EXPLORING PRESCHOOLERS' COMMUNICATIVE PARTICIPATION OUTCOMES

EXPLORING COMMUNICATIVE PARTICIPATION OUTCOMES FOR PRESCHOOLERS WITH SPEECH AND LANGUAGE DELAYS

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Lay Abstract

The work presented in this dissertation explored participation-based outcomes for preschoolers with communication disorders. First, by completing a scoping review, I identified the need to explore participation-based outcomes for preschoolers with communication disorders. Participation-based outcomes are important and meaningful for families, but are not typically used in speech-language research or practice. I next modelled the development of communicative participation skills (how a child uses his/her communication to engage) for preschoolers with speech and language delays who were accessing services in Ontario's Preschool Speech and Language Program (PSLP). Following this I identified both demographic and intervention-based predictors of that communicative 'growth'. Development was modelled separately for children in five levels of communicative function using a reliable classification tool that I validated for use with this general community-based population. This work addresses a major gap in the speech-language literature and has important implications for clinicians, administrators and policy makers in the PSLP and beyond.

Abstract

This dissertation explored new ways of evaluating outcomes for preschoolers with communication disorders. It identified a need to evaluate outcomes as they relate to a child's communicative participation and provided initial models for doing this.

Chapter 1 provides the context for the dissertation, discussing the theoretical framework used, the literature on communicative participation outcomes, and Ontario's Preschool Speech and Language Program (PSLP) and its program evaluation project (the setting for the studies presented in Chapters 4 & 5).

Chapter 2 is a scoping review of the literature exploring the ways in which outcomes for preschoolers with communication disorders have been evaluated. It identifies a gap in the literature related to participation-based outcomes, and thus the need for the work presented in Chapters 4 and 5.

Chapter 3 presents further evidence of both construct and predictive validity of the Communication Function Classification System (CFCS), the classification tool used for PSLP program evaluation. This tool was previously validated for use with children with Cerebral Palsy, and this study provides evidence of its validity with other groups of children.

Chapter 4 explored communicative participation outcomes for preschoolers accessing PSLP services by developing growth curves that predict development of preschoolers' communicative participation skills. The models provide a first look at the growth of those skills, and show that all children make meaningful change regardless of their communicative function.

Chapter 5 added meaningful predictor variables (based on available data) to the previously defined growth curves (Chapter 4) and identified both demographic and intervention-specific variables that were predictive of growth. Predictors varied by level of communicative function, a new insight in the field. This work has clinical implications both within and beyond the PSLP.

Chapter 6 discusses the clinical and research implications of this dissertation work as well as ideas for future directions of my research.

Acknowledgements

I can never properly thank my supervisor, Dr. Peter Rosenbaum, for all he has done to support me on my PhD journey. Over the course of my four years at McMaster he has provided me invaluable mentorship related to this work, but the impact he has had on my life goes far beyond this dissertation. He has provided me with an exemplary role model for what a good academic researcher can and should be. In my future endeavours, I will strive to be the type of academic, teacher, and person Peter is. This will surely enrich my collaborations with others, enhance my work and research, and help me make a meaningful difference in the lives of children with disabilities. Working with Peter has truly been an honour, a privilege, and a transformative experience I will carry with me always.

I am also sincerely grateful to the members of my advisory committee: Dr. Steven Hanna, Professor Nancy Thomas-Stonell, and Professor Debra Stewart for their never-ending support and encouragement. It has been my privilege to work with each of them in various components of my PhD work and I have benefited greatly from their interdisciplinary experiences and knowledge.

This work would not have been possible without the generous support of Ontario's Preschool Speech and Language Program. I am grateful for their willingness to share their program evaluation data so that I could do this work. I am also indebted to Dr. Bruce Oddson, who took those data and made them useable, and who provided me with mentorship in statistics and writing code for statistical software.

I am grateful for the generous funding support that I received throughout my doctoral work, including an Ontario Graduate Scholarship, and an American Speech-Language-Hearing Foundation New Century Scholar's Doctoral Award.

Last, but certainly not least, I thank my family, especially my wonderful husband and our beautiful children for their tremendous support and encouragement, for reminding me what is truly important, and for always believing in me.

Preface

The preface summarizes all author contributions to each of the manuscripts presented in this dissertation.

For the manuscript titled *Current Methods of Evaluating Speech-Language Outcomes for Preschoolers with Communication Disorders: A Scoping Review Using the ICF-CY*: I was the lead researcher, developing the research questions and search queries, executing database searches, coordinating research colleagues to assist with reviewing articles, completing half of all reviews, collating and summarizing results, and writing the manuscript. The second (KW) and sixth (PR) authors provided consultation throughout the process, and provided editorial assistance and feedback on both the initial manuscript and its subsequent revision.

For the manuscript titled *Validity of the Communication Function Classification System for use with preschool children with communication disorders:* The first (MJCH) and third (NTS) authors of this paper had previously begun a study to assess the validity of the CFCS in groups of children other than those with cerebral palsy, but had not progressed beyond designing the study and collecting data. I was granted access to the study data, and independently completed the statistical analyses and wrote the manuscript. The fourth author (BO) confirmed the accuracy of my statistical analyses, and all co-authors reviewed the manuscript before it was submitted for publication.

For the manuscript titled *A population-based study of communicative participation in preschoolers with speech-language delays*: I completed the literature review, statistical analyses, and wrote the manuscript, however all co-authors also contributed to this work. The fifth author (PR) provided input with respect to clinical applications of the work as well as the conceptual framework – modelling it after previously developed models of gross motor growth. The third author (BO) extracted the data from the PSLP's original excel spreadsheets, formatted them into a useable form, and provided ongoing consultation regarding use of Stata (the statistical software package used). The second author (SH) provided statistical consultation, advising about methodological approaches for finding the best fitting growth curves, and interpreting results. The fourth author (NTS) provided consultation with respect to content and application to clinical practice. All co-authors provided editorial assistance with the manuscript before it was submitted for publication.

For the manuscript titled *Factors contributing to preschoolers' communicative participation outcomes: Findings from a population-based longitudinal cohort study in Ontario Canada*: I completed the literature review, undertook the statistical analyses, and wrote the manuscript. The second author (SH) conceptualized the statistical methodology, and provided statistical consultation for interpreting the results. The third (NTS) and fifth (PR) authors provided consultation related to clinical and research applications. The fourth author (BO) extracted additional data from the PSLP's Excel spreadsheets and provided consultation regarding use of Stata (the statistical software used). All co-authors provided editorial assistance with the manuscript before it was submitted for publication.

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List of Abbreviations and Symbols

ASHA	American Speech-Language-Hearing Association
CP	Cerebral Palsy
CFCS	Communication Function Classification System
CINAHL	Cumulative Index to Nursing and Allied Health Literature
EMBASE	Excerpta Medica dataBASE
ERIC	Educational Resources Information Center
FOCUS©	Focus on the Outcomes of Communication Under Six
FOCUS-34	Focus on the Outcomes of Communication Under Six – 34 item version
GMFCS	Gross Motor Function Classification System
ICF	International Classification of Functioning, Disability, and Health
ICF-CY	International Classification of Functioning, Disability, and Health – Child and Youth
MACS	Manual Ability Classification System
MEDLINE	Medical Literature Analysis and Retrieval System
PSLP	Preschool Speech and Language Program
PsycInfo	Psychological Information Database
SAC	Speech-language & Audiology Canada
SD	Standard deviation
SLP	Speech-language pathology/speech-language pathologist
SLPs	Speech-language pathologists
WHO	World Health Organization

List of Appendices

Declaration of academic achievement

The work presented in this dissertation is original and was completed by the doctoral candidate. The doctoral candidate formulated the research questions, completed data collection (as needed), analyzed data, interpreted findings and wrote all of the included manuscripts. The thesis supervisor and advisory committee provided mentorship with respect to each of the tasks described above. The doctoral candidate is the author of this work, but has benefited from feedback from the advisor and advisory committee.

Chapter One: Introduction

Upon graduating from Western University with a Master's degree in Communication Sciences and Disorders (2006) I began my clinical practice working in Ontario's Preschool Speech and Language Program (PSLP) with preschoolers with a wide range of communication disorders. As a new graduate, there was so much to learn, and I spent the next several years participating in continuing education seminars and workshops to improve my clinical skills. In these early years, I clearly remember being thrilled with my practice working directly with children and families, and wanting to do that type of work forever. As I gained more years of clinical experience, however, my perspective changed.

I became frustrated at the lack of research evidence to support the interventions we (the speech-language pathologists (SLPs)) were providing. It was unclear which interventions were best suited to which children, and it was difficult to evaluate the true impact of my intervention efforts. Many of the available assessment tools would show that a child remained in the same centile, after what I (and the family) judged to be a successful period of intervention. I also had serious concerns about the lack of evidence to inform decisions regarding service delivery planning. I witnessed the creation of many evaluation tools that were developed with good intentions, but were not supported by research evidence or tested to determine their effectiveness to do the jobs for which they were being developed. These tools did not provide valid or reliable information, but were nevertheless used to collect data that informed service delivery planning and resource allocation.

As well, I began to notice a discrepancy between the kinds of goals clinicians targeted and measured in therapy and the kinds of outcomes that were important and meaningful to families. In my clinical experience, families had a strong interest in broadly-focused outcomes (e.g., Will my child make friends? Will we be able to communicate with each other? Will my child be able to participate in a school/preschool classroom?). They valued these outcomes over those in which clinicians were interested (e.g., Can the child produce the /s/ sound accurately? Can the child use pronouns in sentences?).

It was these frustrations that led me to pursue PhD training at McMaster University. I wanted to be able to contribute meaningfully to both clinical practice and service-delivery planning and decision-making within the PSLP, and I wanted to explore the idea of evaluating outcomes that were important and meaningful to families of children with communication disorders. My ultimate goal was to be able to evaluate the impact of the various interventions offered in the PSLP. I believed the interventions provided by PSLP SLPs were effective and led to meaningful outcomes for children and families. I hoped that by using my clinical experience and having a sense of the directions I wanted to see the field move, I could apply my energies and curiosity to addressing and possibly resolving some of the challenges I knew we faced.

Thus, in my dissertation work I have explored the idea of evaluating outcomes for preschoolers with communication disorders within the World Health Organization's International Classification of Functioning, Disability, and Health – Child and Youth Version (ICF-CY) (WHO, 2007). The framework and its application to studying outcomes for preschoolers with

communication disorders is presented next.

Theoretical Framework that Guided my Thinking

In 2001 the World Health Organization published its International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2001): a child and youth version (ICF-CY) followed in 2007 (World Health Organization, 2007). The ICF-CY provides a very useful framework for understanding the ways in which speech-language clinicians and researchers have provided intervention and evaluated outcomes for children under a biomedical approach, and how those things might be done differently now that a new and broader way of thinking has emerged (McLeod & Threats, 2008; Threats, 2008).

The ICF-CY framework is comprised of two parts – Functioning and Disability, and Contextual Factors. All parts of the framework interact to influence a child's health and health outcomes. Outcomes are typically measured within Functioning and Disability, although Contextual Factors (Environmental and Personal Factors) also influence health and health outcomes (Threats, 2013; WHO, 2007).

The Functioning and Disability component is traditionally considered to have two elements: Body Functions and Structures, and Activity and Participation. The WHO has, however, noted that it is possible to separate the Activity and Participation components so that outcomes can be viewed separately as either an Activity ('execution of a task of action by an individual') or Participation ('involvement in a life situation') (WHO, 2001). Specifically, in the WHO's fourth option for applying the ICF framework, the Activity and Participation components are theoretically separate, but have some overlapping features (WHO, 2001). For example, an increase in expressive vocabulary (an outcome related to Activity) may also impact a child's ability to interact with peers (an outcome related to Participation).

Most research in speech-language pathology has traditionally focused on outcomes related to the Body Functions and Structures and Activity components, with very little reported on communication outcomes as they relate to a child's Participation (Cunningham, Washington, Binns, Rolfe, Robertson & Rosenbaum, 2017; Threats, 2013). As such, we do not know whether improvements in the Body Functions and Structures and Activity components translate to improvements in children's Participation (Dykstra, 2013). Outcomes related to Participation are important, as they are most meaningful to families of children with communication disorders (Thomas-Stonell, Washington, Oddson, Robertson & Rosenbaum, 2013a) and are likely to have the biggest impact on the lives of children. As such, for the purposes of this dissertation work, I consider the Functioning and Disability section to have three components: Body Functions and Structures, Activity, and Participation, so that outcomes related to Participation can be explored separately.

For preschoolers with communication disorders, outcomes related to the Body Functions and Structures component might include improvements to speech fluency or intelligibility (McLeod & McCormack, 2007; Yaruss, 2007). For the Activity component, outcomes might include improvements to understanding of language, use of grammatical markers, mean length of utterance, or early literacy skills (Washington, 2007; Westby, 2007). For the Participation component, outcomes could include improved play and engagement with peers, conversational

skills, involvement in home/school-based activities, or communicative participation skills (Thomas-Stonell et al., 2013a; Threats, 2013).

As a speech-language clinician, and now researcher, I believe it is critical that we move beyond the traditional focus on intervention and evaluation of impairments towards addressing a child's ability to use their communication meaningfully to engage with others and participate fully in life (Rosenbaum & Gorter, 2012). In this way, we can shift our focus beyond trying to fix children towards helping them to achieve their potential to the best of their individual abilities (Rosenbaum & Gorter, 2012). More specifically, it is my hope that the field will begin to shift more toward the treatment and evaluation of children's communicative participation skills – or how a child uses communication to interact in real world situations that are meaningful to them (Eadie et al., 2006). Communicative participation is an important and desired outcome of speech-language therapies; however, the evidence base related to this relatively new construct is limited, particularly as it relates to children.

Foundational Work in Communicative Participation Outcomes Research

Much of the published research on communicative participation outcomes relates to adults with acquired communication disorders. To date, one tool for adults with communication disorders evaluates the extent to which a communication disorder interferes with life participation, namely The Communicative Participation Item Bank (CPIB) (Baylor, Yorkston, Eadie, Miller & Amtmann, 2010; Baylor, Yorkston, Eadie, Kim, Hyewon & Amtmann, 2013; Eadie et al., 2006). The CPIB has primarily been used to evaluate outcomes for adults with multiple sclerosis (Baylor, Amtmann & Yorkston, 2012; Baylor, Yorkston, Bamer, Britton & Amtmann, 2010; Yorkston, Baylor & Amtmann, 2014); and head and neck cancer (Bolt, Eadie, Yorkston, Baylor & Amtmann, 2016; Eadie, Lamvik, Baylor, Yorkston, Jiseon & Dagmar, 2010).

Similarly, one pediatric outcome measure has been developed specifically to evaluate communicative participation outcomes in preschoolers with communication disorders, namely The Focus on the Outcomes of Communication Under Six (FOCUS©) (Thomas-Stonell, Oddson, Robertson & Rosenbaum, 2009; Thomas-Stonell, Oddson, Robertson & Rosenbaum, 2010; Thomas-Stonell, Robertson, Walker, Oddson, Washington & Rosenbaum, 2012; Thomas-Stonell et al., 2013a; Thomas-Stonell, Oddson, Robertson & Rosenbaum, 2013b; Washington, Oddson, Robertson, Rosenbaum & Thomas-Stonell, 2013a; Washington, Oddson, Robertson, Rosenbaum & Thomas-Stonell, 2013b). Three published quantitative studies have investigated communicative participation outcomes for preschoolers with communication disorders. Thomas-Stonell et al. (2013a) measured preschoolers' communicative participation skills before and after a period of intervention (7-10 hours), demonstrating positive changes in communicative participation skills for children with a range of communication disorder types and severities. Washington, Thomas-Stonell, McLeod & Warr-Leeper (2015) explored predictors of communicative participation skills and identified social skills at pre-test, motor impairment in addition to communication disorders, and whether the child was in active treatment or waiting for intervention to begin as factors that contributed to outcomes (Washington et al., 2015). Thomas-Stonell, Robertson, Oddson, and Rosenbaum (2016) observed changes in communicative participation skills for preschoolers receiving augmentative and alternative (AAC) interventions; they found that communitive participation skills improved significantly during treatment, and that improvements were the result of intervention, and not attributable solely to natural child development.

A handful of qualitative studies related to children's communicative participation skills have also been published. Baxendale, Lockton, Adams and Gaile (2013) asked parents and teachers to describe how speech-language therapy had improved participation for school-aged children with pragmatic language disorder. Respondents identified three groups of factors that they believed influenced therapeutic outcomes: (i) Factors related to *context* included the number of intervention sessions, and the level of classroom support; (ii) *Process-related* factors focused on therapy being fun for children, therapists liaising with parents, and therapists consulting with classroom teachers; (iii) Factors related to *content* included the nature of the intervention plan (Baxendale et al., 2013). In two other studies, parents identified the SLP's rapport with the child, professional competence, support of parent involvement, approachability, communication skills, and respect for parents' ideas and beliefs as influencing children's communicative participation outcomes (Watts Pappas, McLeod, McAllister & McKinnon, 2008; Washington, Thomas-Stonell, McLeod & Warr-Leeper, 2012). Washington et al. (2012) also identified sub-factors that included the child's enjoyment of therapy, whether parents thought the SLP liked their child and whether they thought their child liked the SLP, the SLP's management of the child's personality, and the child's improvement/progress in therapy.

These studies suggest that children's communicative participation skills change as a result of speech-language therapy. They also identify some factors that may influence outcomes for those children. There is, however, still much to learn about the development of preschoolers' communicative participation skills and the factors that may impact the development of those skills. An ongoing program evaluation project in Ontario Canada's PSLP afforded me the amazing opportunity to explore these types of outcomes in greater detail than had previously been possible.

Ontario's Preschool Speech and Language Program (PSLP)

In the PSLP children from birth to five years of age with a range of communication challenges receive publically-funded assessment and intervention services prior to starting senior kindergarten (OMCYS, 2013). Services include assessment, individual and group intervention, and parent/community training, education, and consultation. Over 50,000 children access these services each year (OMCYS, 2013). In the fall of 2012, the PSLP adopted two new tools to be used in their provincial program evaluation project. Both tools address issues of social functioning and communicative participation, and each is currently meant to be used every six months for all children accessing services within the program.

The Focus on the Outcomes of Communication Under Six (FOCUS©) is a valid and reliable parent-report measure that assesses changes in children's communicative participation skills over time. It was developed for use with preschoolers with a range of communication disorder types and severities (Thomas-Stonell et al., 2009; Oddson, Washington, Robertson, Thomas-Stonell & Rosenbaum, 2013; Thomas-Stonell et al., 2013a; Thomas-Stonell et al., 2013b; Washington et al., 2013a; Washington et al., 2013b; Washington et al., 2015). There is also a speech-language pathologist version of the FOCUS© available, to be used in situations where parents are not available to complete the measure (e.g., if assessments are done at a daycare without parents present). Psychometric properties of the SLP version are strong, suggesting that either a parent or SLP can complete the measure if necessary (Thomas-Stonell et al., 2013b).

The Communication Function Classification System (CFCS) is a validated classification tool that is used to categorize children's everyday communication skills into one of five meaningful levels of function (Hidecker et al., 2011; Hidecker et al., 2012). Used together with the FOCUS©, we can report communicative participation outcomes for children according to their varied levels of everyday function. Other benefits to using the CFCS include introducing standard terminology to a field riddled with problems of consistent terminology (Speech Pathology Australia, 2008; Walsh, 2006a; Walsh, 2006b); and introducing neutral wording for children's communicative abilities. Therapists have traditionally described children's 'impairments' as being "mild", "moderate", or "severe" (Rosenbaum, Eliasson, Hidecker & Palisano, 2014). The CFCS promotes a neutral language about children's abilities, focusing on what children can do (not what they cannot) (Rosenbaum et al., 2014).

As a doctoral student at *CanChild*, and a member of the group that collaborated with the PSLP to develop and implement these outcome measurement tools, I was granted access to these data for part of my dissertation work. My dissertation work includes four components, which are described next.

The four components of this dissertation

1. The first paper is a scoping review of the literature. The purpose of the review was to look broadly at the 'state of the field' and to identify how outcomes for preschoolers with communication disorders were being evaluated using the ICF-CY framework. The review was done to substantiate reports in the literature that outcomes related to the Participation component of the ICF-CY were lacking, and to identify a need for more research in this area. Results from the review showed that there is still a lack of research related to Participation outcomes, and that additional research related to Participation outcomes for preschoolers was warranted.

2. The CFCS is the classification tool used by the PSLP in its program evaluation project. It was developed and validated for use with children with cerebral palsy (CP) (Hidecker et al., 2011; Hidecker et al., 2012), but was being used by the PSLP with preschoolers with a host of other communication disorders (usually not CP). Before beginning analysis on the PSLP program evaluation data, it was important to determine whether the CFCS was in fact valid for use with children who had communication challenges other than those associated with CP. I found evidence of construct and predictive validity of the CFCS for children accessing PSLP services, and therefore felt comfortable proceeding with my analysis of the PSLP data.

3. As a first step exploring preschoolers' communicative participation outcomes, I decided to look at the development of those skills over time, as this was not yet well (if at all) represented in the literature. Statistical models of growth had previously been developed for children with specific impairments, however a model of growth that focused on participation had not yet been done. The models presented in this dissertation focus on communicative function (i.e., how preschoolers' communication skills improve in the context of their everyday lives, as assessed with the FOCUS©), and have the potential to facilitate a much-needed shift towards focusing on children's participation and engagement (as opposed to the traditional impairment-based approach). Models of predicted growth (change in FOCUS©

scores over time) are presented for children in each of five CFCS levels of function. Children in each CFCS level had distinct growth curves, suggesting varying rates of development.

4. The growth curves presented in the third paper represented an initial view of the predicted development of children's communicative participation skills, but they did not account for the many factors that likely impacted that development. For the final paper meaningful variables that were available in the PSLP datasets were added to the previously fit growth curves to identify statistically and clinically significant predictors of preschoolers' communicative participation outcomes. Both demographic and intervention-based variables were identified as being statistically significant predictors of communicative participation outcomes, although these differences were not always clinically meaningful. Predictors of outcome differed by CFCS level. This was particularly salient for the intervention-based variables, resulting in important clinical implications of the work.

This dissertation represents an initial exploration of communicative participation outcomes for preschoolers within Ontario's Preschool Speech and Language Program. With some knowledge translation efforts, this work can make what I believe are meaningful and important contributions to both research and practice. In the concluding chapter I offer my thoughts on both my journey thus far, and some possible directions for my future work, which will explore the territory in even more detail.

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Chapter Two: Current Methods of Evaluating Speech-Language Outcomes for Preschoolers With Communication Disorders: A Scoping Review Using the ICF-CY

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Review Article

Current Methods of Evaluating Speech-Language Outcomes for Preschoolers With Communication Disorders: A Scoping Review Using the ICF-CY

Barbara Jane Cunningham,[a] Karla N. Washington,[b] Amanda Binns,[c] Katelyn Rolfe,[d] Bernadette Robertson,[e] and Peter Rosenbaum[a]

Purpose: The purpose of this scoping review was to identify current measures used to evaluate speech-language outcomes for preschoolers with communication disorders within the framework of the International Classification of Functioning, Disability and Health–Children and Youth Version (ICF-CY; World Health Organization, 2007).
Method: The review involved 5 phases outlined by Arksey and O'Malley (2005) and further developed by Levac, Colquhoun, and O'Brien (2010): (a) articulating the research question; (b) identifying relevant studies; (c) selecting studies; (d) charting the data; and (e) collating, summarizing, and reporting the results. The ICF-CY was used to frame the measures included.
Results: A total of 214 relevant peer-reviewed publications were included in the review. Most publications used measures to evaluate changes in outcomes for Activities (65%), followed by measures evaluating changes in Body Functions (20%), and finally measures evaluating changes at the level of Participation (15%). There has been a slight increase in the evaluation of Participation-based outcomes in the past 4 years (2012–2015).
Conclusion: The review revealed a dearth of measures in the pediatric speech-language literature that address Participation-based outcomes. The authors strongly advocate for the use of Participation-based outcome measures to detect meaningful change in the lives of children and families.

