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Communicative participation outcomes of preschool speech-language services: Opportunities, challenges, and solutions

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Health and Rehabilitation Sciences

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Title: Communicative participation outcomes of preschool speech-language services: Opportunities, challenges, and solutions

Abstract

It has been estimated that speech and language disorders impact as many as 15-22% of preschoolers. In Ontario, Canada, families who are concerned about their children's speech, language, or communication skills can access publicly funded services through Ontario's Preschool Speech and Language Program. In this program, speech-language pathologists provide assessments and early interventions to improve children's communication skills and lessen the negative effect of communication delays on development. Since 2012, the Program mandated the use of an outcome measure, the Focus on the Outcomes of Communication Under Six® (FOCUS), but there has been inconsistent uptake among speech-language pathologists. Using a practice-based research approach, this dissertation explores issues related to outcome measurement within the Preschool Speech and Language Program in Ontario through several studies. Study 1 explored the potential uses of the FOCUS data collected within a real-world clinic. Study 2 engaged speech-language pathologists across Ontario to investigate the facilitators and barriers related to the implementation of the FOCUS. Study 3 engaged relevant stakeholders (speech-language pathologists, policy makers, researchers who developed the FOCUS tool) to identify practical ways to resolve the implementation challenges. Results of these studies indicate that the collected outcomes data offer a way to demonstrate intervention effectiveness and to understand predictors of children's outcomes. Barriers within practice, however, are currently impeding speech-language pathologists' capacity and motivation to fully implement the FOCUS into routine practice. Practical implementation strategies that balance the perspectives of relevant stakeholders were selected to resolve the practice barriers. The methodologies and findings of this dissertation inform outcome measurement improvement across all health and rehabilitation disciplines.

Keywords

early intervention, program evaluation; implementation, practice-based research, quality assurance, child

Summary for Lay Audience

In Ontario, Canada, families who are concerned about their children's speech, language or communication skills can get assessments and treatments from speech-language pathologists from Ontario's Preschool Speech and Language Program at no charge. Being able to track children's growth in this program is very important. In 2012, the Program asked speech-language pathologists to use the Focus on the Outcomes of Communication Under Six® (FOCUS) to monitor children's growth. This dissertation includes three studies. Study 1 looked at children's growth in a free parent training program called Target Word. The data from the FOCUS shows that most children made clinically significant gains during the Target Word program. In study 2, speech-language pathologists across Ontario shared their experience using the FOCUS. They identified three major factors that are currently limiting data collection using the FOCUS. In Study 3, speech-language pathologists, policy makers, and researchers worked together to identify practical ways to improve the regular use of the FOCUS. Overall, this dissertation looked at issues surrounding the outcome monitoring system in Ontario's Preschool Speech and Language Program in order to improve the services offered to children and their families.

Co-Authorship Statement

Chapter 2:

Kwok, E. Y. L., Cunningham, B. J., & Oram Cardy, J. (2019). Effectiveness of a parent-implemented language intervention for late-to-talk children: A real-world retrospective clinical chart review. *International Journal of Speech-Language Pathology*, 1-11.

Chapter 3:

Kwok, E. Y. L., Moodie, S. M., Cunningham, B. J., & Oram Cardy, J. (Submitted). Barriers and facilitators to the implementation of a preschool outcome measure: Speech-language pathologists' perspectives. *American Journal of Speech-Language Pathology*.

Chapter 4:

Kwok, E. Y. L., Moodie, S. T., Cunningham, B. J., & Oram Cardy, J. E. (2020). Selecting and tailoring implementation interventions: a concept mapping approach. *BMC Health Services Research*, 20, 1-13.

Chapters 2,3,4 included in this dissertation are co-authored manuscripts completed by the candidate (the first listed author), along with collaborators. The candidate completed the majority of the work contributing to the manuscripts, including obtaining ethics approval, data collection, analysis, manuscript preparation and submission. The co-authors on the manuscripts contributed significantly in securing funding and partnerships for the work, recruitment, methodological counselling, and to the final drafts of the manuscripts.

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Chapter 1

Introduction

It has been estimated that speech and language disorders impact as much as 15-22% of the preschool population (Beitchman, Nair, Clegg, & Patel, 1986; Law et al., 1998; McLeod & Harrison, 2009). In the preschool years, speech and language difficulties can limit children's ability to communicate (e.g., to be able to understand others, to speak clearly to be understood) (Paul & Norbury, 2012) and form relationships with peers and parents (McCormack, McLeod, Harrison, & McAllister, 2010; McLeod & Threats, 2008).

If speech or language difficulties do not resolve by early school years, children are at elevated risk for learning difficulties (Bishop & Edmundson, 1987; Harrison, McLeod, Berthelsen, & Walker, 2009; Law, Boyle, Harris, Harkness, & Nye, 2000; Law et al., 1998) as well as behavioral and psycho-social problems (Beitchman, Wilson, Brownlie, Walters, & Lancee, 1996). When language disorders persist into adulthood, not only do individuals experience many behavioral, emotional, and social difficulties, they are more likely to receive psychiatric diagnoses (Clegg, Hollis, Mawhood, & Rutter, 2005; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011; Wadman, Durkin, & Conti-Ramsden, 2011) and have poorer employment outcomes (Felsenfeld, Broen, & McGue, 1994; Law & Schoon, 2009). Early assessments and interventions, particularly when provided prior to formal school education, are thought to help reduce the cascading effects of speech and language difficulties on development (Beitchman et al., 1996; Leew et al., 2014).

There is evidence to suggest that preschool interventions are effective, but the effect sizes across intervention studies are heterogenous and vary widely (Law et al.,

2017, 1998; Nelson, Nygren, Walker, & Panoscha, 2006; Sullivan & Field, 2013). These discrepancies may be a result of multiple factors such as biased reporting, methodological variation across studies, and inconsistent reporting of outcome data (Law, Garrett, & Nye, 2004). One way to advance our understanding of the effectiveness of speech and language intervention is by using a consistent outcome measure and collecting data at a population level (Law et al., 2004; Mullen & Schooling, 2010).

In Ontario, Canada, families who are concerned about their child's speech, language or communication skills can access publicly funded services in Ontario's Preschool Speech and Language Program (Ministry of Children, Community and Social Services, 2019). In this program, speech-language pathologists (SLPs) provide assessments and early interventions to improve children's communication skills and to lessen the negative effect of communication delays on development (Speech-Language & Audiology Canada, 2012). In 2012, an initiative was launched to gather outcome data of preschool children in this public program. The Focus on the Outcomes of Communication Under Six (FOCUS), a communicative participation outcome measure, was mandated for use in all regional sites of the Preschool Speech and Language Program across the province of Ontario.

This outcome measurement initiative in Ontario offers a unique opportunity to understand the effectiveness of early speech and language interventions at a population level. Only three studies to date explored the data collected from the FOCUS within Ontario's Preschool Speech and Language Program (Cunningham, Hanna, Oddson, Thomas-Stonell, & Rosenbaum, 2017; Cunningham, Hanna, Rosenbaum, Thomas-Stonell, & Oddson, 2018; Smyth, Theurer, Archibald, & Oram Cardy, 2020). These

studies modelled the growth of children's communicative participation skills during intervention and explored predictors of children's outcome in early interventions, but the analyses in all three studies were limited by missing FOCUS data. No study has investigated the reasons behind the missing data or how to improve data collection.

Using an integrated knowledge translation research approach, this dissertation explores issues related to outcome measurement within the publicly funded preschool speech-language program in Ontario through three studies. Study 1 (Chapter 2) explored the potential uses of the FOCUS data collected within a real-world clinic that is a regional site within the Ontario Preschool Speech and Language Program. Study 2 (Chapter 3) engaged SLPs to investigate the facilitators and barriers related to the implementation of the FOCUS. Lastly, Study 3 (Chapter 4) engaged relevant stakeholders (SLPs, policy makers, FOCUS tool developers) to identify practical ways to resolve the implementation challenges of the FOCUS.

What are outcome measures?

The quality of a healthcare system can be broadly assessed using three indices: *structure*, *process* and *outcome* measures (Agency for Health Research and Quality, 2011; Donabedian, 1988). *Structure* measures reflect the context in which care is being delivered, including considerations of infrastructure and human resources. Some examples of structure measures include the proportion of clinicians relative to patients and the waiting time for service (Agency for Health Research and Quality, 2011; Rademakers, Delnoij, & De Boer, 2011). *Process* measures reflect the care providers' actions when delivering care. An example of a process measure is clinician-patient interaction (Rademakers et al., 2011). *Outcome* measures concern the impact of care on

the receiver of care (i.e., on the patient). An example of an outcome measure may be the rate of hospital-acquired infection (Agency for Health Research and Quality, 2011).

Amongst these indices, outcome measures are unique in that they capture something that is intrinsically meaningful and valuable to all stakeholders (Mant, 2001; Smith, Mossialos, Papanicolas, & Leatherman, 2008). Additionally, outcome measures capture the impact of both structure and process factors, whereas structure and process measures on their own have little meaning without referencing outcome measure data (Mant, 2001). In summary, outcome measures are one index of healthcare system quality that reflect the impact of healthcare interventions on service receivers.

Why do speech-language pathologists need outcome measures?

Across the globe, SLPs are encouraged to use outcome measures by their professional organizations due to their many benefits (Mullen & Schooling, 2010; Royal College of Speech & Language Therapists, n.d.; Speech-Language & Audiology Canada, 2010). When outcome measures are collected at a population level, they allow for a) evaluation of health policy impact on client outcomes, b) epidemiological investigation of predictors of outcomes; c) characterization of the needs of clients at local or population levels (American Speech-Language-Hearing Association., n.d.; Schmidt, Garratt, & Fitzpatrick, 2002). Professional organizations representing SLPs advocate for outcome data collection because such data allow for evaluating/ demonstrating clinical effectiveness, informing quality improvements, and establishing preferred practice (American Speech-Language-Hearing Association., n.d.; Royal College of Speech & Language Therapists, n.d.). In particular, outcome measures data provide a basis to study optimal service types, length, and intensity, as well as client prognosis (Bowen, 1997). In

countries where healthcare costs are primarily covered by third-party payers, in the United States for example, outcome measures also provide tangible data to justify expenditures on professional services (Mullen, 2004).

At an organizational level, outcome measures data allow for benchmarking services (e.g., by comparing organizational outcomes to national norms, or within the organization over time) (American Speech-Language-Hearing Association., n.d.; Enderby, John, & Patheram, 2013). Administrators can use outcome measures to evaluate and advocate for staffing levels (Mullen, 2004). For clinicians, one of the most important uses of outcome measures is to obtain feedback on the level of function or the progress of their clients (Hatfield & Ogles, 2004; Lambert & Hawkins, 2004). Outcome measures offer a way to gather objective and quantitative data on individual client's functions, which provides additional information to guide clinical management decisions (Garland, Kruse, & Aarons, 2003; Hatfield & Ogles, 2007). The use of outcome measures may also improve clinician's accountability to service receivers (Mullen, 2004). From a service receiver's perspective, outcome measures offer avenues for them to express their perspectives (e.g., their values and preference) with regards to their own care (Clancy & Eisenberg, 1998; Ronen, Rosenbaum, & Streiner, 2000).

These are just a few of the many benefits of outcome measurement (for a more detailed analysis, refer to Golper & Frattali, 2013). In order to attain these benefits, many argue that outcome measures need to comprehensively address the concept of "health" and have good psychometric properties (Enderby et al., 2013; John, 2011; Perry et al., 2004; Speech-Language & Audiology Canada, 2012; Threats, 2013; World Health Organization, 2001).

Outcome measures and World Health Organization’s International Classification of Functioning, Disability and Health framework

Defining “outcome” is a major consideration while choosing an outcome measure for speech-language pathology (Golper & Frattali, 2013). In 2001, the World Health Organization published the International Classification of Functioning, Disability and Health (ICF) framework, which provides an international standard to describe health (World Health Organization, 2001). Consistently, it has been argued that outcome measures within speech-language pathology should consider the different facets of health as defined by the ICF framework (Enderby et al., 2013; Golper & Frattali, 2013; Speech-Language & Audiology Canada, 2010; Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2010).

Under the ICF framework, health conditions are viewed as the result of the interactions between three levels of function and the contextual factors surrounding the individual (Figure 1 provides a schematic representation of the ICF). These components of the ICF are expanded below with examples from speech-language pathology practice (Cunningham et al., 2017; McLeod & Threats, 2008; Washington, 2007).

The three levels of functions in ICF include:

- i. *Body Function & Structure*: the physiology and anatomy of the body (e.g., range of motion of lips, tongue, and jaw; brain anatomy). Deviation from normal structure or function within this domain of function are described as *Impairments*.
- ii. *Activities*: a person’s ability to perform a task or an action (e.g., understanding of language, use of verbal and non-verbal modes of communication including

speaking and gesturing). Difficulties performing these functions at a typical level are described as *Activity Limitations*.

- iii. *Participation*: a person's involvement in life situations (e.g., forming interpersonal relationships, maintaining conversations, engaging in community activities). Difficulties engaging in the various life situations are described as *Participation Restrictions*.

The contextual factors in ICF include:

- i. *Environmental factors*: factors external to the individual, including for example social attitudes, legal structure, terrain surrounding the individual (e.g., access to interventions, funding availability for augmentative and alternative communication devices)
- ii. *Personal factors*: factors intrinsic to the individual (e.g., age, gender, temperament)

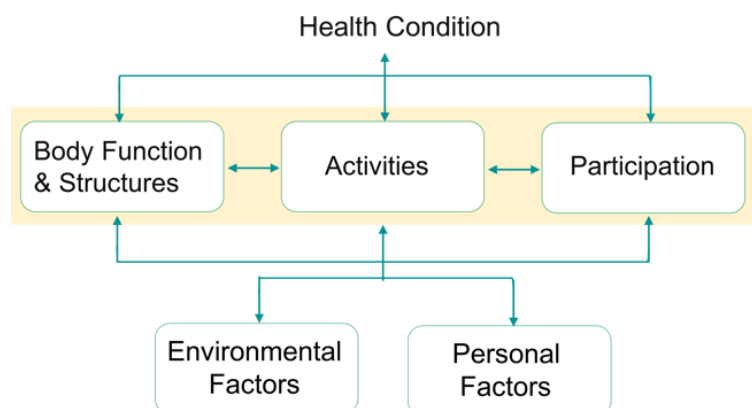


Figure 1. The World Health Organization's International Classification of Functioning Disability and Health (ICF) framework.

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The ICF further recognizes the complexity of the interaction between an individual's function and their environment by differentiating *capacity* versus *performance*. An individual's *capacity* describes their level of function in a standard environment (e.g., assessed in a clinic), whereas their *performance* describes function within their typical everyday environment (e.g., at home or in daycare).

In contrast to the traditional biomedical model that emphasizes levels of function within the *Body Function & Structure* and *Activities* domains, the ICF framework specifically considers *Participation* in life situations (Rosenbaum & Gorter, 2012; World Health Organization, 2001). For paediatric SLPs, this additional focus on *Participation* is crucial. For one, language development during early childhood occurs fundamentally through engagement in naturalistic, language-rich social situations (e.g., during parent-child interactions, play with peers), which are better described in the ICF framework than the biomedical model (Hoff-Ginsberg & Shatz, 1982; Hoff, 2006). Secondly, the ultimate goal of language interventions is to support children to achieve their potential as effective communicators in real-life settings – at home, at daycare, or in the community (American Speech-Language-Hearing Association, n.d.; Paul & Roth, 2011).

Interventions that support children's language development in life situations are thought to be more effective as they ensure the practice of the developing skills in daily activities beyond clinic rooms (Roper & Dunst, 2003). Additional support for the use of the ICF by paediatric SLPs comes from parents of children with developmental disabilities, who consistently identify outcomes in the *Participation* domain (e.g., their child's ability to make friends) as most meaningful and important to them (Lindsay & Dockrell, 2004; Roulstone, Coad, Ayre, Hambly, & Lindsay, 2013). These are amongst the many reasons

used to advocate for paediatric SLPs to use outcome measures that reflect the WHO's ICF (Cunningham et al., 2017; Enderby et al., 2013; Speech-Language & Audiology Canada, 2010; Thomas-Stonell et al., 2015).

Important psychometric properties of outcome measures

Another important consideration when choosing outcome measurement tools is their psychometric properties. While the standard with regards to the psychometric properties of outcome measures are always evolving (American Educational Research Association, American Psychological Association, Joint Committee on Standards for Educational Psychological Testing (US), & National Council on Measurement in Education, 2014; Daub, Skarakis-Doyle, Bagatto, Johnson, & Oram Cardy, 2019), several psychometric properties remains essential for outcome measurement.

The COnsensus based Standards for the selection of health Measurement INstruments (COSMIN) is an initiative of an international, multidisciplinary team of researchers with the goal of offering tools to help improve the development and evaluation of outcome measures. Using a Delphi approach, the COSMIN team reached a consensus on a taxonomy of the terminology and definitions for the psychometric properties relevant to outcome measures used in healthcare (Mokkink et al., 2010). Broadly speaking, outcome measures should satisfy three psychometric properties: *validity*, *reliability*, and *responsiveness* (Barten, Pisters, Huisman, Takken, & Veenhof, 2012; Lambert & Hawkins, 2004; Mokkink et al., 2010).

Validity refers to how closely (and comprehensively) an outcome measure reflects the constructs it claims to measure, and can be further characterized into content, construct, and criterion validity. Often, validity of an outcome measure is achieved via

expert opinion (e.g., in the case of face and content validity), as well as through testing the outcome measure against other gold standard tools (e.g., in the case of construct and criterion validity) (Enderby et al., 2013; Westen & Rosenthal, 2003).

Reliability indexes how well the outcome measure captures the client's 'true' level of function as opposed to errors. Often, reliability of an outcome measure is demonstrated by assessing the consistency in scores measured over time (i.e., test-retest reliability) and when used by different individuals (i.e., inter-rater reliability). Reliability can also be measured in terms of how closely the items on the outcome measure relate to each other (i.e., internal consistency reliability) (Tavakol & Dennick, 2011) and the range of standard error of measurement (i.e., measurement error) (Mokkink et al., 2010).

Responsiveness refers to the outcome measurement tool's ability to detect change over time (sometimes also referred to as *sensitivity*, Lambert & Hawkins, 2004). There is no single agreed upon approach that best measures or demonstrates responsiveness (Thomas-Stonell, McConney-Ellis, Oddson, Robertson, & Rosenbaum, 2007). One way to demonstrate responsiveness is for an outcome measure to have absolute measurement errors smaller than the minimally important difference score (Terwee et al., 2007). Another way to demonstrate responsiveness is for an outcome measure to demonstrate that changes measured in an intervention group exceed the changes measured in a non-treatment group (Lambert & Hawkins, 2004). In other words, responsiveness considers the credibility of the changes in score of an outcome measure (Mokkink et al., 2010). For example, an outcome measure designed to capture intervention changes should have a minimally important difference score that rules out the contribution from natural development, measurement, or random errors. This way, when clients make the

minimally important difference score change on the outcome measure, it is more likely due to an intervention effect as opposed to other causes.

In addition to validity, reliability, and responsiveness, the COSMIN team further acknowledged the importance of *interpretability*, which refers to the ease of deriving meaning from the scores generated from an outcome measure (Mokkink et al., 2010). Strictly speaking, interpretability is not an index of measurement properties, nevertheless, it is an important consideration for the practical use of the outcome measure (Mokkink et al., 2010). Interpretability can be satisfied when outcome measures provide clear information on the level of changes in scores that would be considered clinically meaningful (e.g., by providing a reference value for minimal clinically important change) (Lohr et al., 1996). Ideally, such a reference value should be derived based on the comparison of the outcome measure scores to an external measure (i.e., anchor-based), as opposed to drawing a cut-off score based on the statistical distribution of change scores on the outcome measure alone (i.e., distribution-based) (Crosby, Kolotkin, & Williams, 2003; Terwee et al., 2007).

Thus far, arguments have been presented to support the need to: a) collect outcome measures within speech-language pathology; b) measure outcomes comprehensively as defined by the WHO's ICF framework; and c) select outcome measures with good psychometric properties. In practice, however, are outcome measures that satisfy these ideals available to paediatric SLPs?

Cunningham et al. (2017) reviewed the literature to identify and categorize assessment tools available to paediatric SLPs. They found a dearth of measures that assess, in particular, the "Participation" domain of the WHO's ICF framework. Similarly,

efforts of various speech-language pathology organizations to identify a reliable and comprehensive outcome measure have yielded little to no results (American Speech Language Hearing Association, n.d.; John, 2011; Mullen & Schooling, 2010). Within Ontario, the FOCUS was created to meet these outcome measurement challenges in paediatric speech-language pathology (Thomas-Stonell, Robertson, Walker, Oddson, & Rosenbaum, 2012).

What is the FOCUS?

The FOCUS is an outcome measurement tool developed in Canada that aims to capture the treatment changes associated with speech-language therapy offered to preschool children. The FOCUS can be completed by either parents or SLPs. This section will briefly introduce the constructs being measured by and the psychometric properties of the FOCUS.

The conceptual framework of the FOCUS

The FOCUS was specifically designed to reflect the different constructs of health defined by the WHO's ICF framework (Thomas-Stonell et al., 2010). Importantly, the items on the FOCUS were developed to reflect the real-world intervention outcomes observed by the intended users of the tools (i.e., parents and preschool SLPs).

To generate the items on the FOCUS, a survey study was conducted with the parents and SLPs of 218 preschool children receiving speech-language services in Ontario's publicly funded program (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2009). Parents and SLPs described the changes they observed in the preschool children during the intervention, which were then analyzed qualitatively using content analysis. Frequently recurring themes in parents' and SLPs' responses (i.e., those reported by at

least 10% of the study sample) were extracted and included as an item on the FOCUS. These themes were turned into 103 statements (using wording from parents' and SLPs' responses) and then tested with parents and SLPs across three provinces in Canada (Nova Scotia, Newfoundland and Labrador, and Ontario). On a 7-point anchored scale from "not at all like my child/client" to "exactly like my child/client", users provided ratings of these statements based on the preschooler's functioning at the beginning and at the end of an intervention block. Based on users' feedback and statistical analyses (i.e., item and factor analysis), 50 statements were selected to be included in the FOCUS outcome measure (Thomas-Stonell et al., 2010).

The 50 items on the FOCUS were further mapped onto the different constructs of the WHO's ICF framework of health (Thomas-Stonell et al., 2010). On the FOCUS, 18 items measure preschool children's capacity in the *Body Function and Structure* domain. These items reflect children's level of function in a standardized environment. An example of these items includes "My child's speech is clear." The remaining 32 items measure children's performance in the *Activities and Participation* domains of the ICF framework. These items measure children's function in naturalistic, daily environments. An example item is "My child is confident communicating with adults who do not know my child well."

The psychometric properties of the FOCUS

As discussed earlier, outcome measures can be evaluated for their validity, reliability, responsiveness and interpretability. This section considers these psychometric properties of the FOCUS.

Validity. Validity concerns the constructs being measured by an outcome measurement tool. In the case of the FOCUS, the construct being measured is communication-participation domains as defined by the WHO's ICF model (Thomas-Stonell et al., 2010). Validity is commonly demonstrated in several ways, including, for example, using expert opinion, through hypothesis testing, or by comparing an outcome measure to other existing measures.

The face and content validity of the FOCUS were assessed using users' opinions. Parents and SLPs agreed that the items on the FOCUS were clear and accurate descriptions of preschoolers' abilities (Thomas-Stonell et al., 2010). The researchers who developed the FOCUS also mapped items on the FOCUS onto all major domains of the WHO's ICF framework, which speaks to the content validity of the FOCUS (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2013).

