores (GHQ) or parenting stress (PSI) Improved positive coparenting and communication (observed), and quality of marriage (QMI), decreased depression (CES-D), and anxiety symptoms (PSWQ) at 10 mo of age
ezParent, Breitenstein et al ⁵²	RCT	N = 79, Chicago, IL	2–5 y low-income families, mostly African American or Latino	1	No difference in child behavior (ECBI) at 6 mo postintervention	No difference in parenting behavior (PQ), self-efficacy (TCQ), or stress (PSI-SF) at 6 mo postintervention
PriCARE, Schilling et al ⁵³	RCT	N = 120, Philadelphia, PA	2–6 y	1	Decreased behavior problems (ECBI) at 7 wk post intervention	Increased parental empathy (AAP/2) and decreased harsh discipline at 7 wk postintervention
			Mean age: 4.3 y Low income, child behavior problem			

AAP/2, Adult Adolescent Parenting Inventory – 2; ADAS, Abbreviated Dyadic adjustment scale; CDS, Child Discipline Survey; CES-D, Center for Epidemiologic Studies-Depression Scale; DASS, Depression-Anxiety-Stress Scale; DPICSR, Dyadic Parent-Child Interactive Coding System—Revised; ECB-IS, Eyberg Child Behavior Inventory-Problem Scale; ECBI-PS, Eyberg Child Behavior Inventory-Problem Scale; FOS, Family Observation Schedule; GHQ, General Health Questionnaire; HCPC, Home and Community Problem Checklist; NLSOY, National Longitudinal Survey of Children and Youth; PBC, Parent Behavior Checklist; PDR, Parent Daily Report; PLOC-SF, Parenting Locus of Control Short Form; PPC, Parent Problem Checklist; PPI, Parenting Practices Interview; PQ, Parenting Questionnaire; PS, Parenting Scale; PSI, Parenting Stress Index; PSI-SF, Parenting Stress Index Short Form; PSOC, Parenting Sense of Competence; PSWQ, Penn State Worry Questionnaire; QMI, Quality of Marriage Index; ROI, Relationship Quality Index; SDQ, Strength and Difficulty Scale; TCQ, Toddler Care Questionnaire.

General Behavioral Development

Four interventions resulted in decreased behavioral intensity between 2 and 24 months after the intervention: IY,^{35,36} Triple P levels 3 and 4,^{38,40–45} PCIT,⁴⁶ and PriCARE.⁵³ Children engaged in the Webster-Stratton intervention exhibited fewer behavioral problems at 6 months, but this difference did not persist at the 12-month follow-up.^{49,50} The Universal Parenting Program^{47,48} and ezParent⁵² did not result in any difference in child behavior between the intervention and control groups.

A number of the behavioral interventions also affected parenting behaviors and psychological outcomes. IY resulted in improved positive parenting behaviors 12 months postintervention,^{35,36} and multiple interventions (IY, Triple P level 3 and 4,^{38,40,42} PCIT,⁴⁶ and PriCARE⁵³) led to reductions in the use of harsh discipline. Parental satisfaction,^{35,40,41} self-efficacy,^{40,41,43,44} or confidence⁴⁶ improved significantly with 3 different interventions, and marital health improved with Triple P^{40–42} and Family Foundations.⁵¹ Although in most studies assessed parent mental health, only the Webster-Stratton^{49,50} intervention and Family Foundations⁵¹ were associated with a reduction in depressive symptoms beyond 10 months postintervention.