Like all health care disciplines in the Western world, pediatric speech-language therapy has traditionally been delivered on the basis of thinking informed by a biomedical approach in which interventions are designed to normalize or "fix" children's communication skills (McCormack, McLeod, Harrison, & McAllister, 2010; McLeod & Threats, 2008; Threats, 2008; Washington, 2007). In the same way, research evaluating the effectiveness of speech-language therapies has traditionally been focused on outcomes related to impairments such as improved articulatory function, use of grammatical markers, or increased sentence length (McCormack et al., 2010; Washington, Thomas-Stonell, McLeod, & Warr-Leeper, 2015). Although important in many ways, this approach has a narrow focus. It assumes that changes in these impairments will translate to improvement in everyday functioning, and it fails to consider the myriad real-world issues that affect children's communication and their ability to use that communication to participate and engage in their world.

The World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF; WHO, 2001) and its subsequent Child and Youth version (ICF-CY; WHO, 2007) provide a framework for examining the ways in which we think about and evaluate outcomes in pediatric speech-language pathology. Along with many other international associations, the American Speech-Language-Hearing Association (ASHA) has adopted the ICF to help guide practice, advocating for its use in both clinical and research activities. The ASHA document "Scope of Practice in Speech-Language Pathology" (2016) specifically states that the "ICF framework is useful in

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describing the breadth of the role of the SLP [speech-language pathologist] in the prevention, assessment, and habilitation/rehabilitation of communication and swallowing disorders and the enhancement and scientific investigation of those functions" (p. 5).

The ICF-CY, which was based on the original ICF, provides a biopsychosocial framework that uses universal language to address health concerns that are specifically relevant to infants, toddlers, children, and adolescents. The ICF-CY framework comprises two parts: (a) Functioning and Disability and (b) Contextual Factors that influence children's health (WHO, 2007). The Functioning and Disability section consists of two components: Body Functions and Structures, and Activities and Participation. Contextual Factors include both Environmental and Personal ones (WHO, 2007). Definitions for each component of the framework are presented in Table 1.

Within the ICF-CY framework, a child's functioning and disability are viewed as being in dynamic interaction between health conditions and contextual factors. For instance, an impairment at the level of body functions and structures, such as a speech sound disorder, influences not only the child's speech sound system but also the child's ability to perform Activities (e.g., reading) as well as to Participate (e.g., engage in peer interactions; WHO, 2007). A visual representation of the interaction between the various components of the ICF-CY is presented in Figure 1.

There has been much debate in the literature about whether to distinguish between the Activities and Participation components of the ICF framework (Threats & Worrall, 2004; Washington, 2007). For this reason, the WHO has identified four options that can be used to interpret the relationship between Activities and Participation (WHO, 2001). Option 4, interpreting Activities and Participation as overlapping constructs (e.g., the act of "speaking" is considered under both Activities and Participation) has been the most popular in the literature (Threats & Worrall, 2004). However, for the purposes of this review article, we have chosen to use another option, in which the components of Activities and Participation partially overlap. In this option, certain ICF chapters (e.g., communication) are open to interpretation as both Activities (i.e., execution of a task or action by an individual) and Participation (i.e., involvement in a life situation; WHO, 2007). We felt that this option best accounted for the overlapping nature of children's communication skills, where skills in one area typically affect functioning in other domains (Lee, 2011). For example, increases in vocabulary and sentence length in the Activities component would also likely improve peer engagement and play in the Participation component. In addition, we believed that this option afforded the most comprehensive examination of how clinicians and researchers have thought about and measured communication outcomes within the ICF framework because we could examine Activities and Participation outcomes separately. Examples of intervention outcomes for the various components of the ICF-CY are presented in Table 2.

Table 1. Description of the components of the International Classification of Functioning, Disability and Health—Children and Youth Version.

Component	Description
Body Functions and Structures	**Body Structures** are anatomical parts of the body such as organs, limbs, and their components. **Body Functions** are the physiological functions of body systems (including psychological functions).
Activities and Participation	**Activity** is the execution of a task or action by an individual. **Participation** is involvement in a life situation.
Contextual Factors	**Environmental Factors** make up the physical, social, and attitudinal environment in which people live and conduct their lives. **Personal Factors** are the particular background of an individual that are not part of a health condition or health states. These factors may include gender, age, other health conditions, upbringing, and coping styles.

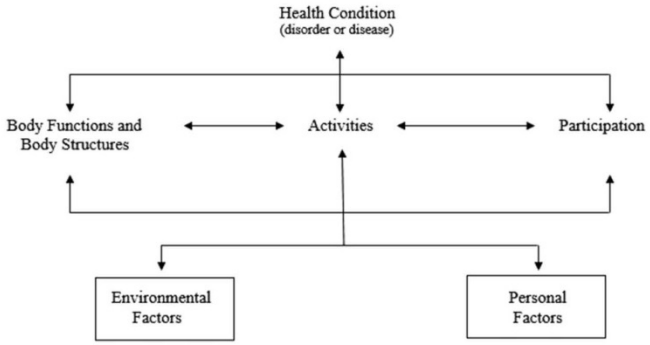
Note. Descriptions from *International Classification of Functioning, Disability and Health—Children and Youth Version*, by the World Health Organization, 2007. Copyright © 2007 by the World Health Organization. Reprinted with permission.

Since the introduction of the ICF and ICF-CY, clinicians and researchers have been encouraged to use the ICF framework to guide clinical research, practice, and student education; to inform selection of assessment tools; and to define the outcomes of intervention (Campbell & Skarakis-Doyle, 2007; McLeod & McCormack, 2007; McLeod & Threats, 2008; Skarakis-Doyle & Doyle, 2008; Threats, 2008; Washington, 2010; Westby, 2007; WHO, 2007; Yaruss, 2007). To be more specific, clinicians and researchers have been urged to consider communication outcomes as they contribute to a person's overall functioning and life participation. Despite this push, it has been reported that much of the available outcomes research in pediatric speech-language pathology continues to evaluate the impacts of interventions on impairments for the Body Functions and Structures component and limitations in the Activities component (Threats, 2013). Several reports have identified a particular lack of research looking at intervention outcomes for the Participation component, specifically whether speech-language interventions affect how a child uses communication to participate in his or her world (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2009; Thomas-Stonell, Washington, Oddson, Robertson, & Rosenbaum, 2013; Washington et al., 2015). We believe these outcomes should be the ultimate goal of all our intervention efforts. For more information on use of the ICF in speech-language pathology, please refer to the special issues of *Seminars in Speech and Language* (November 2007) and the *International Journal of Speech-Language Pathology* (2008).

The Current Study

The primary goal of this review was to gain a more thorough understanding of the state of the field by conducting

Figure 1. Interactions between the components of the International Classification of Functioning, Disability and Health—Children and Youth Version. From *International Classification of Functioning, Disability and Health—Children and Youth Version*, by the World Health Organization, 2007. Copyright © 2007 by the World Health Organization. Reprinted with permission.



a scoping review of the literature on current methods for measuring speech-language outcomes for preschoolers with communication disorders within the ICF-CY framework. For the purposes of this review article, an outcome was defined as any event (e.g., therapy interventions, child development over time) that might be associated with (causative of) the later event (e.g., changes in speech-language or communication skills; Threats, 2013).

In particular, we wanted to answer a two-part question: How have speech-language outcomes for preschoolers with communication disorders been measured since the introduction of the ICF-CY, and which components of the ICF-CY do they address? In answering these question, we would be able to identify whether outcomes for the various components of the ICF-CY framework have been evaluated equally and whether there has been a shift in how the components have been measured since the ICF-CY was first introduced in late 2007. We acknowledge that the basic tenets of Body Functions, Activities, and Participation have been discussed in the literature since the 2001 release of the ICF; however, discussion in the field of speech-language pathology began to unfold around the time the ICF-CY was released in 2007 with the publication of the special issue of *Seminars in Speech and Language*.

Table 2. Example intervention outcomes across the various components of the International Classification of Functioning, Disability and Health—Children and Youth Version.

Component	Possible intervention outcomes
Body Functions and Structures	**Body Structures:** medical procedures or prostheses to improve structures of the ear, structures involved in voice or speech (e.g., cleft palate), neurological structures, anatomical structures of the vocal tract, respiratory system and larynx, brain, or nervous system. **Body Functions:** improved speech and voice production and quality, speech intelligibility, fluency and rhythm of speech, hearing acuity and discrimination, oral and pharyngeal swallowing, memory, problem solving, attention, and mental functioning.
Activities and Participation	**Activities:** improved understanding of language, use of language (e.g., mean length of utterance, syntax, semantics); use of communication technologies (e.g., augmentative and alternative communication), use of nonverbal communication (e.g., requesting using the Picture Exchange Communication System), reading and writing skills (e.g., decoding and encoding); phonological awareness; production of narratives. **Participation:** increased ability to converse and interact with others (e.g., start/end/sustain a conversation); improved interpersonal relationships (e.g., making and maintaining friendships); increased engagement in play with peers; involvement in preschool/community/classroom activities, book reading/home activities.
Contextual Factors	**Environmental Factors:** familial social supports and relationships, access to intervention services, attitudes of others, cultural beliefs, access to products and technology (e.g., augmentative and alternative communication devices), social systems and policies. **Personal Factors:** age, other health conditions, lifestyle habits, coping styles, social background, education.

Note. Data derived from McLeod and McCormack (2007), McLeod and Threats (2008), Threats (2013), Washington (2007), Westby (2007), and Yaruss (2007).

In clinical terms, SLPs regularly address Participation restrictions that are important to children and families. For instance, in addition to treating a child with speech sound disorder in the clinic, an SLP may also provide consultation to the child care facility, providing augmentative communication tools (e.g., picture symbols) and enabling the child to engage more easily in the preschool classroom. However, as clinicians and researchers, we do not measure outcomes within the Participation component as well as we measure outcomes related to the Body Functions and Structures and Activities components, and we often fail to evaluate Participation outcomes at all (Eadie et al., 2006). For a child with speech sound disorder, traditional outcome measurements might include increases in use of targeted speech sounds and overall speech intelligibility but not improvements in communication and participation in the classroom or increases in the child's ability to engage with and be understood by peers.

Due to our keen interest in the inclusion of outcomes within the Participation component of the ICF-CY in clinical practice and research, a secondary goal of this work was to identify measures that were both valid and reliable that could be used to measure Participation-based communication outcomes. This could ultimately help both clinicians and researchers to better measure this component in the future.

We wanted specifically to identify those studies that had used published (peer-reviewed) evaluative tools to measure outcomes either longitudinally or following a period of intervention. Evaluative outcome measures differ from assessment tools that discriminate between children with and without a particular impairment (e.g., children with and without specific language impairment) because evaluative tools are validated specifically to demonstrate that they are responsive to clinically meaningful change over time (Rosenbaum et al., 1990).

We chose to study outcomes specifically for preschoolers because we understand and endorse the importance and effectiveness of early intervention for children with communication disorders for overall life outcomes (Canadian Association of Speech-Language Pathologists and Audiologists [now Speech-Language & Audiology Canada], 2013). We chose to complete a scoping review because we wanted to examine the extent, range, and nature of research activity in the field broadly (Arksey & O'Malley, 2005):

> A scoping review is a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in the research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge. (Colquhoun et al., 2014, pp. 1292, 1294)

A scoping review differs from a more traditional systematic review in several ways. The most important distinction in this case is that in a scoping review, the nature of the research question is broadly focused, whereas a systematic review uses a specific research question, typically focused on the effect of a particular intervention (Armstrong, Hall, Doyle, & Waters, 2011).

Arksey and O'Malley (2005) provided the original methodological framework for conducting scoping reviews, an approach that was further developed by Levac, Colquhoun, and O'Brien (2010). The current scoping review will use the original Arksey and O'Malley framework, incorporating the enhancements recommended by Levac et al.

Method

The present scoping review involved five key phases: (a) articulating the research question; (b) identifying relevant studies; (c) selecting studies; (d) charting the data; and (e) collating, summarizing, and reporting the results. The optional sixth phase, consulting with stakeholders, was not conducted (Arksey & O'Malley, 2005; Levac et al., 2010). This sixth phase is intended to allow stakeholders to contribute to the review, consulting about inclusion criteria and providing insights about the content and relevance of the scoping review. For this review article, the primary stakeholders were clinical SLPs and speech-language researchers, both of which were well represented on the review team.

Phase 1: Articulating the Research Question

In conducting this review of the literature, we wanted to answer the following question: How have speech-language outcomes for preschoolers (ages birth to 5 years, 11 months) with communication disorders been measured since the introduction of the ICF-CY, and which components of the ICF-CY do they address? The secondary question was: Has there been an increase in the evaluation of participation-level outcomes since the introduction of the ICF-CY in 2007?

Phase 2: Identifying Relevant Studies

In consultation with an experienced McMaster University Health Sciences librarian, we created a search-strategy concept map and detailed search queries for five electronic databases: MEDLINE, Embase, CINAHL, PsycINFO, and ERIC. These databases were selected in an attempt to conduct a comprehensive search that would include speech-language research from a range of disciplines, including health services, education, and psychology. Search queries were tailored to the specific requirements of each database. Queries are included in online Supplemental Material S1.

The initial search of the literature published between 2010 and 2014 was carried out in the summer of 2015. Following feedback from reviewer colleagues, a supplementary search of the literature for articles published in the years 2008–2009 and 2015 was carried out in early January 2016. Limits set on searches were that publications be in English and citations have been published between January 1, 2008, and December 31, 2015.

Phase 3: Selecting Studies

The selection of studies for inclusion in the review was conducted in two phases: an initial title and abstract

screening, followed by full-text review of those articles included after the screening.

Title and Abstract Screening

Prior to starting title and abstract screening, three authors (the first, fourth, and sixth) held an initial meeting to develop inclusion/exclusion criteria on the basis of the research question. Inclusion criteria were as follows: (a) published between 2008 and 2015, (b) peer-reviewed research publication (e.g., not a book chapter or invited commentary), (c) involved the study of preschoolers (ages birth to 5 years, 11 months), (d) evaluated outcomes (see Threats, 2013), (e) used published (reliable and valid) measures, (f) used evaluative tools (i.e., to measure change over time), and (g) written in English.

We included articles published between 2008 and 2015 in order to understand how outcomes have been measured in the field of pediatric speech-language pathology since the introduction of the ICF-CY. The ICF-CY, which was specific to children and included more relevant codes than the original ICF (e.g., singing, talking, playing), was first published in late 2007. We reasoned that no studies or articles would have been published between the time the ICF-CY was introduced and the beginning of the 2008 research year. As already described, our second search was run early in 2016 and therefore includes all relevant articles between 2008 and 2015 that were available in the databases at that time. We included only peer-reviewed research publications as a way of controlling for study quality. We included only those studies that used published outcome measures because, presumably, they have been found to be valid, reliable, and responsive to change prior to use in research (Rosenbaum et al., 1990).

Following development of the inclusion/exclusion criteria, we conducted two reliability trial runs in which three authors completed inclusion/exclusion screening on 10 titles and abstracts for each run. After each trial, we met to discuss coding and to review inclusion/exclusion criteria. This was done to help establish consistency of coding and decision making and to finalize our inclusion/exclusion criteria for the review.

Two reviewers (the first and fourth authors) completed inclusion/exclusion screening for each of the eight years to determine whether articles were relevant to the research question. The first reviewer was an experienced SLP and doctoral candidate. The second reviewer was an undergraduate student majoring in biology and psychology who was well versed in the literature. The reviewers used a document outlining the specific criteria indicated to either include or exclude references in an online Mendeley group account (https://www.mendeley.com/). Due to the number of references, each reviewer screened half of the titles and abstracts that were identified for a given year. References were divided alphabetically (i.e., Reviewer 1 screened references with author surnames beginning with A–M and Reviewer 2 screened references with author surnames beginning with N–Z). We alternated the reviewer screening references for the first half of the alphabet for each year to reduce bias. To ensure consistency of coding between the two reviewers, a 5% reliability sample of titles and abstracts screened was taken for each year. Half came from papers with author surnames beginning with A–M and half from papers with author surnames beginning with N–Z. The reviewers met after screening their respective references separately to conduct the 5% reliability sample of that year and to discuss any references they were unsure how to code.

Full-Text Review

Full-text review was conducted by four experienced SLPs who worked both clinically and in research (the first, second, third, and fifth authors). One of these SLPs (the first author) also completed title and abstract screening for the review. These SLPs completed the full-text review because they had valuable knowledge of clinical practice and measurement tools.

Similar to what was done for title and abstract screening, two reviewers completed the full-text review for half of each year, with references divided alphabetically. Prior to beginning full-text review, the two reviewers met to discuss the research question and inclusion/exclusion criteria for full-text articles. We used the same inclusion/exclusion criteria document as was used for the title and abstract screening, as well as a form where reviewers indicated whether each reference met each individual inclusion criterion. There was also a space for comments or queries for references requiring further discussion. Following this, the two reviewers conducted an initial trial on 10 full-text articles and then met to compare and discuss how citations were coded and resolve any differences of opinion. Again, this was done to help establish consistency of coding and decision making. Following initial meetings, we added a "discuss" column to our full-text review form so that any uncertainties could be discussed and the two reviewers could come to an agreement as to whether the reference should be included.

Each SLP reviewed half of the full-text articles (divided alphabetically) for a given year. This time, because the number of articles to review had decreased, we used a 20% reliability sample for each year to evaluate reliability of coding between the two reviewers. The two reviewers met after separately completing the full-text review of their respective references to complete the 20% reliability sample and discuss any references they were unsure how to code. Impromptu meetings were also held mid-review when further clarification or discussion was needed.

Phase 4: Charting the Data

Two members of the research team who were experienced SLPs and researchers (the first and second authors) met to develop a data-charting form that could be used to extract data from the included studies. The charting form was based on the research question and was designed to follow Steps 1–4 for extracting data using the ICF-CY as defined in the manual (WHO, 2007, pp. xix–xx). Those

steps, as well as examples of data extracted at each step, are presented below:

1. Step 1. Define the information available for coding and identify whether it relates to the domain of Body Functions, Body Structures, Activities, Participation, or Environmental Factors (e.g., Preschool Language Scale–Fourth Edition [Zimmerman, Steiner, & Pond, 2002]: measures expressive/receptive language development, relates to Activities).
2. Step 2. Locate the chapter within the appropriate domain that most closely corresponds to the information to be coded (e.g., Activities, Chapter 3: Communication).
3. Step 3. Read the description of the four-character code and notes related to the description (e.g., d310 Communicating-with-receiving spoken messages; d330 Speaking).
4. Step 4. Review any inclusion or exclusion notes that apply to the code and proceed accordingly.

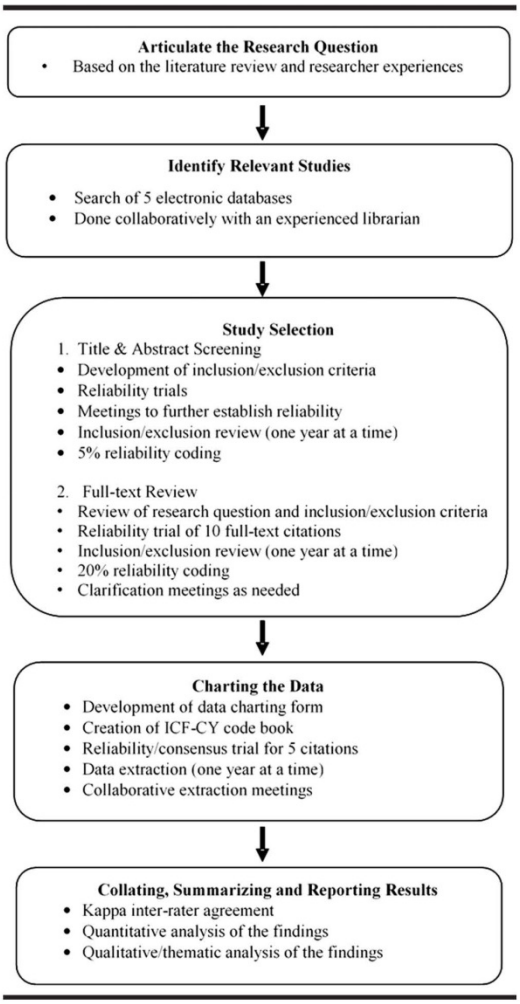
Separating tests to represent the individual components (Body Functions and Structures, Activities, and Participation) can be challenging because each individual measure may address overlapping codes. For instance, the Children's Communication Checklist–2 (Bishop, 2003a) has been used to evaluate both Activities- (expressive/receptive language) and Participation-based (social communication) outcomes. In cases such as this, we relied on the rule for linking clinical measures and interventions to the ICF developed by Cieza et al. (2005), which advises researchers to define the aim with which the corresponding measure was used in each individual study because aims can vary from study to study. Steps 5–10 for extracting data using the ICF were not completed because we could not apply more specific codes (i.e., five- or six-character codes), assign qualifiers (i.e., 0 = *no impairment/difficulty* to 4 = *complete impairment/difficulty*), or identify environmental barriers for entire outcome measures.

Frameworks for extracting data for the three main areas of communication (speech, language, and hearing) were developed on the basis of relevant literature to facilitate the data-extraction process by providing reviewers with examples of impairments, assessments, and interventions for the various components (Body Functions and Structures, Activities, Participation) of the ICF-CY (McLeod & McCormack, 2007; McLeod & Threats, 2008; Threats, 2013; Washington, 2007; Westby, 2007; Yaruss, 2007). We also created a codebook of the major ICF-CY categories (e.g., d330 Speaking) related to pediatric speech, language, and hearing (WHO, 2007).

Three experienced SLPs and researchers completed all data extraction (the first, second, and third authors). Again, references were divided alphabetically, and two SLPs reviewed half of the references for each year (i.e., for 2008, one SLP reviewed references for authors with surnames A–M, and the other reviewed references for authors with surnames N–Z). As outlined by Colquhoun et al. (2014), reviewers met prior to beginning data extraction to discuss the research question and criteria for data extraction. Following this, reviewers conducted an initial trial on five citations and then met to discuss how data were extracted and resolve any discrepancies. This was done to help establish consistency of data extraction and ensure that the approach to data extraction was consistent with the research question and purpose of the review.

After both reviewers had extracted data for the first five papers of a particular year and met to review the process, data were extracted for the remainder of that year. If reviewers were unsure of how to extract data for a particular citation, that article was flagged for discussion at the end of the review period for that year, and data extraction was done collaboratively between the two reviewers (see Figure 2 for a visual representation of this process). A

Figure 2. Flow diagram of the scoping-review process.



20% reliability sample was also taken for the data-extraction phase of the review.

Phase 5: Collating, Summarizing, and Reporting the Results

Following data extraction, we created tables to summarize our findings, both quantitatively and descriptively, as recommended by Colquhoun et al. (2014).

Results

Quantitative Findings

Interrater Reliability and Number of Included Citations

In our initial search of the five databases, we identified 7,951 potentially relevant citations. After removing duplicates (n = 3,504) and completing title and abstract screening, we were left with 758 citations for full-text review. There was 92% interrater agreement for the title and abstract screening on the basis of the 5% reliability sample taken (n = 224). An interrater reliability analysis using the kappa statistic was performed to formally determine consistency between the two reviewers (Landis & Koch, 1977). The interrater reliability for the title-and-abstract-screening phase was $\kappa = .66$, $z = 10.12$, $p < .001$, 95% CI [.52, .81]. Percent interrater agreement for inclusion/exclusion of full-text papers was 89% (n = 153), $\kappa = .77$, $z = 9.59$, $p < .001$, 95% CI [.67, .87].