The construct validity of the FOCUS was demonstrated in several ways. First, it was found that changes in FOCUS scores were higher during a period of speech and language intervention compared to a waitlist period. This substantiates the intended use of the FOCUS, which is to capture outcomes resulting from interventions provided by SLPs, as opposed to natural development (Thomas-Stonell et al., 2013). Second, the FOCUS was tested against other published standardized tools. Specifically, the FOCUS demonstrates convergence validity with the Pediatric Quality of Life Inventory (Varni, 1998), a standardized measure of health-related quality of life developed based on the WHO's core dimensions of health (Thomas-Stonell et al., 2010). At the end of intervention, preschool children with higher scores on the FOCUS also had higher scores on this quality of life measure. Additionally, the changes in scores on the FOCUS (from

the start to the end of interventions) were tested against the Ages and Stages Questionnaire – Social/Emotional (Squires, Bricker, & Twombly, 2003, a screening tool completed by parents that assesses pediatric developmental performance across areas such as communication, gross/fine motor skills) and the Vineland Adaptive Behavior Scales (Sparrow, Cicchetti, & Balla, 2005, a semi-structured interview assessment tool for children’s behavior across domains such as communication, daily living skills). The changes in scores on the FOCUS correlated only to the changes in scores on the communication-related domains of these measures, and not with scores on non-communication domains (Thomas-Stonell et al., 2013; Washington et al., 2013). These findings demonstrate that the FOCUS has convergent validity and discriminant validity with existing standardized measures. In other words, these findings suggest that the FOCUS is measuring constructs that it claims to measure (i.e., communication related constructs) while not measuring constructs that it was not designed to measure (e.g., gross motor development). Lastly, scores on the FOCUS were found to correlate with commonly used clinical measures of speech clarity (i.e., the Children’s Speech Intelligently Measure, Percentage Consonant Correct) and expressive language (i.e., Developmental Sentence Scoring of a language sample).

Reliability. Reliability reflects how well a tool measures the intended constructs as opposed to errors. Reliability is often inferred from the margins of errors of an outcome measurement tool, the cohesiveness of the items, and the stability of the scores (e.g., over time or when administered by different individuals).

The margins of errors of the FOCUS were not explicitly stated in the user’s manual, however, the manual explained that a change score of less than 9 points is

unlikely meaningful (Thomas-Stonell et al., 2015). A validation study of the FOCUS tool provided corroborating evidence for this score. Children's scores on the FOCUS were found to change significantly more during the intervention period (average gain: 18.2 points) as compared to a waitlist period (average gain: 5.87 points) (Thomas-Stonell et al., 2013). Together, these data suggest that when children make less than or equal to 9-point gain on the FOCUS, it may be a result of natural development or measurement error. In terms of cohesiveness of the items on the FOCUS, analysis of responses from parents and SLPs revealed Cronbach's α of 0.87 and 0.97, respectively, suggesting that the items on the FOCUS are conceptually related (Thomas-Stonell et al., 2010). Furthermore, the FOCUS demonstrated good test-retest reliability within parents ($r = 0.95$) and SLPs ($r = 0.7$), and good interrater reliability between parents and SLPs (ICC = 0.78) (Thomas-Stonell et al., 2013),

Responsiveness. Responsiveness refers to the ability of the FOCUS tool to detect changes over time. As mentioned in the validity section above, children tended to accrue more changes on the FOCUS during an intervention period compared to being on a waitlist. This suggests that the FOCUS is sensitive to detecting changes over time and is particularly sensitive in detecting the changes associated with intervention.

In addition to considering the responsiveness of the FOCUS tool as a whole, the responsiveness of individual items on the FOCUS were also considered. After a preliminary data collection period across the province of Ontario, which resulted in data from 18,931 preschool children, the responsiveness of each individual item on the FOCUS was analysed. Using item response analysis, items on the FOCUS that were most responsive to change over time were kept, and the FOCUS was reduced from 50 items

(the FOCUS) to 34 items (the FOCUS-34) (Oddson, Thomas-Stonell, Robertson, & Rosenbaum, 2019; Thomas-Stonell et al., 2015). The reduced set of items was found to highly correlate with the scores from the original 50 items ($r = 0.98$) (Oddson et al., 2019).

Interpretability. The FOCUS has a reference value to suggest that a minimal clinically important difference (MCID) has occurred. This MCID is 16 points for the 50-item version of the FOCUS and 11 points for the 34-item version. To derive the MCID score of the FOCUS, an external measure approach was taken (as opposed to a distribution-based approach, as described previously in the “Important psychometric properties of outcome measures” section). During the validation study of the FOCUS, parents and SLPs not only completed the FOCUS at the beginning and the end of an intervention, they were also asked to provide descriptive comments on children’s progress. These qualitative comments were analyzed to determine if a functional improvement had occurred during the intervention period. Analysis of these comments and the corresponding changes in FOCUS scores of the preschoolers showed that when a child made at least a 16-point gain on the FOCUS, parents and SLPs agreed 95% of the time that an important functional change had occurred. To assist with SLPs’ interpretation of the FOCUS scores, the MCID scores were explained in the FOCUS user’s manual (Thomas-Stonell et al., 2015).

In summary, the FOCUS has been validated and revised using real-world data and possess many of the psychometric properties important for an outcome measurement tool. Additionally, the FOCUS is one of the very few tools available to paediatric SLPs that was informed by the WHO ICF model and reflects outcomes in the Participation domain

of health (Cunningham et al., 2017; Roulstone et al., 2013). In 2012, the FOCUS was chosen as the outcome measure tool mandated in the provincial outcome monitoring initiative in Ontario's publicly funded speech-language program (Government of Ontario & Ministry of Children and Youth Services, 2016).

Recommended clinical practice with the FOCUS

Under the outcome monitoring initiative in Ontario's Preschool Speech and Language Program, SLPs were recommended to administer the FOCUS at initial assessment, at the start and end of a treatment block, and during clinical reassessments (Thomas-Stonell et al., 2015). Additionally, it was recommended that the FOCUS should be re-administered within no more than 6 months (Thomas-Stonell et al., 2015). SLPs were allowed to administer the parent version of the FOCUS or to complete the clinician version themselves. In the former case, SLPs were instructed to review the purpose of the tool with parents and provide them with instructions to complete the parent version of the FOCUS. In the latter case, SLPs were instructed to observe the child's skill levels and interview parents to complete the clinician version of the FOCUS. After the FOCUS data are collected, the SLPs were encouraged to score the tool and review the results with parents (Thomas-Stonell et al., 2015). The data from the FOCUS were required to be entered into the provincial database, the Healthy Child Development - Integrated Services for Children Information System (HCD-ISCIS), which collects data from all publicly funded programs in the Province of Ontario (Ministry of Children, Community and Social Services, n.d.).

Issues with implementing outcome measures

We have, thus far, considered the benefits of outcome measurement and quality indices of outcome measure tools. We have also discussed the quality of the FOCUS in terms of its conceptual foundation and psychometric properties. We have also briefly considered the guidelines given to SLPs regarding the use of the FOCUS tool in practice. These, however, are not the only considerations when it comes to being able to collect outcome data. As Lambert and Hawkins (2004) observed, “as difficult as it is to select a particular outcome instrument or instruments, it is a relatively minor obstacle compared with the challenges of collecting outcome data.” The challenges referred to by Lambert and Hawkins relate to the *implementation* of evidence into practice. These implementation challenges (or barriers) have caused significant time lag for healthcare innovations to make an impact on clinical practice (Morris, Wooding, & Grant, 2011).

To shorten the time lag between healthcare discoveries and their adoption into real-world clinical practice or policies, many have argued for an active knowledge translation plan (Davis et al., 2003; Graham & Tetroe, 2009; Grimshaw, Eccles, Lavis, Hill, & Squires, 2012). Knowledge translation, as defined by the Canadian Institutes of Health Research (CIHR), is “a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system” (CIHR, 2016). CIHR further specifies that knowledge translation should take place within the complex healthcare system, and engage knowledge users as needed (CIHR, 2016).

This CIHR definition highlights many important aspects of knowledge translation. For the purpose of this dissertation, three aspects of the definition are particularly important. First, the CIHR definition describes multiple activities that constitute knowledge translation, including synthesis, dissemination, exchange, and application of knowledge. Second, it emphasizes that knowledge translation is an *iterative* process that involves getting feedback and taking feedback into account to make modifications. Third, knowledge translation activities should take into account the *context* and the *users* of such knowledge. Later in this chapter, the *Objectives & overview* section will include a discussion on how the studies included in this dissertation were designed to address these important aspects of knowledge translation.

The CIHR definition provides a broad summary of knowledge translation. In practice, however, how is knowledge translation achieved? The next sections will consider a) the steps (or actions) involved in knowledge translation and b) an approach to conducting research that maximizes relevance of research findings to real-world practices.

Knowledge translation process

The knowledge-to-action (KTA) process is one of many frameworks that offer a way to conceptualize the steps involved in knowledge translation (Graham et al., 2006). At the center of this framework are steps involved in synthesis of knowledge. Primary research studies are screened, appraised, summarized, and refined into a knowledge tool or product (e.g., in the form of clinical tools or clinical practice guidelines). In this knowledge synthesis process, research knowledge is tailored into a product that is based on the needs of the knowledge users (e.g., the frontline clinicians) (Graham et al., 2006).

Once a knowledge product is created, deliberate steps are taken to apply such knowledge into practice. These steps include: a) adapting the knowledge product to the local context; b) assessing barriers to the use of the knowledge product; and c) selecting and tailoring implementation interventions to promote the use of the knowledge product (Graham et al., 2006). The implementation of the knowledge product is continuously monitored and evaluated to ensure the sustainability of knowledge application into practice (Graham et al., 2006; Proctor et al., 2011). These action steps form an iterative cycle, surrounding the knowledge synthesis steps. As users' needs and the context of healthcare are constantly evolving, there is a need to continuously monitor and solicit feedback from users in order to adapt implementation efforts (or the knowledge products themselves). The continuous effort to monitor and adapt is the key to sustain knowledge use (Graham et al., 2006).

Practice-based research approach

A practice-based research approach is a way of conducting research where researchers and knowledge users (also refers to as “stakeholders”) collaborate during the different stages of the research process (also referred to as integrated knowledge translation) (Canadian Institutes of Health Research, 2016; Gagliardi, Berta, Kothari, Boyko, & Urquhart, 2016). Additionally, practice-based research is informed by practice and aims to improve practice (Westfall, Mold, & Fagnan, 2016). The engagement of relevant stakeholder groups in health research is particularly important because issues within the healthcare system are often complex, thus requiring transdisciplinary expertise (Cargo & Mercer, 2008; Denis, Hébert, Langley, Lozeau, & Trottier, 2002). Research conducted using a practice-based approach is thought to be an ideal way to ensure

research products are directly relevant to stakeholders, and as a result, improve the uptake of knowledge discoveries into practice (Dooley, 1997; Gagliardi et al., 2016).

Outcome measurement implementation in speech-language pathology

Few studies to date have explored the implementation of outcome measures into SLPs' practice. In the United States, for example, there has been a national effort to implement a unified outcome reporting measure since 1999 (Mullen & Schooling, 2010). Despite years of advocating for a consistent and regular use of this outcome measure, it is unclear whether and to what extent the national outcome measure has been adopted into practice (e.g., see report from American Speech-Language-Hearing Association, 2017). In the United Kingdom, surveys found that about two thirds of SLPs reported not being required by their organization to collect outcome data (Roulstone, Wren, Bakopoulou, Goodlad, & Lindsay, 2012). However, the implementation barriers to outcome measurement were not further explored in these reports. Within Ontario, SLPs in the publicly funded preschool system were required by the Program to administer the FOCUS as an outcome measure. To date, we know FOCUS data are missing in the provincial data collection system (Cunningham et al., 2018), however, the reasons behind these missing data remains unclear.

Objectives & overview

Given the dearth of literature examining the implementation of a population-based outcome measure in our field, the overarching goal of this dissertation is to improve the understanding of outcome measurement in speech-language pathology. Using the implementation of the FOCUS within Ontario's Preschool Speech and Language Program as the context, this dissertation explores issues related to outcome measurement

in paediatric speech-language pathology. To maximize the potential to impact real-world practice, studies in this dissertation applied principles of knowledge translation and engaged relevant stakeholders in the research process.

Chapter 2 explores the clinical utility of outcome measurement data. This study was purposefully designed to reflect how outcome data collected within the day-to-day practice context (as opposed to in an ideal experimental environment) can be used to answer clinical questions. Recognizing the potential limitations of routinely collected outcome data (e.g., possibilities of missing and incomplete data), this chapter aims to illustrate the clinical questions that are feasible to be answered using real-world data. A retrospective chart review was conducted in a publicly funded clinic within Ontario's Preschool Speech and Language Program. Children's outcome data (i.e., FOCUS data) collected in this clinic were used to ascertain the effectiveness of a language intervention program for late-to-talk preschoolers. Furthermore, predictors of children's outcomes in the intervention were explored. SLPs' (i.e., knowledge users') opinions about predictors of treatment outcomes were surveyed and used to guide the analysis.

Chapter 3 of this dissertation explores the real-world application (i.e. the implementation) of an outcome measure. Specifically, this chapter recognizes that it has been over 7 years since the outcome measurement tool (i.e., the FOCUS) was implemented into the publicly funded preschool program across Ontario. Following the recommended steps outlined in the knowledge-to-action process, this study fills the need to assess the barriers and facilitators to the implementation of the FOCUS. This study investigates, from the perspectives of knowledge users (i.e., SLPs), the most commonly

experienced barriers and facilitators to the adoption of outcome measure into day-to-day clinical practice (i.e., within their practice context).

Chapter 4 of this dissertation explores strategies to promote the implementation of an outcome measure (i.e., the FOCUS) into SLP practice. According to the recommended steps in the knowledge-to-action process, after implementation barriers have been identified (i.e., Chapter 3 of this dissertation), the next step is to tailor implementation strategies to resolve the existing barriers. This study solicited feedback from a variety of relevant stakeholders (policy makers, SLPs, tool creators) who brainstormed and identified implementation strategies that are both practical and important.

Chapter 5 of this dissertation summarizes the main findings across the three included studies (Chapter 2, 3 and 4) and discusses the implications of these studies for Ontario's Preschool Speech and Language program and for outcome measurement in the speech-language pathology profession more broadly. Additionally, this chapter includes discussion of the implications of this dissertation work for implementation science. Lastly, this chapter highlights the future directions of this work and final conclusions.

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Chapter 2

Effectiveness of a parent-implemented language intervention for late-to-talk children: A real-world retrospective clinical chart review

Introduction

Two essential guiding principles for early language interventions include the provision of family-centered services, and supporting children's development in their natural environment (American Speech-Language-Hearing Association 2008). Family-centered services are provided when speech-language pathologists (SLPs) recognize that the family is the expert on their child and work to include the family in all aspects of assessment and intervention services (Paul & Roth, 2011). One way SLPs support children's development in naturalistic environments is by coaching parents to create language rich home environments that can facilitate children's development (Woods, Wilcox, Friedman, & Murch, 2011).

Parent-implemented language intervention embedded in the natural environment has theoretical support. A major benefit of supporting children in their natural, everyday interactions with parents is proposed to be that it maximizes opportunities for learning and generalization of skills (Roper & Dunst, 2003). Family involvement is also thought to ensure that the benefits from intervention continue beyond the period of intervention (White, Taylor, & Moss, 1992).

Despite its theoretical grounding, to date, randomized controlled trials have been inconsistent in their support for the effectiveness of parent-implemented interventions for late-to-talk children. Some trials found parent-implemented interventions significantly improved children's expressive vocabulary and grammar skills compared to a waitlist control group (Buschmann et al., 2009; Girolametto, Pearce, & Weitzman, 1996), while

others found no improvements in expressive language/vocabulary in the intervention group compared to waitlist controls (Wake et al., 2011). These discrepancies may be a result of differences in the intensity and duration of trainings provided to parents (Wake et al., 2011). Moreover, while these studies investigated linguistic outcomes following intervention, it remains unclear whether parent-implemented interventions impact the everyday lives of children who are late-to-talk.

In order to fully understand the impact of parent-implemented interventions, we need to evaluate children's participation-based outcomes. These have only recently begun to be explored and reported in the literature (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2010). *Participation*, as defined by the World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF) framework, relates to a child's involvement in a life situation (WHO, 2001). In the context of preschool language interventions, *Participation* refers to a child's ability to use newly developed language skills to communicate in everyday life situations such as their home, preschool, or community (Eadie et al., 2006).

Until recently, a barrier to studying children's communicative participation outcomes after language interventions was the lack of a valid and reliable measure (Washington, Thomas-Stonell, McLeod, & Warr-Leeper, 2015). The *Focus on the Outcomes of Communication Under Six (FOCUS)* was created in response to this need (Thomas-Stonell et al., 2010). Developed using the ICF framework and with input from SLPs and parents, the FOCUS measures changes in communicative participation skills for children receiving speech-language intervention services by providing an ecologically-sound cut-off score for interpreting the changes that occur from pre- to post-

intervention (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2009, 2013).

Specifically, a clinically meaningful change is said to have occurred if a child gains 16 or more points on the FOCUS between assessments. A change of 10-15 points suggest a possible clinically meaningful change and a change of 9 points or less is not likely to be clinically meaningful (Thomas-Stonell et al., 2013). With the introduction of the FOCUS, it has become possible to explore whether and how parent-implemented interventions for children who are late-to-talk improve children's communicative participation skills.

In addition to exploring the impact of this type of intervention on children's communicative participation skills, it is important to identify clinically-significant predictors of participation-based changes. Previous work on late-to-talk children explored predictors of change in children's linguistic (Fisher, 2017) and social communication skills (Chiat & Roy, 2008). For example, researchers identified expressive vocabulary and the ability to retell a story during the preschool years as predictors of later expressive language skills (Bishop & Edmundson, 1987; Rescorla, 2011). It is not yet known which factors predict changes in children's communicative participation skills following intervention. This knowledge would allow SLPs to better tailor interventions to meet the needs of each child and family (e.g. to determine which child may need closer monitoring or additional supports to ensure optimal growth in communicative participation skills).

Only a handful of studies to date have identified predictors of communicative participation changes during intervention. Cunningham, Hanna, Rosenbaum, Thomas-Stonell and Oddson (2018) found that children who participated in intervention had greater gains in communicative participation skills than children who did not, and that those who spent more time in intervention had greater gains than those who spent less

time, but more specific predictors of these changes were not available. Washington et al. (2015) identified social skills, the presence of a comorbid mobility impairment, and active intervention status (versus waitlist) as significant predictors of communicative participation changes, but again, more specific predictors were not available

Yoder and Compton (2004) argue that predictors of intervention outcomes are frequently, if not always, specific to the intervention of interest, as the predictors should be related to the theoretical knowledge of the reasons thought to underlie treatment effects. We further argue that researchers should consult clinicians and consider clinical experience, empirical data, and theory when selecting predictors of intervention outcome to follow principles of evidence-based practice (Rycroft-Malone et al., 2009; Sackett, Rosenberg, Gray, & Haynes, 1996).

The inconsistent support for the effectiveness of parent-implemented language interventions, along with our lack of understanding of the real-world impact of these interventions, motivated the current study. The primary objective was to evaluate the effectiveness of a parent-implemented language intervention, the *Target Word™ – The Hanen Program® for Parents of Children Who are Late Talkers*, a program that is offered to preschoolers across the publicly funded system in Ontario, Canada. This was done through retrospective chart review. The secondary objective was to identify predictors of children's communicative participation changes during intervention using a prospective survey of SLPs with experience delivering the *Target Word* program.

Methods

Participants

Target Word program. A total of 76 children (51 boys, 25 girls) who were on average 1.92 years ($SD = 0.29$) at the start of the intervention participated in the Target Word program. All children were assessed by a SLP and met three inclusion criteria: (1) the child spoke fewer than 24 words at 18-20 months OR fewer than 40 words at 21-24 months OR fewer than 100 words at 24-30 months OR had no two-word combination at 24 months, (2) the child had typically-developing receptive language skills OR a mild receptive language difficulty, and (3) the child had two or more risk factors for developmental language disorder (e.g. family history of speech/language/learning disorders, limited phonemic inventory).

Clinicians' online survey. Twenty-five SLPs anonymously completed the online survey. On average, respondents had 5.8 years of experience delivering the Target Word program ($SD = 4.3$ years, range: 1-18 years). The frequency with which clinicians offered the Target Word program varied from once every two years to 5 times a year.

Design

The Target Word intervention. During the Target Word program, parents/caregivers attended four to five group training sessions with a Hanen Target Word certified SLP (Earle, 2015; Earle & Lowry, 2011). During the parent group sessions (2.5-3 hours each), SLP discussed and demonstrated language stimulation strategies with parents. Language stimulation strategies taught included: let your child lead, expand your child's message, highlight words and add gestures, and create language learning opportunities (Earle & Lowry, 2011). Videotapes and role-playing activities were often used to illustrate those strategies. Parents were encouraged to practice the

strategies with their child at home between training sessions. Each parent was provided with a Target Word parent handbook to facilitate learning.

In addition to group training sessions, parents/caregivers and children participated in three individual sessions with the SLP (one initial consultation session and two individual video feedback sessions). The initial consultation session took place at the start of the program. During this appointment, the SLP and family agreed on the child's intervention goal, which can include: increasing vocalizations during communication turns (noisy), increasing the child's ability to spontaneously copy single words (imitation), increasing the child's ability to produce single words spontaneously (single word), and increasing the child's use of word combinations either spontaneously or in imitation (combination) (Earle & Lowry, 2011). Through interview with parents, the SLP also completed a detailed checklist of risk factors concerning the child in the Target Word program (see Appendix 1). The two individual video feedback sessions took place between group training sessions. During the individual video feedback sessions (1 hour each), the SLP videotaped parents/caregivers as they interacted with their child and demonstrated their use of the language facilitation strategies introduced in the Target Word program. The SLP and parent then reviewed the video and parents were asked to observe their own use of the strategies and the impact on their child. SLPs also provided specific feedback about strategy use.

After the final group training session, parents were given a period of 12-18 weeks to consolidate the skills learned in the Target Word program. This meant that parents were instructed to continue to practice the strategies they had learned with their child at home, but they did not have regular visits with the SLP. A follow-up session took place at

the end of the consolidation period, where the child's skills were re-assessed to determine next steps.

As part of routine care, parents were asked to complete the FOCUS at three assessment points: the initial consultation session (pre-intervention, up to 4 weeks prior to the first group training session), the final group training session (post-intervention, 9 weeks after the first group training session), and at the consolidation follow-up appointment (18-24 weeks after the first group training session). They also completed the McArthur-Bates Communicative Development Inventories (CDI) - Words and Gestures (Fenson, Marchman, Thal, Dale, & Reznick, 2007) at pre- and post-intervention. The SLP classified the child's communicative function using the Communication Function Classification System (CFCS; Hidecker et al., 2011) at each of the three time points. More detailed descriptions of the CDI, FOCUS, and CFCS are provided below.

During our retrospective chart review, the 4th edition of the Target Word program was launched, so data from both the 3rd (n = 57 families) and 4th (n = 19 families) editions of the program are included in our analyses. The respective timelines of both editions of the program are illustrated in Appendix 2. The main difference between the editions is that parents who participated in the 4th edition had five group training sessions whereas those in the 3rd edition only had four. In both programs, parents had the same number of one-on-one sessions with the SLP (Earle, 2015; Earle & Lowry, 2011). Children who participated in the 3rd and 4th editions did not differ in child-specific characteristics at pre-intervention (sex, age, goals for the program, FOCUS score, expressive and receptive vocabularies on the CDI) or post-intervention variables (changes in FOCUS score, number of words understood/produced on the CDI) (see Appendix 3).

Additionally, after comparing the 3rd and 4th editions, we were confident that the majority of language facilitation strategies parents learned were the same. Therefore, we elected to combine the data for the children and families who participated in both editions of Target Word.

Chart review. With approval from the university Research Ethics Board, a retrospective clinical chart review was conducted for children whose parents participated in the Target Word program through a publicly funded clinic in London, Ontario, Canada (between January, 2015 to April, 2017). None of the authors delivered the intervention. A Hanen-certified SLP provided a list that contained the names and birth years for every child who participated in the Target Word program at the clinic. The clinical charts of these children were located and the following information was extracted into a secured, de-identified spreadsheet: child age, child sex, risk factors (from the checklist in the Target Word program), parent attendance and punctuality during the program, CFCS classification, FOCUS score, and CDI vocabulary counts.

