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Where do we go from here? Examining pediatric and population-level interventions to improve child outcomes

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ABSTRACT

This paper summarizes and comments on emerging, but important, developments in practice, policy, and research focused on population-level interventions to address disparities in language development among young American children. This examination draws parallels between the need for broad scale Word Gap interventions and existing public health approaches to prevention and early intervention across many dimensions of child well-being.

The authors conducted a review of the literature showing both the limited evidence base and promising aspects that predict efficacious implementation in pediatric and public health systems. Based on the results of a literature search, as well as the authors' experiences in reviewing and developing interventions designed for implementation at scale, we describe some of the important considerations and challenges associated with designing and implementing a population-level effort. After a summarizing the results of the formal literature review, we present case studies of 2 community-based interventions with an evidence base for addressing the word gap as well as 4 promising programs that suggest innovative and scalable ideas for broader implementation, dissemination and research exploration. Further, we highlight the ways in which these interventions, individually and collectively, are showing promise and evidence for implementation in pediatric and public health settings. Interventions include components of universal contact with populations of interest, early and continuous contact with individuals within these populations, coordinated and aligned messaging and intervention across multiple service sectors, and use of both stakeholder engagement in intervention design and trusted messengers in intervention delivery. We close by providing suggestions for population-level interventions aimed at the word gap, including: universal contact with populations of interest, early and continuous contact.

1. Introduction

This special issue of ECRQ addresses various aspects of the word gap - persistent disparities (Gilkerson et al., 2018; Hart & Risley, 1995; Rowe, 2008) in the early language development of young children. Research is accelerating and expanding our knowledge of both basic features and pragmatic correlates of this developmental phenomenon, and is providing sample-specific or localized examples of intervention to reduce noted disparities. As yet, however, this growing body of research is not represented in a set of practices that is population based; such practices would provide broad-scale screening and detection of children and families potentially requiring intervention and intervention options varying in intensity to meet the needs of these families. In fact the published research relevant to population-level language intervention is still rather small (i.e., Greenwood et al., 2017). This paper provides a framework to consider early childhood development broadly, and the word gap specifically, as not only a school readiness issue, but as a public health issue and the topic of a public health campaign. The purpose of this paper is to identify and review that empirical literature, to highlight the state of development in this area by reviewing case studies of growing efforts, and to offer provisional recommendations for ongoing development of the conceptual, practical, and empirical dimensions of this area.

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Based on widely accepted empirical findings on the development of language and the significance of multiple variables either assisting or inhibiting the language development of young children, this paper outlines programs and practices that are emerging to address the strong and healthy language development of young children. While some programs have a strong empirical basis, others are in earlier stages of assessing efficacy and effectiveness. Some programs are focused on metrics like feasibility and population reach and are clearly undergirded by strong principles of population health. While existing programs and practices vary in empirical evidence, they are designed to address prevention and public health and do so in unique ways.

Babies grow and develop in rich and complex social contexts. Features of these social contexts contribute directly to young children's development (Shonkoff & Phillips, 2000), and differences in access to these important developmental assets can be expected to produce differences in the developmental outcomes that we observe across individuals and groups (Ford et al., 2018; Hart & Risley, 1995). In many instances, differences such as neighborhood and family income influence a child's developmental trajectory; pediatric healthcare and home visiting may represent an underutilized opportunity to address these disparities through promotion of language- and literacy-rich activities for at risk families beginning in infancy and continuing through school entry.

This process of opportunity and outcome is perhaps singly most important when considering the development of language among young children. Language competence is, in and of itself, an important developmental asset. Through language, children learn about and can access the world around them, are embedded in their culture and history, and gain the tools to seek and make meaning of old and new experiences (Head Zauche et al., 2017; Shonkoff & Phillips, 2000). Language is also a foundational skill, serving as a precursor and base for social-emotional interaction and development, for academic competence in reading and mathematics, and for lifelong success in learning, working, and being a participating citizen (Snow et al., 1998). In fact, a child's vocabulary at the age of three is a key predictor of school readiness at kindergarten and third grade reading comprehension, which is a powerful predictor of subsequent academic success (Dickinson & Porche, 2011; Duncan & Brooks-Gunn, 1999; Durham, Farkas, Hammer, Tomblin, & Catts, 2007; Rowe, Raudenbush, & Goldin-Meadow, 2012; Walker, Greenwood, Hart, & Carta, 1994). Ensuring successful development of language skills and competence is both specifically and generally a critical feature of supporting young children's lifelong trajectories of well-being.

The responsive and engaging nature of interactions between young children and their parents and other caregivers (Hirsh-Pasek et al., 2015) is central to language learning and, most likely, broader child development. Attuned caregivers provide rich, interesting, and engaging opportunities, engage the child in repeated back-and-forth communication, and produce warm and positive experiences that are important features of the rich language environments that promote developmental competence. In fact, the impact of frequent language interactions between children (two to three years of age) and their caregivers correlates with language and cognitive skills more than 10 years later (Gilkerson et al., 2018).

Differences in early language environments lead to dramatic differences in vocabularies of 18 month-old children, which increase steadily between 18 months and 24 months (ASHA, 2014; Halle et al., 2009; Hart & Risley, 1995). Children who have *heard* fewer words since birth, are likely to *know* fewer words and have a less diverse vocabulary by age three (Hurtado, Marchman, & Fernald, 2008; Rowe, 2012; Weisleder & Fernald, 2013). These children will be less ready for school, may be unable to catch up and the gap in achievement widens for a large proportion of children (U.S. Department of Education, 1999).

Disparities in early language development related to family income have received significant attention (e.g., Fernald, Marchman, & Weisleder, 2013; Hart & Risley, 1995). Although there is great variability within low-income and higher-income groups (e.g., Gilkerson et al., 2018), on average, early gaps in language development can contribute to stark disparities in academic performance through generational lack of access to education and language nutrition for children from lower-income families (Language Nutrition is the use of language that is sufficiently rich in engagement, quality, quantity, and context that it nourishes the child neurologically, socially and linguistically, Weldon, 2014). This so-called "achievement gap" is typically noted in elementary and secondary grades, but potential precursors can be detected in early childhood (Fernald et al., 2013; Walker et al., 1994).

Early language experiences impact the long-term educational outcomes in children. Disparities in early language development affect the overall well-being of the population, and thus represent a public health problem that warrants attention and resolution. Logically, we can now conclude that early language development, and the experiences that contribute to it, vary systematically across elements of our population, that these variations are associated with future deficits and delays for affected individuals and for costs to the broader population - both in terms of opportunity costs associated with citizens not sufficiently skilled to contribute at levels otherwise attainable and actual costs (e.g., remedial education, health interventions). Given this logical conclusion, disparities in early language development affect the overall well-being of the population, and thus represent a public health problem that warrants attention and resolution (Greenwood et al., 2017).

Given these relations, a path toward prevention and early intervention becomes clear. A reasonable first order of business becomes supporting more adaptive parent-child interactions and relationships, across the population and from the very beginning of each child's life. When parents believe they have more control over their child's outcomes, they will increase the quality of interaction with their children (Elder, Eccles, Ardelt, & Lord, 1995; Luster & Kain, 1987). When parents and caregivers are given training on how to use evidence based strategies, they gain the knowledge and skills necessary to improve their child's outcomes (e.g., Roberts & Kaiser, 2011). And, as important, as parents' skills and knowledge grows they gain a vision of themselves as key players in the effort to build language and communication proficiency.

While the imperative for this public health approach may be clear, evidence to support its design and scaling is arguably scant. A reading of the professional and academic literature in this area suggests that research is still in a relatively early stage, with systematic interventions and empirical evaluations just beginning to appear.