Following full-text review, 214 citations remained for data extraction and inclusion in the scoping review. There was 95% agreement between reviewers for the data-extraction phase. The flow of citations from identification through to data extraction, as well as the number of articles removed by exclusion criteria at the full-text-review phase, is presented in Figure 3. The number of included citations by search year is presented in Figure 4. References for the 214 included papers by year of publication are available in online Supplemental Material S2.

Number of Included Measures by ICF-CY Component

We extracted data regarding the evaluative tools used from each identified citation and subsequently identified which component of the ICF-CY framework (i.e., Body Functions and Structures, Activities, or Participation) was most relevant for that particular measure of change. The number of unique tools used was 155, with the majority measuring changes in the Activities component (n = 87, 56%), followed by Body Functions (n = 44, 28%) and Participation (n = 24, 15%).

The total number of measures reported across all years was 449. This number was significantly higher than the number of citations included in this review (n = 214) and the total number of unique measures reported across all years (n = 155). There were three main reasons for this discrepancy. First, many of the reported measures were duplicates. For example, the Clinical Evaluation of Language Fundamentals–Preschool–2 (Wiig, Semel, & Secord, 2004) was used in many studies and was therefore counted more than once. In addition, there was some overlap between components of the ICF-CY framework because some tools that were used measure changes in more than one component. For example, the Vineland Adaptive Behavior Scales, Second Edition (Sparrow, Cicchetti, & Balla, 2005), were used to measure changes in limitations for Activities (e.g., expressive/receptive language skills) in some studies, whereas in other studies they were used to measure changes in Participation restrictions (e.g., social-skill development). Many studies reported using multiple evaluative tools.

The majority of measures reported across all years used measures related to the Activities component to evaluate speech-language outcomes (n = 290, 64.5%). The second most frequent group of measures evaluated changes in impairments related to the Body Functions component

Figure 3. The flow of citations from identification through data extraction.

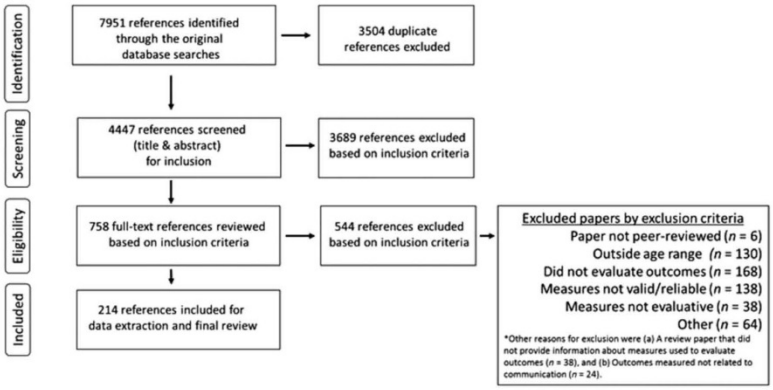
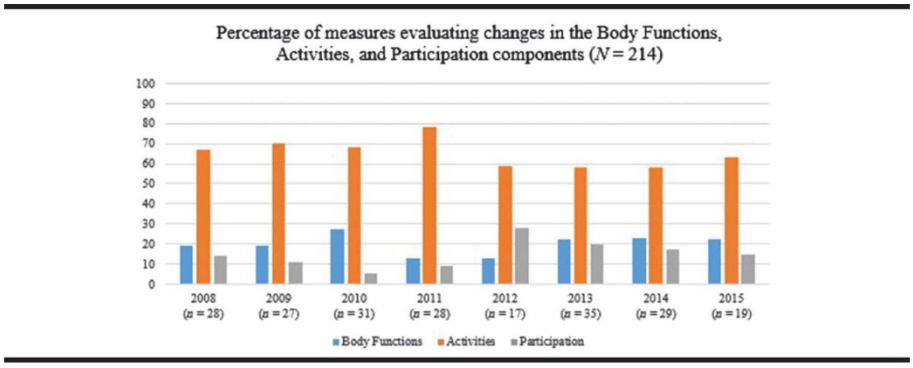


Figure 4. Percentage of measures evaluating changes in the Body Functions, Activities, and Participation components of the International Classification of Functioning, Disability and Health—Children and Youth Version (n = 214).



(n = 92, 20.5%), followed by measures evaluating outcomes related to the Participation component (n = 66, 14.7%). One study evaluated an outcome related to the Body Structures component (0.2%) using magnetic resonance imaging to measure changes in cortical thickness following intervention for apraxia of speech (Kadis et al., 2014), but it was not included in further analyses because it was the sole article evaluating changes in Body Structures.

The percentage of measures on the basis of Body Functions, Activities, and Participation used to evaluate speech-language outcomes is presented by year in Figure 4. As can be seen in this figure, the percentage of published evaluative tools used to measure changes in Body Functions has remained relatively stable over the past 8 years, the percentage used to measure changes in Activities has decreased slightly, and the percentage of tools used to measure changes related to Participation has fluctuated since the introduction of the ICF-CY. Although there is fluctuation, there does seem to have been an increase in the evaluation of Participation-based outcomes in the years 2012 to 2015 (n = 45, 19%) as compared with earlier years (i.e., 2008–2011, n = 21, 10%).

Excluded Measures by ICF-CY Component

One consideration in interpreting these results was whether in fact there had been a significant increase in Participation-based research in studies using experimental measures, not those using the published, valid, and reliable tools that were included in this review. To ensure that this was not the case, we also reviewed the references that were excluded at the full-text-review stage for using experimental measures. When linked to the components of the ICF-CY, the distribution of experimental measures was quite similar to that of the published measures included in this review: Body Structures (n = 1, 0.07%), Body Functions (n = 46, 33%), Activities (n = 60, 43%), and Participation (n = 31, 22%). Participation-based tools were still used least often, although the percentage of experimental tools measuring Participation-based outcomes was higher than the percentage of published measures reported in the review. There was no clear pattern demonstrating an increase in the percentage of reported Participation-based experimental measures from 2008 to 2015.

Thematic Description of Included Measures

Almost all citations that used measures designed to evaluate outcomes at the level of Body Functions fell under the broad category of speech, with a few falling under hearing. These studies measured changes in the clarity of children's speech using measures of articulation, phonology, and speech intelligibility. Changes in motor movements used for speech were evaluated using measures of motor planning. Voice-related changes were evaluated using measures of nasality, prosody, and overall voice quality. Measures evaluating changes in speech fluency and hearing, perception, or listening related to speech were also included in this classification. Included measures used to evaluate changes in the Body Functions component are presented in Table 3.

Most citations that used measures to evaluate outcomes for the Activities component fell under the broad category of language. These citations looked at changes in children's expressive and receptive language skills, including changes in early communication skills, use and understanding of grammar and vocabulary, and increases in productive language or sentence length. Measures of change in early literacy skills included those related to early reading ability, phonological awareness, narrative skills, and story retelling. Included measures used to evaluate changes related to Activities are presented in Table 4.

The citations that were identified as evaluating outcomes for the Participation component typically fell under the broad category of language and addressed changes in children's nonverbal communication skills such as initiating joint attention, requesting, and social interaction. They also measured changes in children's social engagement, social communication, play, and communication in

Table 3. Measures used to evaluate changes in Body Functions component.

Body Function (impairment)	Measurement tool	Reference
Articulation/phonology	Arizona Articulation Proficiency Scale–Third Edition	Fudala (2000)
b320 Articulation function	Clinical Test of Articulation	Wang & Liao (2007)
	Diagnostic Evaluation of Articulation & Phonology	Dodd et al. (2002)
	Early Repetition Battery	Seeff-Gabriel et al. (2008)
	Edinburgh Articulation Test	Anthony et al. (1971)
	Finnish Articulation Test	Remes & Ojanen (1996)
	Glaspey Dynamic Assessment of Phonology	Glaspey & Stoel-Gammon (2005)
	Goldman-Fristoe Test of Articulation–Second Edition	Goldman & Fristoe (2000)
	Groningen Diagnostic Speech Norms	Luinge et al. (2006)
	Hodson Assessment of Phonological Patterns–Third Edition	Hodson (2004)
	Hodson Computerized Analysis of Phonological Patterns, Third Edition	Hodson (2003)
	Khan-Lewis Phonological Analysis	Khan & Lewis (2002)
	Le Profile Acceptation, Perception, Compréhension, Expression, Intelligibilité	Noel-Petrof et al. (2006)
	Phonological Assessment of Child Speech (Portuguese)	Yavas & Goldstein (1998)
	Picture Labelling Test	Frontczak et al. (2002)
	Sensory Integration Functions Assessment Scale	Lin (2010)
	Teste Fonético-Fonológico-Avaliação da Linguagem Pré-Escolar	Mendes et al. (2009)
	Weighted speech sound accuracy	Preston et al. (2011)
	Word Complexity Measure	Stoel-Gammon (2010)
	Meaningful Use of Speech Scale	Robbins & Osberger (1990)
Fluency	Percent syllables stuttered	Jones et al. (2005)
b330 Fluency and rhythm of speech function	Stuttering Severity Instrument	Riley (2009)
	Prosodic Assessment Procedure (using visual analogue scales)	Samuelsson et al. (2003)
Hearing	Le Profile Acceptation, Perception, Compréhension, Expression, Intelligibilité	Noel-Petrof et al. (2006)
b230 Hearing function	Deafness and Additional Disabilities Questionnaire	Palmieri et al. (2012)
	Early Speech Perception Test	Moog & Geers (1990)
	Glendonald Auditory Speech Perception Test	Erber (1982)
	Infant–Toddler Meaningful Auditory Integration Scale	Zimmerman-Phillips et al. (2000)
	Listening Progress Score	Archbold (1993)
	Meaningful Auditory Information Scale	Robbins et al. (1991)
	Speech Perception Battery (PLOTT)	Plant (1984)
Intelligibility	Beginner's Intelligibility Test	Osberger et al. (1994)
b320 Articulation function	Children's Speech Intelligibility Measure	Wilcox & Morris (1999)
	Speech Intelligibility Rating Scale	Allen et al. (1998)
	Test of Children's Speech Plus	Hodge et al. (2009)
Motor planning/apraxia	Kaufman Assessment Battery for Children	Kaufman & Kaufman (2004)
b176 Mental function of sequencing complex movements	Spatio-Temporal Index	Smith et al. (1995)
	Verbal Motor Production Assessment for Children	Hayden & Square (1999)
Voice	Acoustic Voice Quality Index	Reynolds et al. (2012)
b310 Voice function	Consensus Auditory-Perceptual Evaluation of Voice	Kempster et al. (2009)
	Dysphonia Severity Index	Wuyts et al. (2000)
	Grade, Roughness, Breathiness, Asthenia, and Strain scale	Hirano (1981)
	MacKay-Kummer Simplified Nasometric Assessment Procedures Revised	MacKay & Kummer (1994)
	Meaningful Use of Speech Scale	Robbins & Osberger (1990)
	Pediatric Voice Handicap Index	Zur et al. (2007)

Note. Complete reference list available from the authors.

daily life situations. A list of identified Participation-based measures is presented in Table 5.

Discussion

This scoping review examined the ways in which speech-language outcomes have been evaluated for preschoolers with communication disorders. We linked the outcome measures used in the included studies to three main components of the ICF-CY framework (Body Functions, Activities, and Participation) to determine whether there had been a shift toward measuring outcomes related to the Participation component since the ICF-CY was first introduced in late 2007.

The majority of studies included in the review used measurement tools that evaluated outcomes related to the

Table 4. Measures used to evaluate changes in Activities component.

Activity (limitation)	Measurement tool	Reference
Language		
Early communication d161 Directing attention d335 Producing non-verbal messages	Bayley Scales of Infant and Toddler Development–Third Edition, Language scale	Bayley (2006)
	Deafness and Additional Disabilities Questionnaire	Palmieri et al. (2012)
	Early Social Communication Scales	Mundy et al. (2003)
	Play in Early Childhood Evaluation System	Kelly-Vance & Ryalls (2005)
	Test of Early Verbal Comprehension	Chilosi et al. (2003)
Expressive and receptive language (including syntax and morphology) d310 Communicating with – receiving – spoken messages d330 Speaking	Autism Behavior Checklist	Krug et al. (1980)
	Autism Diagnostic Observation Scales (ADOS)	Lord et al. (1999)
	British Abilities Scale	Elliott et al. (1997)
	Clinical Evaluation of Language Fundamentals–Preschool–2	Wiig et al. (2004)
	Clinical Evaluation of Language Fundamentals–Fourth Edition	Semel et al. (2006)
	Children's Test of Nonword Repetition	Gathercole & Baddeley (1996)
	Comprehensive Assessment of Spoken Language	Carrow-Woolfolk (1999)
	Fluharty Preschool Speech and Language Screening Test	Fluharty (2000)
	Pictorial Test of Intelligence	French (1964)
	Grammar and Phonology Screening	Gardner et al. (2006)
	Griffiths Mental Development Scales	Griffiths (1984)
	Hundred Pictures Naming Test	Fisher & Glenister (1992)
	Language Development Survey	Rescorla (1989)
	Language sample (mean length of utterance)	Brown (1973)
	Le Profile Acceptation, Perception, Compréhension, Expression, Intelligibilité	Noel-Petrof et al. (2006)
	MacArthur–Bates Communicative Development Inventories	Fenson et al. (1993)
	Mullen Scales of Early Learning	Mullen (1995)
	Nonword Repetition Test	Dollaghan & Campbell (1998)
	Parent Perceptions of Language Development	Romski et al. (2000)
	Preschool Language Scale, Third and Fourth Editions	Zimmerman et al. (2002)
	Receptive-Expressive Emergent Language Scales	Bzoch et al. (2003)
	Renfrew Action Picture Test	Renfrew (2003)
	Renfrew Word Finding Vocabulary Test	Renfrew (1988)
	Reynell Developmental Language Scales	Reynell (1977)
	Schlichting Test for Language Production	Schlichting et al. (2003)
	Sequenced Inventory of Communicative Development	Hedrick et al. (1984)
	Sprachentwicklungstest für zweijährige Kinder	Grimm (2000)
	Sprachentwicklungstest fur drei- bis funfjährige Kinder	Grimm (2001)
	Sprachscreening für das Vorschulalter	Grimm (2003)
	Structured Photographic Expressive Language Test Preschool	Werner & Kresheck (1983)
	Taaltoets alle Kinderen	Verhoeven & Vermeer (2001)
	Test for Auditory Comprehension of Language–Third Edition	Carrow-Woolfolk (1985)
	Test of Grammatical Comprehension for Children	Chilosi & Cipriani (1995)
	Test of Early Language Development–Third Edition	Hresko, et al. (1999)
	Test of Language Development–Primary: Third Edition	Newcomer & Hammill (1997)
	Test of Problem Solving 3–Elementary	Bowers et al. (2005)
	Test for Reception of Grammar–2	Bishop (2003b)
	Token Test for Children	Di Simoni (1978)
	Vineland Adaptive Behavior Scales, Second Edition	Sparrow et al. (2005)
	Wechsler Preschool and Primary Scale of Intelligence–Revised	Wechsler (2003)
Vocabulary d310 Communicating with – receiving spoken messages d330 Speaking	Aktiver Wortschatztest für 3- bis 5-jährige Kinder–Revision	Kiese-Himmel (2005)
	British Picture Vocabulary Scale	Dunn et al. (1997)
	Expressive One-Word Picture Vocabulary Test	Brownell (2000)
	Expressive Vocabulary Test	Williams (1997)
	MacArthur–Bates Communicative Development Inventories	Fenson et al. (1993)
	Peabody Picture Vocabulary Test–III and Fourth Edition	Dunn & Dunn (2007)
	Receptive One-Word Picture Vocabulary Test	Brownell (2000)
	Woodcock-Johnson III Tests of Achievement	Woodcock et al. (2001)

(*table continues*)

Table 4. *(Continued).*

Activity (limitation)	Measurement tool	Reference
Literacy		
Narrative skills and story retell	Children's Communication Checklist–2	Bishop (2003a)
d140 Learning to read	Edmonton Narrative Norms Instrument	Schneider et al. (2005)
d330 Speaking	Index of Narrative Complexity	Petersen et al. (2008)
	Narrative Assessment Protocol	Justice et al. (2010)
	Narrative Comprehension of Picture Books task	Paris & Paris (2001)
	Renfrew Bus Story	Renfrew (1997)
	Strong Narrative Assessment Procedure	Strong (1998)
	Test of Narrative Language	Gillam & Pearson (2004)
	Test of Narrative Retell: School Age–Kindergarten	Petersen & Spencer (2012)
Phonological awareness	Assessment of Literacy and Language	Lombardino et al. (2005)
d140 Learning to read	Comprehensive Test of Phonological Processing	Wagner & Torgesen (1999)
	Computer-Based Phonological Awareness Assessment	Carson et al. (2011)
	Dynamic Indicators of Basic Early Literacy Skills	Good et al. (2002)
	Get Ready to Read	Whitehurst (2001)
	Observation Survey of Early Literacy Achievement	Clay (1993)
	Phonological Abilities Test	Muter et al. (1997)
	Phonological Awareness Literacy Screening–PreK	Invernizzi et al. (2004)
	Pre-Reading Inventory of Phonological Awareness	Dodd et al. (2003)
	Individual Growth Development Indicator: Rhyming	Early Childhood Research Institute (2000)
	Ringerike Material	Lyster et al. (2002)
	Sutherland Phonological Awareness Test–Revised	Neilson (2007)
	Test of Phonological Awareness–Second Edition: Plus	Torgesen & Bryant (2004)
	Test of Preschool Early Literacy	Lonigan et al. (2007)
Reading ability	Aimsweb	O'Connor & Jenkins (1999)
d140 Learning to read	Burt Word Reading Test	Gilmore et al. (1981)
	Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 reading test	Najarian et al. (2009)
	Early Grade Reading Assessment	Gove (2008)
	Early Word Reading Test	Hatcher et al. (1994)
	Get It, Got It, Go! (Now called the My Individual Growth & Development Indicators [IGDIs] Assessment)	McConnell (2012)
	Gray Oral Reading Tests, Fourth Edition	Wiederholt & Bryant (2001)
	Graded Nonword Reading Test	Snowling et al. (1996)
	Neale Analysis of Reading Ability–Second Revised British Edition	Neale (1997)
	Preschool Word and Print Awareness test	Justice & Ezell (2001)
	Reading Freedom Diagnostic Reading Test	Calder (1992)
	Reading Progress Test	Vincent et al. (1997)
	Salzburg Reading and Spelling Test	Landerl et al. (1997)
	Schonell Essential Spelling Test	Schonell (1932)
	Sheffield Early Literacy Development Profile	Nutbrown (1997)
	Woodcock Reading Mastery Tests–Revised, Word Identification subtest	Woodcock (1987)
	York Assessment of Reading for Comprehension	Hulme et al. (2009)

Note. Complete reference list available from the authors.

Activities component, followed by the Body Functions component. The Participation component was measured least often. This finding is consistent with previous reports of the pediatric speech-language-pathology literature (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2010; Thomas-Stonell et al., 2013; Threats, 2013). Use of Participation-based outcomes has fluctuated since the introduction of the ICF-CY and seems to have increased slightly in the last 4 years, but they are still relatively underrepresented in the literature.

Although there has been a slight increase in the evaluation of Participation-based outcomes, most articles included in this review that evaluated changes related to Participation did so for groups of children for whom those changes would be the primary goal of therapy. For example, many studies reporting Participation-based outcomes evaluated changes in social communication skills for children with autism spectrum disorder. Those studies used tools such as the Vineland Adaptive Behavior Scales, Second Edition, and the Communication and Symbolic Behavior Scales Developmental Profile (Wetherby & Prizant, 2002) to evaluate changes in children's ability to engage in reciprocal social relationships. Other studies reported Participation-based outcomes using measures for children with selective mutism for whom the primary goal of intervention is to increase speaking in various social contexts. Thus, the observed increases in studies evaluating Participation-based outcomes may be due to increases in research related to children with autism spectrum disorder and selective mutism.

Table 5. Measures used to evaluate changes in Participation component.

Participation (restriction)	Measurement tool	Reference
Communicative participation	National Outcomes Measurement System Functional Communication Measures	American Speech-Language-Hearing Association (2003)
d350 Conversation	Focus on the Outcomes of Communication Under Six	Thomas-Stonell et al. (2010)
d720 Complex interpersonal interactions	Functional Communication Profile	Kleiman (2003)
d750 Informal social relationships	School Speech Questionnaire	Bergman et al. (2002)
d880 Engagement in play	Selective Mutism Questionnaire	Bergman et al. (2008)
Nonverbal interaction	Early Social Communication Scales	Mundy et al. (2003)
d335 Producing nonverbal messages	Classroom Observation Schedule to Measure Intentional Communication	Pasco et al. (2008)
	Child Behavior Rating Scale	Bronson et al. (1990)
	Communication and Symbolic Behavior Scales	Wetherby & Prizant (2002)
	Children's Communication Checklist–2	Bishop (2003a)
Play	Communication and Symbolic Behavior Scales	Wetherby & Prizant (2002)
d880 Engagement in play	Developmental Play Assessment	Lifter (2000)
d720 Complex interpersonal interactions	Griffiths Mental Development Scales	Griffiths (1984)
	Pragmatics Observational Measure	Cordier et al. (2014)
Social communication	Children's Communication Checklist–2	Bishop (2003a)
d335 Producing nonverbal messages	Ages and Stages Questionnaire:Social-Emotional	Squires et al. (1990)
d350 Conversation	Autism Behavior Checklist	Krug et al. (1980)
d720 Complex interpersonal interaction	Autism Diagnostic Observation Schedule	Lord et al. (1999)
d750 Informal social relationships	Classroom observation measure	Wong & Kasari (2012)
d880 Engagement in play	Communication Rating Scale	Johnson & Wintgens (2001)
	Deafness and Additional Disabilities Questionnaire	Palmieri et al. (2012)
	Parent–child interaction measure	Shapiro et al. (1997)
	Pragmatics Profile of Everyday Communication Skills in Children	Dewart & Summers (1995)
	Social Competence Scale	Conduct Problems Prevention Research Group (1995)
	Social Skills Rating System	Gresham & Elliott (1990)
	Vineland Adaptive Behavior Scales, Second Edition	Sparrow et al. (2005)
	Griffiths Mental Development Scales	Griffiths (1984)
	Pragmatics Observational Measure	Cordier et al. (2014)
	Strengths and Difficulties Questionnaire	Goodman (1997)

Note. Complete reference list available from the authors.

Findings from this scoping review are relevant to both researchers and clinicians working in the field of pediatric speech-language pathology. Implications for both communities are presented next.

Research Implications

What we would like to see in future research is an increase in Participation-based outcomes looking at changes in the way speech-language interventions affect a child's ability to engage in life—or, said differently, changes in their communicative participation. For children, this means "the child's communication and interaction in real world situations at home, school, or in the community" (Eadie et al., 2006). This construct is more broadly focused than the Participation-based outcomes evaluated in populations such as children with autism spectrum disorder and selective mutism but is an important outcome for children with all types of communication disorders, who we know are often socially isolated from their peers (Brinton & Fujiki, 2005) and struggle to engage in environments outside the home, such as school (McLeod, Daniel, & Barr, 2013).

Many studies have assessed the broad-based impact of speech-language therapy on untargeted outcomes related to participation using tools such as the Vineland Adaptive Behavior Scales, Second Edition, that probe parental perspectives of children's social skills (Washington et al., 2013, 2015). Drawbacks to using this type of tool are that although they provide useful information, they were not designed for use specifically with children with communication disorders, and the construct evaluated focuses specifically on social skills (e.g., table manners) rather than communication as it relates to life participation.