Clinician survey to identify predictors of change. An online survey was conducted to gather SLPs' perceptions of clinically meaningful predictors of change in the Target Word program. Through the Hanen Target Word program coordinator, an email containing a link to an online survey was distributed to the coordinators at the 30 publicly funded preschool language program regions in Ontario, Canada. These coordinators were asked to distribute the survey link to Target Word certified-SLPs who practice in their region. The survey contained two demographic questions: SLPs' years of experience running the Target Word program and the frequency with which they ran the program. From a list of 34 possible predictors, SLPs were also asked to identify and rank

the five predictors they felt most influenced children's communicative participation outcomes following the Target Word program. The list of possible predictors was generated from reviewing the data collection forms and the Target Word clinician's handbook (i.e. Leader's Guide) (See Appendix 1 for a list of predictors included in the survey).

Measurement tools

The CDI Words and Gestures (Fenson et al., 2007) is a parent-report checklist that evaluates children's expressive and receptive vocabulary knowledge, as well as their use of communicative and symbolic gestures. The Words and Gesture form was developed for use up until 18 months of age, but is used by clinicians running *Target Word* throughout the program.

The FOCUS is a 50-item parent report tool that measures real-world communicative participation changes during speech-language interventions that has good test-retest reliability, content validity, and construct validity (Thomas-Stonell et al., 2013). The FOCUS also includes nine subskill scores that are categorized as *capacity/activity* (further subdivided into speech, expressive language, pragmatics, and receptive language) and *performance/participation* (further subdivided into intelligibility, expressive language, social/play, independence, and coping strategies/emotion). Subskill scores for capacity/activity reflect the child's ability to execute a specific task or action in a standard environment like a therapy room or at home when provided with cueing and supports from parents (Thomas-Stonell, Robertson, Walker, Oddson, & Rosenbaum, 2012). Subskill scores for performance/participation reflect how children use their communication in everyday environments such as the home or preschool (Thomas-

Stonell et al., 2012). These subskill scores correspond to the *Activity* and *Participation* components of the ICF, respectively (Thomas-Stonell et al., 2012). On the FOCUS, the minimum Total score is 50 and the maximum is 350. The minimum subskill score is 1 and the maximum is 7.

Research on the FOCUS has established that when a child made 16 points gain on the FOCUS Total score during intervention, both parents and SLPs agreed 95% of the time that an important change in this child's functional skills had occurred. Additionally, children on a waitlist for speech and language services ($n = 97$) made an average of 5.87 points change, which is significantly lower than the suggested cut-off of 16 points to be considered clinically significant (Thomas-Stonell et al., 2013). Based on these results, we believe the FOCUS offers an ecologically-valid cut-off for clinicians and researchers to interpret change in children receiving speech and language services even when a waitlist control group is lacking.

The CFCS was originally developed for use with children with cerebral palsy (Hidecker et al., 2011), but has recently been validated for use with preschoolers with a range of speech and language impairments other than cerebral palsy (Hidecker, Cunningham, Thomas-Stonell, Oddson, & Rosenbaum, 2017). SLPs classified children's communication skills into one of five levels of function at each assessment point (Hidecker et al., 2011). Functional communication levels include: level I (effective sender and receiver with unfamiliar and familiar partners); level II (effective but slower-paced sender and/or receiver with unfamiliar and familiar partners); level III (effective sender and effective receiver with familiar partners); level IV (inconsistent sender and/or receiver with familiar partners); and level V (seldom effective sender and receiver with

familiar partners). Most young children who are late talkers would be classified as CFCS level IV as communication breakdowns are common and they do not consistently understand or express themselves even with familiar partners (e.g. parents, childcare providers).

Statistical analyses

We calculated the changes in FOCUS Total scores and the number of words understood/ produced on the CDI from pre- to post-intervention and from pre-intervention to consolidation follow-up. Parametric analyses were used as none of these variables violated assumptions of normality (Kim, 2013).

Repeated measures ANOVA was used to determine whether there were statistically significant differences in the FOCUS Total score at the three assessment points, and post-hoc pairwise comparisons were conducted to determine where significant differences existed. We also further characterized changes on the FOCUS Total score between assessment points into (a) minimally clinically important difference (16+), (b) possibly a meaningful clinical change (9-15), and (c) not likely a meaningful clinical change (< 9) according to the FOCUS interpretation guidelines (Thomas-Stonell et al., 2013). The subskill scores on the FOCUS were also analyzed using repeated measures ANOVA to determine whether changes occurred in specific skills.

Paired t-tests were conducted to investigate the difference in CDI scores from pre-to-post intervention to determine whether children made statistically significant changes in expressive/receptive vocabulary skills. No CDI scores were available at the follow-up session. The CDI Words and Gestures has norms for children up to 18 months of age, but most of the children enrolled in this study were older than this. Since no age-appropriate

normative information was available, we were unable to further determine whether significant changes occurred at an individual level (e.g. using non-overlapping 90% confidence intervals of the pre- and post-intervention CDI scores) or to comment on whether the magnitude of change on the CDI scores were within the limits of the standard error of measurement of the tool (i.e. resulted from measurement errors rather than meaningful change).

The number of children classified in each CFCS level was also computed for each assessment point. Non-parametric Friedman test and Wilcoxon signed-rank tests were conducted to determine whether a significant proportion of children changed CFCS communication levels between assessments.

Backward regression analyses were conducted to identify which predictors identified by clinicians significantly predicted change on the FOCUS immediately after the program (i.e. pre-to-post intervention) and after the consolidation period (i.e. pre-intervention to follow-up).

Results

Participants' age, sex, FOCUS Total Score, FOCUS subskill scores, CDI scores, and CFCS levels at pre-intervention, post-intervention, and follow-up are presented in Table 1.

Table 1. Characteristics of children in the Target Word Program

Characteristic	Pre-intervention (<i>n</i> = 59)	Post-intervention (<i>n</i> = 38)	Follow-up (<i>n</i> = 23)
Age in years (<i>SD</i>)	1.42 (0.28)	2.11 (0.30)	2.54 (0.32)
Sex (M:F)	40:19	27:11	16:7
<i>Communication Function Classification System</i>			
Level I	0	0	1
Level II	0	0	8
Level III	6	12	2
Level IV	46	23	8
Level V	4	0	1
Missing	3	3	3
FOCUS			
Total score (<i>SD</i>)	144.5 (33)	182.9 (44)	207 (62)
Capacity/Activities subscales			
Speech	1.7 (0.8)	2.4 (1.1)	3.2 (1.6)
Expressive Language	1.5 (0.5)	2.7 (1.3)	3.6 (1.6)
Pragmatics	3.0 (1.1)	4.0 (1.1)	4.6 (1.1)
Receptive Language	4.5 (1.0)	5.0 (1.0)	5.3 (1.0)
Performance/Participation subscales			
Intelligibility	1.9 (0.9)	2.6 (1.2)	3.3 (1.7)
Expressive Language	1.2 (0.5)	1.8 (1.1)	2.7 (1.8)
Social	3.4(1.0)	4.0 (1.1)	4.4 (1.3)
Independence	3.2 (1.1)	4.3 (1.2)	4.5 (1.5)
Emotion	4.1 (1.2)	4.8 (1.0)	4.8 (1.3)
CDI			
Number of words understood	217 (101) ^a	279 (79) ^b	Not available
Number of words produced	49 (51) ^a	97 (80) ^b	Not available

Note. *n* = The number of children included at each assessment point based on the availability of FOCUS data: *n* = 59 completed the FOCUS at pre-intervention, *n* = 38 completed FOCUS at both pre-and post-intervention, and *n* = 23 completed FOCUS at pre-post and follow-up.

FOCUS = *Focus on the Outcomes of Communication Under Six* (Thomas-Stonell et al., 2010)

CDI = *McArthur-Bates Communicative Development Inventories* (Fenson, Marchman, Thal, Dale, & Reznick, 2007)

^a Based on *n* = 67 children with pre-intervention CDI data.

^b Based on *n* = 49 children with post-intervention CDI data.

Participant characteristics pre-intervention

The three most commonly reported risk factors were limited vocabulary with few verbs (*n* = 60); family history of speech, language, or learning disorders (*n* = 50); and

quiet as an infant ($n = 30$) (Appendix 1). The most common intervention goals were imitation ($n = 23$), single words ($n = 21$), and word combinations ($n = 18$). Two children had noisy as their therapy goal. We were unable to identify the goals from the charts of 12 children.

On average, at pre-intervention, children scored 144.5 points ($SD = 33$, range = 69-214) on the *FOCUS* ($n = 58$) and could understand 217 ($SD = 101$) words and speak 49 ($SD = 51$) words according to parent report on the CDI ($n = 67$) (see Table 2). Because the CDI Words and Gestures was normed for children younger than those in our sample, we could not determine whether individual children's scores were age-appropriate. However, we did count the number of children who scored below the 15th percentile of the 18-month-old data (i.e. the oldest available norm). For children with pre-intervention CDI data, 55% ($n = 37$) had an expressive vocabulary score below the 15th percentile for an 18-month-old child.

Missing data

Of the 76 clinical charts reviewed, 59 had FOCUS data at pre-intervention and 38 had complete pre- and post-intervention FOCUS data; 67 charts had CDI data at pre-intervention and 49 also had post-intervention CDI forms. Due to the amount of missing data, we compared child characteristics at pre-intervention to ensure there were no differences between the children for whom we had complete versus incomplete post-intervention FOCUS data. At pre-intervention, there were no differences between the two groups on sex, age, goal in the *Target Word* program, FOCUS Total score, or expressive and receptive vocabularies on the CDI (see Table 2).

Table 2. Pre-intervention characteristics of children with and without post-intervention FOCUS data

Characteristic	With post-intervention data (<i>n</i> = 38)	Without post-intervention data (<i>n</i> = 38)	<i>p</i>
Age in years (<i>SD</i>)	1.92 (0.29)	1.92 (0.32)	0.995
Sex (M:F)	27:11	24:14	0.464
<i>Communication Function Classification System</i> [†]			0.854
Level III	4	2	
Level IV	29	18	
Level V	3	1	
Missing	2	17	
<i>Goal in Target Word</i>			0.117
Noisy	0	2	
Imitation	11	12	
Single Words	15	6	
Word Combinations	8	10	
Missing	4	8	
FOCUS			
Total score (<i>SD</i>)	142 (29)	150 (37) ^a	0.347
CDI			
Number of words understood	230 (88)	202 (115) ^b	0.263
Number of words produced	49 (56)	47 (47) ^b	0.855

^a *n* = 21

^b *n* = 30

FOCUS = *Focus on the Outcomes of Communication Under Six* (Thomas-Stonell et al., 2010)

CDI = *McArthur-Bates Communicative Development Inventories* (Fenson, Marchman, Thal, Dale, & Reznick, 2007)

Note: Independent t-tests were used to compare continuous variables (i.e. age, FOCUS scores, CDI scores) and none of these variables violated the assumption of equal variance ($p \geq 0.06$ on Levene's Test). Chi-square tests were used to compare categorical variables (i.e. sex, Communication Function Classification System, goal in Target Word program) for children with and without post-intervention data.

Communicative participation changes

Data for 23 children with FOCUS scores at all assessment time points were entered into a repeated measures ANOVA. FOCUS Total scores increased significantly across the three assessment points ($F(2,44) = 31.22, p < 0.001, \eta^2_{\text{partial}} = 0.587$). Post-hoc pairwise comparison with Bonferroni correction ($\alpha = 0.016$) revealed a significant

increase in FOCUS scores between pre-intervention and post-intervention ($t(22) = -6.792$, $p < 0.001$) and between pre-intervention and follow-up ($t(22) = -6.43$, $p = 0.001$) but no significant difference between post-intervention and follow-up ($t(22) = -2.39$, $p = 0.026$). Due to the amount of missing data, we also ran linear mixed effect modelling to verify that statistically significant changes in FOCUS Total scores between assessment points could still be observed if all data were included in the analysis (see Appendix 4). The predicted FOCUS scores from the linear mixed effect model were similar to the scores available in our dataset. Both repeated measures ANOVA and linear mixed effect modelling found significant changes in FOCUS Total score across assessment points.

Using the recommended interpretation of FOCUS change scores, we also identified the number of children who met the minimally clinically significant change criterion in their communicative participation skills (i.e. 16 points). Three-quarters of children made clinically significant improvements on the FOCUS from pre- to post-intervention and from pre-intervention to the follow-up session (See Figure 2). For the 23 children for whom we have follow-up data, 43% ($n = 10$) made further minimally clinically significant change (i.e. gained at least 16 points during both the intervention and consolidation), while 48% did not make gains during the consolidation period (see Figure 2). To better understand how children changed in their communicative participation skills, we grouped the patterns of changes in FOCUS scores into four profiles (see Figure 3): (a) Profile 1: Child gained at least 16 points in FOCUS Total score from pre- to post-intervention, but lost at least 16 points between post-intervention and follow-up ($n = 5$), (b) Profile 2: Child gained at least 16 points in FOCUS Total score from pre- to post-intervention and maintained this gain between post-intervention and follow-up ($n = 6$),

(c) Profile 3: Child made no gains between pre- and post-intervention but gained at least 16 FOCUS Total score points between post-intervention and follow-up ($n = 2$), and (d) Profile 4: Child gained at least 16 points in FOCUS Total score from pre- to post-intervention and again between post-intervention to follow-up ($n = 10$).

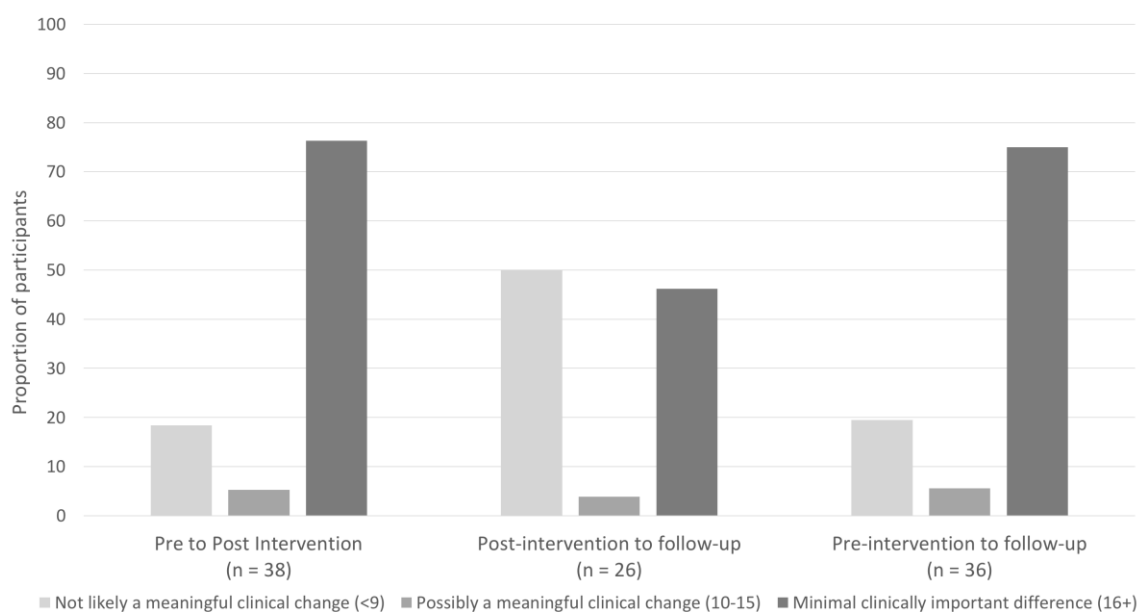


Figure 2. Changes in FOCUS Total score.

A within-subjects repeated measures ANOVA (2 assessment times and 9 FOCUS subskill scores) was conducted to explore which FOCUS subskill score(s) contributed to the changes in FOCUS Total score. There was a significant interaction between assessment points (pre and post) and FOCUS subskill scores ($F(1, 5.69) = 4.40$, $p \leq 0.001$; Greenhouse-Geisser adjusted). Post-hoc pairwise comparisons with Bonferroni adjustment ($\alpha = 0.006$) revealed significant improvements in all but one of the FOCUS subskill scores from pre- to post-intervention ($p = 0.02$ for the receptive language subskill and $p \leq 0.001$ for all other subskills).

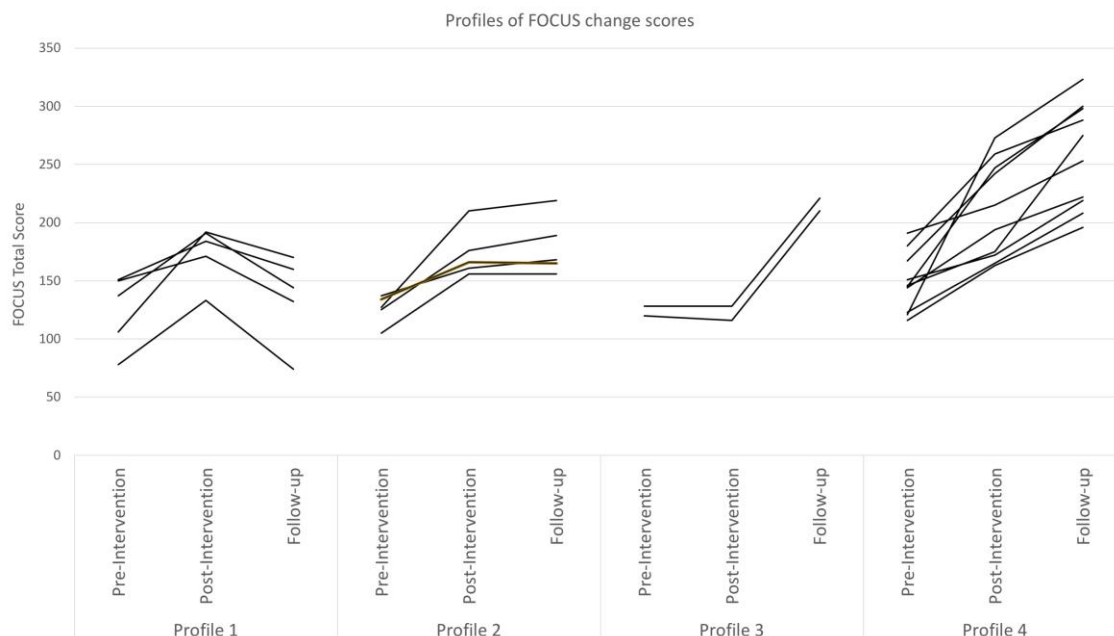


Figure 3. Different profiles of changes in FOCUS Total score.

Expressive and receptive vocabulary changes

We had complete pre- and post-intervention CDI data on 49 children. Prior to the *Target Word* program, these children produced an average of 47 words ($SD = 50$) and understood an average of 216 words ($SD = 98$). At the end of the program, children produce an average of 97 words ($SD = 80$) and understood an average of 279 words ($SD = 79$) (see Table 2). During the program, children gained an average of 55 words ($SD = 54$) expressively and an average of 53 words ($SD = 37$) receptively. These changes were statistically significant ($t(48) = -7.10, p < 0.001$ and $t(48) = -9.95, p < 0.001$, respectively). CDI data were not available at the follow-up assessment. Since most children were over 18 months of age when they began the program, we are unable to report whether their expressive and receptive vocabulary skills were at, below, or above age expectations or whether the changes in scores were clinically meaningful.

Changes in levels of communicative function

Significant changes in CFCS levels were found during the *Target Word* Program ($\chi^2(2) = 12.05, p = 0.002$). Post-hoc Wilcoxon signed-rank tests revealed that children made significant improvements in communicative functioning from pre- to post-intervention ($Z = -3.317, p = 0.001$) and from pre-intervention to follow-up ($Z = -3.659, p < 0.001$), but not from post-intervention to follow-up ($Z = -2.311, p = 0.021$) (Bonferroni adjusted $\alpha = 0.016$).

Predictors of outcome from the clinician survey

Twenty-five *Target Word* certified SLPs responded to the online survey. Because we had no way of confirming that all coordinators forwarded the survey link to *Target Word* certified SLPs in their regions, we were unable to determine how many SLPs were reached using our recruitment method to provide an estimation of response rate. We know that there are at minimum 60 SLPs across the province who offer *Target Word*, so the response rate was a maximum of 42%. The three most commonly selected risk factors were “not imitating verbal models” ($n = 17$), “language stagnation to date” ($n = 13$), and “parent interaction style” ($n = 12$) (see Appendix 1). To avoid inflation of false positives, we only explored three predictors, following the heuristic practice of exploring one predictor per ten observations. These predictors were entered into a backward regression analysis (summarized in Table 3). None of these risk factors were significant predictors of FOCUS change between pre- and post-intervention ($F(3,33) = 0.362, p = 0.781$). For FOCUS change between pre-intervention and follow-up, language stagnation to date was not a significant predictor and was eliminated from the regression model after step 1. In step 2, when the variance contributed by parent interaction style was controlled, verbal imitation risk was a significant predictor of FOCUS change scores ($F(2, 30) = 3.715, p =$

0.036). Children who had limited verbal imitation at the beginning of the *Target Word* intervention made fewer gains on the FOCUS from pre-intervention to follow-up. Our regression did not violate the assumption of circularity ($VIFs \geq 1.007$).

Table 3. Predictor analysis of changes in FOCUS (Focus on the Outcomes of Communication Under Six) Total scores

Variables	<i>t</i>	<i>p</i>	Standardized β	<i>F</i>	<i>df</i>	<i>R</i> ²	<i>p</i>
Pre- to post-Intervention FOCUS change							
Model 1 (Final model)				0.362	3,33	0.032	0.781
Verbal imitation risk	0.040	0.968	0.007				
Parental interaction risk	1.000	0.325	0.182				
Language stagnation to date	-0.128	0.899	-0.023				
Pre-intervention to follow-up FOCUS							
Model 1				2.664	3,29	0.216	0.067
Verbal imitation risk	-1.837	0.076	-0.312				
Parental interaction risk	1.808	0.081	0.300				
Language stagnation to date	-0.805	0.428	-0.137				
Model 2 (Final model)				3.715	2,30	0.199	0.036*
Verbal imitation risk	-2.094	0.045*	-0.344				
Parental interaction risk	1.915	0.065	0.314				

* $p < 0.05$

Discussion

The primary objective of this study was to provide an ecologically valid evaluation of a parent-implemented language intervention for children who are late-to-talk. We conducted a retrospective clinical chart review of 76 children whose parents/caregivers participated in the *Target Word* program in a publicly funded, community clinic. Three-

quarters of children showed clinically significant gains in their communicative participation skills (reflected by FOCUS scores) and statistically significant gains in expressive and receptive vocabularies (reflected by CDI scores) immediately following the 10-week program. The majority of these children maintained their communicative participation gains during a three-month consolidation period in which they were not in regular contact with the SLP. Clinicians' CFCS classifications corroborated the findings from parent-report FOCUS and CDI scores. Clinicians classified children as improving in their levels of communicative function following the intervention. Our data provide some preliminary evidence that the *Target Word* program may effectively improve preschoolers' communicative participation skills and further investigation is warranted.

As a group, children made significant gains in their communicative participation skills and communicative function (reflected by both FOCUS scores and CFCS levels) while parents/ caregivers were actively participating in the *Target Word* program, but not during the consolidation period. It may be tempting to conclude that the consolidation period is not particularly effective, however, a more detailed exploration of the individual profiles of children's FOCUS change scores revealed four patterns of change during intervention. Our exploratory analysis revealed that 43% (10 of 23) of children made clinically significant gains on the FOCUS during both the active intervention period and again during the consolidation period. In contrast, a smaller group of children (5 of 23) made clinically significant gains during the active intervention period only and regressed during the consolidation period. This individual profile analysis shows that the consolidation period may be effective for some children, but not others. Our ability to further understand what child and family characteristics may predict these outcome

profiles was limited by our sample size, but the predictors of communicative participation changes we identified provide a fruitful start for future research.