2. Status of an emerging scientific literature on population-level efforts to promote language development

Public health interventions are, by definition, focused on broad groups and populations. To achieve this level of reach, at a minimum these interventions must provide ways to make contact with all members of that population, ideally at times when assessment and/or intervention is especially warranted. For infants, toddlers, and their families – individuals who are not yet routinely enrolled in local educational programs or other community-wide services, making contact through existing health care and other services may be particularly useful.

We conducted a review of the literature for interventions aimed at the word gap for very young children (birth to three years of age) and implemented in health care settings, by healthcare providers,

and/or as part of a home visiting or home-based program. We specifically focused on these particular interventions because of the nearly universal reach of primary pediatric care; the large population served by home visiting (80,000 families) at the federal and state level, and the variety of programs being rolled out from local and state programs (U.S. Department of Health and Human Services, 2018).

This type of review is important in that it provides researchers, clinicians, educators, policymakers and other stakeholders with a broad overview of the current state of science (including both strengths and important limitations) and of dissemination/implementation of relevant programs. We were interested in interventions that instructed caregivers on the importance of creating language- and/or literacy-rich environments for their young children, ages birth up to three, and interventions that included child-level language and/or literacy outcomes (or caregiver outcomes related to child language and/or literacy development). Articles were limited to peer-reviewed single-case or group design interventions (quasi-experimental and randomized control studies) and excluded secondary analyses. We included studies conducted in the U.S., written in English, and published since the seminal Hart and Risley study in 1995 up until February 2018.

We searched CINAHL, PsychINFO, ERIC, Academic Search Complete, and Web of Science and PubMed using the following terms: (infant* OR toddler* OR child*) AND (language OR vocabulary OR "language nutrition" OR "word gap" OR communication OR talk OR interact* OR word* OR gesture*) AND (interven* OR strateg* OR treatment) AND (poverty OR "at risk" OR low-SES) AND ("health care" OR healthcare OR "primary health care" OR hospital* OR "health care center*" OR "health center*" OR pediatrician* OR nurse* OR "nurse practitioner*" OR physician* OR "primary health care provider*" OR "primary provider*" OR "primary care provider*" OR "home visit*" OR "parent educat*"). Initially, titles and abstracts were reviewed for eligibility followed by full-text review.

Articles were reviewed to describe participant characteristics (age, race and ethnicity, language background, disability status, and risk factors) and intervention details, including intervention setting, child language and/or literacy outcomes (or caregiver outcomes related to child language and/or literacy development). The inclusion of studies with caregiver outcomes only is based on the extensive literature connecting parent behaviors to child language outcomes (see Head Zauche, Thul, Darcy Mahoney, & Stapel-Wax, 2016). For example, interventions that targeted responsive caregiving with parent-level outcomes were included because of the research on the association with responsive caregivers and child language development (e.g., Tamis-LeMonda, Bornstein, & Baumwell, 2001). In reviewing eligible articles, we also identified the overall efficacy of the intervention (for child outcomes and/or caregiver outcomes related to child language and/or literacy development).

3. Results of literature review

A total of 2505 articles were retrieved through the database search with 1963 after deduplication. A large number of the articles, more than 99%, were excluded based on the abovementioned inclusionary criteria, and remaining articles were thought to be particularly illustrative towards our goal of identifying interventions aimed at the word gap for children under age three in the settings of interest here (public health and pediatric care). The full text of 30 articles was reviewed by the third and fourth authors to confirm whether studies met all inclusionary criteria. After this full-text review, a total of 14 articles were retained for analysis here (see Fig. 1 for details on the search strategy). In our review and analysis of these investigations, we were interested in summarizing characteristics of participant samples, intervention characteristics (including settings where intervention occurred), and assessment of intervention effects.

3.1. Participant description

Participants in the selected studies included children and their caregivers recruited from community settings as part of a feasibility study (Nagamine, Ishida, Williams, Yamamoto, & Yamamoto, 2001), enrolled on the postpartum unit of an inner-city public hospital (Mendelsohn et al., 2007; Mendelsohn et al., 2011) as part of a series of investigations (High, Hopmann, LaGasse, & Linn, 1998; High, LaGasse, Becker, Ahlgren, & Gardner, 2000) or across multiple programs (Love et al., 2005). Half of the studies ($n = 7$) included mother-child dyads, whereas, 29% ($n = 4$) of the studies referred to the participants as *families*. The remaining three studies (21%) involved parents and children. Sample size ranged from 23 to 3001 participants. About a third of studies (36%, $n = 5$) included less than 100 participants, and half of the studies (50%, $n = 7$) had between 135 and 410. Two studies had a sample size of either 1647 or 3001 families.

3.1.1. Participant risk factors

Most of the participants in studies reviewed here had low educational levels. In 36% of the studies ($n = 5$), none of the participants had obtained a high school diploma, whereas in 29% of the studies ($n = 4$), participants had a mix of educational levels, ranging from 47% to 90% of participants not having obtained a high school diploma. One study did not report the level of education, and in another, the educational level data was reported insufficiently. All of the studies in this review included a majority of participants described as being from low-income backgrounds. None of the children or adults in these studies had disabilities; however, Love et al. (2005) included participants with, "...biological or medical risks including: congenital heart disease, diabetes, low birthweight or a severe chronic illness" (p. 891).

3.2. Intervention description and effects

The setting for the majority of the studies in this review (86%, $n = 12$) was either in pediatric primary care health center ($n = 6$) or as part of a home-visiting or other home-based program ($n = 6$). The two remaining studies took place in hospital settings, one in the emergency department of a children's hospital and one in a neonatal intensive care unit (NICU). In the following section, we describe interventions and their outcomes by setting. Details on study design, participant characteristics, and study outcomes are presented in Table 1.

3.2.1. Primary care-based studies

Six studies assessed the effects of language and literacy promotion during routine well-child visits. All of these studies focused to some extent on providing books and anticipatory guidance to parents by healthcare providers (and, in the case of VIP, coaching around parent-child interactions). All interventions were relatively brief in duration (from several moments for Reach Out and Read to 30 min for VIP), and all were evaluated on the basis of changes in parent attitudes for, and reports of, reading to their child. Additional outcomes measured by Mendelsohn et al. (2007) and Mendelsohn et al. (2011) are reported below.

In one of the largest studies included in this review (but the only study in primary care-based settings that did not use a randomized controlled study design), Needlman, Toker, Dreyer, Klass, and Mendelsohn, (2005) measured the effects of the Reach Out

Table 1
Overview of studies reviewed.