Specific Developmental Topic

All 3 interventions designed to address infant colic revealed improvement in colic symptoms in short-term follow-up, but they resulted in mixed results beyond 2 months postintervention (Table 6). The Baby Business Program was also associated with lower maternal depressive symptom scores at 6 months postintervention.⁵⁶ In contrast, The Happiest Baby video was associated with higher parental stress scores at 12 weeks postintervention.⁵⁷

TABLE 6 Specific Developmental Topic Interventions: Results and Levels of Evidence

Intervention, Reference	Study Design	Sample Size, Location, Age	Age, Specific Population	Levels of Evidence	Effect	Child Outcomes	Parent Outcomes
Family-centered treatment, Salisbury et al ⁵⁵	RCT	N = 62, United States	4–8 wk Infants with colic, mostly white	1	Decreased child crying (h/d) at 6 wk and time spent feeding at 6 and 10 wk postintervention	Decreased child crying (h/d) at 6 wk and time spent feeding at 6 and 10 wk postintervention	No difference in maternal depressive symptoms (BDI) or stress (PSI) at 6 or 10 wk postintervention
BBP, Hiscock et al ⁵⁶	RCT	N = 770, Melbourne, Australia	4–13 wk High income families	1	No difference in total h of sleep per d Decreased crying severity at 4 mo of age and fewer changed formula at 6 mo of age. No difference in sleep problems or duration	No difference in total h of sleep per d Decreased crying severity at 4 mo of age and fewer changed formula at 6 mo of age. No difference in sleep problems or duration	Decreased maternal doubt at 4 mo of age, and depressive symptoms at 6 mo of age
THB, McRury and Zolotor ⁵⁷	RCT	N = 35, Columbus, OH	Newborn middle to high income families	1	No difference in crying (h/d) or sleep (h/d) at 6 or 12 wk of age	No difference in crying (h/d) or sleep (h/d) at 6 or 12 wk of age	Greater parental stress (PSI) in the intervention group at 12 wk of age
Infant massage, Sheidaei et al ⁵⁸	RCT	N = 100 Iran	<12 wk	1	Decrease severity of colic (VAS), duration of crying (min/d), and increased duration of sleep (min/d) 1 wk postintervention	Decrease severity of colic (VAS), duration of crying (min/d), and increased duration of sleep (min/d) 1 wk postintervention	None reported
Literacy promoting intervention, High et al ⁵⁹	RCT	N = 205, United States	5–11 mo low income, multiethnic families	1	Increased receptive vocabulary in children 13–17 mo of age, expressive vocabulary in children 18–25 mo of age (MCDI-SF)	Increased receptive vocabulary in children 13–17 mo of age, expressive vocabulary in children 18–25 mo of age (MCDI-SF)	Increased frequency of reading at bedtime (d/wk) at mean age of 18 mo
ROR, Silverstein et al ⁶⁰	Pre/post quality improvement	N = 173, Seattle, WA	5.5 mo–6 y	4	Greater report of reading as favorite activity immediately after intervention	Greater report of reading as favorite activity immediately after intervention	Greater report of reading aloud as favorite activity, >10 children's books in home, and reading aloud at least once per wk immediately postintervention Greatest effect for non-English speakers
ROR, Needlman et al ⁶	Quasi-experimental historical controls	N = 1647, 10 states in United States	6–72 mo	4	None reported	None reported	Greater report of reading aloud as favorite activity, >10 children's books in home, and reading aloud at bedtime, and aloud ≥ 3 per wk immediately postintervention Greatest effect for parents with less than a completed high school education.
ROR, Jones et al ⁶¹	Quasi-experimental Prospective controlled study	N = 352, Louisville, KY	2–24 mo	2	None reported	None reported	More likely to report enjoyment in shared reading 2 y postintervention

TABLE 6 Continued

Intervention, Reference	Study Design	Sample Size, Location, Age	Age, Specific Population	Levels of Evidence	Effect	Child Outcomes	Parent Outcomes
ROR + M, Jones et al ⁶²	Cohort study	N = 72, Southern United States	Low income families, mostly African American 12–36 mo	3	None reported	Increased reading activities related to math (counting, shapes, numbers, addition/subtraction, and position), mathematics engagement score at 3 wk postintervention	

BBP, Baby Business Program; BDI, Beck Depression Inventory; MCDI-SF, MacArthur Communication and Development Inventories – Short Form; PSI, Parenting Stress Index; THB, The Happiest Baby; VAS, Visual Analog Scale.