The secondary objective of this study was to identify predictors of communicative participation changes. *Target Word* certified SLPs identified “not imitating verbal models,” “parent interaction style,” and “language stagnation to date” as the most likely pre-intervention predictors of children’s changes in the intervention. Those factors did not predict change in communicative participation skills immediately following intervention, but verbal imitation risk was a significant predictor of communicative participation changes at follow-up when the variance contributed by parent interaction style was controlled. Children identified as at risk due to limited verbal imitation made fewer gains in communicative participation skills than those without this risk factor. One interpretation of this finding is that limited verbal imitation was an indicator of other developmental issues such as oral motor impairment or autism spectrum disorder. Another possible interpretation is that a child’s ability to imitate is a foundational skill that is necessary before language stimulation strategies taught to parents during the *Target Word* program can be effective. In both cases, a restricted ability to imitate may limit the benefits children derive from the *Target Word* program, suggesting that clinicians should closely monitor children presenting with verbal imitation risk to ensure the effectiveness of the intervention provided. It is important to note that verbal imitation risk alone was not a significant predictor of communicative participation changes, but became a significant predictor when parent interaction style was controlled in the regression analysis. This suggests that parent interaction style likely is an important consideration when predicting children’s changes in intervention, but our small sample

size may have limited our ability to detect it as a predictor. We encourage future studies to continue to consider the role of parent interaction style as a predictor of intervention changes.

Limitations and future directions

The changes found on the FOCUS, CDI, and CFCS should be interpreted with some caution. Due to the retrospective nature of this study, we did not have a control group to whom we could compare changes in the scores. This means it is possible that the observed changes were the result of maturation instead of intervention. However, based on the results of the validation study conducted on the FOCUS, we do not believe this is the case. Thomas-Stonell et al. (2013) found that a change score of 16 points on the FOCUS (i.e. the cut-off we used in this study to identify children who made clinically significant gains) was unlikely to be found in children on a waitlist for services. Given this work, it seems unlikely that children who made 16 points or more of change on the FOCUS in the current study did so as a consequence of maturation alone. We also compared the expressive vocabulary changes on the CDI to the normative data reported by Fenson et al. (1994). On average, children started the *Target Word* program at 23 months old with 47 spoken words and were 25 months old at the end of the program with 97 spoken words (i.e. an average gain of 50 words over the 2-month intervention period). According to the normative data from Fenson et al., children performing at the 50th percentile for expressive vocabulary have roughly 50 words at 16 months and 100 words at 18 months (i.e. a gain of 50 words in a 2-month period of natural growth). In other words, during the *Target Word* program, children who are late-to-talk were developing expressive vocabulary at an average rate. Given that many children began the *Target*

Word program with an expressive language skill below the 15th percentile for 18-month olds, which placed their expressive language development at a slower rate than average, our result could suggest that the intervention accelerated the expressive vocabulary development in these late-talkers. However, only data on rate of vocabulary growth during a baseline period would be able to confirm this.

Another limitation of this study is the amount of missing data from the clinical charts. Complete pre- to post-intervention data were not available for half of the 76 families who participated in the *Target Word* program. We compared child-specific characteristics at pre-intervention and can report that the children for whom we had complete data were not different from those with incomplete data, but there is no way for us to know whether children with and without complete data would be different post-intervention. Similarly, we lacked information such as intervention dosage (e.g. the amount of time parents spent practicing language strategies at home with their child) and the statistical power to control for individual differences in intervention goals and parental attendance that would allow us to more comprehensively investigate the effectiveness of the *Target Word* program. Our limited sample size also restricted our ability to explore more than three predictors of change in intervention from the list of 34 collected as part of the *Target Word* program. It is possible that other predictors identified by clinicians were significant predictors of communication participation changes.

A final concern relates to our lack of information about the size of children's expressive and receptive vocabularies relative to same-age peers. Although all children who participated in the program met the pre-determined inclusion criteria (see Methods

section) and were identified as late-talkers after an assessment by a SLP, we do not have norm-referenced language assessment information for most children. The lack of such information prohibited us from (a) providing a baseline description of the children's language ability relative to their same-aged peers and (b) fully understanding the clinical relevance of changes in children's vocabularies.

There is a dearth of literature exploring parents' experiences providing early intervention for their late-to-talk children. One future direction is to explore parents' experiences in the *Target Word* program in order to understand why some children make clinically meaningful changes in their communicative participation skills while others do not. One possible barrier may be caregivers' expectations as Glogowska and Campbell (2000) found that many parents expected the SLP to provide the bulk of the therapy to their child. Other barriers may include parental self-efficacy, their perceptions of the usefulness of language facilitation strategies, and their ability to implement strategies at home with their child (Roulstone et al., 2015).

Another future direction is to understand the effectiveness of the *Target Word* program in comparison to a control group. As discussed above, the lack of a waitlist control group in our study limited our ability to fully contextualize the changes in various outcome measures. In particular, we cannot confirm that the changes observed were due to intervention versus maturation. Future research using a prospective, randomized control design could address this.

Conclusion

A major contribution of our study is that our findings reflect day-to-day clinical practice, thereby providing evidence for the real-world *effectiveness* (as opposed to

efficacy) of the *Target Word* program. As pointed out by Roberts and Kaiser (2011), most current intervention studies lack external validity given that families who volunteered to participate in research studies rarely reflected the diversity of families seen as part of routine care. Additionally, we evaluated communicative participation outcomes, an outcome focused on how children use their communication to engage in everyday encounters that has largely been ignored in our profession until recently. Finally, we found that two predictors identified by *Target Word* certified-SLPs (verbal imitation risk and parent interaction style) play an important role in children's communicative participation after the program, underscoring the value of bringing the expertise of front-line clinicians into the research process (Crooke & Olswang, 2015).

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Chapter 3

Barriers and facilitators to the implementation of a preschool outcome measure: Speech-language pathologists' perspectives

Outcome measures are tools to assess patients' condition and status (Enderby, John, & Patheram, 2013). If collected over time (e.g., over the duration of an intervention), changes on the outcome measure allow clinicians to gather information on patient progress (John & Enderby, 1999). Outcome measures add value to the healthcare system (Department of Health, 2000; Weinstein, Siegel, Gold, Kamlet, & Russell, 1996). For policy-makers, data collected from health outcome measures provide a basis to evaluate the effectiveness (cost and otherwise) of the health care system (Sanders et al., 2016; Weinstein et al., 1996). For healthcare professionals, outcome measures can demonstrate treatment effectiveness and support clinical decision-making (American Speech-Language-Hearing Association, 2017). Outcome measures that are completed by patient or caregiver report are particularly useful because they can positively impact treatment (Black, 2013; Kotronoulas et al., 2014). When a consistent outcome measure is used within a delivery-of-care system, it enables clinicians and researchers to compare the effectiveness of different interventions (Black, 2013).

For speech-language pathologists (SLPs), an initial challenge to the implementation of outcome measures was the lack of functional, reliable and sensitive measures (Mullen & Schooling, 2010). This led to the development of Therapy Outcome Measures (TOMs) in the United Kingdom (John & Enderby, 1999, 2000), the National Outcomes Measurement System (NOMS) in the United States (Mullen, 2004), and the Australian Therapy Outcome Measures (AusTOMs) in Australia (Perry et al., 2004). While SLPs in these countries have been encouraged to use these tools, it is unclear

whether and to what extent they have been adopted into practice (e.g., see report from American Speech-Language-Hearing Association, 2017).

In Canada, a national outcome measurement system for preschoolers with communication disorders is lacking, but a provincial outcome monitoring tool was introduced by the Ontario Ministry of Children, Community and Social Services' Preschool Speech and Language (PSL) Program. In the publicly-funded PSL Program, 400 SLPs provide services to over 60,000 preschoolers at 30 regional sites each year. Since 2012, the PSL Program mandated the use of the *Focus on the Outcomes of Communication Under Six (FOCUS)*, a parent-report tool that measures change within the Activities and Participation components of the World Health Organization's International Classification of Functioning (ICF), Disability and Health framework (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2010). The ICF framework considers health from biological, individual and social perspectives, and describes health conditions as interactions between three components (Body Functions & Structures, Activities, and Participation) and two contextual factors (Environmental and Personal) (World Health Organization, 2001). The Activities component describes children's abilities to perform different tasks or actions, whereas Participation describes children's involvement in life situations. Children's outcomes within the Participation component have been reported to be most meaningful and important to parents (Lindsay & Dockrell, 2004; S. Roulstone, Coad, Ayre, Hambly, & Lindsay, 2013) and the FOCUS is one of the few tools available to SLPs to measure these outcomes (B. J. Cunningham et al., 2017). Furthermore, the items on the FOCUS were gathered from SLPs' and parents' descriptions of the changes they observed in children after receiving community-based

speech and language therapy (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2009). Validation studies showed that the FOCUS has good test-retest and interrater reliability, as well as strong content and construct validity (Thomas-Stonell et al., 2010; Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2013). As an outcome measure, the FOCUS provides validated cut-off scores that are sensitive to changes as a result of intervention as opposed to natural development (Oddson, Washington, Robertson, Thomas-Stonell, & Rosenbaum, 2013; Thomas-Stonell et al., 2010, 2013; Washington et al., 2013). Despite its research rigour and nearly eight years of mandated use, inconsistent implementation within the Ontario PSL Program has been reported (B. J. Cunningham, Hanna, Rosenbaum, Thomas-Stonell, & Oddson, 2018; Kwok, Cunningham, & Oram Cardy, 2019; Smyth, Theurer, Archibald, & Oram Cardy, 2020). One retrospective chart review of one clinical site involved in the PSL Program found 22-70% of expected FOCUS data were missing (Kwok et al., 2019).

Successful implementation is needed to ensure SLPs, families, and programs maximize the benefit of functional outcome measures like the FOCUS. The implementation of the FOCUS offers a unique opportunity to investigate factors that may hinder or enable the adoption of an Activities and Participation-based outcome measurement tool at a population-level. An essential first step towards full implementation is understanding the facilitators and barriers from the perspective of those using the tool every day (Graham et al., 2006). Within speech and language therapy, there is an emerging research focus on implementation (Campbell & Douglas, 2017), but research work employing explicit theory is needed to inform the development

of useful interventions to improve implementation (Estabrooks, Thompson, Lovely, & Hofmeyer, 2006; Skeat & Perry, 2008).

The implementation science literature offers several frameworks to guide the investigation of factors influencing implementation (Moullin, Sabater-Hernández, Fernandez-Llimos, & Benrimoj, 2015). Of note, the *Theoretical Domains Framework (TDF)* was developed through a comprehensive review of behavioural change theories in the social and behavioural sciences (Cane, O'Connor, & Michie, 2012; Michie et al., 2005). This 14-domain framework integrates 128 theoretical constructs across 33 theories to offer a comprehensive foundation for identifying barriers and facilitators to implementation (Atkins et al., 2017; Cane et al., 2012). An example domain in the TDF is *Knowledge*, defined as “awareness of the existence of something (e.g., about procedures, rationales, environment etc.)” and has been reported as a barrier to evidence-based practice (Cane et al., 2012). Aside from being evidence-based and comprehensive, the TDF may be particularly suitable for the current study for two reasons. First, the TDF is designed specifically to understand factors that influence health professionals’ uptake of evidence-based practices (Atkins et al., 2017). Second, the TDF provides guidance on selecting behavioural change techniques, which are evidence-informed strategies, to address barriers in each TDF domain (Cane, Richardson, Johnston, Ladha, & Michie, 2015).

The goals of the current study include: (1) to identify and describe the facilitators and barriers frequently experienced by SLPs in Ontario, Canada to implementing the FOCUS in clinical practice; (2) to categorise the facilitators and barriers into the 14 domains of the *Theoretical Domains Framework (TDF)*; and (3) to consider how the

results might be used to design and implement strategies to improve uptake of the FOCUS into clinical practice.

Materials and methods

Study setting and participant recruitment

The province of Ontario in Canada is geographically large (size: 1.076 million km²) and ethnically diverse (36.5% of the population self-identify as visible minorities). Understanding users' experiences across contexts is critical to implementation planning (Wensing, Bosch, & R., 2009). In order to account for the diverse contextual factors (e.g., client demographic composition, management structure) across service regions, a purposive sampling approach was used to recruit SLPs from each of the 30 PSL Program regions. Managers were asked to forward a recruitment email to SLPs in their region. In the email, SLPs willing to participate were asked to contact the first author to schedule a telephone interview. Through this approach, 37 SLPs volunteered to participate in the study.

The Ontario PSL Program provides services children with a wide range of speech, language and communication difficulties (e.g., global developmental delay, pragmatic communication disorder, childhood apraxia of speech, late talkers, autism spectrum disorder) from birth to school-entry (age 4 or 5 in Ontario Canada). Families can self-refer to the program or they can be referred by other healthcare providers (e.g., paediatrician). The clinical practices of individual SLPs vary significantly within the PSL Program. Typically, children and their parents or caregivers attend an hour-long assessment appointment where a SLP determines the child's eligibility for services. In some cases where children are known to have complex needs, SLPs will conduct this

assessment as part of a multidisciplinary team. Eligible children are placed on a waitlist for intervention services. The length of the waitlist depends on multiple factors including the child's age, type of speech-language impairment, and intervention program availability. Intervention services vary based on the needs of the child and family and can include parent training, childcare visits and consultation, and group and individual intervention.

Data collection

During recorded telephone interviews, SLPs were asked to describe their practice setting, and their experience and roles within the PSL Program. SLPs then described the current context for implementation of the FOCUS in their practice, and the barriers and facilitators they had encountered with fully implementing the FOCUS (see Appendix 5 – Interview Script). The interviews lasted around 30 minutes.

Data Analysis

With the exception of identifying information (e.g., names of individual SLPs and PSL Program regions), which were replaced with pseudonyms, all interview recordings were transcribed verbatim. A research assistant reviewed all transcripts to ensure transcription fidelity.

Interview transcripts were analysed using a deductive (i.e., theory-driven) approach, which involved categorising the facilitators and barriers reported by SLPs into the 14 domains of the *Theoretical Domain Framework (TDF)* (Cane et al., 2012). Deductive-analysis involves three phases (Burla et al., 2008; Elo & Kyngäs, 2008): (i) preparation; (ii) organisation; (iii) analysis and reporting (summarized in Figure 4).

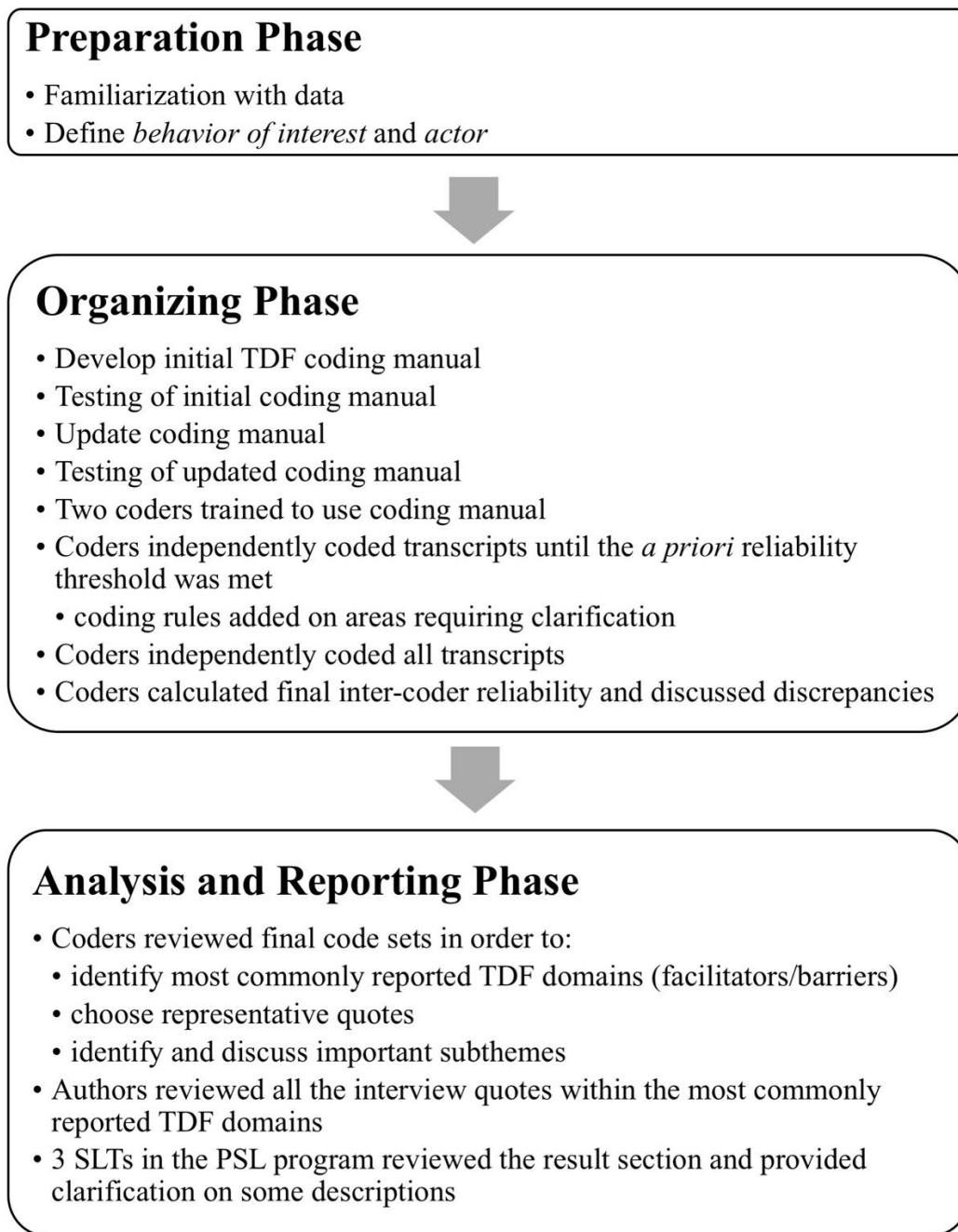


Figure 4. Steps in data analysis

Preparation phase: To familiarise themselves with the data, the two coders participated in transcription of the interviews and repeated reading of the transcripts. The coders were the first author and a research assistant, and both were speech-language

therapy graduate students who had completed clinical placements in the PSL Program. At this phase, a definition was given to the *behaviour of interest* and the *actor* of such behaviour as per the recommendation for TDF application (Atkins et al., 2017). For the purposes of this study, the *behaviour of interest* was completing the FOCUS (i.e., either the SLP completed the clinician version of the FOCUS by interviewing parents, or the SLP invited parents to complete the parent version of the FOCUS) according to the administration guidelines (i.e., completed at initial assessment and re-administered within 6 months or following a major change in services); and the *actor* in this study would be the SLP being interviewed.

Organising phase: First, a preliminary coding manual was generated by the first author through reviewing the literature on the TDF. The first author and second author (a researcher with experience in knowledge translation and implementation science) evaluated the coding manual by independently using it to code two transcripts with the aim to: (a) operationalize the definitions of each of the TDF domains for the current study, and (b) add example quotes from the transcripts to contextualise each TDF domain (Burla et al., 2008). To reduce ambiguity and overlap between domains, definitions, example quotes, and specific inclusion and exclusion criteria were added to the coding manual. This updated coding manual was tested on two additional transcripts to ensure comprehensiveness.

The two coders were trained to use the updated coding manual. After training, the two coders independently applied the coding manual to one transcript then met to calculate their coding reliability and discuss any coding discrepancies. This process was repeated until the coders achieved a reliability higher than an *a priori* Kappa value of

0.61, which is considered substantial agreement (Landis & Koch, 1977). When appropriate, the coders added explicit coding rules to the coding manual to improve reliability. After the coders reached the reliability threshold, they independently coded all the transcripts using Nvivo 12 software (QSR International, Burlington, MA). Engaging two coders and ensuring independence during the coding process improved the trustworthiness (i.e., external validity) of our analysis (Burla et al., 2008; Elo et al., 2014). Once coding was completed independently, the coders compared their codes to calculate inter-coder reliability and resolve disagreements in coding.

Analysing and reporting phase: The coders reviewed the final coded sets to identify TDF domains that were most commonly reported as facilitators or barriers by SLPs. The coders calculated the frequency with which each of the TDF domains was reported as a facilitator or barrier in the 30 program regions, which provided a quantitative index to objectively identify the most prevalent barriers and facilitators. For each domain, representative quotes were chosen from the final coded set, and a brief description was written to summarise the content. For TDF domains that were perceived as a barrier or facilitator in the majority (i.e., greater than 50%) of the PSL Program regions, thematic analysis was conducted on the interview quotes within those domains. This additional inductive analysis is a common practice when applying the TDF (see for example, Heslehurst et al., 2014; Atkins et al., 2017; Weatherson et al., 2017; Istanbulian et al., 2019) because it provides more nuanced understanding of the contextual challenges within the broader TDF framework. Thematic analysis was only conducted on TDF domains most frequently reported in the PSL Program. This is because we reasoned that these domains represented factors that had the strongest impact

on FOCUS implementation at the program level, and thus should be further understood. In addition, we believe that these particular TDF domains also contained sufficient perspectives from SLPs to satisfy the data richness and complexity requirements of thematic analysis (Braun and Clarke, 2006). For the frequently reported TDF domains, two coders independently completed the thematic analysis by generating initial codes for interesting features in the interview quotes, then organized these codes into themes (i.e., recurring ideas) (Braun and Clarke, 2006). Two coders then met to discuss the themes they found within each frequently reported TDF domain. Once the coders came to consensus on the key themes, they wrote a brief description of the themes and selected representative quotes.

To further reduce bias and ensure accuracy, all authors independently reviewed the interview quotes within the most commonly reported TDF facilitator and barrier domains. To maximise external validity, member-checks were completed with three SLPs working in the PSL Program. These SLPs were recruited because they were participants in other ongoing research projects being conducted by members of our team (i.e., convenience sampling). They received a written report of the results (i.e., the TDF domains identified as facilitators and barriers, themes within each domain along with their descriptions and quotes) and were asked to provide written comments on whether the results accurately represented their experience. SLPs were encouraged to suggest modifications to help clarify and enrich the reported results.

Results

Participants

Thirty-seven SLPs participated in the semi-structured interview over the telephone (average length: 25 minutes). Participants had a median of nine years of clinical experience within the PSL Program (range: 1-24 years). We were able to interview at least one SLP from each of the 30 program regions, who provided some insights into the unique challenges in the different clinical contexts. Because there was no way for us to verify that managers had forwarded our email to all SLPs in their region, we could not provide an estimate of the response rate. We do know there were approximately 400 SLPs working in the Ontario PSL program at the time the interviews were conducted, which means our sample represented 9.25% of potential participants.

Coding reliability

The definitions for the TDF domains are presented in Table 4 and the full coding manual is available as Appendix 6. The two coders exceeded the *a priori* threshold of reliability for the coded TDF domains (i.e., $k \geq 0.61$) after independently using the manual to code one transcript, so no modification was made to the coding manual. The coders discussed and added seven specific coding steps to improve consistency in coding (see Appendix 6). Overall, 402 units (i.e., relevant segments of interview transcript, usually a couple sentences in length) were coded into the 14 TDF domains and the kappa value between the two coders was 0.72 (percentage agreement = 79%). After inter-coder reliability was calculated, all disagreements in coding were resolved through discussion to consensus. Analysis of the final coding revealed that item saturation was reached at the 30th interview, and no new TDF domains or themes were identified after that interview.

Table 4. TDF domains and definitions (operationalized for the current study)

Constructs	Definition (operationalized for the current project)
Knowledge	Awareness of the FOCUS and related procedures
Skills	Ability/proficiency/perceived control over completing/collecting FOCUS data
Professional Identity	Impacts from completing the FOCUS on the behaviors/beliefs/qualities that define the role of the SLPs
Beliefs about capabilities	Opinions regarding SLPs' abilities to complete/collect FOCUS data
Optimism	SLPs' confidence implementing the FOCUS
Beliefs about consequences	Expected outcomes related to implementation of the FOCUS
Reinforcement	Rewards/punishments contingent on implementing of FOCUS
Intention	Conscious effort to implement the FOCUS, related to stages of change model
Goals	Mental representations of what SLPs want to achieve, related to setting goals regarding implementation of the FOCUS
Memory, attention, decision	Ability to retain information on and attend selectively to aspects of the environment
Environmental context	Circumstances of SLPs' surroundings that impact their ability to collect/complete the FOCUS
Social influences	Interpersonal relationships that influence SLPs' thoughts and behaviors related to the FOCUS
Emotions	SLPs' feelings/affect towards the FOCUS
Behavioral regulation	Actions/systems in place that aim directly to change/adjust/monitor completion of the FOCUS

Key implementation factors reported

Overall, SLPs reported more barriers than facilitators when describing their experience implementing the FOCUS (see Figure 5 for the proportion of PSL program reporting factors in each TDF domain). Details of facilitators and barriers per (de-identified) program region is available in Appendix 7. In the following section, we describe frequently reported TDF domains (i.e., those impacting the majority of the PSL program regions) and the themes identified from the interview quotes within those domains. These results were reviewed by three SLP volunteers from within the Ontario PSL Program as a member-check step. All SLPs agreed with the domain descriptions and identified themes accurately represented their perspectives. SLPs' comments were

incorporated into the reported results. In addition, a summary is provided for the facilitators and barriers identified in other TDF domains. All authors agreed that the results accurately represented the coded text.

