

Research Statement

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The goal of my research is to understand how children's early environments support the development of language and communication, and to use this knowledge both to illuminate and to address disparities in child development. Experimental research has revealed powerful mechanisms that children bring to the task of learning language, including speech perception, statistical learning, and social and attentional biases. At the same time, studies using observational methods have explored trajectories of language development in diverse groups of children, revealing stunning variability in early environments that are predictive of differences in language growth. My research brings together these two traditions, applying sophisticated infant assessment techniques and extensive naturalistic observation to discover how early experience shapes the skills that enable children to learn most effectively from their environments. Importantly, I use this approach to address fundamental basic-research questions about child development, as well as to evaluate impacts of interventions that target disparities in real-world contexts. This multidisciplinary research program seeks to bring developmental science into the public health sphere by uncovering key influences on development and using this knowledge to design theoretically-grounded interventions for preventing language delays in at-risk children.

How early environments shape early brain and child development

Language ability is among the neurocognitive systems most strongly associated with childhood poverty. A key goal of my research has been to illuminate how early environments shape the underlying language-processing capacities that facilitate language learning (Weisleder & Fernald, 2014; Weisleder & Marchman, in press). In my doctoral work, I utilized innovative eye-tracking methodology to assess infants' speed in processing speech. Using this method, my colleagues and I documented poverty-related disparities in processing speed in both English- and Spanish-speaking infants, showing that 24-month old children from low-income homes processed language at the level of 18-month old infants from higher-income homes (Fernald, Marchman, & Weisleder, 2013; Weisleder et al, in prep). These findings showed that poverty is associated not only with language ability but also with underlying neuropsychological processes, bringing attention to disparities in language development as a critical public health problem. Furthermore, these findings demonstrate that measures of language processing in infancy are a potential biomarker with significant clinical applications, including early identification of language delay in children from diverse cultural and socioeconomic backgrounds.

To better understand *how* early environments shape language development, I pioneered the use of innovative speech analysis technology (LENA™) to investigate the natural language environments of Spanish-speaking and bilingual children. In analyzing over 500 hours of home recordings I discovered large differences in the quantity and quality of language interactions children experienced, which predicted children's future processing skill and vocabulary size (Weisleder & Fernald, 2013). Crucially, this study showed that early language experience supports vocabulary growth in part by strengthening infants' skill in spoken language processing. In addition, I showed that language experience predicted children's ability to infer the meanings of novel words in ambiguous contexts – a vital skill for rapid word learning (Weisleder et al., in prep). Together, these findings shed light into three distinct ways in which rich language environments support language development: by providing data for learning language, by sharpening language processing skills that enable more efficient learning, and by fine-tuning skills used to infer the meanings of new words. These findings also suggest that enhancing children's early language environments has the potential to change trajectories of vocabulary growth, making this a powerful target for intervention.

Translating developmental science into population-scalable interventions

A primary goal of my postdoctoral work has been to translate recent discoveries in how parent-child interactions support child development to the design and evaluation of interventions working with parents in the healthcare setting. My work to date has made key contributions to understanding the efficacy of pediatric-based interventions on child development, and to the adaptation and dissemination of intervention strategies in the US and internationally.

Enhancing parent-child interactions through pediatric-based interventions

Pediatric health care offers a significant opportunity for delivery of population-wide interventions to enhance child development prior to school entry. The Video Interaction Project (VIP) is an intervention developed in Dr. Alan Mendelsohn's lab, which utilizes the pediatric platform to promote parent-child interactions in reading aloud and play. Prior work has shown that VIP has impacts on parent-child interactions and on children's cognitive and language outcomes (Mendelsohn, Cates, Weisleder et al., 2013). My recent work shows that VIP also leads to improvements in social-emotional skills that are considered critical for learning in school (Weisleder et al., 2016). In addition, I have shown that parents' increased engagement in language-rich interactions (reading aloud and play) leads to enhancements in the parent-child relationship that result in reduced child behavioral problems (Weisleder et al., under review). This is an important contribution to the scientific literature, as it reveals interconnections between strategies for enhancing language and social-emotional development that are often assumed to work independently. Moreover, these results have significant policy implications: Given the potential for low cost and population-level reach of primary care interventions, these findings strongly support a role for the pediatric platform in addressing poverty-related disparities in child development.

In ongoing analyses, I am using LENA™ technology to study the natural language environments of families participating in VIP, in order to understand in a more direct way how the intervention changes patterns of parent-child interaction in the home. These new data will help us understand how parents implement advice about shared reading and play in their everyday home environments, leading to key insights that will inform optimization of parenting interventions.

Adapting interventions for wide-scale impact in the US and internationally

In addition to establishing the efficacy of new intervention strategies, a key question is how interventions can be implemented at scale in a way that maximizes impact and leverages existing local systems. I have played a central role in planning for dissemination of VIP across New York City (NYC) and in Flint, Michigan, and in studying implementation effectiveness. As part of the Practice-Based Research Collaborative of the Bridging the Word Gap Network, I am co-leading an evaluation of a NYC-wide initiative in which we are studying community-level impacts of individual programs as well as whether there is added value from linking pediatric- and community-based programs. This innovative project will lead to new insights into how to maximize the impacts of early childhood interventions at the individual and community levels.

I am also working on adaptation of early childhood interventions in various international contexts, including as part of an early childhood initiative in northern Brazil. Within this initiative, I have helped design a parenting program delivered in educational childcare centers, and led a cluster randomized study of this program. Findings from 1-year follow up data reveal enhancements in parent-child interactions and in child vocabulary, working memory and IQ as a result of the intervention (Weisleder et al., under review), suggesting that this is a promising strategy for enhancing child development in low- and middle-income countries. In ongoing analyses we are examining different mechanisms for intervention impacts, as well as maternal, family, and cultural factors that may moderate its effects.

Future Directions

Drawing on diverse methodologies and participant populations, my research has begun to unravel how learning mechanisms interact with differences in experience to guide developmental outcomes. Through my combined expertise in language acquisition, psychology, and public health, I am poised to develop a research program in areas that are of significant scientific and policy interest, and which can be applied to the problem of early identification and treatment of language delays. First, using both experimental and observational methods, I will deepen investigation into how features of naturally occurring language interactions support language and cognitive development in diverse populations. Using techniques developed in my previous work, I will examine how differences in the uptake of linguistic information depend on characteristics of the learner, of the environment, and their interaction. This program of research will thus provide a rich opportunity to unite work on typical and atypical development. Second, I will build on these findings to design and optimize intervention strategies for enhancing language development in at-risk children. In particular, I plan to work on an adaptation of VIP focused on multilingual families, a growing population with unique strengths and challenges. Using a community-based participatory research framework, I will seek to develop strategies to help health care professionals and other practitioners adequately support families raising multilingual children. Third, I plan to expand my work with international collaborators to better understand the diversity of developmental trajectories in children around the world, and to adapt existing interventions for vulnerable children in developing countries. Working in international settings will also help inform the development of culturally sensitive approaches for working with ethnic minority and immigrant families in the United States.

Reducing the effects of poverty on child development requires that we apply new insights from both cutting edge science and practical, on-the-ground experience. I occupy a unique niche as a pioneer in the emerging field of *translational developmental science*, with the capacity to advance scientific knowledge and to build collaborations with clinicians, educators, and policymakers to translate scientific discoveries into practice and policy.