Study citation	Description of intervention	Intervention design	Age of child participants	Participant race/ethnicity	Participant language background	Child and caregiver outcomes related to child language/literacy development
Akai et al. (2008)	At-risk mothers were randomly assigned to a control group or an intervention group. Mothers in the intervention group received a packaged training entitled My Baby and Me that included training in responsiveness, developmental milestones, and loving touch via 10 home visits. The control group mothers received parenting literature and community referrals. Dyads participated for 4.5 months	Randomized control study	*n* = 63 mother–infant dyads Child age (in months): *M* = 4.3 Range = 3.5–5.5 Mother age: 15–38 years	Mothers: 40% African American; 33% European–American; 25% Latina; 2% multi-racial	Not discussed.	No child outcomes reported. Mothers in the treatment condition used verbalizations to scaffold infant language more often than did mothers in the control condition.
Golova et al. (1999)	In the intervention group, doctors distributed age-suitable children's books and handouts in two urban community health centers when participants registered, and at two consecutive well-visits, to offer literary guidance and describe how children can connect with books. In the control group, families received routine care, but were not given any handouts or books.	Randomized controlled study	*n* = 65 (intervention group) *n* = 70 (control group) Child age (in months): Control group = 7.4 (1.7); Intervention group = 7.3 months (1.8).	100% Hispanic	89–91% of the families spoke Spanish at home	No statistically significant child language outcomes; however, in children older than 18 months there was a trend in all subscales for children having higher receptive language on the 50 words present in the books. Parents in the intervention group were more likely to read to children (at least three times a week), placed 'reading to their child' in their top three favorite bonding activities, and reported having more books in the home.
Guttentag et al. (2014)	"My Baby & Me" parenting intervention aimed at shifting the trajectory of maternal behavior and child development. Randomized comparison of high-intensity intervention (55 home visits) and a low-intensity intervention (monthly phone calls, print materials, and referrals to community	Randomized controlled study	*n* = 361 Children were followed from birth to 2.5 years of age.	Mothers self-identified as 56.23% African American; 35.45% Hispanic; 11.91% White, non-Hispanic.	Not discussed in the article.	Children the high-intensity condition showed improvements in their expressive language at a faster rate (between 4–30 months) than children in the low-intensity condition. Mothers in the high-intensity condition used more verbal support and stimulation than those in the low-intensity condition.
High et al. (1998)	Encourage book sharing and routines at bedtime through distribution of books and educational materials with families during well-child doctor visits.	Comparison study of 2 cross-section groups; Group 1: historical control or a comparison group Group 2: intervention group that received two books and educational materials for the children	Group 1: *n* = 51 *families* Group 2: *n* = 100 *families* Child age: 12–38 months Group 1 mean: 23.25 Group 2 mean: 19.2	Families: Group 1: 12% African American; 23% Hispanic; 15% White, non-Hispanic; 1% Other Families Group 2: 13% African American; 33% Hispanic; 44% White, non-Hispanic; 10% Other	Group 1: 26% English; 16% multilingual; 8% Spanish only Group 2: 55% English; 38% multilingual; 7% Spanish only	Increase in child centered literacy orientation (CCLO) for participants in the experimental group – 33% in control/comparison, and 69% in experimental group.

High et al. (2000)	Families across four urban community health centers for pediatric care received books, educational materials, and advice about sharing books with children.	Randomized controlled study	*n* = 205 families from low-income backgrounds Child age (in months): *M* = 7 (.2) Range = 5-11	Intervention group: 21% White; 53% Hispanic; 26% other. Control group; 17% White; 41% Hispanic; 43% other	Intervention group: 26% English only, 62% multilingual, 12% no English Control group: 25% English only, 64% multilingual, 11% no English	Children were divided into two groups for analysis: 13–17 months (younger children) and 18–25 months (older children). Higher receptive and expressive vocabulary scores were found in older, but not younger, intervention toddlers. Increase in CCLO and reading aloud more days a week in intervention families.
Landry et al. (2006)	Intervention families received 10 home visits across 10 weeks to promote parents' learning responsive behaviors to aid infant development using the playing and learning strategies (PALS) program. Comparison condition families received the same number of home visits but the visits were done by developmental assessment screening (DAS) facilitators and participants received information about infant development.	Randomized controlled study	*n* = 264 mother–infant pairs Child age (in months): 6–13	PALS group: 37% African American; 34% White; 27% Hispanic; 2% other. DAS group had a very similar distribution.	Not discussed in the article.	Increase in child word approximations and use of words for infants with mothers in the PALS condition. Mothers in the PALS condition were more responsive and used more verbalized support, object labeling, verbalized motivation, and the labeling of actions.
Love et al. (2005)	This study determined the effectiveness of Early Head Start interventions in 17 programs (4 center-based, 7 home-based, 6 mixed approach) aimed at low-income households with newborns through toddlers. Control group families did not receive the Early Head Start services.	Randomized controlled study	*n* = 3001 families Intervention group: Child age (in months): 24.2% in utero; 36.1% under 5; 39.7% over 5 Control group: Child age (in months): 26.5% in utero; 34.7% under 5; 38.7% over 5	Intervention group: 37.3% White; 34.2% Black; 23.8% Hispanic; 4.7% other Control group: 37.1% White; 35.2% Black; 23.4% Hispanic; 4.5% other	Intervention group: 79.9% primary language is English; 9.6% primary language is not English, but the applicant speaks English well; 10.5% primary language is not English, and the applicant does not speak English well	Children in the intervention group had higher cognitive and language functioning. Parents in the intervention group had higher frequency of reporting for reading aloud daily.
Mendelsohn et al. (2011)	Participants in an urban, public hospital pediatric primary care clinic received either: the Video Interaction Project (VIP) or the Building Blocks (BB) intervention or were assigned to the control group that received standard pediatric care.	Randomized controlled study	*n* = 410 families Child age (in months): *M* = 6.9 (1.3).	VIP: 91.3% Hispanic BB: 95.3% Hispanic Control group: 92.5% Hispanic.	Spanish was the primary language for participants as follows: VIP = 80.2%; BB = 79.3%; control = 85.8%.	Parent–child interactions were assessed at 6 months with the StimQ-Infant assessment, and through 24-h shared reading recall diary Both intervention groups led to elevated parent–child interactions.

Table 1 (*Continued*)

Study citation	Description of intervention	Intervention design	Age of child participants	Participant race/ethnicity	Participant language background	Child and caregiver outcomes related to child language/literacy development
Mendelsohn et al. (2007)	Participants in an urban, public hospital pediatric primary care clinic. Intervention families received VIP program at each of their 10–12 well-child visits. Control families received the same well-child care but did not receive the VIP program intervention.	Single-blind randomized controlled study	*n* = 99 families Children were assessed at 33 months of age	100% Latino	Spanish was the primary language for participants as follows: VIP = 96.2%; control = 91.5%	Children who participated in VIP children were more likely to have normal cognitive development scores (63.5% vs. 44.0%) and less likely to have developmental delays (1.9% vs. 6.7%) as compared to children in the control group. No statistically significant difference between groups on child language development. Families in the VIP group reported higher levels of parental involvement on the StimQ-Toddler
Nagamine et al. (2001)	Families receiving care in the emergency department of a children's hospital were provided with a literacy promotion brochure and a children's book, or just the literacy promotion brochure. Follow up sessions took place to determine the amount of reading aloud per household.	Randomized study with comparison	*n* = 43 Child age: 20 months to 7 years	Not discussed.	Participants were excluded if parents did not speak English well enough to participate in a follow-up interview. 83.7% reported English as the primary language.	No child outcomes measured. No significant changes in amount of reading aloud were noted.
Needlman et al. (2005)	Participants across 19 sites (9 hospitals, 7 community health clinics, and 3 private practice clinics) received Reach Out and Read (ROR) during well-child visits, including anticipatory guidance about the importance of reading aloud, free book, and models for effective reading strategies.	Before-after intervention study (control group received pre-interview and experimental group received post-interview)	*n* = 1647 Control group child age (in months) 6–11.9 *n* = 173 12–35.9 *n* = 415 36–72 *n* = 329 Intervention group child age: 6–11.9 *n* = 146 12–35.9 *n* = 341 36–72 *n* = 243	Intervention group: 20.7% African American; 36.2% Latino; 34.9% White; 8.2% other Control group: 15.8% African American; 39.6% Latino; 36.9% White; 7.7% other	Intervention group: 65.1% English only; 19.9% Spanish only; 10.4% English and Spanish; 8.2% language other than Spanish or English Control group: 59.5% English only; 22.9% Spanish only; 10.7% English and Spanish; 6.9% language other than Spanish or English	No child outcomes measured. Experimental group demonstrated high correlations between exposure to ROR and reading aloud as a favored activity for parent and child interaction. Evidence shows that intervention by doctors during early stages of development is effective in encouraging parents to read to their children.
Suskind et al. (2018)	Families in the intervention group received 8 weekly (60-min) home visits to increase parental knowledge of child language development and parent–child verbal interactions.	Randomized controlled study	Control: Baseline *n* = 19 Completers *n* = 11 Intervention: Baseline *n* = 18 Completers *n* = 12 Child age (in years): control group *M* = 2.1 (SD 5.5 months) Child age (in years): intervention group *M* = 2.5 (SD 4.4 months)	89.5% Black; 10.5% White	100% English	Child vocalization counts increased during the intervention but did not hold post-intervention. Caregiver knowledge of language development increased for parents in the experimental group between one week and four months. Growth in parent word types and tokens within the first week, but not continuing four months after the intervention, were noted.