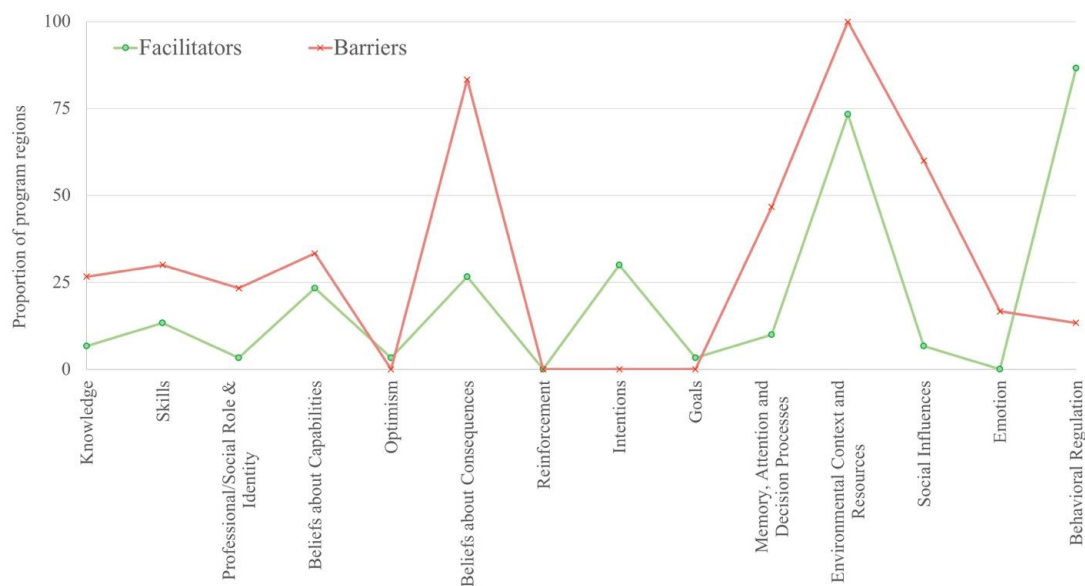


Figure 5. Proportion of program regions reporting facilitators and barriers across the 14 TDF domains

Most commonly reported barriers

Perceived barriers in over 50% of the program regions were found within three TDF domains. These included: (1) Environmental Context and Resources, (2) Beliefs about Consequences, and (3) Social Influences.

1) Environmental Context and Resources

The domain Environmental Context and Resources describes circumstances within SLPs' surroundings that had an impact on their ability to collect/complete the FOCUS. This domain was the most commonly reported barrier, impacting all of the PSL Program regions. Three major themes were identified within this domain. SLPs reported challenges with: (i) integrating the FOCUS tool into assessment sessions, (ii)

incorporating administration of the FOCUS into the intervention schedule at their clinics, and (iii) the complexity of the FOCUS data collection process, which burdened SLPs' and administrative staff's workloads.

(i) *Integrating FOCUS into assessment sessions.* SLPs from 24 PSL Program regions (80%) reported not having sufficient time with families to collect data using the FOCUS. This was particularly problematic during assessment sessions, where they were required to complete the FOCUS within the limited time of assessment sessions (typically one hour in length). SLPs reported having competing demands from required paperwork, assessment tasks, and the priorities of different professionals on a team. These demands often prohibited the collection of FOCUS data. In addition, SLPs reported that it took excessive time during sessions to introduce the FOCUS to parents, particularly at the initial assessment session when parents were completing the tool for the first time.

'Well basically time during our sessions. Biggest hurdle, major hurdle. It [the FOCUS] is not the only thing that is filled out. Here there, for toddlers we are doing a research project and we have to think about that, also and our sessions are an hour to an hour and a half. Really if you want to do a good full assessment initially, if you have a toddler coming in with signs of social communication issues autism and all that. We feel like that there is no time' (SLP09)

'sometimes there is play-based assessments where a team is assessing a child all at once so it could be PT, OT, SLP like lots of different people assessing the child so there's so much going on that it's hard for the parents to be filling out

the FOCUS. Um so that's definitely a barrier when there's just other things going on.' (SLP20)

(ii) *Incorporating the FOCUS into the existing clinic schedule.* SLPs from 19 PSL Program regions (63%) struggled to fit the administration schedule of the FOCUS (no later than every 6 months) into the existing intervention schedule within their region. For example, many SLPs reported that they completed the FOCUS during the initial assessment when a child's candidacy for intervention was decided. Based on needs, after the initial assessment, some children were placed on the waitlist for services while others may begin intervention immediately. In both cases, SLPs reported incompatible timing between when they met with families and when the FOCUS was to be re-administered. Some SLPs reported having long waitlists (over 6 months). For the children on the waitlist, the time gap between the initial and subsequent administration of the FOCUS was often longer than the maximum recommended time of six months, rendering the data invalid for interpretation. Children who began intervention immediately typically received direct SLP services for 6-8 weeks and then had a consolidation period where they were monitored (e.g., parents could call the SLP with concerns), and families did not visit the clinic regularly. In these cases, SLPs reported having difficulty reaching families to complete the FOCUS according to the required assessment schedule. Contacting families to complete the FOCUS was also reported as a challenge when children were being discharged from services either because of their age ('ageing out' of the PSL program upon school entry) or level of ability.

'We've been told that in order for it [the FOCUS] to be valid, it needs to be done uh every six months um and no more than every six months. But we

also run our programs in blocks so they [the clients] get three months worth of services and then three months on a consolidation period. And, by the time they come back from their consolidation period for the next round of services, it's usually over six months' (SLP14)

'The only time we have difficulty getting... so discharge is a point where we have a hard time getting FOCUS back. So if the parents are no longer concerned and they don't book a reassessment, they we never have an opportunity... we email them 25 times and they still won't send us back. So that's a huge challenge.' (SLP32)

(iii) *Workload burden for SLPs' and administrative staff.* SLPs from 19 PSL Program regions (63%) reported challenges specific to the procedures of data collection. The FOCUS data collection process involved many steps, and occasionally involved several personnel, which introduced significant delay in the reporting of data. As well, some SLPs found that the steps in data collection were redundant, often involving entering the same data multiple times.

'So the steps from the parent filling out the paper form, to the point it gets to input to the ministry, there are a lot of steps. That's why the clinicians find this challenging. If it was like "yeah sure, I'll have the parents do that and then it's out of my hair, I'm just sending it on". But there's so many steps because you have to send it to do the data element, put it together, give it to someone to score it, then they bring it back to you, then you have to record it in the EMR [electronic medical record], and then you have to send it back to someone who is going to input it into the ISCIS (the Ministry's) database and

the turnaround time there then becomes an issue with us not meeting our ministry deliverable because we're doing these FOCUS's but they're not getting it in on time. So all this wasted work essentially.' (SLP6)

'Yeah and the data, like the way it works here, it's almost like we got 3 people inputting the same data because the parents are filling out the FOCUS and the SLP is filling out the scoring sheet, and then we have a program assistant that is inputting the data in the system so we have 3 people collecting the data' (SLP18)

2) Beliefs about Consequences

The domain Beliefs about Consequences refers to SLPs' expectations from completing and submitting the FOCUS. Barriers in this domain were reported by SLPs from 25 PSL Program regions (83%). Three major themes were found within this domain. SLPs reported feeling that: (i) FOCUS data did not impact their clinical practice, (ii) FOCUS data were not used by the PSL Program to make system-level decisions, and (iii) the FOCUS data were not valid.

(i) FOCUS data did not impact clinical practice. At 21 of program regions (70%), SLPs reported thinking that data collected using the FOCUS were not relevant to their clinical practice because the FOCUS data did not inform any of their clinical activities (e.g. therapy, recommendations). SLPs explained this was because they felt that some FOCUS items were not representative of children performing at the lower functional levels on their caseloads .

'It's mostly what, what most of the SLPs feel that way. Very few of us use it [the FOCUS], at all really. It doesn't drive our therapies it doesn't drive our

strategies we will recommend, it doesn't really drive anything we do at this point so, so then is really is, it becomes administrative' (SLP07)

'I'll preface this by saying that most, I think it's like 17 or half of the questions [on the FOCUS] are about kids communicating with peers or less familiar adults and typically the kids that I'm seeing are just learning to communicate with their most familiar people which are typically their parents, which is really umm a big deal for these kids but not really reflected in a lot of questions on the FOCUS.' (SLP04)

(ii) *FOCUS data were not used to inform system-level decisions.* SLPs from 11 PSL Program regions (37%) did not believe FOCUS data were used to inform program-level decisions. SLPs reported having received no follow-up information from the PSL Program regarding the collected FOCUS data, which discouraged them from participating in data collection.

'I do think it would be great if there are outcome measures that, you know, show that we're continuing to make a significant progress, or outcomes with these clients, but the other thing with the FOCUS is that it hasn't, we haven't gotten any feedback about how it's being used as a Province so I think that some of the therapists who are using it are frustrated in a sense that we don't know, we're spending so much time and energy submitting these scores and we don't really know what they're being used for.' (SLP19)

'SLP: We have... we've discontinued using the FOCUS probably within this last year, we made the decision to discontinue its use.

Researcher: And why would... can I ask the reason why?

SLP: So what we found was that the only outcomes that's really being reported to the Ministry was what percentage of children was having the FOCUS done. They weren't really seeing the effectiveness of individual intervention.' (SLP12)

(iii) The FOCUS data were not valid. SLPs from 23 of Program sites (77%) explained why they did not believe FOCUS data were clinically relevant. Many of these SLPs said that they had observed families struggling to use the rating scales and comprehend items on the FOCUS. SLPs believed this made it difficult for parents to accurately report their child's abilities. The validity of the FOCUS data was further questioned because different family members may be completing the FOCUS at different assessment points. As family members often have different opinions of a child's skills, SLPs believed the FOCUS data did not accurately reflect the outcomes of intervention, but rather, differences in caregivers' perceptions.

'the number of options [on the FOCUS], seven points, the parents find that very difficult to make a decision. They struggle over whether it's "a little bit like my child", "quite a bit like my child", or "fairly like my child" or whatever the words are. There so, there's such a minuscule difference between them. And then secondary to that, if by chance you happen to have the parent fill it out, um twice in fairly close succession, you know maybe one person did it, didn't realize the other person hadn't and somebody else did it, their answers are all over the place, there's no consistency.' (SLP14)

'there were a couple clinicians that said this, that they didn't necessarily find the score valid in the sense that, I would sort of question it, it's valid for the

parent if that's how they see the client but these clinicians were indicating that they felt that sometimes the parents were very different on the views of their child's skills' (SLP06)

3) Social Influences

The domain *Social Influences* referred to interpersonal experiences that altered SLPs' thoughts, feelings and behaviours towards collecting FOCUS data. SLPs from 18 Program regions (60%) reported that their professional relationship with families of children with communication disorders was a barrier to having parents complete the FOCUS. Many SLPs recounted experiences of parents reacting adversely towards the FOCUS, including bursting into tears, experiencing grief, and getting angry. As a result, many SLPs were reluctant to ask parents to complete the FOCUS.

“Um, so there are a number of issues, but I would say the biggest one is that the impact that it [the FOCUS] has for a lot of the parents that I work with. And I have parents cry when they are filling out, which is... it's not funny. It's quite... it's hard and I don't want to expose undue stress on my families, they have enough challenges that they are facing, and they are working through” (SLP31)

Many SLPs reported that this barrier was exacerbated for families of children with severe communication disorders. SLPs noted that these families found individual items on the FOCUS were biased toward children with higher levels of ability and did not apply to their child. As a result, SLPs felt that asking parents to complete the FOCUS was akin to ‘handing out a platter of everything that is wrong with their child.’ (SLP05)

‘A lot of it [the FOCUS] is about... understandably... is about communication and language. And like some of the pre-intentional nonverbal little kiddos with ASD, you know there's a very few of those items that the families.... or even way very low CP or Down syndrome kids, there's not a lot of questions that families can put higher scores on, and some bottom ones and twos. So it doesn't apply, we tell them [parents] that it is about how we're going to move forward, I don't know how they feel when they fill it out.’
(SLP36)

Most commonly reported facilitators

Perceived facilitators for implementation were reported in the Behavioural Regulation and Environmental Context and Resources domains at over 50% of the program regions.

1) Behavioural Regulation

At 26 Program regions (87%), SLPs reported modifying their habits to ensure collection of the FOCUS data. These behavioural modifications occurred at all steps of data collection. Some SLPs adjusted their behaviour *before* meeting with parents, such as by setting a reminder on the electronic booking system to administer the FOCUS. Some adjustments occurred *during* SLPs’ interactions with families, such as ensuring that they had FOCUS forms available and completed within the clinical session. Some behavioural modifications happened *after* SLPs’ interactions with the families, such as the SLP completing the clinician version of the FOCUS when families could not or did not complete the parent version during the assessment session.

“We do put a reminder in our booking. So the therapist does have to remember that [to input the reminder into the booking system]. But in the booking, we set a reminder to booking. It’s noted and it comes up on the day's log sheet. So when they walk into a session, it says the time the date, and the FOCUS. And so she [the SLP] knows they [the family] need to have the FOCUS done.’ (SLP18)

‘But I always have a copy [of the FOCUS forms] on me during the assessment, so if they didn't bring in their own, they can fill it out during that time.’ (SLP01)

‘A lot of families ask if they can take it home and do it [FOCUS forms], whereas we always encourage... we find that if we let the families take it home to do it, they are not bringing it back in a timely manner. So we give them time in the appointment to be able to fill it out so that we have it before they leave.’ (SLP09)

‘Um, so many kids on my caseload have severe developmental delays or severe communication disorders that it’s been... families have reported distress actually filling these [the FOCUS forms] out. So in those cases I don't continue to give them the form and I complete the clinicians form and in other cases I make that judgement call as to whether this is a tool that is helpful for the family to fill out or if I feel that they may have concerns or if it maybe a challenge to fill out. Um, then I will do the clinician form.’ (SLP31)

2) Environmental Context and Resources

The domain Environmental Context and Resources was also an implementation facilitator. In 22 program regions (73%), SLPs reported having resources such as (i) personnel and (ii) technological support to aid them in completing the FOCUS

(i) Personnel. SLPs from 14 Program regions (47%) reported having administrative support for data collection and entry. In these regions, administrative staff provided clerical support and entered FOCUS scores into the Program's data collection system, which helped reduce errors and SLPs' workload. In some regions, administrative staff provided reminders to ensure SLPs completed the FOCUS. For example, administrative staff would place a FOCUS form into a child's file for the SLPs or contact the SLPs when they noticed a FOCUS form was missing from the file.

'When it first started, we were tallying the scores ourselves, there were lots of errors. So then they employed other people to do that where that was their only thing to do. I think they were volunteers but still they only had to focus on the scores and they think they are satisfied with the outcome of that. So from getting the scores standpoint that's been a huge saviour and also takes a lot of time off of us because you know it's very time consuming to sit there and score.'(SLP34)

'And if we do miss one, (name of staff) has been really good about getting in touch with us and saying you've missed so and so. And she'll do that within a month or less of seeing the child. So there's not too much time between seeing the child and completing the FOCUS. So I think we have a really good system set up here.' (SLP03)

(ii) *Technological support.* In 8 program regions (27%), SLPs reported that their clinic developed some form of technology to facilitate data collection. Technological support reportedly reduced the complexity of the data collection process and reduced SLPs workloads.

‘Well what have helped is we have created spreadsheets in our electronic... oh sorry, flowsheets in our electronic records so it’s now one of the things we can input into that record as we’re doing our assessments. Also creating of the spreadsheet that just calculates the score has been helpful. It makes it faster.’ (SLP08)

In addition to these frequently reported TDF domains, facilitators and barriers were also found in other TDF domains. Due to limited quotes within these domains, we did not conduct a thematic analysis. A description and representative quotes of these domains are presented in Table 5.

Table 5. Description of SLTs’ perspectives across TDF domains

TDF domains*	Frequency (% of total coded units)	Description and representative quote
Environmental Context & Resources	32	Description and summary provided in text.
Beliefs about Consequences	23	
Behavioral regulation	14	
Social Influences	9	
Memory, Attention and Decision Processes	6	Barriers (majority of quotes): SLTs reported forgetting to administer the FOCUS, sometimes because they were overwhelmed by other clinical tasks. ‘...from a therapist point of view, the general cognitive overload. We ask a lot of our therapists. The FOCUS is not the only thing they have to do.’ (SLT18)

		<p>Facilitators (few quotes): SLTs reported when FOCUS administration was associated with an assessment, it was easy to remember to administer the tool.</p> <p>‘It’s easy to remember to do, if it’s part of your assessment every time you do an assessment, you get it completed, you submit it to admin.’(SLT15)</p>
Skills	3	<p>Barriers (majority of quotes): SLTs reported not able to clearly explain items on the FOCUS to parents, or unsure how to interpret the items themselves.</p> <p>‘you can have the speech pathologist explain it to parents but I think it then needs to be more clear to the speech pathologist who is working with those level four and five kids.’ (SLT04)</p> <p>Facilitators (few quotes): SLTs reported developing skills which enabled them to facilitate FOCUS data collection. Examples of these skills include: developing ways to explain the rationale of FOCUS tools, ways to interpret the FOCUS tools with parents.</p> <p>‘I think a lot of it kind of comes with experience. You like we have... when you’ve given it like so many times you tend to know certain questions... so I think one of things that I do and I think a couple of other senior clinicians that have worked there for a while do’ (SLT09)</p>
Professional/Social Role & Identity	3	<p>Barriers (majority of quotes): SLTs reported feeling that the FOCUS tool contradicted what they identify as their professional roles. In particular, many SLTs felt that they had a role in highlighting children’s abilities and improvements for parents, however, they felt that the FOCUS tool amplified children’s disabilities and undermined improvements. Some SLTs additionally reported feeling that in order to complete the FOCUS, they needed to sacrifice therapy time available to families.</p>

		<p>‘They [parents] already feel terrible about, before they come to see me. So, my job is to say, “Hey look what he did today”, or “wow, he never used to be able to that little thing, and now he can do it a little better than he could”. That’s my job. It’s to bring them up and to get them excited about their small achievements. But, that tool[the FOCUS] really does emphasis the huge gap, like chasm, like its immense, between what a typical kid that a preschooler should be achieving and what the kids that I see are achieving. It’s really monumental differences that no parent should have their nose rubbed in.’ (SLT05)</p> <p>Facilitators (few quotes): SLTs reported occasions where they were able to use the FOCUS tool as a means to engage parents in the therapies, which reinforced their clinical roles.</p> <p>‘Then you get the completed FOCUS from the parent and in fact the parent responses on the FOCUS was way more matching the assessment.... And then the clinician can go “I have finished my assessment, this is what it indicates and I see that... its lovely to see that your comments on this questionnaire kind of match what my assessment has found”. And this is so validating for parents. You know... you know because they [parents] feel like they have been an active participant in the assessment of their child. I like that.’ (SLT21)</p>
Beliefs about Capabilities	3	<p>Barriers: Several SLTs reported not feeling confident in answering specific questions on the clinician-version of the FOCUS.</p> <p>‘Some of them[SLTs] said, that some of the questions that were on the clinician’s FOCUS they did not feel prepared to answer, like how is this</p>

		<p>child communicating with peers.’ (SLT06)</p> <p>Facilitators: Some SLTs reported completing the FOCUS was not an “onerous” task, and that they can usually collect the necessary data from parents.</p> <p>‘when we have the parents here, they [the FOCUS] are completed during the assessment. I don’t think there’s a lot of barriers to that.’ (SLT11)</p>
Intention	3	<p>Facilitators (all quotes): SLTs reported having intentions to complete the FOCUS. These intentions were mostly externally driven (i.e., because they were told to collect the FOCUS).</p> <p>‘I feel like at our site we do it a lot more because we have to rather than finding it useful.’ (SLT29)</p> <p>‘And it’s also been reiterated to us how important it is to have it completed.’ (SLT3)</p>
Knowledge	2	<p>Barriers (majority of quotes): SLTs reported lacking knowledge about the administrative schedule of the FOCUS.</p> <p>‘... sometimes I’m not sure when to give it, when is tricky between the 6 months period, where I am like I can give it to them now like three or four months, but then when they go on a break and come back it will be seven or eight months. So is it better to do it sooner or later?’ (SLT01)</p> <p>Facilitators (few quotes): SLTs reported an awareness and understanding of the rationale behind outcome measurement, and the necessity of a standardized administration protocol.</p> <p>‘it’s important to have outcome measures so I understand the</p>

		importance of it [the FOCUS], I just, you know, and things have to be done a certain way so, you know, I understand that aspect of it. I do, again, there's 34 questions, like it's pretty lengthy in terms of what the family has to fill out um, but I understand why they[the FOCUS tool developers] can only reduce it so far' (SLT37)
Emotion	2	Barriers (all quotes): SLTs described negative emotional affects towards the FOCUS or the process of FOCUS data collection (i.e., asking parents to complete the FOCUS). 'I think a lot of people are frustrated with the FOCUS' (SLT19) 'And then you feel really uncomfortable asking them[parents] to do it, yet again.' (SLT14)
Goals	0.02	Only 1 quote (a facilitator) was found in this domain: 'When I... you know... because... after the coordinators meetings and whatever, manager comes back and shows us all the different you know how many are being done and all of that because it is a deliverable.' (SLT26)
Optimism	0.02	Only 1 quote (a barrier) was found in this domain" 'I mean I just think that I understand the ministry interest in trying to have a way to measure a child's progress from the family's perspective but I really think that it's just unrealistic goal. I think that there are so many barriers to families coming and getting treatment already and adding one more thing that's going to delay their service, and shorten the amount of service they get is really unfair to families.' (SLT30)

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*The domain Reinforcement was not reported as a facilitators or barrier by SLTs.

Discussion

Collecting outcome measurement data can benefit children, families, clinicians, and healthcare systems in many ways, but the successful implementation of outcome measures requires an understanding of the factors that influence the uptake of these innovations into practice (Graham et al., 2006). This study investigated the barriers and facilitators to implementing an outcome measurement tool, the FOCUS, into the publicly-funded preschool speech-language programs in Ontario, Canada. Using the Theoretical Domains Framework (TDF) to comprehensively examine factors associated with behaviour change, we summarized the perspectives of 37 SLPs.

Main barriers to implementation were reported in three TDF domains – Environmental Context and Resources, Beliefs about Consequences, and Social Influences. SLPs reported many practical challenges with incorporating administration of the FOCUS into clinical practice. In part, SLPs reported a lack of time to administer the FOCUS in assessment sessions, and difficulty incorporating administration of the FOCUS within existing intervention schedules that typically included families receiving blocks of direct therapy and at home practice. The process of collecting data using the FOCUS was perceived as labor-intensive, time-consuming, and a burden to the workloads of SLPs and administrative staff. SLPs reported further barriers that reduced their motivation to collect FOCUS data. These included their lack of belief in the usefulness of the data for clinical practice and negative emotional encounters with families.

Main facilitators to implementation were reported in two TDF domains – Behavioural Regulation and Environmental Context and Resources. Many SLPs modified their behaviour (e.g., setting up a reminder system) in order to ensure the FOCUS was administered. Some program regions also had resources in place (e.g., administrative personnel and technology) to facilitate the data collection process, which reduced the workloads of SLPs.