More measures that are designed to evaluate Participation-based outcomes for preschoolers related to communication, such as the Focus on the Outcomes of Communication Under Six (Thomas-Stonell et al., 2010), should be developed. On the basis of published findings using that tool, it appears that speech-language interventions do in fact improve children's communicative participation (Thomas-Stonell et al., 2009, 2013). We believe that as researchers begin to develop new tools and use them to evaluate Participation-based outcomes more frequently, it will become even clearer that speech-language interventions are important in supporting and enhancing a child's ability

to be included with others, which is a key intervention outcome (ASHA, 2004).

Assessing Participation-based outcomes in research for children with communication disorders that are not specific to social communication and engagement is not without its challenges. One issue associated with implementing these types of more broadly focused Participation-based outcome measurements in pediatric speech-language pathology is that Participation-based goals are not often directly targeted in therapy. In the absence of a specific and measurable goal related to participation, it would be difficult to know whether the intervention was responsible for any observed changes.

One way to address the uncertainty associated with using an outcome measurement tool that is not directly related to intervention goals in a study might be for researchers to include a Participation-based outcome measure in combination with measures of change for other components of the ICF-CY. For example, researchers evaluating changes in children's speech intelligibility in the Body Functions component might also include a Participation-based outcome measure to see whether those children who demonstrated significant improvements in speech intelligibility also made meaningful gains in communicative participation. This would increase confidence that changes in participation were in fact due to the intervention.

A second issue associated with measuring Participation-based outcomes relates to the reciprocal and interactive nature of the ICF-CY. This scoping review focused on Part 1 of the ICF-CY but did not address Part 2 of the framework, which includes two components: Environmental Factors, which are "the physical, social, and attitudinal environment in which people live and conduct their lives" (WHO, 2007, p. 9), and Personal Factors, not classified in the ICF-CY. A focus on these components in future research would be beneficial, as Environmental and Personal Factors are likely to be strongly linked with Participation-based outcomes. For example, an intervention targeting Participation-based outcomes would likely modify the environment in some way. On the converse, an intervention could focus solely on Environmental Factors (e.g., changes in parents' behavior) using communicative participation as the outcome. Personal Factors can also influence Participation and could be investigated looking at personality traits and children's interests associated with some communication disorders (e.g., stuttering).

Clinical Implications

For SLPs, it is our hope that this review article will shed light on an important component of the ICF-CY that is often overlooked in evaluating the effectiveness of clinical intervention. Most clinicians are already addressing Participation-based issues in therapy. We encourage practicing clinicians to use some of the broadly focused, valid, and reliable Participation-based outcome measures identified in this review (see Table 5) to evaluate the more broadly focused effects of their important interventions.

Including a Participation-based outcome assessment tool in addition to those focused on the Body Functions and Activities components would provide clinicians with a bigger picture of how interventions affect children and families in their everyday lives. The traditional role of an SLP has been to correct speech and language errors in the clinic, but we know that parents are much more interested in how their child's communication disorder affects his or her ability to participate in school and with peers (Thomas-Stonell et al., 2009). Measuring Participation-based outcomes may be more meaningful to families and may facilitate conversations related to goal setting and therapy using family-friendly language.

The inclusion of Participation-based outcomes would also allow health care organizations to evaluate the impacts of speech-language interventions for children with all types of communication disorders, whereas traditionally it has been impossible to compare outcomes for children with different types of disorders (e.g., comparing outcomes for children with speech sound disorders vs. receptive language delays). This could make program evaluation less complicated. Having program-level information related to the outcomes of therapy may also serve an important role for organizations wanting to connect with policy makers and funders. This idea is supported by recent research with adults that has shown that Participation-based outcomes can be relevant and meaningful for individuals with a range of communication impairments (Cieza et al., 2015). Not only would organizations be able to show meaningful changes for large groups of children, they would be able to present information in family-friendly language rather than technical jargon, which may not resonate well with their audiences.

Limitations

This review is not without its limitations, one of which is that some relevant publications may not have been identified despite our systematic search methods. We reviewed citations for the years 2008–2015, but our most recent search was completed at the beginning of January 2016, and databases may not have had up-to-date lists of publications from 2015. Also, only citations that had full text available in English were included in the review. We acknowledge this as a possible limitation. Another limitation is that individual reviewers completed inclusion/exclusion coding for only one half of each year. We tried to mitigate this limitation by including an option for discussing citations and by conducting reliability checks at each stage of the review, but we have no way of knowing whether some citations were missed by not having both reviewers screen all references. As a final limitation, this review identified the measures currently being used but did not undertake a detailed exploration and analysis of the measurement properties of these tools. That kind of analysis is beyond the scope of this review article.

Conclusion

This scoping review identified current practices for evaluating speech-language outcomes for preschoolers with

communication disorders. As expected, we found that most outcomes were evaluated for the ICF-CY Body Functions and Activities components, with fewer evaluating outcomes related to the Participation component. The ASHA document "Scope of Practice in Speech-Language Pathology" (2016) emphasizes the need for continued commitment to the evaluation of outcomes for all components of the ICF, including Participation. Although the ICF has been in use since 2001 and has been included in the ASHA scope of practice since 2007, there continues to be a paucity of Participation-based outcomes research in the field. We encourage others to consider including meaningful Participation-based outcomes in future research, and we strongly advocate for use of these measures in future research and practice so we can explore and capture whatever meaningful life changes might result from children's participation in speech-language interventions beyond changes associated with the Body Functions and Activities components.

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Appendix A – Supplemental Material S1

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Supplemental Material S1. Strategies used to search each health database.

CINAHL SEARCH STRATEGY: JUNE 8, 2015
Limits (2008–2015; English language; birth–5 years)

1. Speech-Language Pathology
2. (speech-language N1 (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*))
3. (speech and language N1(patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*))
4. (speech N1 (patholog* or therap* or rehab& or treat* or assess* or interven* or train*or augment*))
5. (language N1 (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*))
6. Communicative Disorders
7. (communication N1 (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*))
8. 1 or 2 or 3 or 4 or 5 or 6 or 7
9. Speech Disorders/
10. Articulation Disorders/
11. (speech N1 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
12. (articulation N1 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
13. (phonolog* Nl (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
14. Apraxia
15. Apraxia of Speech (Developmental)
16. aprax*.mp.
17. dyspraxia.mp.
18. (motor speech N1 (disorder* or delay* or impairment* or problem* or difficult*or challenge*))
19. Language Disorders
20. (language N1 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
21. (expressive N2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
22. (receptive N2 (disorder* or delay* or impairment* or problem* or difficult* or challenge))
23. (pragmatic N2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
24. (communication N2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
25. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
26. Child, Preschool/
27. preschool*
28. pre-school*
29. toddler*
30. child*
31. boy*
32. girl*
33. 26 or 27 or 28 or 29 or 30 or 31 or 32
34. Treatment Outcomes
35. Evaluation Studies (Term changed to Evaluation Research for 2008/09 search Jan 8, 2016)
36. Child Development Disorders
37. measure*
38. chang*
39. outcome*
40. develop*

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41. 34 or 35 or 36 or 37 or 38 or 39 or 40
42. 8 AND 25 AND 33 AND 41

EMBASE FINAL SEARCH WITH LIMITS: JANUAY 5, 2016
(Limits = 2008–2015; English; age 0–5)

1. Speech therapy (MeSH heading)
2. (speech-language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*)).tw
3. (speech and language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*)).tw
4. (speech adj (patholog* or therap* or rehab& or treat* or assess* or interven* or train*or augment*)).tw
5. (language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*)).tw
6. Communication Disorder (MeSH heading)
7. (communication adj (pathology* or therap* or rehab& or treat* or assess* or interven* or train*or augment*)).tw
8. 1 or 2 or 3 or 4 or 5 or 6 or 7
9. Speech Disorder (MeSH Heading)
10. Speech sound disorder (MeSH Heading)
11. (speech adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
12. (articulation adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
13. (phonological adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
14. Apraxia (MeSH Heading)
15. Apraxia of speech (MeSH Heading)
16. aprax*
17. dyspraxia
18. (motor speech adj (disorder* or delay* or impairment* or problem* or difficult*or challenge*)).tw
19. Language disability (MeSH heading)
20. Language delay (MeSH heading)
21. Developmental language disability
22. (language adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
23. (expressive adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
24. (receptive adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge)).tw
25. (pragmatic adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
26. communication disorders **(MeSH heading)**
27. (communication adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
28. (social adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
29. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 21 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
30. Preschool child (MeSH heading)
31. preschool*
32. pre-school*
33. Toddler (MeSH heading)
34. Child (MeSH heading)
35. boy (MeSH heading)
36. girl (MeSH heading)

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37. 30 or 31 or 32 or 33 or 34 or 35 or 36
38. Treatment Outcome (MeSH heading)
39. Evaluation Study (MeSH heading)
40. Child Development (MeSH heading)
41. measure*
42. chang*
43. outcome*
44. develop*
45. 47 or 49 or 51 or 53 or 55 or 57 or 59
46. 8 AND 29 AND 37 AND 45

ERIC FINAL SEARCH WITH LIMITS: JANUARY 5, 2016
(Limits = 2008–2015; English)

1. Speech therapy (thesaurus term, explode)
2. Speech-language pathology (thesaurus term, explode)
3. (speech-language NEAR/1 (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*))
4. ("speech and language" NEAR/1 (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*))
5. (speech NEAR/1 (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*))
6. (language NEAR/1 (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*))
7. Communication Disorders (thesaurus term, explode)
8. (communication NEAR/1 (pathology* or therap* or rehab* or treat* or assess* or interven* or train* or augment*))
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. Speech Impairments (thesaurus term, explode)
11. (speech NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
12. (articulation NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
13. (phonolog* NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
14. "apraxia*"
15. "apraxia of speech"
16. "dyspraxia"
17. "motor speech" AND (disorder* or impairment or delay or problem or difficult* or challenge*)
18. Language Impairments (thesaurus term, explode)
19. (language NEAR/1 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
20. (expressive NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
21. (receptive NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge))
22. (pragmatic NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
23. (communication NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
24. (social NEAR/2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*))
25. 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 21 or 21 or 22 or 23 or 24
26. Preschool children (thesaurus term, explode)
27. Toddlers (thesaurus term, explode)
28. Young Children (thesaurus term, explode)
29. (preschool* or pre-school* or boy* or girl* or child*)

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30. 26 or 27 or 28 or 29
31. Outcomes of treatment (thesaurus term, explode)
32. Skill development (thesaurus term, explode)
33. (measure* or chang* or outcome* or develop*)
34. 31 or 32 or 33
35. 9 and 25 and 30 and 34

MEDLINE FINAL SEARCH: JANUARY 5, 2016
(Limits = 2008–2015; English; Age = Infant [birth–23 months] or preschool child [2 to 5 years])

1. exp Speech-Language Pathology/
2. (speech-language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*)).tw.
3. ((speech and language) adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*)).tw.
4. (speech adj (patholog* or therap* or rehab& or treat* or assess* or interven* or train*or augment*)).tw.
5. (language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*)).tw.
6. exp Communication Disorders/
7. (communication adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*)).tw.
8. 1 or 2 or 3 or 4 or 5 or 6 or 7
9. exp Speech Disorders/
10. exp Articulation Disorders/
11. (speech adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
12. (articulation adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
13. (phonological adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
14. exp Apraxias/
15. aprax*.mp.
16. dyspraxia.mp.
17. (motor speech adj (disorder* or delay* or impairment* or problem* or difficult*or challenge*)).tw.
18. exp Language Disorders/
19. exp Language Development Disorders/
20. (language adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
21. (expressive adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
22. (receptive adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge)).tw.
23. (pragmatic adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
24. (communication adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
25. (social adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw.
26. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
26. exp Treatment Outcome/
27. exp Evaluation Studies/
28. exp Child Development/
29. measure*.mp.
30. chang*.mp.
31. outcome*.mp.
32. exp "Outcome Assessment (Health Care)"/
33. develop*.mp.

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34. 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33
35. exp Child, Preschool/
36. preschool*.mp.
37. pre-school*.mp.
38. toddler*.mp.
39. exp Child/
40. boy*.mp.
41. girl*.mp.
42. 35 or 36 or 37 or 38 or 39 or 40 or 41
43. 8 and 26 and 34 and 42

PSYCINFO (VIA OVID) SEARCH: JANUARY 6, 2016
(limits = 2008–2015, English, birth to 5-year-olds)

1. Speech-Language Pathology
2. Speech therapy
3. (speech-language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*)).tw
4. (speech and language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*)).tw
5. (speech adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*)).tw
6. (language adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train*or augment*)).tw
7. Communication Disorders
8. (communication adj (patholog* or therap* or rehab* or treat* or assess* or interven* or train* or augment*)).tw
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. Speech Disorders
11. Articulation Disorders
12. (speech adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
13. (articulation adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
14. (phonological adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
15. Apraxia
16. Dyspraxia
17. (motor speech adj (disorder* or delay* or impairment* or problem* or difficult*or challenge*)).tw
18. Language Disorders
19. Language Delay
20. (language adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
21. (expressive adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
22. (receptive adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge)).tw
23. (pragmatic adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
24. (communication adj (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
25. (social adj2 (disorder* or delay* or impairment* or problem* or difficult* or challenge*)).tw
26. 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27. Treatment outcomes
28. Treatment effectiveness evaluation
29. Childhood development

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30. measure*
31. chang*
32. outcome*
33. develop*
34. 27 or 28 or 29 or 30 or 31 or 32 or 33
35. preschool*
36. pre-school*
37. toddler*
38. boy*
39. girl*
40. child*

Appendix B – Supplemental Material S2

Online supplemental materials, Cunningham et al., "Current Methods of Evaluating Speech-Language Outcomes for Preschoolers With Communication Disorders: A Scoping Review Using the ICF-CY," *JSLHR*, https://doi.org/10.1044/2016_JSLHR-L-15-0329

Supplemental Material S2. Final reference list of included citations by publication year.

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Chapter Three: Validity of the Communication Function Classification System (CFCS) for use with preschoolers with communication disorders

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DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY ORIGINAL ARTICLE

Validity of the Communication Function Classification System for use with preschool children with communication disorders

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ABBREVIATIONS

CFCS	Communication Function Classification System
FOCUS	Focus on the outcomes of Communication Under Six
SLP	Speech–language pathologist

AIM To evaluate construct and predictive validity of the Communication Function Classification System (CFCS) for use with preschool children with a range of speech and language disorders.

METHOD Seventy-seven preschool children with speech and language disorders (50 males, 27 females; mean 2y 7mo, standard deviation [SD] 1y) participated in this cohort study. Preschool children had speech and language, language-only, or speech-only disorders. Together with parent input, speech–language pathologists (SLPs) completed the CFCS at time 1. Parents and SLPs then independently completed a validated change-detecting functional communication outcome measure, the Focus on the outcomes of Communication Under Six (FOCUS), three times: at assessment (time 1), at the start of treatment (time 2), and at the end of treatment (time 3).

RESULTS There was a significant negative correlation between CFCS classifications and FOCUS scores at all three measurement points for the ratings by both parents and SLPs (correlations ranged from −0.60 to −0.76). As expected, no correlations between CFCS classifications and FOCUS change scores were statistically significant.

INTERPRETATION This study provides evidence of construct and predictive validity of the CFCS, demonstrating its value as a discriminative tool for use with preschool children with a range of speech and language disorders.

The Communication Function Classification System (CFCS) is a validated discriminative tool that allows clinicians and parents to categorize children's communication skills into five mutually exclusive levels of everyday communicative function. Classifications are made on the basis of explicit written descriptions of the levels and of the distinctions between them.[1] Using the CFCS, adults classify children's communication by how they communicate on a day-to-day basis.[2] The levels vary by the familiarity of the communication partner, the child's successful sending and receiving of messages, and the pace of communicative interactions. Children in level I function best and those in level V function least well in terms of their communication skills. Descriptions for the five levels of communicative function are presented in Figure S1 (online supporting information), and more specific information about differentiating between the five levels of function can be found on the CFCS website (http://cfcs.us/), where the tool can be freely downloaded. (Note that the levels are described with Roman numerals I–V, not Arabic numbers 1–5.)

The CFCS was originally developed for use with children with cerebral palsy (CP) by applying concepts from the World Health Organization's International Classification of Functioning, Disability and Health.[1,3] Specifically, it was intended to shift clinician and researcher focus beyond body functions and structures (i.e. how a child produces individual speech sounds, the length of a child's sentences, how a child uses grammar) towards a focus on participation (i.e. how a child uses their communication to engage in real-life situations).[1] With this population, the CFCS has adequate content validity and interrater and test–retest reliability.[1,2,4,5]

Classification tools are distinct from assessment tools in that they are used to discriminate between children with varying levels of ability. Unlike assessment measures, classification tools do not measure change over time, but simply describe how a child functions at a single point in time.[6]

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Classification tools like the CFCS can be used with traditional measures of assessment to benefit clinicians, administrators, and researchers.[6] Instead of using ill-defined terms grounded in impairment-based thinking such as 'mild', 'moderate', and 'severe' to describe children's communication impairments, clinicians can use the consistent and strengths-focused language in the five CFCS levels to describe children's current communication abilities in real-world situations.[6] Administrators can use CFCS classifications to understand the functional status of the children they service and to plan and allocate resources for those children.[6] Researchers can use the CFCS to stratify children on the basis of functional ability, which should lead to more meaningful interpretations of intervention outcomes based on functional abilities at the start of treatment.[6]

Traditionally, classification tools have organized children's skills according to their primary impairment, such as the type and severity of speech sound disorder.[7 9] To our knowledge, the CFCS is the only classification tool for overall functional communication skills: both sending and receiving messages for children with a broad range of ages (2–18y).[1] One other classification tool, the Functional Communication Classification System, classifies expressive, but not receptive, communication for 4- to 6-year-olds with CP.[10]

The CFCS has recently been adopted by speech–language pathologists (SLPs) and researchers to classify the functional communication skills of children with a wide range of speech and language disorders, beyond those seen in children with CP.[11,12] The CFCS has not yet been validated for use with children other than those with CP. As a first step towards establishing the usefulness of the CFCS with populations other than that for which it was developed, we evaluated the construct and predictive validity of the CFCS with preschool children with a range of speech and language disorders. Specifically, we investigated whether 'the scores on the new test (CFCS) [though the CFCS is not a 'test'] were correlated with another accepted measure of the same behaviour.'[13] In this case, we wanted to know whether classifications on the CFCS (the new tool) were correlated with another tool that evaluated the same participation-based construct.

Another measure that addresses related aspects of children's communicative function is the Focus on the outcomes of Communication Under Six (FOCUS).[14] The FOCUS is a published outcome measure that evaluates changes in how children use their communication to participate and engage in their world – namely, their communicative participation skills.[15] The FOCUS is able to detect changes in communicative functioning in children across a range of speech and language disorders, and has high internal consistency and adequate test–retest reliability among raters.[16 21]

The CFCS and the FOCUS both address children's functional communication skills, in ways that are complementary. The FOCUS describes a child's current communicative functioning in some detail, and has been validated to measure changes in those skills over time; the CFCS classifies children's levels of communicative functioning and has been validated as a discriminative tool. This paper reports further evidence of validity of the CFCS, using data collected with both of these tools to identify meaningful correlations.

What this paper adds

- The Communication Function Classification System is valid for use with preschool children with speech and language disorders.
- It can be used to explore the impact of outcomes by level of function.

It was hypothesized that there would be significant correlations between CFCS levels and FOCUS scores at the point of first assessment, and that CFCS levels identified at the point of first assessment would be correlated with (i.e. predictive of) FOCUS scores at two later assessment points. The study also explored the strength of correlations between CFCS levels and FOCUS change scores, although we did not expect to find correlations between these.

METHOD

Sampling

This work reports a secondary analysis of data collected in a previous study.[18] The original study included a convenience sample of 97 families of preschool children (birth to 6y of age) recruited from eight organizations across Canada that provided publicly-funded preschool speech–language services. Children in the original sample had been identified by a registered SLP as having a speech, language, or speech and language disorder, and were receiving or had received speech–language intervention services of various types. (Note that neither the original study, nor this one, was designed to evaluate a specific type of intervention.) The FOCUS was used as primary outcome measure in the original study, while the CFCS was used to describe levels of communicative functioning. Parents of children included in the sample provided consent for their children to participate in the original study.[18]

Data for 77 of the children included in the original sample were used for this secondary analysis. Data for the other 20 children were excluded because their CFCS classifications were not available.

Participants

Demographic characteristics and information related to speech–language interventions for the 77 children (50 males and 27 females) included in this analysis are provided in Table SI (online supporting information). Children in the original sample were similar in age, sex, CFCS distribution, and type of communication impairment to those included in this secondary analysis. Children in the original sample had slightly more intervention time than those included in these analyses. On average, children included in these analyses received just over 7 hours of intervention. Typical of the programs in which these children were receiving services, most therapy sessions lasted for 60 minutes, but ranged from 30 minutes to 2 hours. Seventy-four per cent (n=54) of children received intervention once a week (fairly common in pediatric rehabilitation across Canada). Others received

intervention less often, ranging from twice a week or monthly to irregularly throughout the year.

Materials

The CFCS

Please see the description of the CFCS in the introduction.

The FOCUS

The FOCUS is a published 50-item clinical tool validated to measure change in the functional communication skills (communicative participation) of preschool children with speech and language disorders; it can be reliably completed either by a parent or by an SLP.[12,18] The FOCUS has two parts. Part 1 includes 34 items assessed on a 7-point rating scale that ranges from 'not at all like my child' to 'exactly like my child'. Part 2 includes 16 items and uses a 7-point rating scale that ranges from 'cannot do at all' to 'can always do without help'. The FOCUS has a minimum score of 50 and a maximum of 350, with higher scores reflecting better communicative function. When used to measure change, the minimal clinically significant difference on the FOCUS is 16 points. Between 10 points and 16 points, some change is occurring, which may or may not be clinically significant.[12] The FOCUS is freely available and can be found at http://research.hollandbloorview.ca/outcomemeasures/focus. There is now a briefer 34-item version (FOCUS-34; Thomas-Stonell et al., personal correspondence, 2016; http://research.hollandbloorview.ca/outcomemeasures/focus/forms%20and%20manuals) that was not available when this study was done.

Procedures

SLPs obtained informed consent from parents of preschool children with speech and language disorders to participate in the study. To be included, children had to be younger than 6 years of age; have an identified speech, language, or speech and language impairment; and be on a waiting list for intervention services.[18]

Parents and SLPs independently completed the FOCUS, and SLPs worked with parents to classify children's functional communication skills using the CFCS once, at the point of first assessment (time 1). Parents and SLPs also independently completed the FOCUS at the start of treatment (time 2), and at the end of treatment (time 3). There was an average of 60 days between time 1 and time 2, and an average of 90 days between time 2 and time 3.

Statistical analysis

To examine construct validity, the relationships between SLPs' and parents' FOCUS scores and CFCS classifications were examined using Spearman's rank correlations at the point of first assessment (i.e. time 1). To examine predictive validity, the relationship between children's initial CFCS classifications and parents'/SLPs' later FOCUS scores (time 2 and time 3) was examined using the same method. Spearman's rank correlations were also calculated for CFCS classifications and FOCUS change scores (i.e. change between time 1 and time 2, and between time 2 and time 3) for both parents' and SLPs' ratings. For the CFCS, a higher level (level IV or V) indicates a lower level of communicative function, while for the FOCUS higher scores indicate better communicative participation skills, so negative correlations were expected.