Three interventions in which the promotion of early literacy was evaluated had relatively consistent results. Three ROR studies revealed a significant increase in the number of parents reporting reading aloud as their favorite activity with their child or increased frequency of reading on a weekly basis in cross-sectional samples or quasi-experimental studies.^{6,60,61} These effects were stronger among non-English speaking families⁶⁰ and families with less than a completed high school education.⁶ The ROR + M intervention resulted in greater mathematics engagement by parents as well.⁶² The Literacy Promoting Intervention by High et al⁵⁹ was associated with increased receptive and expressive vocabulary.

DISCUSSION

In the past 15 years, multiple new interventions have been developed and tested in connection with primary care settings with the goal of improving the developmental trajectories of young children. Twenty-four interventions are included in this review, with data from 48 studies, primarily evaluated by RCT or quasi-experimental study design. A number of these interventions were evaluated across multiple cities and countries in studies with >3000 participants.

The evolution of interventions to promote development of young children in primary care settings is evident when comparing our findings to those of the systematic review by Regalado and Halfon⁴ in 2001. As documented in the previous review, educational interventions were focused on positive parent-child interactions and improved parental knowledge about child development but did not change parenting behavior or child development outcomes.^{63–65} In contrast, 2 interventions explicitly designed to improve parental confidence and

competence through skill building⁶⁶ and coaching⁵ enhanced the quality of parent-child interactions in small trials (<50 participants).

The interventions summarized in this review continued this trajectory of incorporating new strategies to enhance parental skill building and parent-child interactions supported by behavior change theory.^{67,68} These strategies included vicarious learning from peers, role play, homework, feedback through coaching, videotaped observation, and identification of parenting strengths. In some studies, the parental factors that could explain mechanisms of action were measured and included parental resilience,³¹ satisfaction,^{15,35,38–40,45} self-efficacy,^{15,35,38–40,45,46,52} and stress.^{17,18,32,38,44,45,52} The authors of studies of behavioral interventions also frequently explored the impact on parental mental health as a potential mediating factor.^{42,47–51}

The primary challenge in synthesizing and drawing firm conclusions about the efficacy or effectiveness of specific interventions, however, lies in the heterogeneity of outcome measures and reported findings. Among the general developmental studies, a different child outcome measure was used in almost every study, and 3 studies^{16,32,34} had no child outcome measures as part of the evaluation, making comparisons across these studies difficult. Even among studies of the same interventions, the results varied in terms of the time when evaluations occurred and the specific outcome measures that demonstrated improvement (eg, prevention of developmental delay versus behavior problems in VIP and HS studies).^{18,23,26,28} The behavioral development studies were more consistent in their use of the CBCL or Eyberg Child Behavior Inventory (ECBI) as outcome measures of child behavioral problems.

Greater consensus on which child outcomes are most important from a clinical perspective and which validated tools are optimal for assessment of these outcomes is needed, particularly for general developmental interventions. Other specialties, such as mental health, face similar challenges⁶⁹ and may serve as examples for future standardization of quality and outcome measures.^{70,71} With respect to general developmental outcomes, measures of language development may be particularly important given the disparities that exist in this developmental domain^{72,73} and the association with later academic achievement.^{74,75} Studies with longer follow-up periods, such as studies of home visiting or preschool programs,^{76,77} may help identify measures in early childhood that predict long-term health and academic success. The behavioral development studies showed more consistent impact on the clinically relevant measures of behavioral intensity and behavior problems.

Although the factors related to the mechanism of action of interventions were assessed in many studies, the variability of results limits our ability to understand precisely why some interventions work over others, who benefits from interventions, and what may be the common pathway by which different interventions impact the same outcomes. This basic understanding is necessary to inform future policy and services.³ The collection of VIP studies provides an example research strategy to thoroughly study an intervention. The studies identified families that benefited most (on the basis of education level),¹⁸ potential mechanism of action (mediators including responsive parenting and maternal depression),²⁰ and explored clinically significant outcomes such as language, harsh discipline, and social emotional development.^{21,23}