White-Traut et al. (2013)	At two inner-city Midwestern community hospitals with NICUs, mother-preterm infant dyads in the intervention group participated the H-Hope program. The H-Hope program included twice a day baby stimulation with auditory, tactile, visual, and vestibular-rocking sensations, maternal participatory guidance sessions, and two sessions with a nurse-community advocate team. Control group infants received a similar amount of mother and staff attention, but with content that was distinctly different from the H-Hope intervention.	Randomized clinical trial	*n* = 198 premature infants : Intervention group child age (in weeks) average gestational age *M* (gestational age) = 32.2 (1.7) *M* (chronological age at 6 weeks) = 13.6 (1.8) Control group child age (in weeks) average gestational age *M* (gestational age) = 32.5 (1.6) *M* (chronological age at 6 weeks) = 13.2 (1.9)	50% Latina; 50% African American	Not discussed, but each Nurse/Advocate team (NAT) included at least one fluent Spanish speaker	The intervention group demonstrated significantly higher Dyadic Mutuality Code (DMC) scores that included six items: mutuality, mutual attention, positive affect, mutual turn-taking, maternal pauses, infant clarity of cues, and maternal sensitivity to cues and responsiveness.
Zajicek-Farber (2010)	Parents participated in 32–33 mentoring home visits and well-child visits over a span of two years. Participants in the control group (Wave 2) received well baby care only.	Wave 1: Quasi experimental design where the experimental group received pre-post testing and were compared to a static control group who received post-testing only. Wave 2: randomized controlled study.	*n* = 35 (Wave 1) *n* = 38 (Wave 2) Child age (in months): 0–1 month at the beginning of the intervention; 16–18 months at the end of the intervention.	Wave 1 = 57% Latino; 43% African American Wave 2 = 66% Latino; 34% African American	Article states that most of the Latino families in the project preferred to speak in Spanish, and about half were able to converse and write in basic English.	Wave 1: significantly more children in the intervention group had age-level vocabulary (90%), compared to the control group (60%). Wave 2: significantly more children in the intervention group had age-level vocabulary (79%), compared to the control group (51%). Both intervention cohorts showed increased knowledge of parenting (e.g., empathy, developmental expectations, use of non corporal discipline).

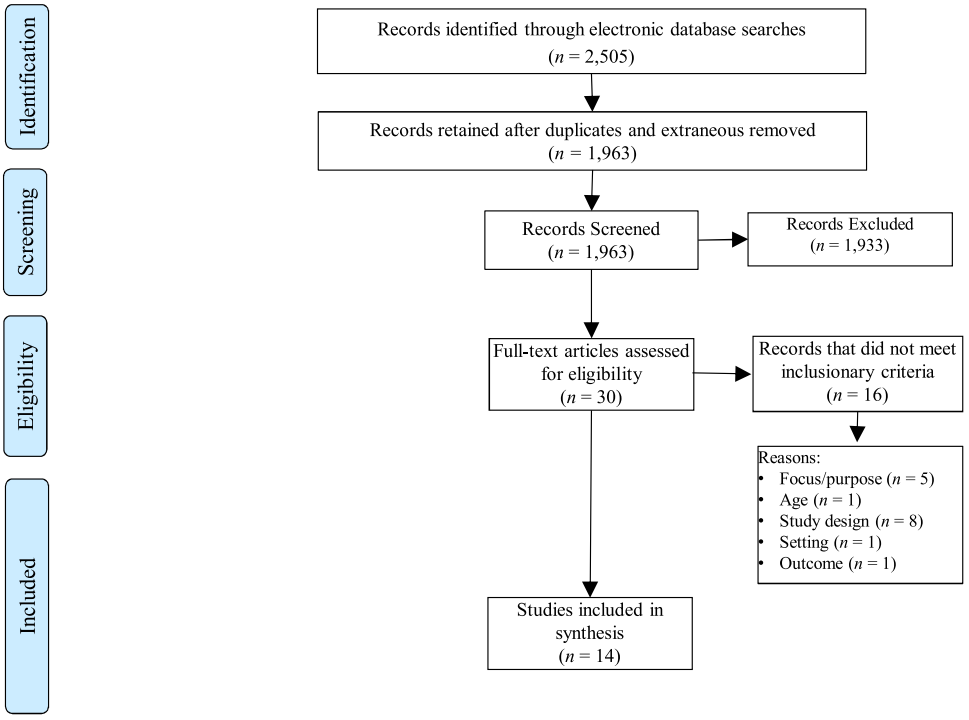

Fig. 1. Process for selecting studies.

and Read (ROR) program on parents' likelihood of reading aloud. Participants received the ROR intervention, including a free age-appropriate book at each well-child visit between six months and five years, and physician anticipatory guidance about the importance of reading aloud. High et al. (1998) and High et al. (2000) examined a similar intervention, which provided picture books, educational materials about reading aloud, and guidance about reading – though with a shorter age span between six months and three years of age. One additional study (Golova, Alario, Vivier, Rodriguez, & High, 1999) evaluated the effects of a literacy promotion program across three visits (study enrollment and two consecutive well-child visits). In addition to providing anticipatory guidance as in the abovementioned studies, Golova et al. (1999) provided bilingual age-appropriate books and a bilingual handout about the benefits of reading aloud to families in the intervention group. In all of these studies, families who received the intervention were more likely to read a book to their child greater than three days per week or to demonstrate child-centered literacy orientation.

The Video Interaction Project (VIP) (Mendelsohn et al., 2007; Mendelsohn et al., 2011) was also implemented at routine well-child visits and demonstrated positive outcomes. In addition to receiving guidance about the importance of reading aloud with children, participants in the intervention groups received VIP through a 30-minute coaching intervention prior to well-child visits. During these coaching sessions, parents received feedback on brief recordings of parent–child interactions. Mendelsohn and colleagues' studies measured the effect of VIP on parent–child interactions including reading activities, parental involvement in developmental advancement, and parental verbal responsivity. In addition to identifying positive caregiver outcomes (as in the abovementioned studies), Mendelsohn et al. (2007), Mendelsohn et al. (2011) and Cates et al. (2018) also noted higher levels of parent-child interaction for caregivers who participated in the VIP intervention, and positive outcomes for children (e.g., higher cognitive development and lower likelihood to have developmental delays).

3.2.2. Hospital-based studies

In contrast to primary care interventions, we identified two hospital-based interventions for children and families in acute care clinics (one NICU and one emergency department). White-Traut et al. (2013) examined the effect of the Hospital to Home: Optimizing the Infant's Environment (H-HOPE) program on the prelinguistic skills of premature infants in the neonatal intensive care units of two community hospitals. Infants in the intervention group received stimulation twice daily along with four maternal guidance sessions, and two phone calls from a nurse-community advocate after returning home. The control group received a similar amount of contact with the mother and staff but received information about car safety and premature infant care, rather than the H-HOPE intervention. Results indicated that infants who received the intervention exhibited clearer cues and that mother-infant dyads who received the intervention were more likely to demonstrate high responsiveness during play.

In contrast to the multi-component and multi-session intervention used by White-Traut et al. (2013) and Nagamine et al. (2001) implemented their intervention during a single visit to the emergency department of a children's hospital. In this study, families in the intervention group were given a book and a brochure about the benefits of reading to children with a recommendation to read aloud their children. Families in the control group ($n = 15$) were given the same brochure, but no book. Results from this study were not able to demonstrate any significant change in parent-child reading for either the intervention group or the control group.