The challenges of implementing clinical outcome measures are not unique to the Canadian context nor to the speech and language therapy profession. The lack of uptake of outcome measures has been reported in SLP in other countries (S. E. Roulstone et al., 2015) and in other allied healthcare professions (Blenkiron, 2005). One systematic review summarized the literature on the facilitators and barriers to routine use of outcome measures in allied health and identified four major themes: 1) clinicians' knowledge about and perceived value for the outcome measure; 2) organization priority; 3) practical constraints including time and resources; and 4) patient considerations (e.g. perceived relevancy to patients care) (Duncan & Murray, 2012). Some of the barriers identified in the present study mirrored those reported in the literature. For example, SLPs frequently reported barriers associated with a lack of time and personnel resources to support the implementation of outcome measures, and a lack of belief in the value of FOCUS data for informing patient care. Unlike what has been reported in the literature, organizational priority and clinician knowledge were not identified as major barriers of implementation in our study. This may be due to the fact that the FOCUS is a government-mandated tool in the PSL Program (i.e., high in organizational priority), and the implementation efforts to-date have focused on improving clinician's knowledge of the tools (Barbara Jane

Cunningham & Oram Cardy, 2020). Alternatively, this difference in findings may be due to our use of an explicit theoretical framework which allowed for an objective way to describe and understand the barriers to implementation.

In their systematic review, Duncan & Murray (2012) identified a potential bias within the existing literature, namely, that many studies focused heavily on examination of the barriers to implementation at the level of clinicians. This approach assumes clinicians are at fault for poor implementation and neglects organizational-level barriers. This bias has the potential to result in the selection of ineffective implementation strategies such as audit and feedback on clinicians' practice and educational outreach, which are, incidentally, some of the most commonly selected implementation strategies. These strategies target barriers to behaviour change in clinicians but may be inappropriate for organizational barriers (Boaz, Baeza, & Fraser, 2011; Davies, Walker, & Grimshaw, 2010). The use of explicit theory can minimize these biases and errors (Eccles, Grimshaw, Walker, Johnston, & Pitts, 2005). Using a theoretical framework to guide our analysis, we found that clinician-level factors such as those within the Behavioural Regulation domains were, in fact, facilitators to implementation of the FOCUS. In contrast, the barriers to implementation involves factors beyond the control of the clinicians (e.g., the complex procedure of FOCUS data collection). These barriers reflected implementation challenges at the organizational and systems level or related to the outcome measurement tool, which can only be effectively addressed by individuals other than clinicians.

Our findings should not be interpreted to imply that the FOCUS is not valid or reliable. In fact, a considerable amount of work was done to validate the FOCUS,

including collecting input from parents and SLPs as knowledge-users (Thomas-Stonell et al., 2010, 2013). Our findings reiterated the fact that even good evidence needs to be properly tailored to the practical needs of clinicians and the contexts in which it will be used. The barriers identified in the current study provide insight into areas that require improvement to facilitate implementation.

This study has several strengths. The use of an explicit and comprehensive framework not only reduced the bias in our analysis, but also ensured a standardized terminology was used to describe implementation challenges. Doing so consistently across studies will allow us to aggregate findings across research projects. We recruited SLPs across each of the 30 PSL Program regions in Ontario to include representation of the diverse needs across the province. By doing so, we have identified barriers that were shared by the majority of clinical regions, which if addressed, might bring the most widespread impact on implementation. The facilitators and barriers reported by clinicians in this study may provide a useful reference for implementation planning at other large, publicly-funded programs (e.g., for anticipating necessary resources for implementation). However, it should be emphasized that implementation challenges are often influenced by the context (McCormack et al., 2002), so our findings may not directly generalize to other clinical practise environments or to the implementation of clinical tools other than the FOCUS.

As with all research, there are noted limitations associated with the chosen methodology and analysis approach. First, while the framework chosen for this study allows for the identification of facilitators and barriers to FOCUS implementation, it does not investigate any interaction that may exist between factors. A narrative or grounded

theory approach might be better suited to fully describe the complexity and nuances in SLPs' experience. The factors identified in this study can be a useful foundation for our field to begin to understand clinicians' decision-making with regards to implementation of evidence-based practice or a population-level outcome monitoring system. Second, the interview script used in this study was developed by the study authors, who are clinician-scientists in Communication Sciences and Disorders. The interview SLPs were asked to describe their perceived facilitators and barriers to FOCUS implementation until their ideas were exhausted. We did not ask specific questions for each TDF domain. All authors felt the interview script was sufficient to solicit SLPs' perspectives on the main facilitators and barriers to FOCUS implementation. Although our interview reached saturation, it is possible that a framework-driven interview script would have revealed other implementation factors. As well, this study did not consider implementation factors from the perspective of parents or administrative staff involved in FOCUS implementation. As such, the current findings should not be interpreted as a comprehensive investigation into all implementation factors, but rather, a survey of SLPs' most commonly experienced implementation factors.

The current study was also limited by practical constraints. Although we recruited volunteers from across all program regions as a way to gather diverse perspectives from SLPs working in different implementation contexts across the province, self-selection biases may have limited the representativeness of our sample. We were unable to verify, for example, whether our participants represent the range of data collection fidelity across the program (e.g., data collection rate). In part, this was because data on FOCUS implementation fidelity were not available at the level of individual SLPs. In addition, as

described in the introduction, the majority of SLPs within the PSL program support a diverse caseload, and offer a variety of service types and lengths. These practical constraints have prohibited us from investigating questions such as whether some (or a combination of) facilitators/barriers played a larger role in implementation outcomes (i.e., fidelity of adoption), or whether specific clinical service contexts (e.g., types of interventions) underlined specific implementation factors. Future research will address these questions to provide a deeper understanding of the relations between practice context, implementation factors, and adoption outcomes (e.g., fidelity). Another future direction of this work is the development of an implementation plan. To maximize the effectiveness of the implementation plan, relevant stakeholders (e.g., SLPs, families, policy makers, the FOCUS tool developers) will be engaged to discuss strategies to resolve the barriers to FOCUS implementation identified in this study (Powell et al., 2019).

Conclusions

Using a theoretically driven approach, we examined SLPs' perspectives of the facilitators and barriers to implementing an outcome measurement tool. Identifying these factors was a first step toward improving implementation of the FOCUS in Ontario's PSL Program (Graham et al., 2006). A future direction of this work is to develop implementation materials and strategies to directly address barriers identified by SLPs.

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Chapter 4

Selecting and Tailoring implementation interventions: A concept mapping approach

Background

The knowledge-to-action framework (Graham et al., 2006) is a widely adopted framework to support the implementation of best evidence into practice. This framework offers a step-by-step approach to improving the uptake of evidence into practice. Once barriers to uptake are identified, implementation strategies are selected and tailored to address them (Graham et al., 2006). Implementation strategies are methods (or the “how to”) for promoting the use of research evidence in practice (Proctor, Powell, & McMillen, 2013). The literature offers as many as 73 implementation strategies that vary in their impact and feasibility (Powell et al., 2015; Waltz et al., 2015), and there are different methods researchers can take to select appropriate strategies.

One way to select implementation strategies is to consult the research literature and apply explicit theories (Davies, Walker, & Grimshaw, 2010). Once barriers are identified, appropriate theories can be used to guide the design of implementation strategies that will address the barriers and lead to practice change (e.g. to target a lack of self-efficacy, Social Cognitive Theory suggests strategies such as peer modelling) (Kok, Schaalma, Ruiter, Van Empelen, & Brug, 2004). A major benefit of this approach is that theory can be used to predict and explain the mechanism by which implementation strategies will impact barriers, and therefore, may increase the likelihood of changing behaviour (Davies et al., 2010; Williams, 2016). Frameworks that summarize behavioral change theories have been developed to help support researchers in this process. Of note, the Theoretical Domains Framework (TDF) consolidated 33 psychological theories (Michie et al., 2005) to offer a theory-driven way of characterizing implementation

barriers and facilitators (Atkins et al., 2017). The TDF describes 14 unique domains of factors that impact the implementation of evidence-based practices (e.g. knowledge, skills, emotion) (Atkins et al., 2017; Cane, O'Connor, & Michie, 2012). Emerging work has expanded the use of the TDF beyond the description of these factors. For example, the TDF domains have been linked to specific behavior change techniques (Cane, Richardson, Johnston, Ladha, & Michie, 2015; Michie, Johnston, Francis, Hardeman, & Eccles, 2008), which are described as the components (or the “active ingredients”) that constitute behavior change interventions (Michie et al., 2013). Furthermore, through an expert consensus approach, the mechanisms of action of the behavior change techniques have been identified (Connell et al., 2018). These mechanisms of action describe how (i.e., the process by which) different behavior change techniques can resolve implementation barriers (Connell et al., 2018).

Selecting implementation strategies based on theoretical frameworks, such as the TDF and behavior change theories, has limitations. One is that the conceptual link between the domains on the TDF and behavioral change techniques is still emerging. To date, not all TDF domains have been linked with specific behavior change techniques (Cane et al., 2015). In other words, the literature may not offer guidance on the appropriate implementation strategies for some barriers (e.g., skills, social/professional identity). More importantly, behavioral theories that apply in controlled experimental settings may be difficult to translate into real-world implementation strategies where naturally occurring practical or contextual constraints are present and cannot be modified (Bhattacharyya, Reeves, Garfinkel, & Zwarenstein, 2006; Moodie, Kothari, et al., 2011).

Another way to select implementation strategies is to collect data related to stakeholders' experiences and preferences (Moodie, Kothari, et al., 2011). Using this type of approach, stakeholders are engaged in the process of identifying implementation barriers and strategies to address them from the beginning of the research process. Including stakeholders in the process "up front" has been shown to positively impact implementation and clinical outcomes, perhaps because specific practice contexts and barriers within them are considered (Denis, Hébert, Langley, Lozeau, & Trottier, 2002; Gagliardi, Kothari, & Graham, 2016; Wensing, Bosch, & R., 2009). Engaging stakeholders in selecting implementation interventions is also beneficial because they are the intended knowledge-users. When stakeholders' experiences and opinions are integrated into decision-making processes, the selected implementation intervention strategies may be more important to knowledge-users and more feasible at their organizational context (Gagliardi et al., 2016; Moodie, Kothari, et al., 2011).

Concept mapping has been proposed as one potential approach for engaging stakeholders in the design of implementation strategies (Powell, Beidas, et al., 2017). In concept mapping, stakeholders participate in brainstorming, sorting, and rating activities to reach a consensus on the best strategies to improve implementation (Kane & Trochim, 2007; Powell, Beidas, et al., 2017). The concept mapping approach has several benefits: (i) it offers clear and structured activities for data collection; (ii) these activities encourage equal participation from all stakeholders; (iii) the collected data allow for the identification of group consensus; and (iv) the analyses are flexible and allow for balancing the opinions from multiple stakeholder groups (Kane & Trochim, 2007). How

the concept mapping approach may be applied for tailoring implementation strategies is currently not clear.

To be effective, implementation strategies should be selected based on practice barriers and theories of implementation, and should be tailored to the contexts in which they will be implemented (Baker et al., 2010; Graham et al., 2006; Moodie, Kothari, et al., 2011; Powell, Beidas, et al., 2017). The purpose of this study was to illustrate a research approach that considers both research evidence (i.e., the TDF) and stakeholder perspectives and feedback to identify strategies to improve implementation of a new outcome measurement tool across a large preschool speech-language health system. We asked two specific questions: (i) how can stakeholders be engaged to identify barrier-specific implementation strategies and (ii) is there evidence to suggest the implementation interventions generated by stakeholders will resolve practice barriers? This study will illustrate how the concept mapping approach may be applied to answer these research questions. The discussion highlights the necessary modifications, benefits, and practical limitations to be considered when applying the concept mapping methodology.

Methods

Study setting

In Ontario, Canada, a provincial outcome monitoring protocol was implemented by the Ontario Preschool Speech and Language (PSL) Program. This program serves over 60,000 children annually across 30 service regions. Since 2012, speech-language pathologists (clinicians) have been required to collect parent-report outcome data using the *Focus on the Outcomes of Communication Under Six* (FOCUS) at 6 months intervals

for all children 18 months of age and older. The FOCUS is a tool designed to measure changes in communicative participation skills for preschool children receiving speech and/or language therapy (Thomas-Stonell et al., 2015).

The FOCUS was developed and validated by engaging knowledge users (i.e. clinicians and parents of preschoolers with speech and language impairments) throughout the development process (Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2010). As a measurement tool, the FOCUS has good internal consistency, reliability, and validity (construct, convergent, and discriminant) (Thomas-Stonell et al., 2010; Thomas-Stonell, Oddson, Robertson, & Rosenbaum, 2013) and its items reflect the Activity and Participation components of the World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF) framework (Thomas-Stonell et al., 2010). As a criterion-referenced measurement tool, the FOCUS allows clinicians to measure change within an individual child by providing validated reference values that indicate whether a child made clinically meaningful change during an intervention period (Thomas-Stonell et al., 2015). In 2015, based on the feedback from clinicians working in the PSL Program, the FOCUS was shortened from 50 to 34 items (Oddson, Thomas-Stonell, Robertson, & Rosenbaum, 2019).

Despite its strong psychometric properties and initial implementation efforts, the adoption and consistency of use of the FOCUS continued to vary across the 30 PSL Program regions (Cunningham, Hanna, Rosenbaum, Thomas-Stonell, & Oddson, 2018; Kwok, Cunningham, & Oram Cardy, 2019). For instance, clinicians at some PSL Program regions stopped collecting and reporting FOCUS data. In 2018, we began working to understand the contextual challenges related to implementation of the

FOCUS, and to identify ways to improve implementation. In our first study, we interviewed 37 clinicians representing the 30 PSL Program regions to learn their perceived facilitators and barriers for implementing the FOCUS (Chapter 3). Clinicians reported major barriers in three TDF domains: environmental context and resources, beliefs about consequence, and social influences. In the present study, we used concept mapping to select implementation strategies to target the barriers identified by the clinicians.

Participant recruitment

We identified three stakeholder groups involved in the implementation of the FOCUS in the Ontario PSL Program. Stakeholders included clinicians (knowledge users), representatives from the PSL Program (policy makers and managers), and the FOCUS research team, whom were responsible for developing, validating, and initial implementation of the FOCUS. Purposeful sampling was used to recruit clinicians. We contacted the clinical coordinators (similar to regional managers) from the 30 PSL Program regions. These coordinators forwarded recruitment emails to SLPs who worked within their respective regions. Clinicians were asked to contact us by email if they were interested in participating. Using this method, we were contacted by 37 clinicians, all of whom agreed to participate in telephone interviews. The sample included at least one clinician from each of the 30 regions, providing representation from across the PSL Program. At the time of the study, there were 400 SLPs working in the PSL Program, which means our sample represented 9.25% of potential participants. We cannot report response rates as there was no way for us to verify whether all clinicians received the

email invitation to participate. Convenience sampling was used to recruit policy makers ($n = 3$) and members of the FOCUS research team ($n = 6$).

Procedure

Concept mapping provides a rigorous approach that engages stakeholders in a series of sequential tasks. It is fundamentally a mixed-methods approach that involves multiple sequential stages. These include: (1) brainstorming and statement analysis, (2) structuring of statements (sorting and rating) by stakeholders, (3) concept mapping analysis, and (4) data interpretation (Kane & Trochim, 2007; Powell, Stanick, et al., 2017; Trochim, 1989). Qualitative steps include brainstorming and sorting, quantitative steps include the multidimensional scaling, cluster analysis, and computation of a concept map (see Appendix 8 for our reporting guideline checklist, O’Cathain, Murphy, & Nicholl, 2008).

Stage 1: Brainstorming and statement analysis. The goal of this stage was to generate a list of strategies that would improve implementation of the FOCUS based on stakeholders’ experiences and perspectives. Over telephone interviews, 37 clinicians brainstormed strategies to improve the implementation of the FOCUS using the prompt “*One specific thing that will help me complete and submit the FOCUS regularly is....*” In addition, clinicians were asked to elaborate on the barrier(s) that their strategies would address. This stage was completed via telephone interviews to facilitate participation across a wide geographic region. Phone interviews were recorded and transcribed verbatim, but pseudonyms were used for identifying information. A research assistant reviewed all transcripts to ensure transcription fidelity.

Stage 2: Structuring the statements. Data were collected from stakeholders to develop a common framework for conceptualizing and prioritizing the suggested implementation strategies. We invited clinicians ($n = 37$ who participated in the brainstorming stage), policy-makers ($n = 3$ representatives from the PSL Program), and members of the FOCUS research team ($n = 6$) to sort and rate the 90 implementation strategies over the web-based Concept System Global Max™ software (“The Concept System Global Max,” n.d.).

For the sorting task, participants were instructed to sort the strategy statements into categories that made sense to them and to generate a label for each category they created. Participants were instructed not to create a miscellaneous category nor to sort strategies by degree of importance or feasibility. There was no limit to the number of categories participants could create, but we suggested that most complex ideas could be summarized within 20 categories.

For the rating task, clinicians were asked to rate the importance of each strategy statement on a scale ranging from 0 (not important at all) to 5 (extremely important) based on the impact each strategy would have on the implementation of the FOCUS. As well, all participants (clinicians, researchers, and policy makers) were then asked to rate each strategy statement on its feasibility using the scale 0 (not feasible at all) to 5 (extremely feasible). Clinicians were asked to consider the feasibility of implementing the strategies within their practice environments whereas policy makers and FOCUS research team members were asked to consider the feasibility of adopting/implementing the strategies from their administrative and research perspectives.

Stage 3: Concept Mapping Analysis. Based on how participants sorted and rated the 90 suggested implementation strategies, we generated a conceptual framework and prioritized the list of strategies. To create a concept map, sorting data from all participants was entered into CS Global MAX™ software (Concept System Inc., Ithaca, NY) to create a similarity matrix. In this matrix, a numerical value of similarity was assigned to any two strategy statements based on the number of participants who sorted them into the same category. Through multidimensional scaling, the value of similarity between any two statements was converted into distance (expressed as X,Y coordinates) on a two-dimensional concept map (the higher the similarity value, the shorter the distance between the statements). The X,Y coordinates of every statement were then analyzed using hierarchical cluster analysis, which grouped statements located closer together into the same category. In other words, statements that were grouped together more frequently appeared closer on the concept map and had a higher likelihood of being included in the same category, whereas statements that were less frequently grouped together appeared further from each other on the concept map, and had a lower likelihood of being included in the same category (Kane & Trochim, 2007).

The next step was to determine the most appropriate number of categories to include in the concept map. To this end, we first reviewed participants' sorting data to determine whether there was a consensus on the number of categories created by each participant. The most common number of categories created by participants was seven ($n = 14$ of our participants created seven categories). To determine whether there was a different number of categories that better represented the data, we also created concept maps that included 4–10 categories (using 7 ± 3 , the interquartile range of our sample).

These maps were reviewed by the authors starting with the map that had 10 categories and moving to the map that had four. Each time the number of categories was reduced, we reviewed the contents of the new categories to determine whether the statements were conceptually related.

To prioritize the implementation strategies, we created *Pattern Match* and *Go-Zone* graphs using the CS Global MAX™ software. The Pattern Match graphs are ladder graphs that illustrate the correlation between two sets of ratings. In our case, we explored: 1) the correlation between clinicians' ratings of importance versus feasibility, and 2) the correlations between clinicians' rating of importance versus policy makers and researchers' ratings of feasibility. The former was explored to ensure strategies that were important to clinicians were perceived as feasible in clinical settings. The latter was explored to see if strategies that were important to clinicians were feasible from the perspectives of policy makers and researchers (i.e. by those making decisions about policy and resource allocation and those supporting research). These Pattern Match graphs allowed us to visualize data at a category level. The rating plotted on each side of the Pattern Match graph was generated by averaging the ratings of all strategies within a category. To present the importance and feasibility of each strategy, *Go-zone* graphs were plotted. *Go-zone* graphs present each strategy by plotting the feasibility rating from policy makers and researchers (y-axis) against the clinicians rating of importance (x-axis). This means strategies that were highly feasible and important appear in the top-right quadrant.

Stage 4: Data Interpretation. To create labels for the categories identified in the concept map, the authors reviewed strategies within each category and considered the

labels suggested by our participants. We also considered strategies within each category that contributed most to the uniqueness of that category (i.e. statements that were heavily loaded onto one category and contributed less to other categories). After determining the label for each category, a brief description was written to summarize the strategies within each category. As a member-check step, stakeholders reviewed and approved of these labels and descriptions in an online survey (see Appendix 9).

To determine a list of implementation strategies that were rated as both feasible and important by stakeholders, we first reviewed the Pattern Match graphs to identify the categories on the concept map that all stakeholders agreed to be important and feasible. We then consulted the Go-zone graphs of these categories and identified strategies that were rated highly on both importance and feasibility (i.e. those that were in the top-right quadrant of the graph). Lastly, we reviewed importance and feasibility ratings for each suggested strategy to identify those that received high ratings (> 4 points) from all stakeholder groups. These selected strategies were further prioritized based on the importance and feasibility ratings.

We added the following steps to the traditional concept mapping methodology in order to understand the barriers being addressed by the implementation strategies. In our interviews (described in Stage 1 above), clinicians were asked to report what specific barrier would be addressed by each implementation strategy they generated. In this phase, we reviewed all interview transcripts to identify clinicians who recommended the implementation strategies on the prioritized list. We then reviewed those interview transcripts and selected representative quotes to illustrate the barriers clinicians reported.

Through discussions, the authors reached consensus on the specific TDF domain associated with the described barrier.

Additionally, we validated the concept map and the prioritized list of implementation strategies (along with the reported barriers) with our stakeholders who participated in the previous steps in this project. Using an online survey (see Appendix 9), stakeholders rated their level of agreement with our findings on a Likert scale from 0 = strongly disagree to 5 = strongly agree. Participants were given an opportunity to provide written feedback to our findings in open-ended questions. An *a priori* threshold of consensus was defined to be 85% agreement amongst survey respondents, which is considered to be a more conservative threshold compared to published Delphi studies (Diamond et al., 2014).

Stage 5: Verify the mechanisms of action of the prioritized list of implementation strategies. The final step in our approach aimed to verify that strategies considered to be important and feasible by stakeholders were also appropriate from a theoretical perspective (i.e., had evidence demonstrating they could be used to resolve the implementation barriers). The research team first mapped the prioritized implementation strategies in this study to the TDF behavioral change techniques, which are published behavioral change intervention methods (Michie et al., 2013). We then reviewed the mechanisms of action associated with each implementation intervention strategy. Mechanism of action is defined as “the processes through which behavior change occurs” (Connell et al., 2018). We considered whether the prioritized implementation intervention strategies had a mechanism of action known to impact the purported implementation barriers. Implementation intervention strategies prioritized by stakeholders that did not

have empirical evidence to suggest potential for impact on the purported barriers were removed. Intervention strategies that were supported by the literature were retained as recommended strategies.

Results

Thirty-seven clinicians brainstormed strategies for improving implementation of the FOCUS in the PSL Program (years of experience, median = 9; range 1-24). Clinicians generated 282 strategy statements to improve implementation. The following steps were taken to prepare the strategy statements for the sorting and rating stage (also illustrated in Figure 6):

1. To determine relevance and redundancy, strategy statements were independently reviewed by the first and third author who had experience in clinical settings where the FOCUS use was mandated.
2. Both raters agreed to exclude 158 strategy statements due to redundancy or irrelevance but disagreed on the eligibility of 31 statements (interrater agreement = 89%, Kappa = 0.78). Additionally, 54 statements were identified by either rater as needing further discussion.
3. After discussion, both raters agreed to exclude an additional of 35 statements due to redundancy and to modify six statements to improve clarity ($n = 90$ strategies were included).
4. As a member-check step, the included strategy statements were sent to a clinician in the PSL Program who verified that there was no redundancy, but suggested editorial changes to 3 statements to improve clarity.

5. A final list of 90 clear and unique strategy statements was entered into the web-based Concept System Global Max™ software (“The Concept System Global Max,” n.d.). As the main goal of this stage was to generate a list of ideas “that represent the diversity of thought” (Kane & Trochim, 2007), we reviewed our interview transcripts to verify that item saturation was reached. This was indeed the case, as our final four interviews did not generate any new strategies.