In addition to examining the individual mechanism of action of the interventions, researchers for future studies should attempt to identify key components that may be common across multiple interventions. Drawing again from the mental health literature, the examination of key components should include intervention content as well as factors that impact the process of intervention delivery (eg, participant and provider attitudes, specific types of interactions, and provider approach to influencing behavior change).⁷⁸ Common elements of evidence-based psychologic treatments for adult anxiety and depression, for example, include altering cognitive appraisal, modifying emotion-driven behavior, preventing emotional avoidance,⁷⁹ as well as demonstrations of warmth and empathy, clear explanations, focused discussion on practical concerns, and well-organized sessions.⁷⁸ Identification of common key components of developmental interventions could have implications for the feasibility of dissemination of these interventions into community settings where the majority of children receive primary care.

Several notable gaps in the literature limit the feasibility of replicating individual interventions in community settings. First, the cost of many of the identified interventions is not well described. VIP and HS reported relatively low costs compared with programs such as home visiting or Early Head Start, although both required a child development specialist.^{20,26,27} The descriptions of trainings are similarly limited. Most of the interventions were delivered by child development specialists or health care professionals that likely bring additional skills and knowledge to interactions with parents. Access to child development specialists is limited in rural settings; thus, understanding the specific skills

needed to conduct the intervention is critical. Chang et al³³ provided an example of a detailed description of paraprofessionals training that could be used in resource-limited settings.

Implications

Although multiple studies showed positive change in a number of different child development and parental outcomes, the heterogeneity of results limit the clear distinction between effective and noneffective interventions. To identify the services and policies that will optimally promote the development of young children, we need a clear understanding of the end point we are collectively trying to achieve. We need greater consensus on the best measures of these outcomes, and we need to understand why interventions work and who benefits most. When considering implementation of these interventions in community settings, health professionals must consider the availability and expertise of their staff and the cost of training and implementation. Examples of highly targeted interventions delivered by paraprofessionals may provide some direction for future dissemination strategies.^{33,34}

Limitations

This review has several limitations. Only articles published in English were reviewed. In addition, the inclusion criteria requiring a connection to primary care limited the focus to US populations and countries with similar health systems. Initially, we considered

limiting our review to studies conducted in the United States given the significant differences between health care systems around the world. Ultimately, we sought to include international studies because multiple interventions were studied in the United States and internationally, and interventions designed for settings with varying levels of resource allocation may also be relevant to lower-resource or rural settings in the United States. Our review may have missed eligible studies for various reasons. Although our search terms were intentionally broad, other terms used to describe similar interventions may have resulted in missed studies. Additional studies may have been missed or excluded because of ambiguity with respect to the age of children enrolled or the connection to primary care. Interventions conducted without a connection to primary care were excluded even if other primary care-based studies of the same intervention were included. We also excluded studies targeting specific populations such as extremely premature infants and parents with diagnosed depression or substance abuse disorders because these populations frequently require targeted therapies or treatment with medication. Finally, the Levels of Evidence system used to summarize and compare the study designs across interventions is not a definitive indicator of the quality of the study because it does not assess bias related to blinding, instrument validation, or observer versus self-report measures. The decision to use this system was based on feasibility

given the variety of study designs used and the variability of reported factors that impact study quality.

CONCLUSIONS

Several interventions delivered in primary care settings can positively impact developmental and behavioral trajectories of children aged 0 to 3 years. These interventions involve the child's parents and frequently a team of health professionals. Common measures of child development outcomes are needed to compare efficacy across studies. Further exploration of why certain interventions work and who benefits from interventions could inform future policy to make these services more widely available.

ABBREVIATIONS

BB: Building Blocks
CBCL: Child Behavior Checklist
CFD: Care for Development
ECBI: Eyberg Child Behavior Inventory
HS: Healthy Steps
IY: Incredible Years
PCIT: Parent-Child Interaction Therapy
POC: Play with Our Children
PP: PrePare
RCT: randomized controlled trial
ROR: Reach Out and Read
ROR + M: Reach Out and Read plus Mathematics
SDP: Sit Down and Play
Triple P: Positive Parenting Program
VIP: Video Interaction Project

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