3.2.3. Home visiting or home-based interventions

Finally, six studies evaluated more intensive (both in session duration and session count) interventions by home-visiting health-care providers or aides in family homes. The largest study evaluated effects of the federally funded Early Head Start (EHS) program (a comprehensive home visiting program to promote school readiness) on children's language development among other outcomes (Love et al., 2005). *My Baby & Me*, a home-based parenting interven-

tion, was examined in 2 studies (Akai, Guttentag, Baggett, Noria, & Centers for the Prevention of Child Neglect, 2008; Guttentag et al., 2014). Akai et al. (2008) randomly assigned mother-infant dyads to receive 12–14 home visits that included training in parental responsiveness. Akai et al. (2008) found that mothers used higher quality verbalizations (including scaffolding infant language) with their children after intervention as compared with mothers in the control group. In a second, larger, study, Guttentag et al. (2014) and colleagues tested the *My Baby & Me* intervention using a higher frequency of home visits ($n = 55$). A randomly assigned intervention group was compared with participants who received monthly phone calls, informational printed materials, and referrals to community resources. In addition to measuring maternal outcomes, Guttentag et al. (2014) also measured child outcomes; generally, parent training during home visiting produced warmer and more responsive parenting from mothers and their children were more engaged and demonstrated higher levels of expressive language.

Two studies examined effects of PALS (*Playing and Learning Strategies*), as implemented during home visiting, on child language and/or literacy development. In the first study, Landry, Smith, and Swank (2006) compared participants who received 10 home visits using the PALS responsiveness curriculum (including videotaped examples and opportunities for mothers to critique themselves) to comparison participants who received information about infant development skills. Intervention group mothers demonstrated greater responsiveness to their child, which in turn produced growth in target infants' social, emotional, communication, and cognitive competence (Zajicek-Farber, 2010).

Finally, Suskind et al. (2018) evaluated parent-directed language intervention for families who had children between 18 and 36 months of age. In this study, the intervention aimed to enrich the home language environment through increased engagement between caregivers and their child. Mother-child dyads in the intervention group ($n = 12$) received eight hour-long home visits once each week by trained home visitors. In addition to interactive educational content, intervention mothers had the opportunity to practice new skills with video-modeling and feedback at each visit. Mother-child dyads in the control group ($n = 11$) received eight weekly home visits as well, but the home visit lasted only 5–10 min, rather than 60 min, and nutrition information was reviewed, rather than education and training aimed at enriching the language environment. Results indicated improvements in parent knowledge of language development, as well as changes in parent and child verbal behavior during the intervention; however, effects were not always sustained post-intervention.

3.3. Implication of literature review

Nearly all studies in this review used rigorous, randomized, study designs with control or comparison groups. Several studies also had very large sample sizes. As noted in our summaries, parent and child outcomes related to language and literacy were positive across all but one (Nagamine et al., 2001) of the 14 studies reviewed. In the remaining studies, the majority focused on outcomes related to book reading, and these primarily took place in pediatric primary care settings. Parent behavior changes were also observed related to language and learning stimulation (e.g., Love et al., 2005), quantity of parental word types and tokens (e.g., Suskind et al., 2018), and general parenting knowledge (e.g., Zajicek-Farber, 2010); however, with the exception of the VIP studies, these broader outcomes were reserved for studies taking place in the home environment. Fewer studies gathered data at the child level, however, those that did often identified increases in language development across settings. For example, enhanced expressive and receptive vocabulary in toddlers through a primary care intervention (e.g., High et al., 2000), and infant word approximations and use during interactions from a home visiting intervention (Landry et al., 2006).

Based on the literature cited in this review, it is evident that interventions implemented in pediatric health care settings, public health and home visiting can yield significant positive outcomes in either parental behaviors that promote language and/or early literacy outcomes and/or in child language outcomes. Despite promise, these studies are limited in that they are few in number ($n = 14$) and interventions that are cross-sector are lacking. Furthermore, studies vary in their approach to targeting language and literacy outcomes, as well as the approach used to measure these outcomes - making it difficult to pinpoint how the active ingredients (e.g., reading and talking with young children) in these interventions affect the word gap overall. Given the current paucity of empirical research for community- and population-based interventions aimed at the word gap, we argue for the value of examining emerging instances of intervention, and considering how these exemplars may guide future research and practice.

4. Rationale for case study approach

Case reports and case series have been used in health professions as a way to provide information about clinical care that has yet to be studied, rare, or overlooked in clinical research. These cases often give clinicians and researchers insights and can be used to expand knowledge in the field by describing important observations that have not previously been written about and/or studied in a formal way. As was noted by Dr. Richard Rison (2013), these types of writings and presentations offer the broader audience and opportunity to learn and explore a novel occurrence. The case study approach is particularly useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural context (Rison, 2013).

The need for a richer foundation for development of population-based early language interventions is clear. To date, much of the literature on the word gap has focused on rather small and localized samples of children rather than large-scale public health interventions However, a few premier programs that engage large segments of a community in common-access settings like health care or home visiting (i.e. cases) have been described in both scientific and lay literatures. Selected cases are time bound, in that they have all been implemented since the advent of the seminal work on the word gap by Hart and Risley (1995). While waiting for continued maturation of a population-based science of language development, these cases may be particularly informative.

The cases described here are all focused on children in the first 3 years of life, and the interventions have some link to the pediatric and/or public health communities in setting or workforce. They all offer a provision of resources that support parent engagement, parent education, and sometimes training to individuals or workforces who have direct contact with parents. The exemplar cases noted here are in no way all-encompassing of the many programmatic intervention efforts related to the word gap across the U.S. However, our goal in presenting these case studies is to review different large-scale case exemplars that appear to be successfully implemented, some include empirically supported practices, are candidates for (and often already involved in) systematic efficacy evaluation, and/or potentially transportable to other communities. Some of these cases are decades old and some are brand new. Some have evidence data behind them and some are educational programs not yet tested, but all are aimed at improving language and literacy outcomes for the most vulnerable populations in an effort to optimize educational opportunities and lifelong health.

We present descriptions of three case studies – intervention efforts that have long and rich histories of implementation and

evaluation, and three promising practices – interventions fully implemented, but still new enough that less implementation and empirical information is yet available. For each case study and promising practice, we provide a brief description of the program and its key elements, setting(s) where it is implemented, workforce and community factors associated with implementation, the population of children and timing of intervention, and summarize empirical evaluations to date.

5. Evidence based practices

5.1. Video Interaction Project

5.1.1. History and description

The Video Interaction Project (VIP) is a unique and innovative approach to reducing disparities through guided parent–child interactions during pediatric visits that foster optimal cognitive, linguistic, and social development. VIP builds on an existing opportunity, regularly scheduled well-child visits to pediatric primary care clinics, to provide time for an interventionist to meet with a family, video-record the parent and child during play and shared reading utilizing a provided toy and/or book, and providing coaching based on the videotaped activity. The video is reviewed to identify and reinforce targeted behaviors (e.g., talking to child, responding to vocalizations, expanding on child language) and given to the parent to promote generalization of these behaviors in the home. During each VIP session, the parent and child receive a half-hour of one-on-one support from their VIP interventionist. The interventionist delivers a curriculum focused on supporting interactions in the context of pretend play, shared reading and daily routines; all shown to enhance child development and school readiness.

5.1.2. Setting

VIP coincides with 13–15 regularly scheduled pediatric well-visits from birth until a child is 5 years old. In 2013, the Video Interaction Project (VIP) became part of the routine pediatric care at Woodhull Medical Center in Brooklyn, NY. Since 2014, VIP has become a participant in City's First Readers (CFR), a city-wide initiative that seeks to close poverty-related gaps in school readiness through building linkages between literacy-promotion programs across multiple platforms.

5.1.3. Workforce/community engagement

Pediatric primary care providers and pediatric interventionist coordinate to provide VIP to participating families.

5.1.4. Population of children/timepoints

Birth to 5 years.