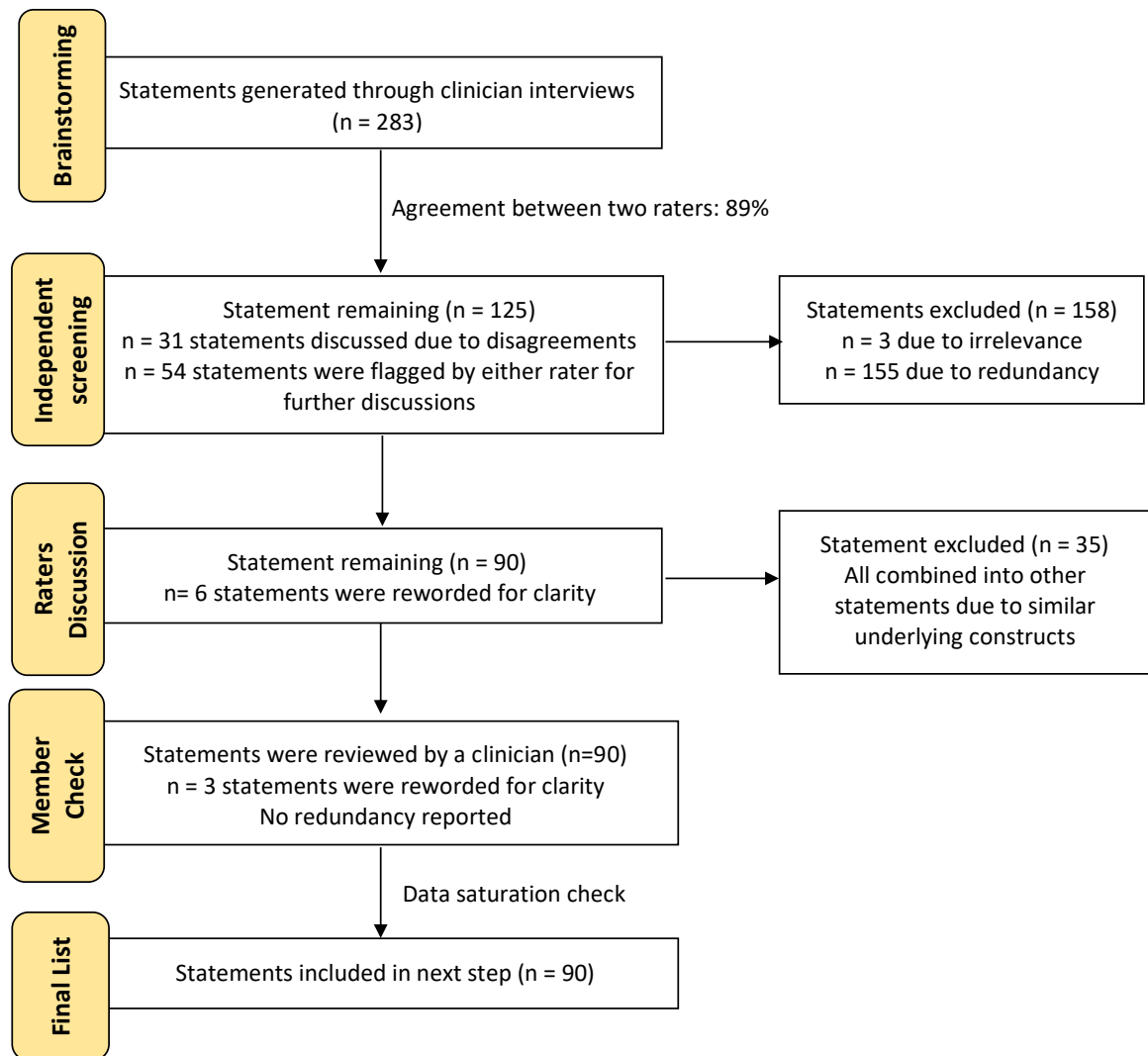


Figure 6. Strategy statements preparation workflow

Based on participants' sorting data, the list of 90 unique implementation strategies was best represented in 6 categories (see Figure 7 and Table 6; Appendix 10 provides the full list of strategies within each category), including:

1. Resources: provide additional financial supports and personnel support
2. Communication: share information with frontline staff and maintain ongoing communication between the Program and clinicians
3. FOCUS administration fidelity: improve the consistency with which the FOCUS is introduced to parents, scored, interpreted, and used to support clinical practice
4. FOCUS administration logistics: facilitate the process of FOCUS data collection as well as the administrative schedule of the FOCUS
5. FOCUS user-friendliness for parents: improve clarity, readability, and literacy level of the FOCUS so it is easier for parents to complete
6. FOCUS comprehensiveness: ensure the FOCUS is applicable and appropriate for all children and families

Six clinicians did not accept our invitation to complete the online sorting and rating tasks, so we recruited three additional clinicians in the PSL Program through personal connections ($n = 34$ completed the online tasks). All invited policy makers and FOCUS research team members completed the online tasks. Despite our instructions and reminders, seven participants ($n = 4$ clinicians, $n = 3$ policy makers) sorted the strategy statements into importance/feasibility categories (e.g. by creating categories such as "Not feasible" or "Not important") and their data were excluded from concept map analysis. All participants rated strategies on importance or feasibility ($n = 43$).

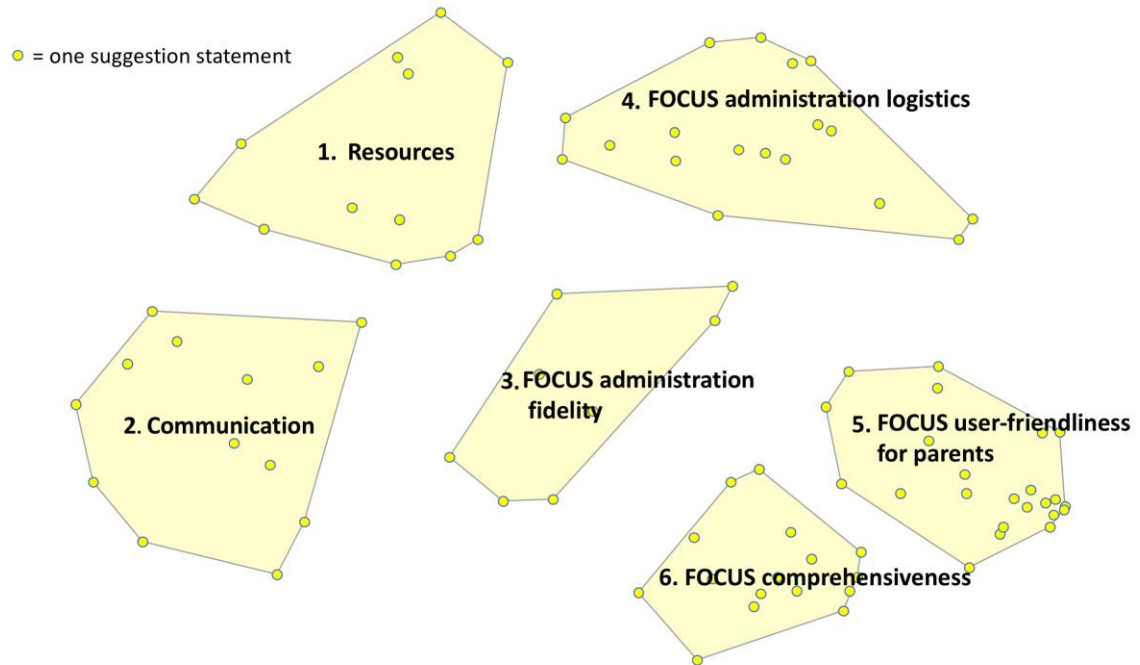


Figure 7. Concept map of the 90 implementation strategies summarized into 6 categories

Table 6. Example strategies for each of the 6 categories on the concept map

1. Resources

Hire more clinicians

Provide more funding for clerical support for data entry

2. Professional communication

Share what is done at a program level to evaluate program effectiveness using the FOCUS

Share information on how other agencies/clinicians are using FOCUS data clinically

3. FOCUS administration fidelity

Create a poster/visual display that explains the purpose of the FOCUS

Make sure FOCUS scores can support functional/clinical activities

4. FOCUS administrative logistics

Offer an electronic fillable FOCUS form (e.g. on tablet/iPad/online/laptop)

Re-examine the frequency and timing with which the FOCUS should be completed

5. FOCUS user-friendliness for parents

Improve readability of the FOCUS (e.g. increase the font size and bubble size, shading of items)

Simplify the wording of FOCUS items so they are appropriate for all reading levels

6. FOCUS comprehensiveness

Make sure FOCUS items apply to children at all levels of communicative function

Have separate sections for items that ask about verbal vs non-verbal forms of communication

Clinicians' ratings for importance and feasibility were highly correlated across categories, $r = 0.80$ (see Figure 8). For most categories, the importance (right) and feasibility (left) ratings were similar. One category, *FOCUS Administration Fidelity*, was the exception. Clinicians rated this category as feasible but not important for implementing the FOCUS.

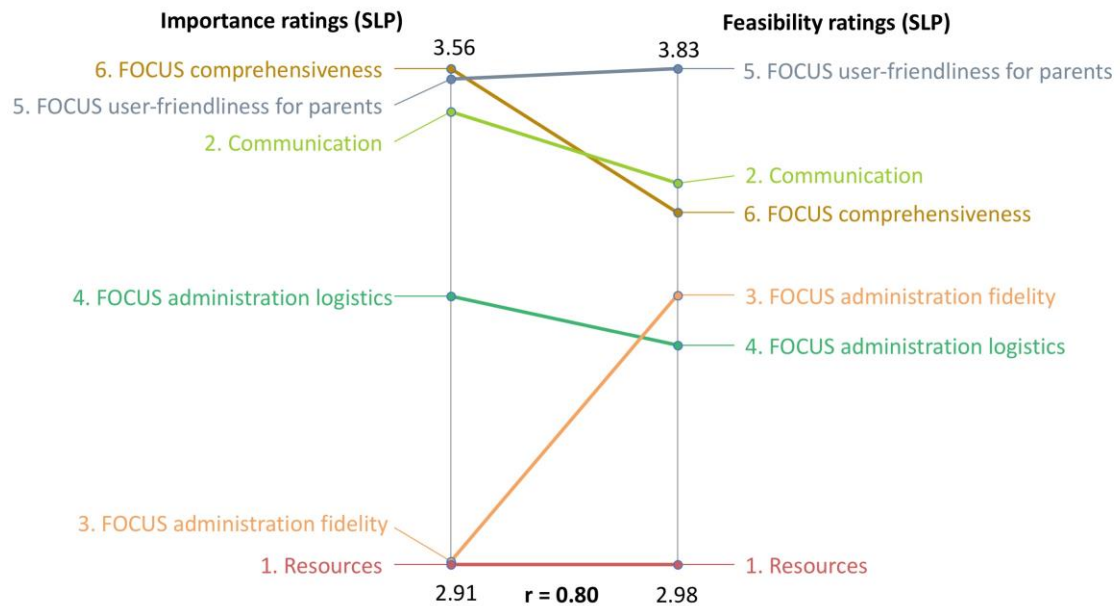


Figure 8. Pattern Match graph of clinicians' ratings on importance (right) versus feasibility (left)

In contrast, there was a moderate negative correlation between clinicians' importance ratings and feasibility ratings from both policy makers and researchers, $r = -0.44$ (see Figure 9). This means that some categories rated as most important by clinicians (i.e. *FOCUS comprehensiveness* and *FOCUS user-friendliness for parents*) were rated as least feasible by policy makers and researchers. The category *Communication* was rated as highly important and feasible by all stakeholder groups and *FOCUS Administration Logistics* were rated as fairly important and feasible by all groups.

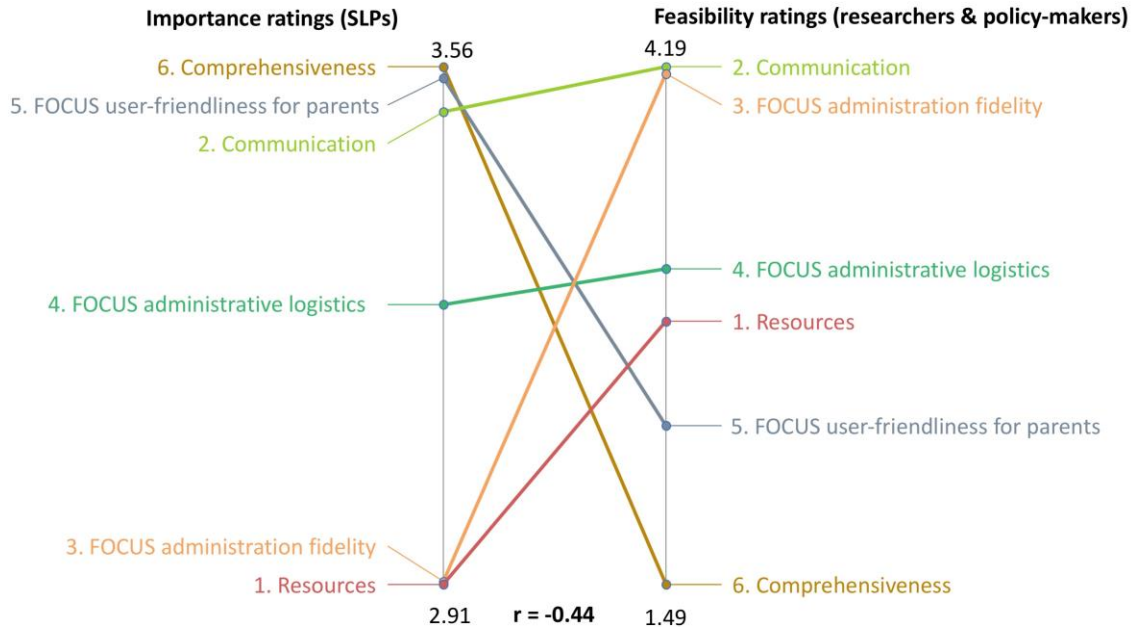


Figure 9. Pattern Match graph of clinicians' importance ratings (right) versus policy makers and researcher's feasibility ratings (left)

Given that two categories (*Communication* and *FOCUS Administration Logistics*) were rated highly on importance and feasibility by all stakeholder groups, we created *Go-zone* figures for strategies in these two categories (Figure 10a & 10b). Five strategies in the *Communication* category and six in the *FOCUS Administration Logistics* category fell into the top right quadrant of the *Go-zone* figures. To ensure that we did not leave out strategies that were important and feasible in other categories, we also reviewed clinicians' ratings of importance and policy makers' and researchers' ratings of the feasibility for all other strategies. A cut score of four points (out of five) was used as a conservative estimate of importance/feasibility. Three additional strategies were identified using this approach. Prioritized strategies are presented in Table 7.

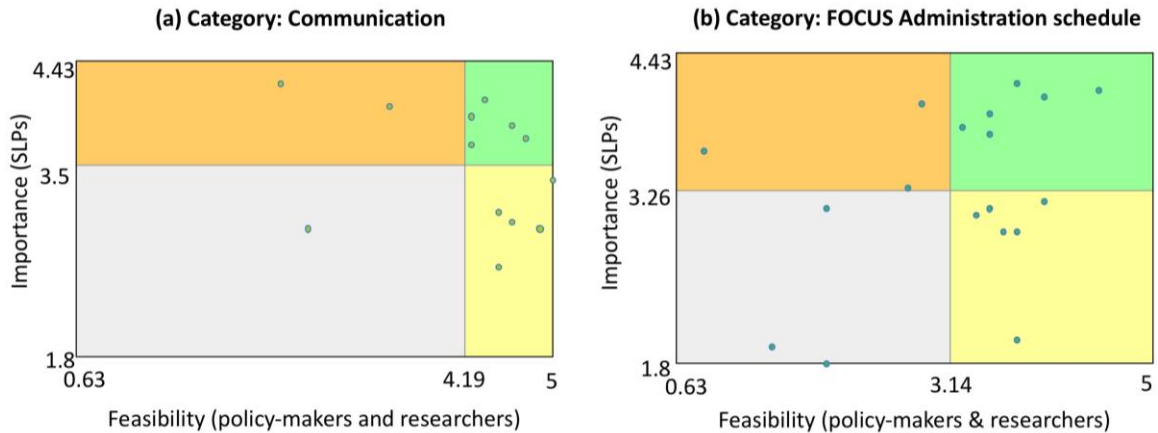


Figure 10. Go-zone display of the (a) Communication and (b) FOCUS Administration schedule categories.

Clinicians were asked during the telephone interviews to elaborate on the barriers their implementation suggestions would address. Based on clinicians' reports, we matched the barriers addressed by each of the 14 strategy statements to the TDF domains (see the Reported Benefits column in Table 7; Appendix 11 provides example quotes from the interviews). The selected strategies addressed two TDF domains, namely *beliefs about consequence* ($n = 7$) and *environmental context and resources* ($n = 7$). The seven strategies reported to address clinicians' *beliefs about consequence* included sharing information on the collected FOCUS data and making sure the FOCUS provides clinically relevant information. The remaining seven strategies related to *environmental context and resources* focused on improving and digitizing the process of FOCUS data collection.

In a survey to validate our findings with stakeholder groups, $n = 25$ clinicians, $n = 4$ researchers and $n = 3$ policy makers responded (response rate = 61%), 87% of stakeholders indicated that they agreed to strongly agreed that the six categories provided

an accurate representation of the suggested strategies to improve implementation of the FOCUS. Stakeholders also agreed that an appropriate label and description was given to each category (90% and 97% selected agree to strongly agree, respectively), 97% agreed with the prioritized list of 14 strategies, and 100% agreed with the benefits associated with each of the strategies (See Appendix 11 for more detail). The level of agreement across all questions exceeded our *a priori* threshold of 85%, indicating that a consensus was reached amongst our stakeholders regarding our findings.

Table 7. Strategies rated as both important and feasible by all stakeholder groups

Priority	Strategies	Importance	Feasibility	Reported Benefits
1	Offer an electronic fillable FOCUS form (e.g. on tablet/iPad/online/laptop)	4.1	4.5	Improves data collection/submission environment
2	Share what is done at the ministry level to look at program effectiveness using the FOCUS	4.1	4.4	SLPs will know what happens to the FOCUS data they collect and submit
3	Make translations of FOCUS available	4.1	4.4	The data collected from FOCUS will be clinically valid
4	Improve readability of the FOCUS (e.g. increase the font size and bubble size, shading the items)	4.1	4.3	Improves data collection/submission environment
5	Make sure FOCUS scores can support functional/clinically-related activities (e.g. helping clinicians form goals)	4.1	4.1	SLPs will know how they can use the FOCUS data in their practice
6	Offer a way for FOCUS to be completed and submitted by parents at home e.g. online/over the phone	4.1	4	Improves data collection/submission environment
7	Keep the dialogue open with SLPs to see what can be improved/changed	4	4.3	Research on the FOCUS will incorporate clinical expertise, and be more relevant to practice

8	Provide a way that automatically calculates scores/statistics of FOCUS (including change scores from the last FOCUS and the subscale scores)	4.2	3.8	Improves data collection/submission environment
9	Make sure FOCUS is valid even if different parents/caregivers/SLPs are completing them	3.9	4.6	The data collected from FOCUS will be clinically valid
10	Create an electronic system that streamlines all administration of FOCUS (e.g. can see all FOCUS of the same child in tabs)	3.9	3.5	Improves data collection/submission environment
11	Share successful research findings with the use of FOCUS (specify the details of the intervention and how FOCUS data was collected)	3.8	4.8	SLPs will know how submitted FOCUS data was used in clinical research
12	Change the schedule of FOCUS such that administration is timed to clinical appointments (e.g. assessment/intervention/discharge) rather than saying every 6 months	3.8	3.3	Improves data collection/submission environment
13	Remove the need to transfer FOCUS score by having an app that connects FOCUS data to the ministry (i.e. remove the need to transfer paper to electronic format)	3.8	3.5	Improves data collection/submission environment
14	Provide more timely feedback about FOCUS outcomes to SLPs (rather than at PSL meetings only)	3.7	4.3	SLPs will know what happens to the FOCUS data they collect and submit

After considering the mechanism of action of the 14 prioritized implementation strategies, all but one strategy had evidence to suggest that it would resolve the associated implementation barriers (see Appendix 11 for a detail report of the mechanism of action of each strategy). The strategy “Keep the dialogue open with clinicians to see what can be improved/changed” (see priority 7 on Table 7) has elements of three behavioral change techniques – *Problem solving*, *Review behavior goals*, *Review outcome goals*. This strategy, despite being considered important and feasible by stakeholders, was removed from the final recommended list of implementation intervention strategies because there

was no empirical evidence to support that it would have an impact on the barrier *beliefs about consequences*. This intervention alone (i.e., having scheduled problem solving/review of the behavior/outcomes of the behavior) has no evidence to support its effectiveness. However, it should be noted that providing clinicians with information about the social and environmental consequences, as well as outcomes of the collected FOCUS data (e.g., priority 2 on Table 7 “Share what is done at the ministry level to look at program effectiveness using the FOCUS”) has evidence to suggest that it would impact the barrier *beliefs about consequences*.

Discussion

To effectively improve implementation, it is important to select implementation intervention strategies that are tailored to existing barriers (Baker et al., 2010; Graham et al., 2006). This study contributes to an emerging body of literature that demonstrates how stakeholders can be engaged in selecting and tailoring implementation intervention strategies, something that until recently, has been referred to as a “black box” because of limited reports detailing the process (Bosch, Van Der Weijden, Wensing, & Grol, 2007).

Our primary research objective was to illustrate how the concept mapping approach can be used to engage stakeholders to select barrier-specific implementation strategies. Three stakeholder groups (clinicians, policymakers, researchers) participated in a concept mapping approach to brainstorm and prioritize a list of 14 strategies that could improve implementation of a clinical outcome measurement tool in pediatric speech-language pathology. To understand what barriers were being addressed by the 14 selected intervention strategies, we modified the traditional concept mapping approach.

In addition to asking clinicians to brainstorm strategy statements using a specific prompt (part of concept mapping methodology), we asked clinicians to elaborate on the barriers that they thought would be addressed by each of their suggested strategies. Specifying which barrier may be resolved by each implementation strategy is crucial because it allowed us to consider how these barriers may be impacted by specific strategies (Powell et al., 2020). Identified barriers were mapped onto domains on the TDF and clinicians' suggested implementation strategies addressed issues within the *beliefs about consequence* and *environmental context and resources* domains, which was consistent with the most commonly reported barriers identified in our previous study (Chapter 3).

Our second research aim was to investigate whether the implementation strategies brainstormed by stakeholders were evidence informed. Based on the available literature, we considered the mechanisms of action of each of the 14 strategies prioritized by stakeholders. All but one of the prioritized strategies had evidence to suggest they would have an impact on the barriers identified by stakeholders. The final list of 13 strategies will be used to develop a detailed implementation plan in the next phases of our research (Proctor et al., 2013).

This study illustrated a step-by-step approach to identifying implementation strategies that were targeted (i.e., would resolve existing barriers), important and feasible to stakeholders, and evidence-informed. In this research approach, stakeholders' perspectives rather than theory guided the initial brainstorming of implementation strategies. We believe this approach was particularly appropriate in the context of our study for two reasons. First, by interviewing clinicians, we engaged stakeholders and

capitalized on their knowledge of the practice context, (Gagliardi et al., 2016; Wensing et al., 2009), allowing us to develop a focused list of strategies that would be feasible in the real-world clinical settings and that would be palatable to clinicians (i.e. the knowledge users). Second, we found a lack of specific details included in strategies we identified in the literature, a limitation acknowledged by others (Powell et al., 2015). For example, *develop educational materials* is a common implementation strategy, however, to adopt this strategy we would still need to engage stakeholders to design the content and format of these materials. From our interviews, clinicians suggested specific implementation strategies such as “Provide training (e.g. case studies), so clinicians can practice completing the FOCUS consistently”. We found that our interview approach was more efficient because it generated actionable implementation strategies that took into account knowledge users’ preferences and practice contexts and, importantly, these strategies were worded in a way that was familiar to our stakeholders.

Certainly, other groups of researchers have demonstrated ways to integrate both empirical evidence and stakeholder expertise in the brainstorming and tailoring phases of implementation strategies (Lewis, Scott, & Marriott, 2018; Powell et al., 2020). However, these approaches involve engaging all stakeholders in a discussion during an in-person meeting. This was not feasible in our study as we needed to engage stakeholders from across a large geographic region (size: 1.076 million km²), making it cost-prohibitive to arrange for all participants to attend in-person meetings. Our study offers an example for tailoring implementation strategies that are practice- and evidence-informed when it is not feasible to have in-person stakeholder meetings.