RESULTS

Relationship between initial CFCS classification and total FOCUS scores

As reported both by SLPs and by parents, FOCUS scores and CFCS levels were inversely correlated (a function of the scaling of the two systems). Mean total FOCUS scores by CFCS level, as reported separately by SLPs and parents, are presented in Table I.

Construct validity

There were statistically significant negative correlations between SLPs' (correlation coefficient, $r_s[77]=-0.76$, $p<0.001$) and parents' ($r_s[77]=-0.65$, $p<0.001$) total FOCUS scores and CFCS classifications at time 1.

Predictive validity

There were also statistically significant negative correlations between CFCS classifications at time 1 and SLPs' total FOCUS scores at time 2 ($r_s[77]=-0.72$, $p<0.001$), and time 3 ($r_s[77]=-0.68$, $p<0.001$); and between CFCS

Table I: Mean Focus on the outcomes of Communication Under Six (FOCUS) scores by Communication Function Classification System (CFCS) level as reported by parents and speech–language pathologists (SLPs)

	SLP FOCUS, time 1	SLP FOCUS, time 2	SLP FOCUS, time 3	Parent FOCUS, time 1	Parent FOCUS, time 2	Parent FOCUS, time 3
	Mean (SD)			Mean (SD)		
CFCS level I	274.0 (32.16)	272 (28.61)	285.6 (33.43)	259.4 (27.34)	263.0 (25.15)	282.6 (38.66)
CFCS level II	202.5 (59.79)	222 (64.56)	234.5 (62.50)	214.8 (61.09)	220.0 (56.07)	248.8 (60.32)
CFCS level III	174.9 (58.94)	193.2 (72.65)	212 (63.65)	192.5 (57.35)	190.0 (49.13)	205.1 (54.02)
CFCS level IV	120.1 (47.52)	129.1 (45.83)	152.3 (56.12)	145.9 (44.69)	152.0 (48.72)	167.0 (53.25)
CFCS level V	72.3 (11.17)	80.4 (21.27)	100.3 (39.52)	107.8 (32.95)	109.3 (34.59)	128.5 (39.66)
Correlation coefficient (r_s)[a]	−0.76	−0.72	−0.68	−0.65	−0.63	−0.60

[a]All significant at $p<0.001$.

Table II: Mean Focus on the outcomes of Communication Under Six (FOCUS) change scores by Communication Function Classification System (CFCS) level based on parent and speech–language pathologist (SLP) ratings

	SLP FOCUS change scores, time 1/ time 2	SLP FOCUS change scores, time 2/ time 3	Parent FOCUS change scores, time 1/ time 2	Parent FOCUS change scores, time 2/ time 3
CFCS level I	−2.0	13.6	3.6	19.6[a]
CFCS level II	19.5[a]	12.5	5.2	28.8[a]
CFCS level III	18.3[a]	18.8[a]	−2.5	15.1
CFCS level IV	8.9	23.2[a]	6.1	15.1
CFCS level V	8.1	19.9[a]	1.5	19.1[a]
Correlation coefficient (r_s)	−0.05	−0.02	−0.00	−0.08

[a]Sixteen points is considered a clinically significant change on the FOCUS. Between 10 points and 16 points, some change is occurring, which may or may not be clinically significant.

classifications at time 1 and parents' total FOCUS scores at time 2 ($r_s[77]=-0.63$, $p<0.001$), and time 3 ($r_s[77]=-0.60$, $p<0.001$).

Relationship between initial CFCS classification and FOCUS change scores

There were some differences between parents' and SLPs' FOCUS change scores within CFCS levels. For example, SLPs rated children in CFCS levels II and III as making clinically meaningful change (16 points on the FOCUS)[12,18] between time 1 and time 2, while parents reported no clinically meaningful change across all CFCS levels. SLPs rated children in levels III, IV, and V as making clinically meaningful change between time 2 and time 3, while parents rated children in levels I, II, and V as making meaningful change during the same period.

No correlations were statistically significant for SLPs' FOCUS change scores between time 1 and time 2 ($r_s[77]=-0.05$, $p=0.67$) or between time 2 and time 3 ($r_s[77]=-0.02$, $p=0.84$). Correlations were also not statistically significant for parents' FOCUS change scores and CFCS classifications between time 1 and time 2 ($r_s[77]=0.00$, $p=0.97$) or for change between time 2 and time 3 ($r_s[77]=-0.08$, $p=0.50$). FOCUS change scores did not differ significantly by CFCS level as reported by SLPs or parents, indicating that mean FOCUS change scores were relatively similar for children at each of the CFCS levels. Mean FOCUS change scores by CFCS level for SLPs and parents are presented in Table II.

DISCUSSION

This is the first study to assess the psychometric properties of the CFCS in a group of preschool children who did not have CP, but who had a range of speech and language disorders. We found evidence of construct validity of the CFCS by identifying strong negative correlations between CFCS classifications and both parent- and SLP-reported FOCUS scores at initial assessment. We found evidence of predictive validity of the CFCS by identifying similar negative correlations between CFCS classifications made at initial assessment and parent- and SLP-reported FOCUS scores at two later assessment points.

As expected, we did not find any statistically significant relationships between CFCS classifications and FOCUS change scores. This is because children in all the CFCS levels showed improvements in their functional communication skills over time. This finding is consistent with development of the FOCUS measure, which was designed to measure change equally for children at all levels of communicative function so that change scores would not be biased by the severity of a child's impairment.[12,14]

A second contributing factor to the absence of significant finding between CFCS classifications and FOCUS change scores might be that opportunities for change in FOCUS scores were variable for children at each of the CFCS levels. For example, children functioning in CFCS level I had relatively high FOCUS scores to begin with and thus less room to change. At the other extreme, children in CFCS level V were significantly impaired, and had considerably more room for improvement but also had more complicated communication issues (hence their categorization in CFCS level V). This may suggest a ceiling effect for the FOCUS and some limits to predictive validity for lower CFCS levels; however, we are hesitant to make this conclusion. SLPs did observe significant change scores, primarily for children in the lower CFCS levels; however, parents rated children in the higher CFCS levels (I and II) as making clinically meaningful change between time 2 and time 3.

The strong correlations between a validated measure of children's communicative function (FOCUS) and CFCS levels of function provide support for both the construct and predictive validity of the CFCS within this group of children. We hope this finding will encourage other research and clinical groups to use the CFCS as a way to classify children's functional skills. We believe using the CFCS can help clinicians, administrators, and researchers to take a strengths-based approach when evaluating children with a range of speech–language impairments, as has been done with the analogue classification systems Gross Motor Function Classification System[22] and Manual Ability Classification System[23] for children with CP. With its focus on participation, the CFCS can also help us to better understand how our interventions affect the everyday lives of children and families.[6]

Further research, now underway by the authors, will explore in greater detail and with a very much larger data set, whether and how children's functional communication skills change by CFCS levels, types of communication impairment, and duration of SLP interventions. So far, we have learned that CFCS classifications can change over time for some children, but we do not yet know whether the CFCS can be used as a change-detecting measure, and thus we do not encourage use of the CFCS as an outcome measure. This will be a focus of future research. Studies to

further validate the CFCS for use with preschool children with a range of speech–language disorders are also planned for the near future. Other validation studies are underway, including the stability and convergent validity of the CFCS.

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SUPPORTING INFORMATION

The following additional material may be found online:

Figure S1: Descriptions for the five Communication Function Classification System (CFCS) levels of function.

Table SI: Demographic and intervention characteristics for children included in the analyses.

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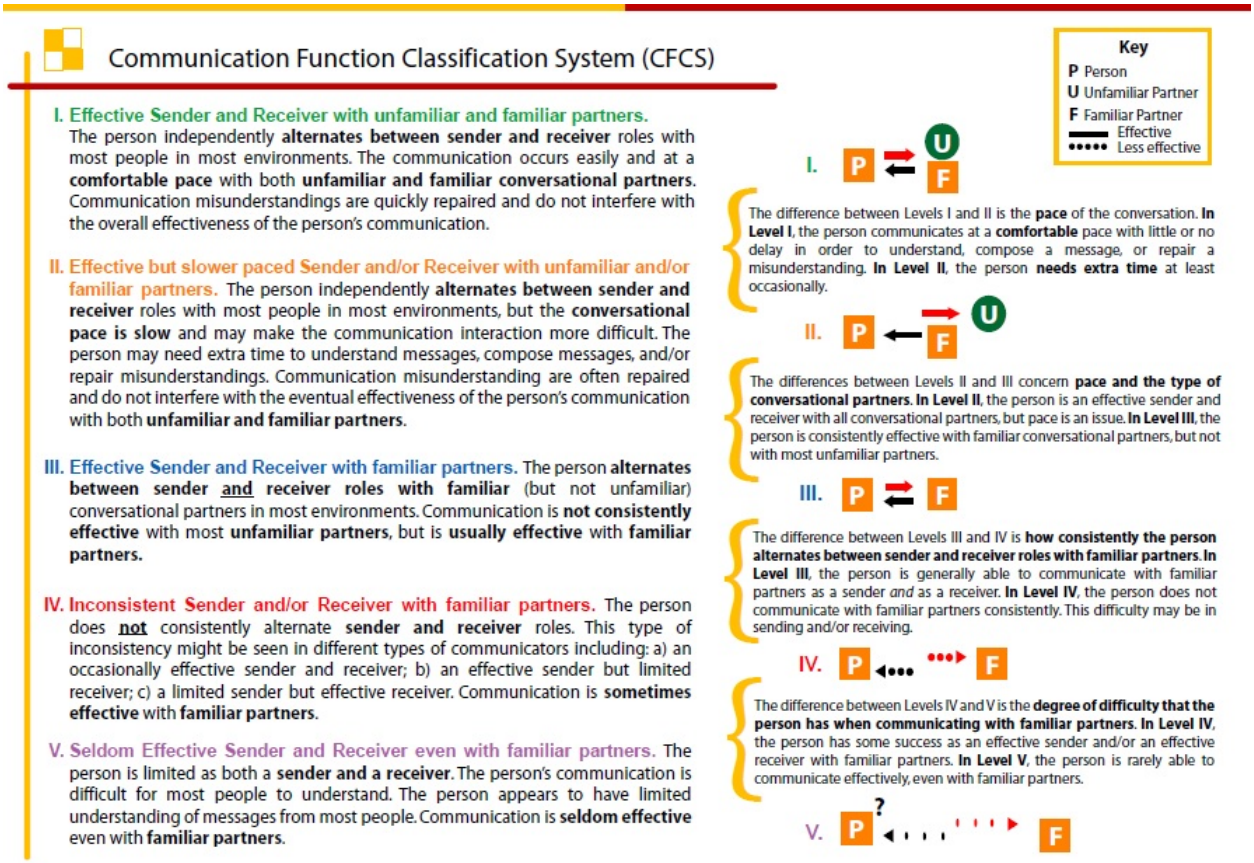
Appendix A: Table SI Demographic and intervention characteristics for children included in the analyses.

Table SI: Demographic and intervention characteristics for children included in the analyses.

	Original sample (*n*=97)	Sample for secondary analysis (*n*=77)
Age	Mean = 31months (2.7 years) SD = 12.48 months (1.04 years)	Mean = 32.48 months (2.7 years) SD = 12.26 months (1.02 years)
Sex	Male = 68 (70%) Female = 29 (30%)	Male = 50 (65%) Female = 27 (35%)
CFCS level of communicative function	Level I = 7 (7%) Level II = 8 (8%) Level III = 16 (16%) Level IV = 44 (45%) Level V = 22 (23%)	Level I = 5 (6%) Level II = 6 (8%) Level III = 11 (14%) Level IV = 40 (52%) Level V = 15 (20%)
Medical diagnoses	Global dev. delay = 28 (29%) Syndromes = 8 (8%) Hearing impairment = 8 (8%)	Global dev. delay = 26 (34%) Syndromes = 19 (25%) Hearing impairment = 3 (4%)
Communication disorder	Speech & language = 81 (84%) Language only = 8 (8%) Speech only = 8 (8%)	Speech & language = 61 (79%) Language only = 10 (13%) Speech only = 6 (8%)
Treatment goals	Expressive language = 71 Receptive language = 44 Articulation/phonology = 39	Expressive language = 57 Receptive language = 44 Articulation/phonology = 31
Amount of treatment	Mean = 8.6 hours SD = 6.6 hours Range = 1-46 hours	Mean = 7.19 hours SD = 5.54 Range = 2-40 hours
Treatment type	Individual = 50 HP/Parent consultation = 29 Group = 25 Parent training = 10	Individual = 33 HP/Parent consultation = 15 Group = 16 Parent training = 7

Appendix B: Figure SI Descriptions for the five Communication Function Classification System (CFCS) levels of function.



Chapter Four: A population-based study of communicative participation in preschoolers with speech-language delays

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A population-based study of communicative participation in preschoolers with speech-language delays.

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Abstract

Aim. To model preschoolers' communicative participation development, and explore variations by level of communicative function.

Methods. This was a **s**econdary analysis of data from a longitudinal observational study of preschoolers with speech and language delays (N = 46,872, M = 41.76, SD = 11.92; 67% male) accessing publicly-funded services in Ontario Canada. Two measures were used: Focus on Communication Outcomes Under Six (FOCUS©), measuring changes in communicative participation skills, and the Communication Function Classification System (CFCS), classifying communication function into one of five levels.

Results. With mixed effects modeling we fit separate growth curves for each CFCS level. Models allowed for variation in intercept and slope, and quadratic terms were included for both the fixed and random effects. Unstructured covariance was used for all models other than CFCS Level IV. Predicted intercepts increased with CFCS levels. Growth was initially rapid and then levelled off as children developed for all CFCS levels but level V, in which growth was slow but continual.

Interpretation. Understanding the development of communicative participation skills will help us move beyond traditional impairment-based thinking. Children can make meaningful communicative changes regardless of their function. Findings will be useful for prognostication, counseling, and planning intervention services.

Running Foot: Development of preschoolers' communicative participation skills.

What this paper adds

- A first look at the development of communicative participation skills in a cohort of preschoolers with speech and language delays.
- Examining development by level of communicative function encourages us to think beyond impairments and focus on function.
- All children with communication disorders can make meaningful changes regardless of their level of function.

Introduction

Speech and language impairments are highly prevalent in preschool children.[1-3] Prevalence estimates vary, ranging from 3 to 16%;[1-2] communication disorders are more frequent among those considered at risk.[2-3] Knowledge of how speech and language skills develop in preschoolers with delays and disorders is important for clinicians, administrators and policy makers; and can be used to facilitate identification, prognostication, counselling and intervention planning for these children and families.

Statistical models of growth have been created to demonstrate how children with speech and language disorders develop. These include models for various impairments, including acquisition of expressive/receptive language,[5-6] grammar,[6] vocabulary,[7] and speech sounds.[8] These models are important in many ways; however, they provide a narrow view, as they focus on individual skills specific to the child's impairments (e.g., use of grammatical markers) rather than looking at the function of the whole child and at their environments (e.g., how children's communication skills affect their ability to engage with others and participate in their worlds).

The World Health Organization's International Classification of Functioning, Disability and Health – Child and Youth Version (ICF-CY) promotes a useful conceptual framework to understand the difference in studying development of specific skills versus the development of communicative participation.[9] Most research studying the development of children with communication disorders has focused on changes to the Body Functions and Structures (e.g., speech sounds) and Activities (e.g., receptive language skills) components; very little research has described outcomes related to the Participation component;[10] and little has been published on the development of communicative participation skills – how children use their communication to engage in everyday life.[11] We believe these are meaningful and practical outcomes, and are the outcomes important to families.[12]

Focusing on participation outcomes removes the need to discriminate between the various speech and language disorders – always a challenging task[13] – instead allowing us to compare children with a wide variety of communication disorders based on how they use communication functionally. From a participation-focused perspective, we are better positioned to answer parents' "big questions" (e.g., "Will my child be able to engage with our family?" "When will other people be able to understand my child?" "Will my child make friends?")

Many of the existing growth curves were developed with typically developing children;[6-7] children with specific impairments (e.g., specific language impairment and hearing impairment);[5,8] or children with specific disorders (e.g., Down Syndrome, Fragile X Syndrome).[4,14] We believe this approach provides a narrow view, suggesting there is only one way for children within these categories to develop. Models of development designed with a focus on communicative function rather than on a specific diagnosis can facilitate a much-needed shift towards 'participation' and support children to develop to the best of their personal potential.

Our research group has worked collaboratively with Ontario, Canada's publicly-funded Preschool Speech and Language Program (PSLP) to establish a large-scale program evaluation using preschoolers' communicative participation skills as the primary outcome. In the PSLP

children under six years of age with an identified concern related to speech and/or language development can access free assessment and intervention services from registered speech-language pathologists.[15] Over 50,000 children are served in this program each year.[15] Our team was granted access to the PSLP program evaluation data to explore the development of children's communicative participation skills.

The PSLP dataset made it possible to address a series of questions related to children's communicative participation. The objective of this first investigation was to create growth curves for preschoolers' communicative participation skills and to determine whether curves differed by the level of a child's communicative function. This broadly-focused work differs from previous clinical studies as it examines an entire unselected population of preschoolers with identified concerns related to communication. The PSLP evaluation project has been running since the autumn of 2012, but these data have not been reported publically.

Method

Study Design. We completed an observational longitudinal study of a cohort of preschoolers in Ontario Canada. This work represents a secondary analysis of data collected prospectively by the PSLP at 31 locations across the province of over 13 million people.[15-16] All children accessing PSLP services were assessed approximately every six months for the duration of their time in the program. Assessments were completed by parents and speech-language pathologists during appointments either at PSLP centres or in community settings. Data were collected between October 1, 2012 and May 1, 2016. During their time in the program, children and families accessed a variety of assessment and intervention services. The Hamilton Integrated Research Ethics Board at McMaster University (Hamilton, Ontario, Canada) approved the use of anonymized data for this investigation.

Participants. Assessment and demographic data were available for 80,413 children. We applied three exclusion criteria to ensure the relevant children remained in our dataset. We removed data for 1,673 children who did not have outcome scores recorded; 2,026 who were outside the ages for which measurement tools were validated or outside the ages typically serviced by the PSLP; and 29,842 who had accessed specialized services other than the PSLP (Table 1). This left us with data for 46,872 children, and all available data were included in the analysis. This non-probability sample represented all children who accessed PSLP services between October 1, 2012 and May 1, 2016 for whom outcomes data were collected. Details of the children's sex, age and levels of communicative function at baseline are presented in Table 2.

Outcome Measures. (1) The Focus on the Outcomes of Communication Under Six (FOCUS©). The FOCUS© is a valid and reliable 50-item parent-report outcome measure that evaluates changes in how children use their communication functionally to engage in life.[17-19] Using a 7-point Likert scale ranging from 'cannot do at all' to 'can always do without help', parents rate their children on a variety of communicative participation skills. FOCUS© scores range from a low of 50 to a top value of 350.[17-19] It has been validated for use with children from one-year, six-months to six-years of age.[18] (2) The Communication Function Classification System (CFCS). The CFCS is a valid discriminative classification tool that categorizes children's communication skills into five levels of function based on how they communicate on a daily

basis.[20-21] "CFCS levels vary by familiarity of the communication partner, the child's successful sending and receiving of messages, and the pace of communicative interactions. Children in Level I function best and those in Level V function least well"[21 (p.1)] The CFCS is free to download at http://cfcs.us/ where more detailed descriptions of the five levels can be found.

Statistical Analysis. Data were analyzed using version 13 of Stata Data Analysis and Statistical Software.[22] The population of children under investigation was described using means and SDs. Analysis of variance was used to examine differences in how children functioned at baseline across each of the five CFCS levels with respect to age, gender, and FOCUS© scores. A p-value of 0.05 was the criterion for a statistically significant result.

Mixed effects modelling was used to develop average growth curves for children in each CFCS level. Mixed effects models are flexible in that they allow for missing data, unequal assessments across children, and unequal spacing between assessments.[23] The data used for this work were collected for program evaluation, not specifically for the purposes of health services research. As such, there was variability in when children entered and left the program as well as the points at which assessments were completed. Although our inclusion criteria required that children be between one-year, six-months and five-years, six-months of age, not all children were first assessed at one-year, six-months of age. Similarly, children remained in the program for varying periods of time, so some children had multiple assessments, while others were seen only once. Finally, the PSLP requested assessments at six month intervals for all children, but logistically this was not always possible. As such, not all assessments were equally spaced for all children.

Average change in FOCUS© scores was modelled within CFCS levels. Age (primary predictor of change) was centered at one-year, six-months, and both centered age and the square of centred age were included as predictors to yield model parameters that described growth in terms of the average FOCUS© score at one-year, six-months, the estimated rate of change in FOCUS© scores, and the deceleration (or acceleration) of change for each month up to five-years six-months of age. Allowing for both random intercept and slopes, we were able to estimate the between-child variability in both the starting score and rates of development.[23]

A Likelihood ratio test and the Bayesian Information Criterion[23] favored models in which the rate of development is expected to change over time and in which all three developmental parameters are allowed to vary randomly among children. The degree of individual variation around the average line is estimated as variances in the random effects for each change parameter. Except for children in CFCS Level IV, the covariance matrix of the random effects included estimates of the covariance among developmental parameters, consistent with the possibility that a child's estimated FOCUS© score at one-year, six-months might be predictive of subsequent change. The data for CFCS Level IV did not allow for estimating these covariances, but the model was otherwise similar to models for the other levels.

Results

Data for 46,872 children were included in this analysis. Average age at the time of first assessment differed significantly among children in the five CFCS levels ($F(4, 46, 867) = 2137.49$, $p < 0.001$), with the youngest children (on average) in Level V and the oldest (on average) in Level I (Table 3). The ages of children in each CFCS level significantly differed from the ages for children in each of the other CFCS level (except for children at Levels IV and V – which were statistically similar). Initial FOCUS© scores also differed significantly among

children in the five CFCS levels ($F(4, 46, 865) = 7491.94$, $p < 0.001$), with children in the lowest levels (V) receiving the lowest FOCUS© scores. FOCUS© scores in each of the CFCS levels differed significantly from FOCUS© scores in each of the other CFCS levels (Table 3). The range of scores in each of the CFCS suggests that SLPs may still not be classifying children correctly in all cases, an issue previously reported within the PSLP.[24] Total FOCUS© scores also differed significantly by age ($F(49, 46, 820) = 384.32$, $p < 0.001$), with older children achieving higher FOCUS© scores than younger children. Finally, there was a significant interaction between Age and CFCS level for FOCUS© Scores. This interaction occurred between CFCS levels IV and V when children were approximately 50 months of age.

Children were grouped into the five CFCS levels based on how they were classified at the point of first assessment. The 46,872 children had a total of 84,495 assessments; on average, children received 1.8 assessments (range = 1-10 observations) (Table 3). Estimates of the parameters for the average (fixed effects) and individual (random effects) development of communicative participation skills for children in each CFCS level are presented in Table 4. Figure 1 provides a visual representation of the population average growth curves for children's FOCUS© scores in each CFCS level (the solid line) as well as individual variation in the growth over time shown by the dashed lines (one SD above/below average).

The predicted intercepts for the fixed effects (i.e., predicted FOCUS© score at one-year, six-months) increased as the CFCS levels increased (i.e., predicted intercepts were highest in CFCS Level I and lowest in CFCS Level V) (Table 4). The 95% confidence intervals for the intercepts in the five CFCS levels did not overlap, suggesting that the average growth curves may be different in each of the CFCS levels; however this was not tested statistically. Predicted average slopes were initially rapid, but levelled off for all children but those in CFCS level V, whose rate of growth was slower, but continuous (Table 4).