5.1.5. Empirical evidence to date

One of the strengths of VIP is that it has been and continues to be empirically researched by a world-class team of developmental psychologists and pediatricians through a series of randomized control trials (Cates et al., 2018; Mendelsohn et al., 2007; Mendelsohn et al., 2011). These studies have shown that VIP has large benefits for parents and their children, extending beyond language and literacy and showing improvements in maternal depression and parenting stress, reduction in physical punishment and television exposure, and enhanced socioemotional development.

5.2. Reach Out and Read

5.2.1. History and description

Reach Out and Read (ROR) is one of the earliest and best examples of an evidence-based strategy to prevent problems of early childhood development and learning delivered in pediatric primary care. With a start in a single clinic in Boston City Hospital in 1989, doctors working in more than 6080 programs gave approximately 7.2 million new books to more than 4.7 million children in all 50 states in 2016. ROR is based conceptually on the idea that encouraging additional reading to infants and young children and providing developmentally appropropriate books will foster interaction and build language-rich routines (Reach out and Read, 2018).

ROR is delivered as a part of routine pediatric care. At the time of children's check-ups, pediatricians and pediatric nurse practitioners provide guidance and encouragement to parents to read to their children, program volunteers model shared book reading for parents, and children are given a new, age-appropriate book to keep.

5.2.2. Setting

Reach Out and Read (ROR) is implemented in examination rooms in pediatric primary care offices.

5.2.3. Workforce/community engagement

Intervention is provided by the physician, nurse practitioner, or other regular healthcare provider for a child and family. During well-child visits, pediatricians and pediatric nurse practitioners give the child an age-appropriate book, encourage parents to read to their children every day, and provide developmentally appropriate guidance in reading aloud.

5.2.4. Population of children/timepoints

Birth – 5 years coinciding with well-child checks in pediatric primary care

5.2.5. Empirical evidence to date

Since ROR started, an increasing amount of research confirms the importance of reading aloud for the development of language and other emergent literacy skills, which in turn helps children get ready for school and leads to later success in reading. ROR has shown evidence of effectiveness in the literature in multiple domains including language and literacy noted in the literature review above. ROR has been shown to lead to minority and high-risk families reading more frequently to their children (Mendelsohn et al., 2001; Needlman et al., 2005). These children had high receptive and expressive language scores that were also dose dependent (meaning increased exposure to ROR led to larger increases in language scores. In addition, a quasi-experimental study showed enhanced vocabulary in the second year, just as the word gap begins to emerge and widen (High et al., 2000). Mothers in the Reach Out and Read group were two times more likely to report enjoyment in reading together with their child than those in the non-Reach Out and Read group (Needlman et al., 2005).

6. Promising programs

6.1. Thirty Million Words (TMW)

6.1.1. History and description

Suskind et al. (2018) developed a strengths-based intervention designed to create parent behavior change that results in child language growth. Parents are introduced to what are referred to as the "3Ts" – talk more, tune in, and take turns during an eight-week curriculum – beginning with an introduction to strategies and following up with opportunities for coach models and parent practice

for embedding strategies into everyday interactions and routines (Suskind et al., 2018). As part of the TMW Center, researchers investigating the home-visiting program and other interventions targeting early language growth describe their mission as creating, "...a population-level shift in the knowledge and behavior of parents and caregivers to optimize the foundational brain development in children, birth to five years of age, particularly those born into poverty" (Mission, 2018).

6.1.2. Workforce/community engagement

The "base" TMW home visiting program is staffed by dedicated home visitors; typically, these are individuals with training in child development and/or public health; home visits are manualized for consistency and quality assurance (TMW is also developing a host of other interventions, including videos shared during newborn hearing screening and well-baby visits, an online curriculum for early childhood educators, face-to-face parent groups, and a comprehensive preschool curriculum with Parent Academy). The TMW Center stresses the importance of working within existing programs and scaling interventions to reach a broader community.

6.1.3. Population of children/timepoints

The TMW initiatives are designed for children from birth to age five – beginning with TMW Newborn in birthing hospitals. Programs are available in English and Spanish, and each intervention focuses on involving families from low-income backgrounds.

6.1.4. Empirical evidence to date

Suskind et al. (2018) presented the first randomized control trial of the Thirty Million Words (TMW) home visiting intervention; however, other quasi-experimental studies helped to inform the project (e.g., Suskind et al., 2013). Further, the TMW Center describes preliminary results of unpublished findings for five other programs (Thirty Million Words, Results & Research, 2018). They suggest that mothers from low-SES backgrounds were significantly more knowledgeable about child development when compared to controls after participating in one of the following interventions: TMW-Home Visiting (1.0 and 2.0), TMW-Newborn, and TMW-Well Baby. Additionally, they suggest that, "...children and parents receiving Cog-X curriculum significantly improve in cognitive abilities..." (Thirty Million Words, Results & Research, 2018). A variety of other empirical evaluations are either underway or in planning stages.

6.2. Providence Talks

6.2.1. History and description

Providence Talks represents the first city-wide effort aimed at closing the word gap. Like other initiatives discussed to this point, the goal of Providence Talks is to improve child language and literacy outcomes through increased parent-child interaction. With funding from the inaugural Bloomberg Philanthropies Mayors Challenge award, the city of Providence, RI implemented a pilot home visiting intervention ($n = 175$ families) to address needs of low-income children and help to improve early development skills beginning in 2014 (Hawkins, 2016). Families receive 13 home visits over an eight-month period during which the Providence Talks curriculum employs strengths-based coaching with LENA technology (Language Environment Analysis) (Bernstein Ratner et al., 2017). Families complete day-long LENA recordings to track the number of words children are exposed to in their environment, as well as the number of back-and-forth conversational exchanges taking place between children and adults throughout the day. Home visitors work collaboratively with families to set data-based goals for increasing the quality and quantity of language from session to session (Hawkins, 2016). In addition to the home visiting model, Providence Talks also runs playgroups and conducts professional development training for early child care providers (Bloomberg Philanthropies, 2017).

6.2.2. Workforce/community engagement

Providence Talks is based out of the Mayor's Office in Providence, RI. Several full-time staff work out of the Mayor's Office while the city of Providence contracts with existing programs and service providers who implement the Providence Talks curriculum in the community. Providence Talks has intentionally involved stakeholders from a variety of sectors through the development and implementation of the program, including: government officials and city departments, the general public, academic and policy/innovation experts, agencies serving families with low-income, the press, and most importantly, families (Bloomberg Philanthropies, 2017).

6.2.3. Population of children/timepoints

The home visiting program was designed for families with children from birth through 30 months of age.

6.2.4. Early reports

There are not any peer-reviewed publications on Providence Talks at this time; however, early results from this program have "...been found to boost participants' language interactions" and increase parent-child talk and engagement with sustained improvements over time (Bloomberg Philanthropies, 2017, p. 17). Data on the scaling of Providence Talks suggests rapid growth in a short period of time with an increase of approximately 1200 children over the course of a calendar year (Bloomberg Philanthropies, 2017). In addition to the data analyzed by Providence Talks itself, an independent quasi-experimental study is underway comparing families with similar language environment profiles located outside of the city of Providence to families who have completed the Providence Talks program (Bernstein Ratner et al., 2017).

6.3. Talk With Me Baby

6.3.1. History and description

Talk With Me Baby (TWMB) is a statewide public health and education initiative and thus outcomes around child language development were not the directly measured as the primary intended goal of this program. Rather, TWMB began in Georgia with a goal of both raising awareness about primacy of language development, and educating and training pediatric providers (beginning with nurses and expanding to WIC nutritionists, pediatricians, midwives, and others) across sectors to transform parents and caregivers into "conversational partners" with their infants in order to nourish critical brain development required for higher learning (Gaines et al., 2017). The projected long term, down stream effects of TWMB was always to enhance and improve the language competency of children through the improvement of their language environment. *Language Nutrition* - the use of language, beginning at birth, that is sufficiently rich in engagement, quality, quantity and context that it nourishes the child socially, neurologically and linguistically – is described by TWMB as critical in developing a child's capacity to learn (Head Zauche et al., 2016; Weldon, 2014). Language-rich adult-child interactions, beginning at birth, have a direct impact on social-emotional and cognitive development and language and literacy ability.

The TWMB movement has several key elements including the convictions that: a) early language nutrition sets a foundation for lifelong success; b) collective impact and cross sector collaborative partnerships are a robust framework and; c) any effective approach or eventual solution needs to be multidimensional and undertaken through multiple channels. The TWMB approach includes:

(1) provider education and training across sustainable workforces; (2) family engagement through implementation of a multi-pronged public action campaign designed to support parents and families in their role as conversational partners with their children, including educational resources and tools; (3) research and evaluation that prioritizes the feasibility and efficacy of each of the educational and skill building training curriculums; (4) an intention to examine the efficacy of the language nutrition education and training as an evidenced based intervention impacting providers, caregivers and children; (5) and a focus on methods and strategies that are designed to rapidly scale to reach all parents and babies by maximizing team strengths and leadership to move quickly and nimbly from design to implementation to expansion.

TWMB is being expanded in several ways, including intervention with incarcerated mothers, preservice and in-service training for early educators, foster parents of high-risk infants and toddlers, and a comprehensive hospital-based initiative. Further, TWMB has been adapted extensively to create *Hablame Bebe* for Spanish-speaking families.

6.3.2. Population of children/timepoints

This effort, beginning at 25 weeks gestation with a focus through 12 months of age, integrates an intensive period of building knowledge and skill with multiple strategies and approaches throughout early childhood.

6.3.3. Settings

TWMB is being launched in multiple settings including: public health and WIC clinics and public health programs such as home visiting, pediatric private practices and medical homes, children's hospitals, affiliated clinics and NICU, early childcare settings, the foster care system, and in schools of nursing and early childhood education. This is occurring throughout the State of Georgia and is beginning to be implemented in other out of state communities.

6.3.4. Workforce/community engagement

TWMB is integrating "Language Nutrition coaching" as a core competency across the large-scale workforces of trusted professionals already reaching most parents and babies such as nurses and WIC nutritionists who see the majority of all new and expectant parents. The workforces have been further expanded to include foster care parents, early childhood caregivers and teachers, and home visitors. Through this wide-reaching approach during natural points of contact, TWMB is designed to transfer the capacity to deliver vital language nutrition to their children, to all parents and caregivers starting at birth.

6.3.5. Early findings

Talk With Me Baby has collected program evaluation and feasibility data from a number of sources. Over the last 4 years, the curriculum for nurses has now been taught to several thousand nurses in pediatric hospital, pediatric practice, OB/GYN, NICU, public health (WIC-Women, Infants and Children) and public service settings. Pre-Post knowledge measures of the TWMB training to nurses and WIC nutritionists showed a significant change in knowledge about early language development and the importance of talking to infants. Nurses and WIC nutritionists also showed increased self-endorsed confidence in their capacity to talk to parents about the importance of Language Nutrition (Gaines et al., 2017). Organizational readiness and feasibility was also surveyed and found to vary widely between settings. Despite the reported desire and willingness to use new knowledge about language nutrition, nurses were not always confident that these efforts would be successful in their environments. A taskforce continues to increase dissemination of TWMB to practicing nurses and nursing students throughout the state of Georgia, and to plan and launch evaluation efforts embedded within these dissemination efforts and to a variety of work forces.

6.4. Too Small to Fail

6.4.1. History and description

Too Small to Fail is a broad public awareness and action effort funded by the Clinton Foundation, the Opportunity Institute, and the Kaiser Family Foundation to address the issue of the importance of early brain and language development and to empower parents with tools to talk, read, and sing with their young children from birth. This effort has developed partnerships with pediatric providers, medical homes and hospitals, and organizations that are faith based, community based, non-profit and for profit to address the need of parents in preparing their children for success (www.talkingisteaching.org).

Talking is Teaching: Talk, Read, Sing is the most widely recognized program of Too Small to Fail with its focus on helping parents "recognize their power to boost their children's early brain and vocabulary development through simple, everyday actions (http://talkingisteaching.org/about)." This campaign has been built with parent education materials and resources such as books, text messaging, expert advice and parent videos on early literacy, early math and social-emotional development for infancy through preschool age, instructive videos, and tips and tools.

6.4.2. Setting

Materials from Too Small to Fail and Talking is Teaching are widely available on the website, with the intent of creating media messages across various platforms (billboards and print ads, bus shelter placards, playgrounds). The campaign also provides a fully usable tool kit that can facilitate a community wide scaling effort. The toolkit houses resources on starting and maintaining a campaign. These resources describe efforts that are taking place throughout the United States in a variety of communities. The toolkit offers a framework and ideas on locations for messages and sites for learning on literacy and language, ideas for communication (e.g., PSAs, bus stop advertisements, clothing, social media) and creative marketing (e.g., logos, posters, grocery store signs). The toolkit also offers examples of training materials as well as research supporting the approach. Widely recognized programs built on the Too Small to Fail resources exist in the pilot cities of Oakland California and Tulsa Oklahoma as well as ten other cities/municipalities across the United States.

6.4.3. Workforce/community engagement

Talking is Teaching: Talk, Read, Sing is designed to be adopted and delivered by civic organizations, including governmental and nongovernmental organizations.

6.4.4. Population of children/timepoints

Birth to five.

6.4.5. Early reports

The online toolkit includes a section on research supporting the approach of Talk, Read Sing as well as case studies and program evaluation reports.

7. Discussion

This paper is designed to provide a review and suggest directions for future research, development, and interventions to promote early language development in a broad pediatric and population health environment. We argue that such an approach has both direct and general implications for young children's development

across the lifespan, that addressing disparities in this area is a public health imperative, and that to meet this challenge successfully will require a community-level approach that efficiently and effectively provides intervention varying in intensity across a range of identified needs. The complex interaction between health and education make this multidisciplinary approach imperative for success in intervening in early childhood experiences aimed at bridging the word gap and promoting literacy.

Our literature review resulted in identification of some interventions that are being developed systematically and evaluated empirically, but also demonstrated the relative dearth of research examining large-scale programs specifically designed to reduce the word gap in the pediatric public health arena (c.f., ROR). We augmented this review with several case study exemplars that describe a way forward in this space, and several additional "promising practices" that are likely to add to this array of exemplars as their development continues.

In the following section, we suggest three main areas of focus for the future (a) interventions developed and implemented in partnership across programs and sectors, (b) tiered systems designed to address varying levels of need, and (c) rigorous evaluation of scalable/scaled approaches. These three directions share important relations to the public health framework proposed here in that they each emphasize *prevention and early intervention*. Public health campaigns seek to improve health outcomes throughout a population by preventing health issues before they start, or by changing behavior to reduce or eliminate the impacts of unhealthy behavior or influences. Public health campaigns have convinced Americans to put their babies on their backs at night, to not smoke when pregnant, and to use seat belts and designated drivers. Broad messaging and locally-based interventions like the ones that led to those important changes are a model for how we can address the disparity in language interactions between the haves, and the have-nots (Crow & O'Leary, 2015).

Such a preventive and early intervention approach is particularly important in areas like language development; both empirical evidence (Hart & Risley, 1995) and practical experience suggest that disparities only grow in magnitude and intervention decreases in efficiency as children age, and language (perhaps uniquely) is a domain that supports, occasions, and contributes to a child's status in other health and developmental domains (e.g., Crow & O'Leary, 2015; Walker et al., 1994). To move upstream and promote early language development in ways that reduce or eliminate later disparities requires resources for early identification of risk or delay, access to appropriate services to address both risk factors and early developmental assets, and an empirically driven continuous improvement process that yields ongoing improvement in efficiency and effectiveness over time.