The coefficients for the random effects indicate the degree to which individual children are expected to vary around the average curve (Table 4). The SD of the intercept (predicted FOCUS© score at one-year, six-months), indicates the variability of initial FOCUS© scores. The SD slope terms indicate individual variability in rates of growth. The correlations between intercept and slope indicate the degree to which a child's intercept is associated with their rate of growth in FOCUS© scores. Initial rate of change at one-year, six-months was negatively related to subsequent change, meaning children starting with higher FOCUS© scores are expected to have less rapid growth in FOCUS© scores, while the opposite is expected for children starting with lower FOCUS© scores.

The residual standard deviations (Table 4) indicate the amount of unexplained variance and provide information about how much a child's FOCUS© score is likely to vary around their true ability at any given time.

Discussion

We used a non-probability sample of a cohort of preschoolers with identified speech-language concerns to create five growth curves based on children's levels of communicative function beginning at one-year, six-months of age. To our knowledge this is the first time the development of communicative participation skills has been modelled longitudinally. The models estimate average growth, while also accounting for individual variability. Predicted

average FOCUS© scores at one-year, six-months increased with CFCS levels. Predicted average slopes were initially rapid, but levelled off as children got older for all children but those in the lowest level of function.

It should be noted that our data show a trend for children with lower levels of functional communication to enter the PSLP earlier. For instance, children in CFCS level V had the youngest average age and the lowest average FOCUS© score at the point of first assessment. As seen in Table 3, children in the lowest levels of communicative function also had more assessments on average than those in the higher levels, which suggests they participated in the PSLP for longer periods of time and likely received more assessment and intervention services.

The growth curves show that children at all levels of function can make meaningful changes in their communicative participation skills. In the past, children with speech and language disorders have been assessed using impairment-focused measures that evaluate changes in specific skills such as articulation of consonant sounds, use of grammatical markers, and speech fluency.[25] With this approach, children may not make measurable change, but parents often report important functional changes (i.e., they may achieve the same standard score, but parents report that other people can now understand their child). As such, it may appear as if children's skills are not improving. Using communicative participation as the primary outcome, we can capture meaningful changes in how children use communication to function in their everyday lives, separate from impairment-based changes.

Clinically these growth curves can serve to facilitate discussions with families about prognosis when a speech-language concern is identified. Since these curves have been developed using children with identified concerns related to communication, a clinician could theoretically use a child's FOCUS© score and CFCS level to see whether they are following a trajectory similar to other age- and CFCS-matched children with communication challenges. If not, further assessment and intervention may be warranted. When a child is first identified with a speech-language delay, parents often wonder what the long-term prognosis is for their child. Considering a child's present level of function, clinicians will be better positioned to discuss prognosis with families based on how children use their communication functionally.

Administrators and policy makers may be interested in the development of communicative participation skills for the purposes of service delivery planning and funding. In the past, researchers have predicted which children will benefit most from speech-language interventions, suggesting that therapy may be more/less warranted for different groups of children. These curves show that children at all ages and levels of communicative function can make meaningful communicative changes.

Study limitations. Our growth curves were developed using a non-probability sample of preschoolers participating in a publically-funded community service for children with communication disorders. Convenience samples such as this are subject to bias in that the individuals included may be fundamentally different from those who did not participate, and may limit generalizability of study findings. We believe that our study population was somewhat different in that PSLP services are available freely to all families who need them. This eliminates financial inequities to a point, but we acknowledge that there may still have been families with personal or social constraints that made PSLP services inaccessible to them. As such, we are cautious in generalizing findings beyond preschoolers who typically access these types of services.

A second limitation lies in the environmental factors to which children were exposed over time. Some of the children included in the model were participating in active speech-language therapies, while others received only assessments. The curves model growth in communicative participation skills, but do not yet consider factors that might influence development of those skills. Next steps for our group will be to identify relevant variables within the PSLP dataset that may be predictive of communicative participation skill development. Of specific interest will be the child's intervention status (i.e., whether they were receiving active intervention). A limitation of our dataset is that we do not have access to information about many of the factors that might influence the development of communicative participation skills. We plan to collaborate with the PSLP to improve data collection to be better able to identify the important factors that facilitate the best outcomes for children and families.

Conclusions

Growth curve modeling of the development of functional communication skills in children with identified speech and language concerns allows us to look beyond impairment-based thinking towards an emphasis on function and participation. From the perspective of participation, children at all levels of function make meaningful changes in their communication skills over time. This information can be used for identification, prognostication, and counselling with families, as well as for service delivery planning. Future work in this research program will investigate factors that predict the development of communicative participation skills, which will have important implications for clinicians and those who fund and plan service delivery.

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Table 1.

Inclusion criteria and rationale.

Inclusion Criteria	**Rationale for criteria**	**# of children excluded by the criteria**
1. Children had FOCUS© scores and CFCS classifications recorded	1. Both pieces of data were needed to develop meaningful growth curves.	1, 673
2. Children were 18 to 67 months old at first assessment.	1. The primary outcome measure (FOCUS©) was validated for children between 18 and 60 months of age (reference). 2. In the PSLP, children can only access services up until August before they start junior kindergarten.	2, 026
3. Children were clients of the PSLP and were not accessing services in conjunction with another program (e.g., Infant hearing program).	1. We judged children with comorbidities known to affect communication (e.g., blindness, hearing impairment) to be conceptually different from children whose primary challenge was 'communication' (reference).	29, 842

Table 2.

Characteristics of Included Children at Assessment Time 1.

Characteristic	Category	*n* (%)
Sex	Male	27, 519 (67)
	Female	13,465 (33)
Age	18-24 months	7,114 (15)
	25-30 months	7,659 (16)
	31-36 months	5,988 (13)
	37-42 months	5,988 (13)
	43-48 months	6,687 (14)
	49-54 months	6,616 (14)
	55-60 months	4,518 (10)
	61-67 months	1,298 (3)
Communicative Function	CFCS Level I	7,991 (17)
	CFCS Level II	9,442 (20)
	CFCS Level III	11,646 (25)
	CFCS Level IV	14,825 (32)
	CFCS Level V	2,968 (6)

Table 3.

Participant Characteristics by CFCS Level at Time 1.

	CFCS Level I	CFCS Level II	CFCS Level III	CFCS Level IV	CFCS Level V	All levels combined
Number (%) of Children	7,991 (17)	9,442 (20)	11,646 (25)	14,825 (32)	2,968 (6)	46,872
Mean (SD) age in months	46.94 (10.88)	43.02 (11.46)	37.74 (11.78)	34.20 (11.10)	33.75 (11.53)	39.0 (12.32)
Mean (SD) FOCUS© score	266.62 (47.33)	236.89 (53.00)	203.83 (54.02)	164.98 (52.28)	125.86 (57.20)	203.97 (67.07)
Number of assessments	10,692	15,730	22,353	29,786	5,934	84,495
Mean number of assessments (range)	1.3 (1-7)	1.7 (1-7)	1.9 (1-8)	2.0 (1-10)	2.0 (1-7)	1.8 (1-10)

Table 4.

Estimates of coefficients for the development of communicative participation skills.

	CFCS Level I	CFCS Level II	CFCS Level III	CFCS Level IV	CFCS Level V
Fixed Effects					
Intercept (95% CI)	190.56 (185.49-195.62)	156.50 (153.29-159.71)	139.90 (137.88- 141.92)	120.46 (118.89-122.04)	101.25 (98.34-104.17)
Slope (95% CI)	4.32 (3.96 - 4.67)	4.97 (4.71 - 5.22)	4.77 (4.58 - 4.97)	3.79 (3.62 - 3.95)	1.65 (1.3 - 2.0)
Slope^2 (95% CI)	-0.05 (-.06 to -.04)	-0.05 (-.05 to -.05)	-0.05 (-.05 to -.04)	-0.02 (-.03 to -.02)	0.01 (.003 to 0.02)
Random Effects					
SD Slope (SE)	3.30 (0.37)	3.32 (2.57)	2.49 (0.18)	1.49 (0.25)	3.77 (0.28)
SD Slope^2 (SE)	0.05 0.008	0.06 (0.006)	0.06 (0.004)	2.23e-11 (4.70e-12)	0.06 (0.009)
Corr. Slope/Intercept (SE)	-0.72 (0.45)	-0.44 (0.07)	-0.29 (0.06)		-0.18 (0.14)
Corr. Slope/Slope^2 (SE)	-0.94 –(0.02)	-0.90 (0.02)	-0.90 (0.01)		-0.84 (0.03)
Corr. Slope^2/Intercept (SE)	0.48 (0.11)	0.04 (0.14)	-0.12 (0.12)		-0.28 (0.30)
SD Intercept (SE)	60.74 (3.32)	44.67 (2.30)	34.61 (1.46)	32.21 (0.49)	23.29 (2.49)
Residuals					
SD Residual (SE)	25.11 (0.41)	25.31 (0.30)	27.39 (0.24)	20.94 (0.20)	26.87 (0.48)

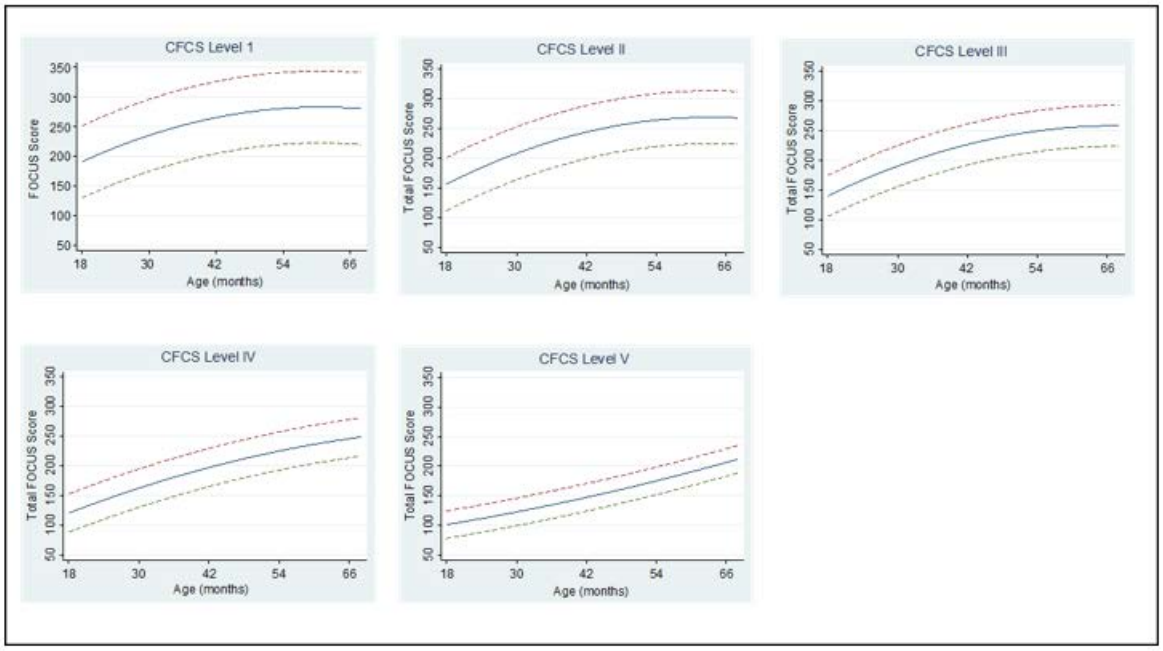

Figure 1. Predicted FOCUS© scores in each of the five CFCS levels of communicative function. The dotted lines above/below the solid line indicate the standard deviation of the predicted line (individual variation in predicted FOCUS© scores).

Chapter Five: Factors contributing to preschoolers' communicative participation outcomes: Findings from a population-based longitudinal cohort study in Ontario Canada

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Factors contributing to preschoolers' communicative participation outcomes: Findings from a population-based longitudinal cohort study in Ontario Canada

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Abstract

Purpose. To identify predictors of communicative participation outcomes for a large cohort of preschoolers with communication disorders. *Method*. This was a secondary analysis of data from a program evaluation project across Ontario Canada's Preschool Speech and Language Program (PSLP). Longitudinal data for 46,872 children between 18 and 67 months of age were available for analysis (M = 41.76 mo, SD = 11.92, 68% male). Children were assessed using two participation-based outcome tools. We previously used mixed effects modelling to fit growth curves for children in five levels of communicative function. These models were re-estimated here by including both demographic and intervention-specific predictor variables. *Results.* Gender, multilingual status, participation in an early learning environment, interventions status, time in intervention, and intervention goals were all statistically significant predictors of preschoolers' communicative participation skill development; however, predictors were not always clinically significant, and they varied by level of communicative function. *Conclusions*. We studied a population of preschoolers with communication disorders to identify predictors of growth in communicative participation skills – an important and meaningful outcome for families. This work has implications for researchers, clinicians, administrators, and policy makers. Findings are generalizable within the PSLP, but may apply to preschoolers outside the program as well.

Keywords. Communicative participation, outcome, predict, development

A number of factors have been associated with outcomes for preschoolers with several specific speech, language, and social communication impairments. In preschoolers with language delay caused by hearing loss, age at first intervention is an important predictor of spoken language development (Boons et al., 2012; Holzinger, Fellinger & Beitel, 2011; Koehlinger, Van Horne & Moeller, 2013). Severity and frequency of stuttering are important predictors of intervention outcomes for preschoolers with fluency disorders (Cook, Donlan & Howell, 2013; Guitar, Kazenski, Howard, Cousins, Fader & Haskell, 2015). Predictors of outcome for preschoolers with language and social communication disorders usually include level of impairment (Legof & Sherman, 2006; Makrygianni & Reed, 2010; Yoder, Molfese & Gardner, 2011), age of first intervention (Luiselli, Cannon, Ellis & Sisson, 2000; Makrygianni & Reed, 2010), intensity of service delivery (Luiselli et al. 2000; Mazurek, Kanne & Miles, 2012), and parent-child interaction style (McDuffie & Yoder, 2010; Roberts & Kaiser, 2012; Yoder & Warren, 2001). Age, speech sound development prior to starting treatment, and expressive language ability predict change in phonological skills following intervention for preschoolers with speech sound disorders (Tyler, Lewis & Welch, 2003).

Clinicians, administrators, and policy makers consider these predictive factors when developing individual intervention plans and coordinating service programs for preschoolers with communication disorders. For example, as a result of research identifying early detection and intervention as important predictors of language development for children with hearing loss, policy makers in many countries implemented national strategies for the early screening, identification, and intervention for newborns (e.g., Speech-Language & Audiology Canada (SAC), 2014a). Identification of early intervention as a predictor of outcome for children with other speech and language disorders has resulted in position papers from national organizations promoting early intervention, which governments use for program planning (e.g., American Speech-Language-Hearing Association (ASHA), 2008; SAC, 2014b).

Information about factors predictive of intervention outcomes is also used by clinicians and administrators to develop plans for therapy, set treatment goals, and counsel parents. For instance, when presented with a preschooler with fluency disorder, clinicians consider the severity of the child's stutter when determining whether to recommend intervention, or how much treatment to offer. For children with severe speech sound disorders clinicians and administrators may consult clinical guidelines that recommend varying intervention format, setting and timing, depending on degree of impairment (ASHA, n.d.). For children with early language delay, where parent-child interaction is paramount, clinicians may recommend parent coaching as a first intervention to promote a language-rich home environment prior to starting more direct intervention with the child (Roberts & Kaiser, 2011). Knowledge of the factors predictive of outcomes may also help clinicians to counsel parents about what to expect from therapy. Specifically, clinicians may be able to provide an idea of how much intervention may be needed and what the outcome of intervention efforts might be.

The World Health Organization's International Classification of Functioning, Disability, and Health – Children and Youth Version (ICF-CY) provides a useful framework for thinking about how we evaluate outcomes in speech-language pathology (WHO, 2007). Within the ICF-CY framework, outcomes can be thought of as being evaluated within the three main components: Body Functions and Structures, Activity, and Participation (WHO, 2007). Within the Body

Functions and Structures component, outcomes may be related to improved speech intelligibility, fluency, or quality. For the Activity component, outcomes may be related to expressive/receptive language skills (e.g., improved use/understanding of grammatical markers, sentence length). For the Participation component, outcomes are more broadly focused and include indicators such as increased engagement in play with peers, engagement in conversations, or involvement in other social activities (Cunningham, Washington, Binns, Rolfe, Robertson & Rosenbaum, 2017a). To date, factors predictive of the development of specific impairment-based outcomes within the Body Functions and Structures and Activity components have been identified, and while this information has been helpful and is important in many ways, it does not help us to understand the impact of our work in ways that are important and meaningful to the families we serve (e.g., Will my child make friends? Will we be able to communicate with each other? Will my child be able to participate in a school/preschool classroom?). Evaluating participation-based outcomes and identifying predictors those outcomes can make it easier for us to show and explain the impact of our work to families, service delivery planners, and funding agencies.

One new participation-based construct that has recently garnered attention in the literature is 'communicative participation'. For preschoolers, this means *how the child uses communication to interact in real world situations* (Eadie et al., 2006). A few studies have investigated communicative participation outcomes for preschoolers with communication disorders, identifying some of the factors related to the child, therapist and intervention that are predictive of outcomes (Baxendale, Lockton, Adams & Gaile, 2013; Pennington, Roelant, Thompson, Robson, Steen & Miller, 2013; Thomas-Stonell, Robertson, Oddson & Rosenbaum, 2016; Thomas-Stonell, Washington, Oddson, Robertson & Rosenbaum, 2013a; Washington, Thomas-Stonell, McLeod & Warr-Leeper, 2012; Washington, Thomas-Stonell, McLeod & Warr-Leeper, 2015; Watts Pappas, McLeod, McAllister & McKinnon, 2008). More evidence is needed to substantiate the relevance of those factors and others, yet to be identified, that may be associated with communicative participation outcomes, so we can help parents, clinicians, administrators, and policy makers to plan and deliver early intervention services that are both effective and meaningful to families (Coleman, Weir, Ware & Boyd, 2015; Thomas-Stonell, Oddson, Robertson & Rosenbaum, 2010). Identifying predictors of communicative participation outcomes can help us to learn more about which children benefit most from early intervention services, and in the future may help to inform decision-making about the nature and intensity of services offered to children as well as decisions surrounding resource allocation (Paul & Roth, 2011; Tyler et al., 2003; Yoder & Compton, 2004). Identifying predictors of communicative participation outcomes can also help clinicians to counsel and advise parents more effectively about the likely course and outcome of intervention efforts.

Our research group is part of a team that worked collaboratively with Ontario, Canada's Preschool Speech and Language Program (PSLP), a community-based publicly-funded government service, to establish a large-scale program evaluation using preschoolers' communicative participation as the primary outcome (Ontario Ministry of Children and Youth Services, 2013). The PSLP evaluates changes in children's communicative participation over the course of their time accessing government-run services. In this program, children access a variety of assessment and intervention-based services. Typically, they attend an initial assessment appointment, which is followed by a period in which children are on a waiting list for intervention. The amount of time children wait varies and depends on the age at which they are

referred as well as the type of communication impairment with which they present. The type and amount of intervention children receive also varies based on those same factors. The program offers various interventions including parent/childcare consultation and training, and group/individual intervention. Since 2012, children who access PSLP services have been assessed using two published tools and one informal checklist approximately every six months Details on those tools are presented in the Method section.

Our team was granted access to the anonymized provincial datasets to investigate communicative participation outcomes for all preschoolers accessing PSLP services across the province. We previously used the data to model the development of children's communicative participation skills by fitting separate growth curves for children in each of the five levels of communicative function (Cunningham, Hanna, Rosenbaum, Thomas-Stonell & Oddson, 2017b). This work provided a broadly-focused view of how communicative participation skills develop in preschoolers with communication impairments, but did not account for the many factors, apart from age and functional level, that likely influenced the development of those skills.

The objective of the present investigation was to explore these data in more fine-grained detail in an effort to identify influences on growth for preschoolers' communicative participation skills. To do this we added factors that were likely to predict outcomes to our previously-defined models of growth. This current work differs from previous clinical studies in two ways: (1) it identifies predictors of preschoolers' communicative participation outcomes – a current gap in the literature, and (2) it identifies those predictors using an entire population of preschoolers with communication disorders accessing services within the PSLP. With this very large sample size, we had enough statistical power to examine outcomes across a wide age span, and across five levels of communicative function (Thygesen & Ersboll, 2014). Using this sample, we were also in a position to comment on generalizability to community-based clinics – as this is where the data were collected and where the outcomes were observed (Thygesen & Ersboll, 2014).

Method

Ethics approval. The Hamilton Integrated Research Ethics Board approved the use of this anonymized dataset for this study.

Participants. Data were collected as part of the PSLP's prospective longitudinal program evaluation project. We previously used all available data (N = 46,872) to fit the growth curves (Cunningham et al., 2017b) for children by CFCS level. This sample represented all children who had accessed PSLP services between October 1, 2012 and May 1, 2016 for whom outcomes data had been collected, and included children between 18 and 67 months of age (M = 41.76 mo, SD = 11.92, 68% male). Details on this sample are presented in Table 1. Our primary objective in creating the growth curves was to understand how communicative participation skills developed in preschoolers – something that had not been reported in the literature. One aim of the present work was to identify predictors of that development and as such, all available data were included when entering demographic predictors into the models.

A second aim of the present study was to identify predictors of communicative participation outcomes for intervention-based variables. In order to do this, we needed data for children who

had received multiple assessments in the PSLP. Thus, when investigating predictors of outcome for intervention-based variables, we only used data for children with two or more assessments (*N* = 21,998). This resulted in a slightly different sample of children (*M* = 41.73, *SD* = 11.50, 69% male). Details on this sub-sample are presented in Table 2.

Outcome Measures. Two outcome tools and an informal checklist were used at each assessment. (1) *The Focus on the Outcomes of Communication Under Six (FOCUS©)* is a valid and reliable 50-item parent-report measure that evaluates changes in communicative participation skills for preschoolers with a range of communication disorder types and severities (Thomas-Stonell et al., 2010; Oddson, Washington, Robertson, Thomas-Stonell & Rosenbaum, 2013; Thomas-Stonell, Oddson, Robertson & Rosenbaum, 2009; Thomas-Stonell et al., 2013a; Thomas-Stonell, Oddson, Robertson & Rosenbaum, 2013b; Washington et al., 2013a; Washington, Oddson, Robertson, Rosenbaum & Thomas-Stonell, 2013b; Washington et al., 2015). On the first 34 items parents to rate their child on a 7-point scale that ranges from '*Not at all like my child*' to '*Exactly like my chid*'. On the last 16 items ratings are made using a different 7-point scale with items ranging from '*Cannot do at all*' to '*Can always do without help*' (Thomas-Stonell et al., 2010). The FOCUS© has good reliability and validity for children from 18-months to six-years of age (Oddson et al., 2013; Thomas-Stonell et al., 2009; Thomas-Stonell et al., 2013a; Thomas-Stonell et al., 2013b; Washington et al., 2013a; Washington et al., 2013b; Washington et al., 2015).

(2) *The Communication Function Classification System (CFCS)* is a validated classification tool that classifies children's communication skills into one of five meaningful levels of function (Hidecker et al., 2011; Hidecker et al., 2012; Hidecker, Cunningham, Oddson, Thomas-Stonell & Rosenbaum, 2017). Children in level I are "*consistent senders and receivers of information with all communication partners*", and function best in terms of their communication; while children in level V are "*seldom effective senders or receivers of information, even with familiar partners*" and function least well in their communication (Hidecker et al., 2011). Clinically, a child in CFCS level I may have only a few speech sound or grammatical errors, while a child in CFCS level V may be an unintentional communicator on the autism spectrum.

(3) Speech-language pathologists also completed an informal checklist at each assessment on which they provided both demographic and intervention-based information about the child.