7.1. Intervention across programs and sectors

The bulk of empirical literature evaluating community- and population-level early language and literacy interventions and the case studies presented here describes interventions either provided exclusively in, or functionally aligned with, pediatric healthcare settings. In contrast to interventions delivered through other systems, healthcare settings provide universal reach for children and families from the prenatal period through the early childhood years. As a result, surveillance and early identification procedures implemented in healthcare settings may be the best way, currently, to identify those children and families for whom some level of intervention is needed. Further, the success of programs like Reach out and Read and VIP demonstrate that primary healthcare providers and interventions within these settings can positively impact language and literacy outcomes.

Nonetheless, reliance solely on healthcare settings for screening and intervention to reduce the word gap may not be appropriate nor, ultimately, optimally effective or cost-efficient. Primary care providers often have a limited amount of time for face-to-face visits and interactions. Regular appointments, although frequent in the first several months of life, may not be frequent enough during important toddler and preschool years. As evidenced by Nagamine et al. (2001), embedding intervention during emergency room visits is not always feasible or practical - essentially, it's not reasonable. For these reasons, identifying and deploying resources in other service delivery settings and/or by other professionals may be necessary.

Building and evaluating partnerships that seamlessly take advantage of resources and mission-related capacity of multiple service delivery systems is needed to come at the word gap problem from a variety of directions. Early Hearing Detection and Intervention (EHDI) programs provide an example of an organized system engaging providers from hospitals, clinics, and early intervention home visiting to focus in on a targeted problem (EHDI, n.d.). Word gap interventions would benefit from similar structures connecting multiple sectors so that practitioners in health care and home visiting, child care, early education, and early intervention can work collaboratively towards improving language skills for young children.

Similarly, coordinated case management and intervention between primary healthcare and community early childhood education services offer potential resources. Such collaboration may already exist in federally and locally mandated services to infants and toddlers with disabilities served under Part C of the Individuals with Disabilities Act, or in states where parent education programs have resources and formal ties to initiate program services based on contact in or referrals from healthcare programs. Development and implementation of coordinated services between primary healthcare and early education can leverage existing community resources, and may well provide approaches to service that can be more intensive, more frequent, and sustainable. As such, models that leverage collective impact (c.f., Hanleybrown, Kania, & Kramer, 2012) may have special promise.Intervention across multiple service delivery systems may facilitate intervention across different settings and, in turn, promote greater intervention intensity and generalization of effects. For instance, while initial contact and "light touch" interventions (like, for instance, Reach Out and Read or Talk with Me Baby) might be feasible and desirable when during well-child visits with health care professionals, aligned and activity-based coaching can be provided to parents and children in visits to community libraries or in families' homes, as is done in Providence Talks. Intervention across systems then has several potentially important attributes. First, this collaboration may take advantage of already frequent events (e.g., well-child visits) and may better leverage existing resources (e.g., health care professionals as trusted advisors, and parent educators as trusted mentors and coaches). Second, by leveraging existing resources, cross-system interventions may be more cost-effective. Finally, this type of coordination likely expands points of contact, and thus intensity, of intervention at all levels in ways that would be expected to contribute to population-level behavior change.

7.2. Multilevel interventions

Families and children vary in their need for support of early language development. Different needs may call for varying levels of intervention intensity and duration, a hallmark of multi-tiered systems of support in public health and early education (Carta & Miller, 2019). Most tiered intervention systems share several common features. First, universal screening of developmental (or health) status is conducted; if warranted, this screening is repeated

over time. Screening functions to identify individual cases where either developmental/health status is not meeting expectations or risk factors associated with future concerns are present; often, screening results are confirmed with brief but more focused assessment activities. When status or risk factors are outside of expected ranges, some additional intervention is typically implemented. While multi-tiered models differ somewhat at this juncture, in general more than one level of intervention intensity is available and selected cases are matched to an intervention intensity or type most clearly indicated by their screening and assessment results. Developmental or health status of individual cases enrolled in more intensive interventions are monitored more closely, and intervention services are adjusted as needed. Beginning with screening measures, which can identify children and families needing support early on, a tiered model focused on addressing the word gap might include base-level supports implemented early in a child's life with increasingly intensive interventions provided to a subsection of the population demonstrating the greatest need. Talk With Me Baby provides a good example by training nurses who work with mothers and newborns how to provide language nutrition from the first days after birth. Reach Out and Read also exemplifies preventative efforts that can be universally implemented to reach all families with infants and young children. Children and families identified as having additional risk-factors (e.g., low or very low birthweight, living in poverty) might receive mid-level interventions similar to those described above with VIP. Finally, home visiting programs might be provided at the highest tier for families and children who do not make substantial progress with primary or secondary interventions. The Thirty Million Words initiative implementing explicit training on "the three Ts" through home visiting is one example.

7.3. Empirical evaluation

Early language development is influenced by multiple factors varying in proximity to the child and caregivers, and in the relative effect that changes in these factors has on observed outcomes (Ford et al., 2018), and disparities in the outcome of this development process are persistent and troubling (Suskind, 2015). To meet the social obligation of reducing these disparities and to do so with rigor and reliability will require thorough, ongoing empirical evaluation of intervention programs.

Some of this evaluation is already underway; in this review, we have noted published evaluations of VIP, Reach Out and Read, and Thirty Million Words. While these specific interventions may benefit from alignment with other initiatives to achieve the "multiple levels of intervention" we argue are necessary, we also acknowledge that ongoing research and development of these existing programs is critically important.

More broadly, Greenwood et al. (2017) proposed a promising vision of what a comprehensive design and evaluation system might look like for language and literacy-based initiatives with increasingly sophisticated evaluation methods. Greenwood and colleagues propose both the content and a research methodology that suggest at least three next steps.

Evaluating the evidence for tiered interventions presents challenges at all levels of intensity. Greenwood and colleagues suggest that in a population-level framework, we must evaluate interventions from population, community, and child perspectives. This focus enables programs to focus their efforts and evaluate the pieces that fit into these areas. In a population-level intervention, assessing the problem, mobilizing the national (or community action) might be one way of evaluating large-scale public health interventions. As the engagement and interventions drill deeper in to engaging people in creating language environments that ultimately improve language outcomes, each of these pieces can offer an opportunity for evaluation in a tiered fashion.

Advancing prevention and intervention work to address the word gap will require us to identify multiple ways to assemble the various population, community, and individual interventions into a "system" that is both universal in its reach and efficient (and sustainable) in its operation. Work being done by Thirty Million Words is aiming to do this by bringing multiple arms of the program into various aspects of health care and home based care. The model moves from universal calls to action to child level change. It remains to be seen whether this model will serve as a sustainable application of a large scale intervention. Evaluating sustainability and efficacy when implementing a public health prevention intervention at varying levels of scale requires an understanding in methodology and some behavioral economics.

8. Conclusion

Health and education are intimately intertwined, especially in young children. Notable health disparities are directly linked to educational inequalities resulting in large differences in chronic illnesses, infant mortality, and adult life expectancy across populations. These substantial differences in human health have lead practitioners to incorporate literacy and language into clinical practice and home visiting as an intervention for lifelong health. Reports on effective intervention studies and anecdotal success of community-based programs provide promising steps to address the word gap nationwide, yet a comprehensive system of support is needed to impact child language and literacy outcomes at a broader scale. The case studies presented here provide several key next steps including coordinated approaches across sectors, a keen focus on measurement of impact and of variables that will predict effective widespread implementation and sustainability, and engagement of caregivers living in everyday communities into which tools, resources and reinforcement can be built. Continued evaluation and associated scaling of effective programs will help decrease language-related disparities in early childhood - leading to better long-term outcomes for children, their families, and society as a whole.

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