Predictor Variables. Our ability to include relevant predictor variables in our analysis was limited by the content of the PSLP datasets; however, in order to maintain some methodological rigour, we selected from the available variables based on (a) knowledge of previously identified predictors of communicative participation and other impairment-based outcomes in the literature, and (b) clinical expertise and theoretical reasoning about which factors might contribute to communicative participation outcomes (Abbot et al., 2016). Table 3 presents a description of and rationale for each included predictor variable.

Procedure and Statistical Analysis. Data were analyzed using Stata Statistical Software – version 13.1 (Stata, 2013). We examined predictors of communicative participation outcomes separately for children in each of the five CFCS levels as we assumed children in each level were functionally different from one another and we therefore suspected predictors of outcome might also differ by CFCS level (Cunningham et al., 2017b).

Our initial models of growth were fit using mixed effects modelling. All models included both fixed and random effects. Fixed effects included an intercept term (predicted FOCUS© score at 18 months of age), a term for Age (centered at 18 months of age), and a squared term for Age^2 (centered at 18 months). The random effects included terms for Participant, Age (centered at 18 months), and Age^2 (centered at 18 months). Unstructured covariance was used for all CFCS levels but IV (Cunningham et al., 2017b).

The models were re-estimated here by including predictor variables into the previously fit models separately (i.e., gender was entered as a predictor and then removed, multilingual status was then entered as a predictor and removed, etc.). Variables were entered into the fixed effects part of the model to identify predictors of communicative participation outcomes for children in each CFCS level. The resulting predictions have a curvilinear form. We comment on the main effects as they related to children's predicted FOCUS© scores at 18 months of age. The interaction between Age and each variable indicates the predicted slope of the curve at 18 months of age (i.e., How quickly are FOCUS© scores predicted to grow?). The interaction between Age^2 and each variable indicates either the deceleration or acceleration in predicted growth over time. Due to the large sample size, we comment on statistically significant differences, but also clinically meaningful differences. For the purposes of our analyses, please note that a clinically meaningful change on the FOCUS© is 16 points (Thomas-Stonell et al., 2013a).

Results

All available data (N = 46, 872) were used to test for significant predictors of growth for the following demographic variables: Gender, Multilingual Status of the family, and Participation in an Early Learning Environment. As reported below, there were times when missing data led to datasets of variable sample sizes for some analyses. This variability was likely the result of problems with compliance with data collection in the PSLP. We believe the data are missing at random, but have no way of confirming this. All available data were included in each analysis.

For the intervention-based variables, only data for children who received multiple (i.e., two or more) assessments in the PSLP were included in the analysis. This amounted to data for 21,998 children being used to test for significant predictors of growth for the following variables: Intervention status, Length of time in Intervention, and Goals Targeted in Intervention. Unstructured covariance was removed from the original models of growth to run the analysis for these predictors.

Gender. There were sex variable data for almost 41,000 children (67% male). Females had higher predicted FOCUS© scores than males across all ages and CFCS levels, but the differences between males and females were not always statistically significant. We found a statistically significant main effect of Gender for CFCS levels III and IV, but no significant interactions between Gender and Age or Gender and Age^2 in either CFCS level (see Table 4). While the main effects were statistically significantly different, they were well below the 16 points required to show a clinically meaningful difference on the FOCUS©.

Multilingual status. Two factors were reported under multilingual status. First, the PSLP collected data on children's 'mother tongue' (language most commonly used at home) for 17,410 of the children. Of those, 15,657 (90%) reported English as their mother tongue. There were 66 other languages reported, with the three next most commonly reported being French (2.7%),

Spanish (1%), and Arabic (0.81%). Second, SLPs reported multilingual status (i.e., whether children were multi- or mono-lingual) for 11,753 children (82% monolingual). It was this variable (multi- vs. mono-lingual) that was entered into the growth models as a predictor.

Multilingual status was a statistically significant predictor of outcome in CFCS level IV. There was a significant main effect, in which multilingual children had higher predicted FOCUS© scores at 18 months than their monolingual peers. Both interaction terms were significant, indicating that predicted growth for multilingual children was more linear than the growth for monolingual children, and at the upper limit of the curve, multilingual children had higher predicted FOCUS© scores than their monolingual peers (see Table 4). These differences were not clinically meaningful (i.e., there was not a 16-point difference on the FOCUS©).

Participation in an Early Learning Environment. An early learning environment was defined as a registered childcare or preschool program. Data for this variable were recorded for 11,753 children, with 62% participating in an early learning environment. This was a statistically significant predictor of outcome for all children but those in CFCS level V. Main effects for Early Learning were significant for CFCS levels I – IV, indicating predicted FOCUS© scores at 18 months were higher for children who participated in an early learning environment than those who did not. Considering only the main effects, predicted FOCUS© scores at 18 months were both statistically and clinically different for children in CFCS levels I, II and III (see Table 4). The main effect was statistically, but not clinically significant for children in CFCS level IV. The interaction terms were also significant for this variable. Interaction terms for Early Learning x Age were significant and negative for CFCS levels I – III, indicating predicted slopes at 18 months were less steep for the children who were in an early learning environment. Interaction terms were significant for Early Learning x Age^2 for CFCS levels I – IV. These interaction terms were positive but small, indicating slightly less deceleration (i.e., more linear growth) in predicted scores over time for those children who participated in an early learning environment (see Table 4 and Figure 1).

Intervention status. Data for the intervention-status variable were available for the full sample of children who received multiple assessments in the PSLP (N = 21,998). Intervention status was a significant predictor in all CFCS levels but level V. Main effects were statistically significant for CFCS levels I-IV and predicted mean FOCUS© scores at 18 months were higher for children who were in intervention than those who were not. The main effects reached the 16 FOCUS© points required to be clinically meaningful for children in CFCS levels II-IV, and those in level I were approaching this criterion for clinical significance. Interaction terms were significant for Intervention status x Age for CFCS levels II – IV. These interaction terms were small and negative, indicating a smaller predicted slope at 18 months of age for children receiving intervention. Interaction terms were significant for Early Learning x Age^2 for CFCS levels I – IV and all terms were small and positive, indicating slightly less deceleration in the growth line over time for those children receiving intervention (see Figure 2 and Table 4).

Time in Intervention. Time in intervention was defined as the amount of time a child spent in the program (i.e., time since their first assessment). While it is likely that this time represents more intervention, we did not have a way to confirm this for certain. There may be some children who were followed every six months, but received little or no intervention, but based on our clinical experience working in this program, this is an unlikely scenario. Data for this variable were also available for the same full sample of children who received multiple assessments (N = 21,998).

Time in intervention was a significant predictor of outcome, and both interaction terms were significant for all CFCS levels. Main effects were statistically significant for CFCS levels I-IV and predicted mean FOCUS© scores at 18 months increased with increasing time spent in intervention. The predicted increase in FOCUS© scores for each 3-month interval did not reach clinical significance in any of the CFCS levels. The Time in Intervention x Age interaction was small and negative for all CFCS levels, indicating a slightly smaller predicted slope with increasing time spent in intervention. The Time in Intervention x Age^2 interaction term was positive but small for all CFCS levels, indicating slightly less deceleration in the growth line with increasing time spent in therapy. The impact of time spent in intervention was greatest for children in the lower CFCS levels (i.e., levels IV and V). In these latter levels, additional months in intervention yielded greater outcomes at 67 months of age, whereas additional months in intervention yielded statistically similar outcomes at 67 months of age for children in CFCS levels I-III (see Figure 3 and Table 4).

Intervention goals. Data related to intervention goals were available for 20,502 of the children with multiple assessments. The breakdown of goals targeted in intervention was as follows: speech only = 19.5%, language only 52.8%, both speech and language 26%, fluency 1.5%, voice 0.05%, feeding & swallowing 0.03%, emergent literacy 0.1%. Since the majority of children accessing PSLP services received intervention targeting speech, language or a combination of speech and language goals, our analysis of this predictor focused on those skills. Outcomes for children with speech-only goals were compared with outcomes for children with language-only goals and then with outcomes for children with both speech and language goals for all CFCS levels. Only outcomes for children with speech-only versus language-only goals were significant, and in each CFCS level the predicted FOCUS© scores for children with speech-only goals were higher than for children with language-only goals. The main effects of treatment goals (i.e., speech-only vs. language-only goals) were statistically and clinically significant for children in CFCS levels II and III. Differences in mean predicted scores were examined at 30 months since children did not typically have speech goals until that time (see Table 4). Both interaction terms were significant in CFCS level II, indicating that children with speech-only goals had predicted slopes that were less steep and curves with less deceleration over time than children with language-only goals (see Table 4). Only the interaction between Treatment Goals x Age^2 was significant for CFCS level III, indicating the two groups had similar predicted slopes, but children with speech-only goals had less deceleration in growth over time than those with language-only goals.

Discussion

In this series of analyses we added variables to previously developed growth curves to identify predictors of children's communicative participation outcomes. This work represents new knowledge in that it identified several new predictors of preschoolers' communicative participation outcomes. It also differs from previous work in that it examined predictors by CFCS level, finding varied results based on level of communicative function. Predictors were entered into separate models for each CFCS level to examine differences in outcomes across the levels. Gender, multilingual status, participation in an early learning environment, intervention status, time in intervention, and intervention goals were all significant predictors of preschoolers' communicative participation skill development; however, predictors affected growth in different ways and were not the same for all levels of function. For example, there was a significant relationship between participation in an early learning environment and growth in

communicative participation skills for children in CFCS levels I – IV, but not for those in level V. Additionally, the effect of an early learning environment on children's growth differed by level of function.

A similar trend was observed for intervention-based predictors of growth. When the Intervention status variable was entered into the models, we found that children receiving intervention had better predicted outcomes than those who were not – indicating that when children start intervention they get a significant bump in predicted FOCUS© scores. Interestingly, the coefficient for the main effect for Intervention Status was in excess of the 16 points determined to be clinically meaningful change on the FOCUS© (Thomas-Stonell et al. 2013) for children in CFCS levels II, III and IV. Predicted slopes at 18-months of age were less steep for those children receiving intervention, likely because of their higher predicted starting scores (i.e., they had less far to go to reach the maximum score). Additionally, there was less predicted deceleration in the curvature of the growth lines for children receiving intervention – meaning that their growth was more linear as predicted FOCUS© scores tended to level out less at the upper age limit (67 months). Taken together, these findings suggest a positive impact of speech-language interventions for the predicted development of preschoolers' communicative participation skills.

The Time in Intervention variable also yielded different models of growth for children depending on their level of communicative function. For instance, there were significant main effects of time spent in intervention for children in all CFCS levels – meaning that the more time children spent in intervention, the greater their predicted outcome. For children in CFCS levels I, II and III, this was true at younger ages, but by 67 months of age children had achieved similar outcomes regardless of the time they spent in treatment. For the lower levels, more time spent in intervention resulted in higher predicted outcome scores at 67 months. This can be used to predict that for children in the lower levels of function, more treatment is warranted, whereas in the higher levels of function, less treatment may still result in a similar outcome as more treatment (i.e., more is not always better). As indicated earlier, we believe most children with multiple assessments in the program were receiving some kind of speech-language intervention, however it is possible that there were some who were simply followed over multiple assessment points without receiving intervention. We believe these cases (if any) are minimal.

This work has applicability for both clinicians and policy makers who work with and plan services for preschoolers with communication disorders. First, we have identified both intervention-based and demographic predictors of communicative participation outcomes. Clinicians could use this knowledge with families, predicting that outcomes will improve if children participate in an early learning environment. Both policy makers and clinicians may use knowledge related to time spent in intervention to predict how long a child will need to be in speech-language therapy to achieve optimal outcomes. If administrators and policy makers have knowledge of the range of CFCS levels for the children accessing their services, they may be better positioned to make informed decisions about service delivery planning and resource allocation.

There are limitations to this work that must be acknowledged. Data used for this study were collected as part of the PSLP's program evaluation project. As such, data collection was not done as systematically as would be desirable in a structured research program. Data for many of the variables included as predictors were collected by SLPs who used an informal checklist to report.

We are not confident that the checklist yielded valid or reliable data for at least one of the variables included here. For example, clinicians were asked to indicate goals targeted in intervention by checking goals from a list of 12 possibilities including 'articulation', 'phonology', 'motor speech', 'expressive language', 'receptive language', and 'social communication'. Due to the well-recognized issues with terminology and terms being used interchangeably in the field (Walsh, 2006), we cannot be sure that SLPs used these terms in the same way across the PSLP. In an attempt to circumvent this issue, we combined all 'speech' goals together (i.e., articulation + phonology + motor speech) and all 'language' goals together (i.e., expressive + receptive + social communication) to compare outcomes by goals broadly targeted in intervention.

A second limitation lies in the nature of the PSLP datasets. We did not have access to information related to the types of communication disorders with which children presented. In some ways this can be inferred based on the types of goals targeted in therapy, but this was not done because, as described above, it was impossible to tell whether a child with speech-only goals did not also have a language disorders and vice versa. We are in the process of developing a research proposal to create a valid and reliable reporting tool that can be used along with the FOCUS© and CFCS in the PSLP so that this type of information can be collected accurately and consistently. We also lacked information about the types of interventions children received in the program. Since data were collected at approximate six month intervals, data collection did not align with the start/end of particular interventions, making it impossible for us to determine whether outcomes differed for children with similar impairments/functional skills accessing different interventions. We are working collaboratively with the PSLP to develop new methods for collecting data and understanding the various interventions offered in the program, so that we can later report on this reliably.

A third limitation is that we have missing data for many of the predictor variables examined here. This was the result of the PSLP datasets being incomplete – and is in part the result of SLPs in the program not consistently completing outcome measures for all of the children they see. This means our results may be biased in some way; however, no attempt was made to impute missing values as it is likely that the data were missing randomly rather than systematically.

Despite these limitations, we feel there is important new knowledge to be gained from this work. Using an unprecedentedly large dataset we have provided additional evidence for some already identified predictors of children's communicative participation skills. We have also identified several new predictors of communicative participation outcomes for preschoolers with communication disorders. Importantly, we have demonstrated that speech-language interventions have an impact on the development of children's communicative participation skills. By examining children's communicative participation outcomes, we have demonstrated that speech-language interventions have a meaningful impact on the lives of children and families.

The importance of examining both outcomes and predictor variables by level of communicative function has also been demonstrated here. We found that predictor variables impacted outcomes differently depending on a child's level of communicative function – a level of investigation not possible before the CFCS was created. In addition, limited sample sizes in reports now using the CFCS make such analyses challenging. It may be important for clinicians and researchers to consider a child's level of communicative functioning when recommending intervention and examining the outcomes of intervention efforts. Our future studies, using the next waves of this

database, will hopefully include more precise data, as identified in the limitations, allowing us to investigate the associations between these possible predictors with greater confidence. Under these improved circumstances it may become clearer and easier to ascribe direct causal connections between interventions and changes in children's communicative development.

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Table 1.

Participant Characteristics by CFCS level at Time 1: Full dataset.

	CFCS Level I	CFCS Level II	CFCS Level III	CFCS Level IV	CFCS Level V	All combined
Number (%) of children	7,991 (17)	9,442 (20)	11,646 (25)	14,825 (32)	2,968 (6)	46,872
Mean (SD) age in months	46.94 (10.88)	43.02 (11.46)	37.74 (11.78)	34.20 (11.10)	33.75 (11.53)	39.0 (12.32)
Mean (SD) FOCUS© score	266.62 (47.33)	236.89 (53.00)	203.83 (54.02)	164.98 (52.28)	125.86 (57.20)	203.97 (67.07)
Number of assessments	10,692	15,730	22,353	29,786	5,934	84,495
Mean number of assessments	1.3 (1-7)	1.7 (1-7)	1.9 (1-8)	2.0 (1-10)	2.0 (1-7)	1.8 (1-10)

Table 2.

Participant Characteristics by CFCS Level at Time 1: Children with multiple assessment points.

	CFCS Level I	CFCS Level II	CFCS Level III	CFCS Level IV	CFCS Level V	All combined
Number (%) of children	1,912 (9)	4,079 (19)	6,107 (28)	8,226 (37)	1,674 (7)	21,998
Mean (SD) age in months	42.69 (10.21)	40.40 (10.50)	36.02 (10.58)	32.60 (9.75)	31.86 (9.98)	35.82 (10.80)
Mean (SD) FOCUS© score	2651.96 (52.71)	230.06 (54.32)	198.92 (53.76)	161.79 (50.52)	117.91 (47.33)	211.08 (65.91)
Number of assessments	4,613	10,367	16,814	23,189	4,640	59,623
Mean number of assessments	2.4 (2-7)	2.5 (2-7)	2.8 (2-8)	2.8 (2-10)	2.8 (2-7)	2.7 (2-10)

Table 3.

Included predictor variables.

Category	Variable	Description	Rationale
Demographic factors	Gender	Binary (1=male, 0=female)	Males typically have poorer outcomes.
	Multilingual Status	Binary (1=multilingual, 0= monolingual)	Processes involved in learning more than one language may affect the development of communicative participation skills.
	Early learning environment	Binary (1=yes, 0=no)	Practice using communication functionally to participate in classroom-based activities with peers/teachers. Exposure to peer models.
Intervention-specific factors	Intervention statu	Binary (1=yes, 0=no)	There has been some evidence showing a relationship between intervention and growth in communicative participation skills.
	Time in Intervention	Continuous (time since starting the program)	More time in treatment may result in better outcomes within CFCS level.
	Intervention Goal	Binary (1=language, 0=speech)	Some evidence showing better outcomes for children with speech-only impairments.

Table 4.

Predicted mean scores at 18 months, main effects, and interactions for each predictor variable by CFCS level.

	CFCS Level I	CFCS Level II	CFCS Level III	CFCS Level IV	CFCS Level V
Gender					
Predicted mean scores at 18 months			*M*(female) = 144.36 *M*(male) = 137.87	*M*(female) = 125.24 *M*(male) = 117.94	
Main effect	$p > 0.05$	$p > 0.05$	$\beta = -5.85$ $z = -3.22$ $p < 0.001$	$\beta = -6.49$, $z = -2.93$ $p < 0.001$	$p > 0.05$
Gender x Age Interaction	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
Gender x Age2 Interaction	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
Multilingual status					
Predicted mean scores at 18 months				*M*(multi) = 123.95 *M*(mono) = 114.25	
Main effect	$p > 0.05$	$p > 0.05$	$p > 0.05$	$\beta = 9.71$ $z = 2.44$, $p < 0.05$	$p > 0.05$
Multilingual x Age Interaction	$p > 0.05$	$p > 0.05$	$p > 0.05$	$\beta = -1.55$ $z = -4.02$ $p < 0.001$)	$p > 0.05$
Multilingual x Age2 Interaction	$p > 0.05$	$p > 0.05$	$p > 0.05$	$\beta = 0.03$ z = 3.50 p < 0.001	$p > 0.05$
Participation in an Early Learning Environment					
Predicted mean scores at 18 months	*M*(early learning) = 190.88 *M*(no early learning) = 150.00	*M*(early learning) = 156.61 *M*(no early learning) = 128.60	*M*(early learning) = 140.05 *M*(no early learning) = 119.00	*M*(early learning) = 120.09 *M*(no early learning) = 113.05	
Main effect	$\beta = 40.90$, $z = 4.99$, $p < 0.001$	$\beta = 28.02$, $z = 5.32$, $p < 0.001$	$\beta = 21.05$, $z = 5.61$ $p < 0.001$	$\beta = 7.05$, $z = 2.19$, $p < 0.05$	$p > 0.05$
Early learning x Age Interaction	$\beta = -2.90$, $z = -4.98$, $p < 0.001$	$\beta = -2.01$, $z = -4.60$, $p < 0.001$	$\beta = -1.78$, $z = -5.09$, $p < 0.001$	$p > 0.05$	$p > 0.05$
Early learning x Age2 Interaction	$\beta = 40.05$, $z = 4.16$, $p < 0.001$	$\beta = 0.03$, $z = 3.80$, $p < 0.001$	$\beta = 0.04$, $z = 4.49$, $p < 0.001$	$\beta = 0.02$, $z = 2.24$, $p < 0.05$	$p > 0.05$
Intervention Status					
Predicted mean scores at 18 months	*M*(Intervention) = 172.09 *M* (No intervention) = 163.69	*M*(Intervention) = 172.71 *M*(No intervention) = 146.95	*M*(Intervention) = 145.69 *M*(No intervention) = 127.67	*M*(Intervention) = 130.60 *M*(No intervention) = 113.95	
Main effect	$\beta = 11.30$, $z = 1.96$, $p = 0.05$	$\beta = 27.53$, $z = 8.15$, $p < 0.001$	$\beta = 18.02$, $z = 2.29$, $p < 0.001$	$\beta = 16.65$, $z = 1.98$, $p < 0.001$	$p > 0.05$

Intervention x Age Interaction	$p > 0.05$	$\beta = -1.99$, $z = -7.24$, $p < 0.001$	$\beta = -0.83$, $z = -3.88$, $p < 0.001$	$\beta = -0.60$, $z = -3.21$, $p < 0.05$	$p > 0.05$
Intervention x Age2 Interaction	$\beta = 0.02$, $z = 2.09$, $p < 0.05$	$\beta = 0.04$ $z = 7.29$, $p < 0.001$	$\beta = 0.02$, $z = 3.25$, $p < 0.05$	$\beta = 0.01$, $z = 2.89$, $p < 0.05$	$p > 0.05$
Time in Intervention					
Main effect	$\beta = 2.17$, $z = 3.06$, $p < 0.05$	$\beta = 4.01$, $z = 9.65$, $p < 0.001$	$\beta = 4.92$, $z = 16.96$, $p < 0.001$	$\beta = 5.25$, $z = 22.24$, $p < 0.001$	$\beta = 4.35$, $z = 8.89$, $p < 0.001$
Time x Age Interaction	$\beta = -0.12$, $z = -2.85$, $p < 0.05$	$\beta = -0.20$, $z = -7.89$, $p < 0.001$	$\beta = -0.20$, $z = -10.90$, $p < 0.001$	$\beta = -0.17$, $z = -11.18$, $p < 0.001$	$\beta = -0.14$, $z = -4.09$, $p < 0.001$
Time x Age2 Interaction	$\beta = 0.007$, $z = 2.53$, $p < 0.05$	$\beta = 0.003$, $z = 7.09$, $p < 0.001$	$\beta = 0.003$, $z = 8.42$, $p < 0.001$	$\beta = 0.002$, $z = 7.56$, $p < 0.001$	$\beta = 0.002$, $z = 2.92$, $p < 0.05$
	M(0mos) = 220.53 *M*(3mos) = 223.07 *M*(6mos) = 225.62 *M*(9mos) = 228.16 *M*(12mos) = 230.70	*M*(0mos) = 205.20 *M*(3mos) = 210.82 *M*(6mos) = 216.44 *M*(9mos) = 222.06 *M*(12mos) = 227.69	*M*(0mos) = 185.25 *M*(3mos) = 192.22 *M*(6mos) = 199.20 *M*(9mos) = 206.17 *M*(12mos) = 213.15	*M*(0mos) = 158.50 *M*(3mos) = 168.90 *M*(6mos) = 179.30 *M*(9mos) = 189.69 *M*(12mos) = 200.09	*M*(0mos) = 116.15 *M*(3mos) = 125.06 *M*(6mos) = 133.96 *M*(9mos) = 142.87 *M*(12mos) = 151.77
Intervention Goals					
Predicted mean scores at 30 months		*M*(speech) = 237.66 *M*(language) = 205.99	*M*(speech) = 209.44 *M*(language) = 194.39		
Main effect	$p > 0.05$	$\beta = -54.35$, $z = -4.06$, $p < 0.001$	$\beta = -24.22$, $z = -2.18$, p < 0.05	$p > 0.05$	$p > 0.05$
Goals x Age Interaction	$p > 0.05$	$\beta = 2.35$, $z = 2.70$, $p < 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
Goals x Age2 Interaction	$p > 0.05$	$\beta = -0.04$, $z = -2.76$, $p < 0.06$	$\beta = -0.03$, $z = -2.16$, $p < 0.05$	$p > 0.05$	$p > 0.05$

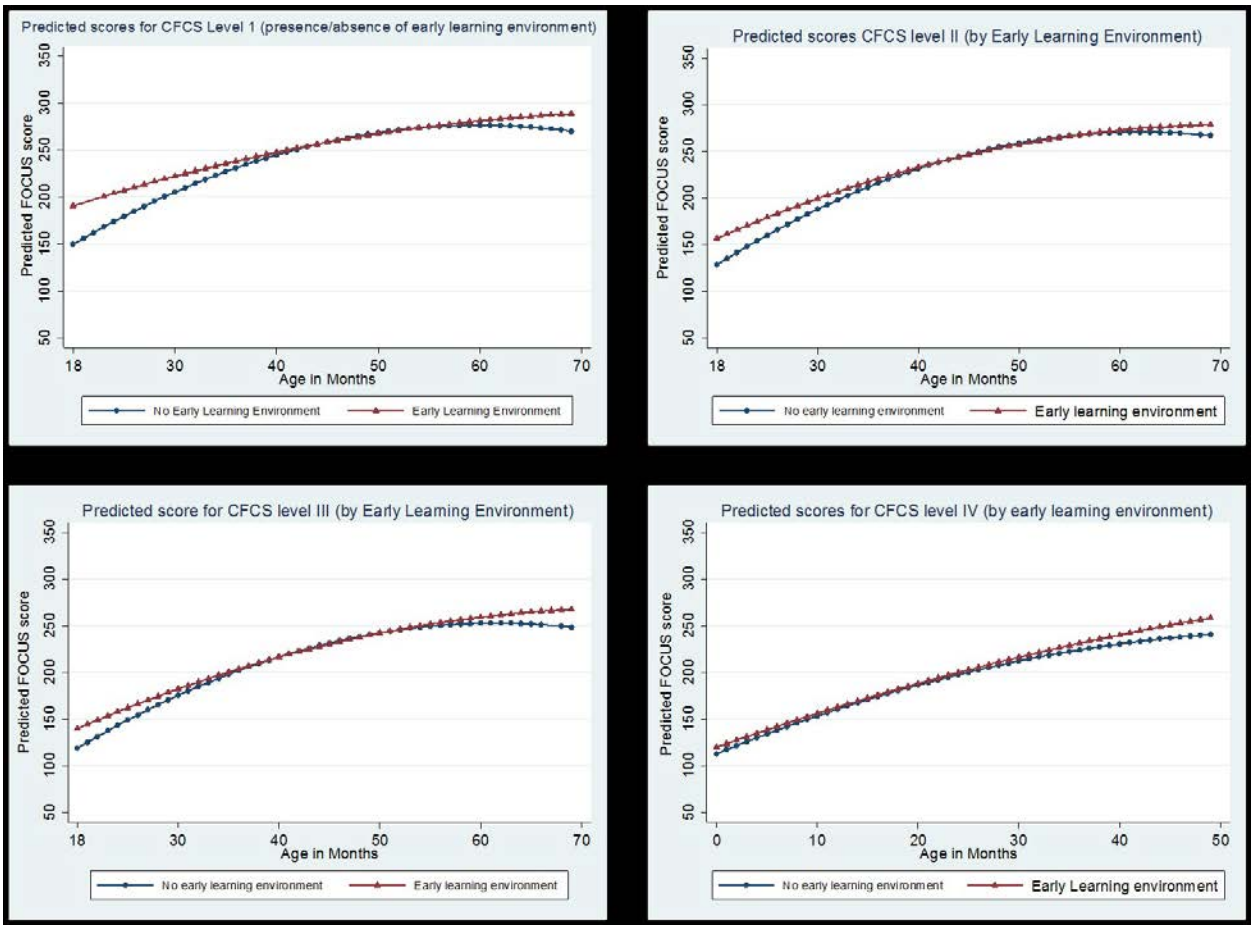

Figure 1. Predicted FOCUS© scores for children in CFCS levels I-IV who did/did not participate in an early learning environment.

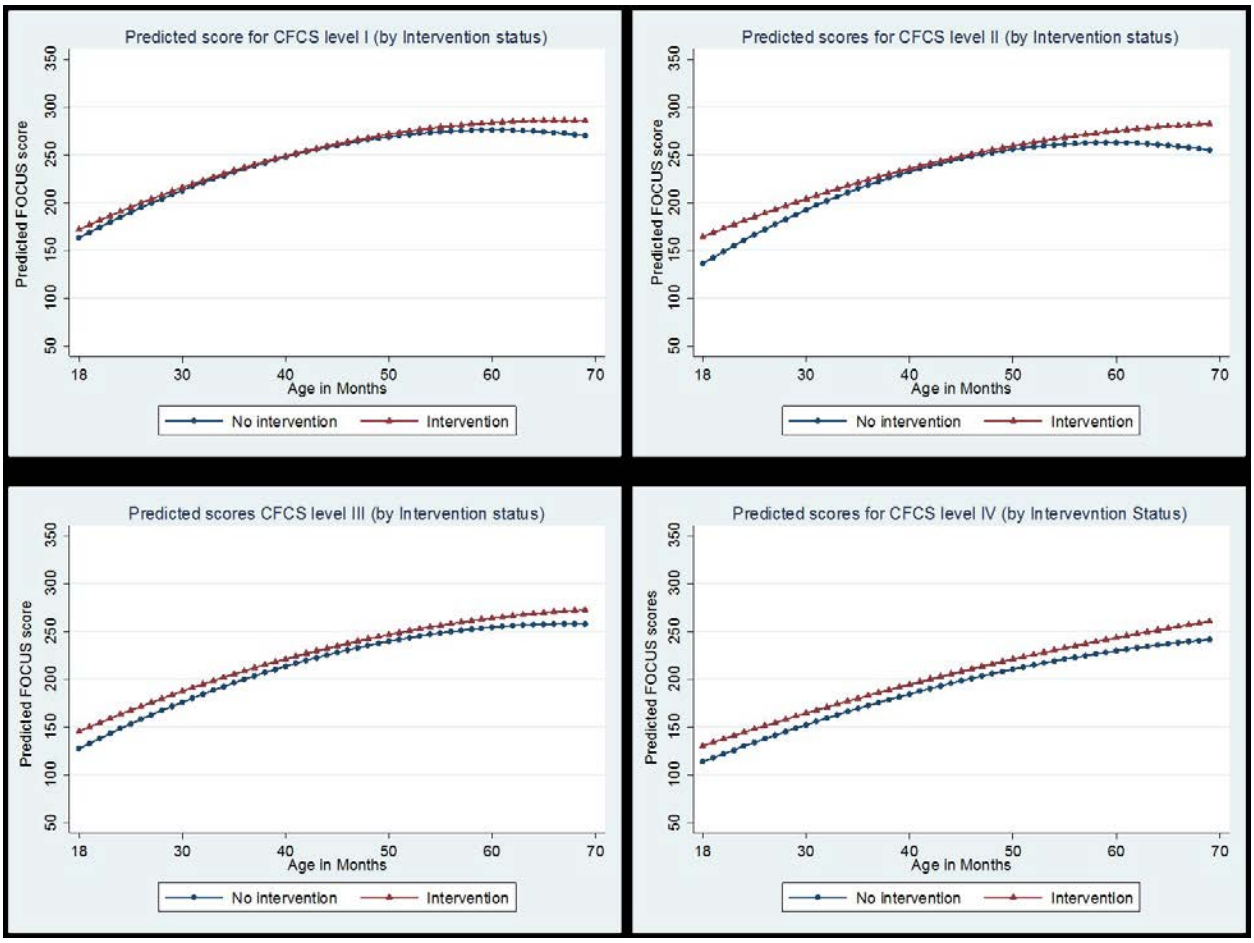

Figure 2. Predicted FOCUS© scores for children in CFCS levels I-IV by Intervention Status.

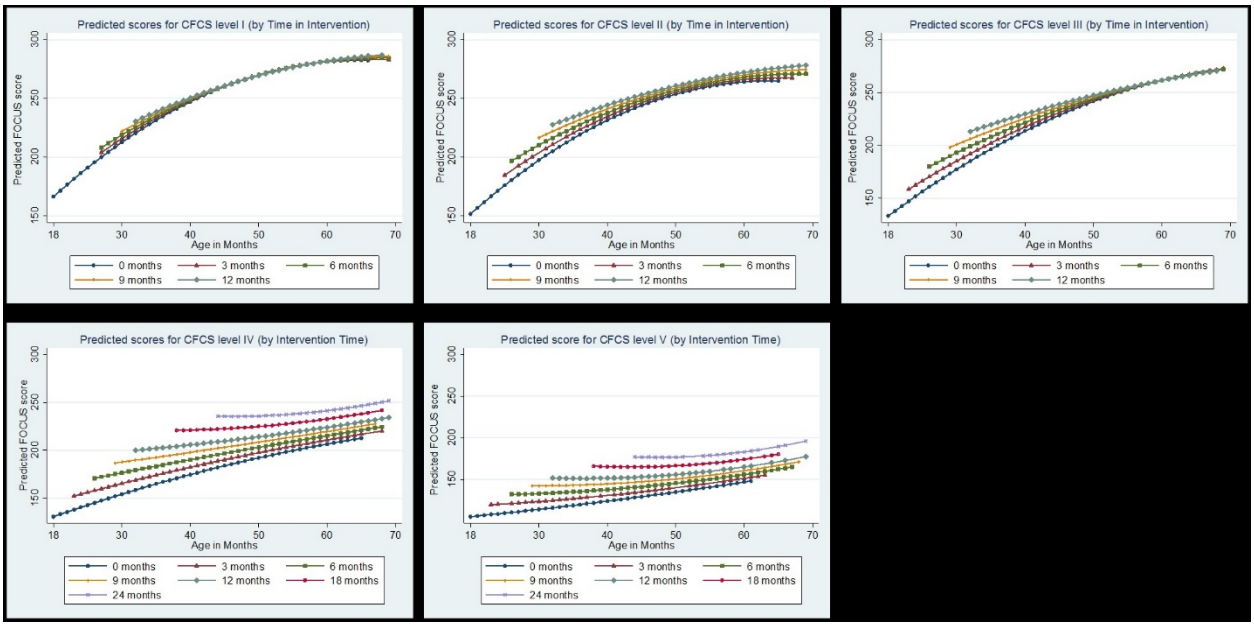

Figure 3. Predicted FOCUS© scores for children in CFCS levels I-IV by time spent in intervention.

Chapter Six: Conclusion

My frustration at the lack of research evidence available to support both clinical and service delivery decision-making, as well as the mismatch between the outcomes valued by clinicians and those that were important and meaningful to families, led me to pursue this PhD work. As a clinician working in Ontario's PSLP, I wanted to do work that was meaningful to my clinical practice and service-delivery planning within the program. As a researcher, I wanted to make a meaningful contribution to the literature by showing how outcomes can be conceptualized and measured differently in the field. As I conclude my PhD journey I feel I have accomplished both these goals. I have provided important evidence showing the need to expand our idea of what makes a successful outcome in speech-language pathology. I have also contributed foundational knowledge to the literature about the development of preschoolers' communicative participation skills as well as some of the factors predictive of that development.

My doctoral work explored communicative participation outcomes for preschoolers with communication disorders across four studies. In each study, outcomes were viewed through the lens of the World Health Organization's International Classification of Functioning, Disability, and Health – Child and Youth Version (ICF-CY) (WHO, 2007). The scoping review identified and characterized the gap in outcomes research in speech-language pathology related to Participation and thus confirmed a need for the rest of my dissertation work. The second study provided evidence that the Communication Function Classification System (CFCS) was valid for use with preschoolers accessing services in the PSLP – a necessary step before I could begin to explore the PSLP's data at a provincial level. In the third study, I used the PSLP's provincial data and mixed effects modelling to create growth curves showing how communicative participation skills developed for children in each of the five CFCS levels of function. The final study identified both demographic and clinical predictors of preschoolers' communicative participation outcomes. Taken together, this body of work makes an important contribution to the literature, and has meaningful implications for clinical practice. The ways in which this work can contribute to both research and practice in speech-language pathology are presented next.

Expanding the concept of a successful outcome in speech-language pathology

To date, most outcomes research for preschoolers has evaluated changes related to Body Functions and Structures (e.g., speech intelligibility, fluency) and Activity (e.g., use and understanding of grammar, sentence length) (Cunningham, Washington, Binns, Rolfe, Robertson & Rosenbaum, 2017). Some have examined participation-based outcomes, but those have typically been for special populations of children who access speech-language therapies expressly to work on social communication goals, such as children with autism spectrum disorders or selective mutism (Cunningham et al., 2017). The findings presented in the scoping review can add to the push in the field for both clinicians and researchers to measure meaningful participation-based outcomes for all children with communication disorders. The scoping review can also be used as a rationale for future participation-based research, and as evidence in funding competitions.

The ideas presented in the scoping review have already garnered the attention of researchers and clinicians in the field. A summary of the study's findings and recommendations was recently reported in a newsletter from The Informed SLP, a website that publishes a monthly newsletter of new research to connect speech-language pathologists and researchers (Harold, 2017). In

February 2017, 34 journals and 66 research articles were reviewed for potential inclusion in the newsletter (Harold, 2017); the scoping review was one of five papers featured in the newsletter, which is distributed to over 7,000 SLPs. A summary of the review was also published in *CanChild*'s monthly newsletter in February, 2017. The *Can Child* newsletter reaches over 6,000 families, clinicians, and researchers each month (*CanChild*, 2017).

One of my aims in doing this work was to convince others of the value of evaluating participation-based outcomes for children with all types of communication disorders, not just those for whom social communication is obviously challenging, and to provide important clinical information to help SLPs implement these ideas into practice. In speaking with SLP colleagues, I learned that they did not understand the value of using the FOCUS© and CFCS in the PSLP's provincial program evaluation project. SLPs completed these tools because they were required to, but they did not use the information clinically, and they did not understand why they had to use the tools at all. Thus, there was a great disconnect between how clinicians measured outcomes, and how the PSLP measured outcomes.

The work done for the scoping review has increased my understanding of how outcomes are typically evaluated in the field and why it is important that we begin to focus on participation-based outcomes. With this new knowledge, I am better positioned to explain the idea of evaluating participation-based outcomes by describing the components of the ICF-CY framework and how they relate to clinical practice. In my limited experiences translating this knowledge (to one group of SLPs and managers at the Waterloo PSLP site on April 4, 2017; and to a group of PSL coordinators in Toronto on April 19, 2017), once clinicians and managers understand the basic tenets of the ICF-CY framework they can very clearly articulate why participation-based outcomes are meaningful and important. They also demonstrate an understanding of the discrepancy between the way they have typically evaluated outcomes and the outcomes that matter to the families they serve. I will continue engaging in knowledge translation efforts to increase the reach of these ideas. At the time of writing this chapter (spring 2017) I have been invited to speak at a second PSLP site (May 29, 2017 – Ottawa). Through presentations like these, I can continue to increase clinicians' understanding of participation-based outcomes and how they can increase the relevance and impact of our practice (Rosenbaum & Gorter, 2012).

Foundational knowledge of the development of communicative participation skills.

Through the development of the growth curves (Chapter 4) I have made a new and important contribution to the speech-language literature by providing foundational knowledge about how communicative participation skills develop in preschoolers with communication disorders. The field has developmental models for most impairment-based skills including the development of speech sounds (Tomblin, Peng, Spencer & Lu, 2008), grammatical morphemes (Hadley & Holt, 2006), vocabulary (Huttenlocher, Hait, Bryk, Seltzer & Lyons, 1991), sentence length (Rice, Redmond & Hoffman, 2006), and others. The work presented in Chapter 4 provides the first developmental model for growth in communicative participation skills, and is in line with the call for more research related to participation-based outcomes (Threats, 2013).

Another unique contribution of this work is that growth in communicative participation skills was modelled by CFCS level. Classification tools such as the CFCS are not commonly used in the speech-language literature. Traditional models of growth in the field have explored the development of skills over time (i.e., age), but that development was explored globally, and was

not stratified by the nature or severity of impairment (Chapman, Hesketh & Kistler, 2002; Hadley & Holt, 2006; Huttenlocher, Haight, Bryk, Seltzer & Lyons, 1991; Rice, Redmond & Hoffman, 2006; Tomblin, Peng, Spencer & Lu, 2008). I believe this is an important component of speech-language outcomes research and will continue to use the CFCS in my work because classifying children based on their functional skills is likely to result in more meaningful and targeted interventions and interpretations of outcomes (Hidecker, Cunningham, Thomas-Stonell, Oddson & Rosenbaum, 2017; Rosenbaum, Eliasson, Hidecker & Palisano, 2014). I hope that publication of the work presented in Chapter 3 (validating the CFCS) will facilitate its uptake with researchers. In fact, this paper has already been the subject of a positive commentary in *Developmental Medicine and Child Neurology* (McCartney, 2017), the journal where the paper appeared.

In practice, SLPs could use information about predicted growth in communicative participation skills to prognosticate meaningful outcomes for families. Often, one of the first questions SLPs are asked when they meet a family relates to the child's long-term prognosis, and questions are often specifically related to how they will engage with peers and participate in school. The growth curves show that all children progress in their communicative participation skills regardless of their communicative function. This knowledge will allow clinicians to provide a positive prognosis about development for children accessing services in the PSLP. Theoretically, if a clinician knew a child's age, CFCS level and FOCUS© score they could show families what typical development looked like for children in that particular level of function; however, before this can happen I believe this work needs to be formatted in a way that makes it more accessible to clinicians.

Factors influencing the development of communicative participation skills.

The study presented in Chapter 5 identified predictors of development in preschoolers' communicative participation skills. Similar to the growth curves work, predictors of outcome differed by CFCS level. This work provides basic information to support clinical decision-making, intervention planning, and resource utilization within the PSLP (Hardin & Chhieng, 2007). The new knowledge about the clinical predictors of development will be of particular interest to stakeholders in the PSLP involved in the planning and delivery of children's therapy services. For instance, the PSLP may consider streamlining intervention services to children differently depending on their level of communicative function at entry to the program. For children in CFCS level I, the gain in predicted FOCUS© scores when they started intervention was limited (they start 'high'), and the difference between those in/out of intervention across all ages was small (and below the 16 FOCUS© points identified as a clinically meaningful). For children in this highest level of function, less intensive interventions, such as home programming and parent consultation, may be all that is required. Additionally, we found that more time in intervention led to higher predicted outcomes for children in the lower levels of function, whereas predicted outcomes for children in the higher levels of function were similar regardless of how much time they spent in intervention.

Information related to demographic predictors may also have important implications for practice. For instance, SLPs often recommend an early learning environment such as a childcare program to boost communication for children with speech, language and social communication disorders – a recommendation that to date has not been well supported by research evidence related to improvements in impairment-based skills (Booth & Kelly, 2002; Girolametto, Hoaken,

Weitzman & van Lieshout, 2000; National Institute for Health and Human Development). The work presented here suggests that exposure to an early learning environment may be an important predictor of outcome for most of the children served in the program, providing the therapists with useful information for practice. While findings from both the growth curves and predictors papers contain important clinical information, these results are not yet in a format that is easily accessible to clinicians. Further work is needed to ensure findings are applicable and generalizable within the PSLP, and to make the information accessible before it can be applied in practice (Bellazi & Zupan, 2008). In the future, SLPs may benefit from a tool (for example a clinical algorithm based on these findings) to support decision-making (Bellazi & Zupan, 2008).

Future Directions

My dissertation work has provided a first look at how participation-based outcomes can be explored for preschoolers with communication disorders. In doing this work, many important issues were identified that must be addressed before we can more fully understand the development of children's communicative and formal participation skills. My ultimate goal with respect to research is to form a collaborative partnership with the PSLP so we can one day reliably report on the outcomes of their numerous interventions in relation to several important clinical factors. However, before intervention outcomes can be explored, several issues must first be addressed.

At present, it is impossible to report on the type of communication disorder with which children present at assessment. It is likely that communicative participation outcomes differ both by CFCS level and by type of communication impairment (e.g., children with speech sound disorders likely have better outcomes than those with language disorders) (Thomas-Stonell et al., 2013). The PSLP does not currently have a valid or reliable tool to collect this information. Similarly, a tool to collect reliable information about the types of goals children work on in therapy is needed. The development of a consensus-based, valid and reliable tool to collect this information is an essential next step towards the future exploration of intervention outcomes.

A second issue that must be addressed prior to studying the impact of the PSLP's interventions is that we do not yet understand what happens in these various interventions (i.e., what the 'active ingredients' are) to make them effective (Turkstra, Norman, Whyte, Dijkers & Hart, 2016). Using a theoretically-driven rehabilitation treatment taxonomy (RTT), we can classify PSLP interventions with greater precision, and identify the active ingredients of those interventions (i.e., what makes them effective/ineffective?) (Turkstra et al., 2016). This would provide the PSLP with a much more refined understanding of what 'works' for what kinds of children than is currently possible using the provincial datasets with its very imprecise terminology (Walsh, 2006).

Thirdly, the PSLP assessments are currently meant to be done every six months, and there is a wide range of the time between assessments within the program. PSLP assessments are not currently aligned with the start/end of specific interventions. Under these circumstances, a child may have multiple, or no, interventions between assessment periods. A demonstration study with a few PSLP sites would allow us to identify and characterize the feasibility of completing outcome measurement tools at the start/end of specific intervention periods. If feasible, this could be implemented across the PSLP as a whole so that data collection would reflect gains

made during specific intervention periods rather than arbitrary time intervals as is now done. I have already been approached by multiple PSLP sites wanting to participate in and collaborate on this type of research.

Addressing these issues would allow for the collection of more meaningful and reliable data, providing exciting opportunities to explore intervention outcomes for preschoolers in the PSLP and beyond. Success in this effort would be an unprecedented contribution to the literature, and because of the size of the PSLP and it is unparalleled rich database, findings could inform PSLP services, and generalize to preschool-based services around the world. It is therefore essential to establish clearly defined tools and methods for evaluating intervention outcomes, as well as to classify the ingredients of those interventions accurately. Interventions can then be streamlined and targeted, on the basis of sound evidence, improving efficiency and cost-effectiveness of services.

Conclusions

The past four years have considerably increased my understanding of the literature related to outcomes for preschoolers with communication disorders, various research methodologies, the complexities of working with large datasets, the importance of translating research knowledge to practice, and how to collaborate on research teams. Each step of this journey has been informed by my clinical experience working in the PSLP and I hope my research will be useful to both researchers and clinicians.

I have now reviewed much of the available literature related to evaluating outcomes for preschoolers and am keenly aware of the need for more research related to children's participation outcomes – something I will continue to do in my future work. As a clinician, I know these are the outcomes that are most important to children and families, and I will strive to help clinicians and organizations understand the importance of participation-based outcomes and how they can relate meaningfully to clinical practice. By completing the four studies presented in this dissertation, I have gained experience using multiple research methodologies, but there is much more to learn. I will continue to study and collaborate with others to learn new methodologies that I will use in my future work. I have also had the opportunity to work with an unprecedentedly large dataset in my field. This has been both extremely challenging and rewarding, and I am now better positioned to understand the strengths and drawbacks of this approach in my future work. As a clinician I know that much of the work I have done using the PSLP datasets remains largely inaccessible to SLPs in practice, and I will work to transform and translate this knowledge to them in a useable form. Perhaps most importantly, I have learned how to work collaboratively on research teams. My wonderful supervisor and advisory committee members made collaborating easy for me. From them I have learned the importance of working with well-intentioned and dedicated people who are committed to bettering the field and to helping children and families achieve their best possible outcome.

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