We made other modifications to the concept mapping approach to engage stakeholders remotely. Rather than in-person focus groups, stakeholders participated in our study via telephone interviews and web-based software, methods that may have limitations. For example, since clinicians were not able to discuss and exchange ideas in a group setting, they may have generated a lists of barriers/implementation strategies that were not exhaustive. We do not however believe this to be the case. Five clinicians disclosed having informally surveyed their colleagues for strategies to improve implementation of the FOCUS tool prior to our phone interview. To some extent, we believe their discussions with peers achieved a similar result as having focus group discussions. Additionally, we reviewed our interview transcripts and confirmed that our last four interviews did not generate any new implementation strategies (i.e. our data collection reached saturation), which suggested the interviews generated a comprehensive list of implementation strategies.

A consideration for engaging stakeholders remotely was time. A substantial amount of time was needed to transcribe the interviews conducted to identify the strategy statements generated by our participants. This introduced a significant time gap between the brainstorming stage and the sorting and rating stage. As a result, we had six clinicians choose to cease participation in the study. Although we were able to recruit three additional clinicians to participate in the sorting and rating stage, we did not have representation from all 30 service regions across all the stages of our study. To avoid the need for transcription, an alternate approach would be to ask participants to submit written statements via email or web-based software. Unlike interviews, however, there would be no opportunity for the research team to interact with participants to request

clarifications, or to confirm which barriers each suggestion would address. In this case, the research team may need to rely on theoretical knowledge to associate implementation strategies suggested by the participants to practice barriers and validate the results through a member check step (i.e., seeking feedback from stakeholders). Finally, even though we attempted to engage all stakeholders to validate the concept map and selected implementation strategies using an online survey, we were only able to solicit feedback from 61% of our stakeholder participants. This may have impacted the external validity of our results. On-site meetings may have allowed us to engage more directly with all stakeholders during this process.

Despite the above limitations, we believe the concept mapping approach remains a powerful tool for incorporating various stakeholder views into the selection of implementation strategies. Completing the concept mapping project remotely maximized our ability to engage multiple stakeholder groups from across a wide geographic region. By remotely engaging stakeholders, we were able to provide anonymity to all participants, a challenge reported in previous work that engages multiple stakeholder groups (Oliver, Kothari, & Mays, 2019). During our interviews, clinicians generated implementation suggestions that they did not believe would be implemented by the policy-makers. For example, one clinician noted “*I recognize that probably isn't going to be the case*” after making an implementation suggestion. Reflecting on our experience, we felt strongly that an interview approach encouraged clinicians to freely brainstorm all possible ways to improve the implementation of the FOCUS, whereas focus groups may have been more limiting due to the hierarchy of power between policy-makers (the

funders) and clinicians working in the public system (the employees) (Mansell, Bennett, Northway, & Mead, 2004).

Our research also informs the evolving body of literature linking behavior change techniques and TDF domains (Cane et al., 2015). While mapping implementation strategies to TDF domains was not the major goal of the current study, we were able to use our data from knowledge-users' perspectives (as opposed to experts' perspectives in the current literature (Cane et al., 2015)), to confirm an association between implementation strategies and TDF domains. One future direction for this work is to compare the association between implementation strategies/behavior change techniques and TDF domains from the perspectives of different stakeholders (e.g., knowledge-users, implementation experts, policy makers), which may build a more accurate representation of the complex mechanism linking barriers and implementation strategies. With the list of implementation intervention strategies from this study, our team will focus on planning a system-wide implementation intervention and evaluation next (Graham et al., 2006; Proctor et al., 2013). To evaluate the impact of the implementation intervention strategies, we will monitor changes in the identified mechanism of action of these strategies. Additionally, stakeholders will be consulted to identify and prioritize outcomes. Example outcomes may include improved implementation of the FOCUS (e.g., fidelity of FOCUS use in practice), new knowledge about the impact of services (e.g., intervention effectiveness), and individual client's outcomes (e.g., children's communication participation skills) (Proctor et al., 2011).

Conclusions

Our study demonstrates a real-world application of the concept mapping methodology, which we used to tailor implementation strategies to specific practice barriers. Clinicians, researchers, and policy makers across a large geographic region brainstormed and prioritized 14 important and feasible strategies they believed would improve the implementation of an outcome measurement tool in pediatric speech-language pathology. These implementation strategies were reported to resolve barriers within the environmental context and resources and beliefs about consequences domains of the Theoretical Domains Framework. Based on the best-available empirical evidence, 13 of the 14 strategies were judged to potentially have an impact on current practice barriers and were recommended for further implementation planning.

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Chapter 5 . Discussion

The overarching goal of this dissertation was to improve the understanding of outcome measurement in speech-language pathology. Using the implementation of the FOCUS within Ontario's Preschool Speech Language (PSL) Program as the context, this dissertation explored issues related to outcome measurement in paediatric speech-language pathology. Chapter 2 of this dissertation explored the use of FOCUS data to answer important clinical questions about treatment effectiveness and predictors of treatment outcomes. Chapter 3 explored implementation facilitators and barriers of the FOCUS. Chapter 4 identified practical ways to improve the implementation of this outcome measure.

This discussion chapter will begin with a review of the main findings from each study, along with their implications for Ontario's PSL Program and outcome measurement in the speech-language pathology profession at large. Next, implications of this dissertation for implementation science, the implementation framework and theory that guided this work, and practice-based research (or integrated knowledge translation) will be discussed. The chapter will end with discussion of future directions of this work and overall conclusions.

Summary and Implications of Chapter 2

Main findings from chapter 2

Chapter 2 considered uses of the FOCUS data (i.e., outcome data) collected within a real-world clinical setting. A range of benefits of collecting outcome measurement data was introduced in Chapter 1. These benefits included being able to understand the effectiveness of interventions and to estimate prognosis of clients. Chapter

2 explored whether data collected using the FOCUS can indeed answer these important clinical questions. The results from Chapter 2 showed that at the end of the *Target Word* intervention, 75% of children had made a clinically significant change in communicative participation skills based on their scores on the FOCUS tool. There was also a statistically significant increase in the number of words children can speak and understand after the intervention (as measured by the MCDI, a vocabulary checklist completed by parents), and improvements in communication function (as measured by the CFCS, a checklist completed by SLPs). Predictors of children's communicative participation outcomes were identified through an online survey of SLPs. Of the top three predictors identified by SLPs, ability to imitate verbally was a significant predictor of children's prognosis in the *Target Word* intervention.

Practical implications for the Ontario PSL Program

The *Target Word* program is the chosen intervention in the Ontario's PSL Program for children who are late-to-talk. Demonstrating the effectiveness of *Target Word* and predicting children's prognosis in this program has implications across the province. Chapter 2 provided preliminary evidence to support the effectiveness of the *Target Word* program at improving children's vocabulary knowledge (i.e., the ICF Activity domain) and communicative participation skills (i.e., the ICF Participation domains). These findings were replicated in another study conducted across six different clinics in the Ontario PSL Program (Cunningham, Kwok, Earle, & Oram Cardy, 2019). The data collected using the FOCUS tool provided the necessary data to demonstrate the effectiveness of the *Target Word* program.

Furthermore, Chapter 2 revealed a predictor of children's outcome in the *Target Word* intervention. Children who have poorer verbal imitation ability at the beginning of the *Target Word* program tend to make less gains in their communicative participation outcomes. At this time, because this finding was based on a small dataset from one clinic, it should be replicated in a larger population. With data from a larger population, the other predictors identified by SLPs in the online survey should also be investigated. The underlying reasons behind children's lack of progress should be also be further explored (e.g., why is verbal imitation a predictor of participation outcomes?). Based on our current findings, one recommendation is for SLPs to carefully and consistently assess children's ability to imitate verbally prior to enrolling families into the *Target Word* intervention. This would allow for the collection of data to evaluate the link between verbal imitation and prognosis. When the link between verbal imitation (or other predictors) and children's prognosis is established, it may be important to consider what other intervention programs may be available that would be more effective for children with these risk factors.

Implications for outcome measurement in speech-language pathology

Ontario's PSL Program offers a unique opportunity for us to investigate the practical aspects of outcome data collection within SLPs' practice. The results from Chapter 2 revealed several practical constraints of data collection within the real-world clinical context. The following section will highlight the constraints and discuss their implications for the purported benefits of outcome data collection.

Practical constraint 1: Missing data. In Chapter 2, we found that 50% of FOCUS data were missing at the follow up session, which limited the possibility of fully

understanding program effectiveness and exploring more predictors. The missing data in this study reflect that there were barriers in day-to-day clinical practice that limit data collection. While the percentage of missing data we found in one clinical site is not representative of the situation across the province, anecdotally, we know that the issue of missing data is prevalent across different locations in Ontario's PSL Program. In fact, the clinic where the Chapter 2 study took place is located in a region with one of the highest rates of outcome data collection within the PSL Program. This suggests to us that, at a system level, there may be a significant amount of missing data, which may limit the program's ability to make important decisions based on the collected data. To ensure decisions are made based on representative data, it will be important know the proportion of missing data and the reasons for the missing data. In other words, clarifying that data were missing due to random, rather than systemic, reasons will be important prior to decision making. The perspectives shared by SLPs in Chapter 3 provide a first step towards understanding the reasons behind these missing data.

Practical constraint 2: Lack of baseline information. As mentioned in Chapter 2, there was a lack of information about children's growth during a baseline period (i.e., prior to intervention). This restricted our ability to differentiate how much of children's progress during the *Target Word* intervention was due to natural growth versus intervention effects. This particularly limited our interpretation of children's vocabulary knowledge, which was measured using the MCDI, a vocabulary checklist completed by parents. Unlike the FOCUS, the MCDI is not an outcome measurement tool *per se*, so it does not offer any reference value to suggest when clinically significant changes may have occurred. This finding highlighted the importance of outcome measurement tool

selection. Chapter 2 revealed that, unlike research studies, collecting data during a baseline period is not a routine or common practice for SLPs in real-world clinical settings. Because the FOCUS tool was purposefully validated to provide a reference value to indicate when clinically important changes have occurred, it allowed us to interpret children's progress despite not having their baseline growth data available.

These findings suggest two important considerations in outcome measurement planning if the goal is to explore or demonstrate intervention effectiveness. First, it is important to select an outcome tool to support interpretation of minimally important change. In this regard, the *interpretability* domain of the COSMIN checklist (see Chapter 1) offers some excellent guidance (Mokkink et al., 2010). If this is not feasible (e.g., if no such tool is available), it is then important to implement a data collection schedule to ensure baseline information of children's growth is available.

Practical constraint 3: Limited predictors. In Chapter 2, three predictors of children's progress in the *Target Word* intervention were explored. Being able to predict clients' outcomes is one of the purported benefits of outcome measurement (see Chapter 1) and results from Chapter 2 demonstrated one way of achieving this. It should be explicitly acknowledged that the predictor analysis conducted in this chapter was only feasible because the Hanen *Target Word* program has designed and systematically implemented a checklist of risk factors that all SLPs administered as part of the program. Reporting these risk factors is currently not a part of the Ontario PSL Program's outcome monitoring process, nor is this a common practice in other population-based outcome data collection approaches in speech-language pathology (American Speech language-Hearing Association., 2016; Mullen & Schooling, 2010). In the Ontario PSL Program, for

example, only three risk factors are consistently collected across the province: (i) whether the child has an autism spectrum disorder diagnosis, (ii) whether the child is multilingual; (iii) whether the child is attending an early learning environment (e.g., daycare program). In other words, the risk factor analysis that we conducted cannot be replicated using the data collected using the current outcome monitoring systems in the Ontario PSL Program. If the goal for outcome data collection is to understand the impact of risk factors on children's prognosis in speech and language interventions, important changes would have to be made so that risk factors are collected and reported at a population level.

Summary and Implications of Chapter 3

Main findings from chapter 3

Chapter 3 used a theory-driven approach to identify the facilitators and barriers to the implementation of the FOCUS from SLPs' perspectives. Three barriers were highly prevalent in the Ontario's PSL Program, impacting over 50% of clinical regions. These included barriers within the *environmental context and resources* domain (e.g., insufficient time during assessment sessions, difficulties incorporating the FOCUS into clinical programs, and staff workload); *beliefs about consequences* domain (e.g., data did not impact clinical practice/ system level decisions, data were not valid); and *social influences* domain (e.g., negative encounters with parents). Two facilitators were reported in majority of the program sites, which included the *behavioral regulation* domain (e.g., clinicians designing ways to modify their habits); and *environmental context and resources* domain (e.g., availability of personnel and technology).

Practical implication for the Ontario PSL Program

The results from Chapter 3 may not have an immediate impact on SLPs' practices, however, anecdotally, SLPs reported during their interviews that being engaged in this research project was a positive experience because they felt that their opinions were being valued and used to improve the outcome collection practice in the Ontario PSL Program. The following excerpt from one SLP provides an example:

“If you read those and consider those, and find they're not clear, call one of us because both of us would be very happy to try to help you understand what's causing a struggle for us with some of those things. I would be really happy. I appreciate that you're actually, like when we were writing it, we were kind of chuckling because you know what it's like. People ask for feedback and they don't really look at it. So I was really happy to hear that you're actually calling us back and are looking into it at a deeper level. I think we could really improve it and make more people interested in it, and using the tool with a little more enthusiasm if there are fewer hiccups like that.” (SLP5)

The perspectives SLPs shared during their interviews provided important insights into current issues in outcome measurement within Ontario's PSL Program. As discussed earlier in this discussion chapter, the barriers reported by SLPs shed some light into the reasons behind the missing data found in our retrospective chart review study (i.e., in Chapter 2), as well as in the provincial outcome monitoring system. A major barrier reported by SLPs is interpersonal interactions with families whose negative responses to the FOCUS tool is limiting clinicians' ability to collect outcome data. Moreover, this

barrier is exacerbated in families with children who are severely delayed in their development. If a majority of the FOCUS data were missing due to this barrier, it may suggest that the current outcome data available in the Ontario PSL Program does not provide a good representation, particularly of children with severe developmental delay. In such a case, decisions made based on existing outcome data should take this into consideration.

The barriers reported by SLPs increased the awareness of practical challenges users faced while trying to implement the FOCUS. These barriers form the basis of the design of better implementation methods (e.g., by including strategies designed to resolve the current barriers, which was explored in Chapter 5). Some of the barriers raised by SLPs can also be turned into research questions. For example, SLPs were concerned about the interrater reliability of the FOCUS data when it is reported by different caregivers or between caregivers and clinicians. In response, a study is currently underway to investigate the correlation in FOCUS scores reported by clinicians versus parents (B. Cunningham, personal communication, April 2019).

Implication for outcome measurement in speech-language pathology

For the broader speech-language pathology field, the findings from Chapter 3 provided some insights into the necessary considerations for the successful implementation of outcome measurement tools into practice. First, these findings reiterate the fact that having good psychometric properties is necessary for adequate data quality, but not *sufficient* to ensure successful implementation of standardized tools. Indeed, an existing study has already found that psychometric properties of standardized assessment tools do not correlate with how frequently tools are being used by SLPs (Betz, Eickhoff,

& Sullivan, 2013). The findings from Chapter 3 suggest that this is also the case for outcome measurement tools. In other words, psychometric properties may not be SLPs' major consideration when deciding to adopt outcome measurement tools into practice. This mismatch between the quality of tools versus frequency of use may be due to a dichotomy between test developer and clinician perspectives, which has resulted in the development of many tools that are not equipped to support all aspects of clinical decision-making (Daub, Skarakis-Doyle, Bagatto, Johnson, & Oram Cardy, 2019). This may be the case for the FOCUS tool. In Chapter 3, many SLPs reported a lack of belief that the FOCUS tool provided information relevant to their day-to-day practice. This finding further substantiates that there is a need to consider SLPs' needs during the development of new outcome assessment tools (Daub et al., 2019).

Second, findings from this chapter highlighted the importance of considering implementation factors from users' perspectives to ensure the successful collection of outcome data. The barriers to SLPs' adoption of outcome measurement tools has only been investigated in a handful of studies (Duncan & Murray, 2012; Skeat & Perry, 2008). From our understanding, this dissertation is the first attempt within Ontario's PSL Program to comprehensively understand implementation barriers and facilitators from users' perspectives. SLPs shared many barriers in the context in which the outcome measurement tool is being administered. For example, clinicians reported a lack of time, personnel, and technology resources within their clinical environment (see barriers within *environmental context and resources* in Chapter 3). They also shared their negative encounters with families (see barriers within *social influences* in Chapter 3). Clinicians' knowledge of barriers within the clinical contexts and patients' preferences will inform

better ways to collect outcome data within real-world clinical practice (Gagliardi, Kothari, & Graham, 2016; Haynes, Devereaux, & Guyatt, 2002; Moodie, Kothari, et al., 2011; Sackett, Rosenberg, Gray, & Haynes, 1996).

Overall, the findings from Chapter 3 contribute to growing considerations of ways to improve implementation of evidence-based tools for outcome measurement and other purposes. For outcome measurement tools to be adopted into practice, there is a need to understand users' perspectives (i) in the development of new outcome measurement tools and (ii) when identifying implementation barriers.

Summary and Implications of Chapter 4

Main findings from chapter 4

Chapter 4 engaged three groups of stakeholders (i.e., SLPs, policy makers, and FOCUS tool developers) in a modified concept mapping process to identify implementation strategies to resolve barriers to the implementation of the FOCUS. A practice-based approach was used to generate implementation strategies (i.e., SLPs were asked to brainstorm ways to resolve current practice barriers). Stakeholders then sorted the 90 unique strategies into 6 categories (resources, communication, FOCUS administration fidelity, FOCUS administration logistics, FOCUS user-friendliness for parents, and FOCUS comprehensiveness). They also provided ratings on the importance and feasibility for each strategy. Based on these ratings, 14 strategies that stakeholders believed would be highly important and feasible were prioritized. According to SLPs, these strategies will resolve existing barriers within the *environmental context & resources* and the *beliefs about consequences* domains of the Theoretical Domains Framework, which were amongst the most frequently reported barriers found in Chapter

3. Using the best available evidence, the mechanisms of action of these strategies were considered. Finally, 13 strategies were recommended as having evidence to suggest they will have an impact on the existing practice barriers.

Practical implication for Ontario's PSL Program

The final list of 13 strategies identified in Chapter 4 offers some practical ways to improve the current implementation of the FOCUS outcome measurement tool in the Ontario PSL Program. These strategies were selected through considering both theoretical and practical perspectives, making them more likely to be effective (Michie, Johnston, Francis, Hardeman, & Eccles, 2008; Powell et al., 2017). Amongst these 13 strategies, at least 5 were related to a need for an electronic version of the outcome measure. This electronic version will remove barriers within the environmental context and resources by offering an alternative way for collecting data (e.g., for families to complete at home or while waiting in the clinic). It will also remove clinicians' need to calculate scores and transfer data from the FOCUS forms into databases. Additionally, at least 3 of the strategies reflect clinicians' desire to learn about the outcomes and consequences of the collected FOCUS data (e.g., decisions made by the ministry, research findings), which were reported to resolve clinicians' lack of beliefs in the consequences of FOCUS data collection. As such, offering clinicians an electronic option of the FOCUS tool and communicating outcomes of the FOCUS data collected should direct the immediate implementation planning in Ontario's PSL Program,

While the 13 prioritized strategies would inform immediate implementation planning, for long-term and sustainable implementation of the FOCUS tool, other strategies suggested by clinicians may be informative. In this chapter, strategies within

two of the six categories of implementation strategies (i.e. FOCUS comprehensiveness and FOCUS user-friendliness for parents) were rated as most important by clinicians but were rated as least feasible by policy makers and researchers who developed the FOCUS tool. These two categories included suggestions to modify the wording and questions on the FOCUS form and to change which preschool populations FOCUS tool use is mandated. Considering these suggestions together with the barriers reported by SLPs in Chapter 3, it is clear that these suggestions aimed to improve the frequently reported barriers within the *beliefs about consequences* and *social influences* domains of the Theoretical Domains Framework. In other words, the suggestions to modify the FOCUS tool stemmed from clinicians' belief that the current FOCUS tool does not represent the clinical populations they encounter, and that the wording and questions on the FOCUS is dampening clinicians' interpersonal relationships with families. Anecdotally, we know that suggestions in those categories were rated as not feasible by policy makers and FOCUS tool developers because making those changes will challenge the psychometric properties of the FOCUS tools and necessitate re-validation of the modified FOCUS tool, which will be both costly and labour-intensive. It is entirely understandable that due to time and resources constraints, the FOCUS tool developers and policy makers may not be able to implement changes to resolve these barriers in the short term. Clinicians' concerns in these areas, nevertheless, are pervasive across the Ontario, and should not be neglected. One possibility is for stakeholders to continue their discussion and come to a consensus on feasible solutions to address these barriers.

Implication for outcome measurement in speech-language pathology

Chapter 4 contributes to a growing literature that unfolds the process to improve implementation of evidence-based practices. The methods used in this study have two specific implications for improving outcome measurement within speech-language pathology. First, Chapter 4 offers a clear, step-by-step description of the methodology to select and tailor implementation strategies. Second, this chapter demonstrated the possibility of using a practice-led approach in the selection of implementation strategies.

To improve evidence-based practice in speech-language pathology, Campbell and Douglas (2017) reviewed the implementation science literature and identified a four-step process to guide the design of implementation intervention. This four-step process includes: (i) identifying barriers, (ii) selecting intervention components, (iii) using theory, and (iv) engaging end-users (Colquhoun, Squires, Kolehmainen, Fraser, & Grimshaw, 2017). Chapter 4 contributes to the emerging literature that reveals the detailed steps (i.e., the “how to”) in carrying out this four-step approach (Colquhoun et al., 2017; Powell et al., 2017). The case example in Chapter 4 will hopefully offer some methodological guidance for future studies on implementation planning in speech-language pathology.

A distinction of the methodology used in Chapter 4 relative to other implementation planning studies is the use of a practice-led approach during the brainstorming phase of implementation strategies. In many existing studies (see Lewis, Scott, & Marriott, 2018; Powell et al., 2020; Taylor, Lawton, Slater, & Foy, 2013), the strategy brainstorming phase is led by the research team using knowledge from the existing literature. For example, Taylor et al. (2013) described their methods as follows: “The generation of the ideas by each group was guided by the project team’s knowledge of the current literature. Participants were provided with information about which

behavior change techniques (BCTs) had been suggested as effective in addressing each type of barrier.” Lewis et al. (2018) described their approach where “strategies were selected from the compilation generated from a review and synthesis including 68 unique strategies.” As already discussed in Chapter 4, we took a practice-led approach and let stakeholders brainstorm strategies for several reasons. One major reason was that we did not have the resources to organize in-person meetings or engage stakeholders in lengthy discussions so as to inform them of the behavioral change techniques available in the literature. The lack of resources is a common barrier for many practice-based research or integrated knowledge translation initiatives (Camden et al., 2015; Gagliardi, Berta, Kothari, Boyko, & Urquhart, 2016). The methodology used in Chapter 4 offers a workaround solution to engage stakeholders when resources were limited.

Using a practice-led, as opposed to research-led, approach to brainstorming implementation strategies has potential limitations. One possible limitation is that stakeholders may generate strategies with no evidence to support their effectiveness. Our findings in Chapter 4 suggest that this was not the case. The majority of strategies suggested by stakeholders (i.e., 13/14 of the prioritized strategies) had evidence to suggest that they may have an impact on associated barriers. This finding provided some reassurance for other researchers who wish to use a practice-led approach and allow stakeholders to identify strategies based on their own practical knowledge. Allowing stakeholders to brainstorm strategies may be especially important in some cases because the literature currently does not offer recommendations for all implementation barriers (Connell et al., 2018). A second possible limitation is that stakeholders may have only considered a fraction of the strategies available in the literature, in which case, only some

but not all feasible and effective implementation strategies will be selected. This is indeed a limitation that is worthy of further investigations. As a first step to addressing this limitation, I compared the results of Chapter 4 to the results from Taylor et al. (2013) because both studies were guided by the Theoretical Domains Framework (Michie et al., 2005) and reported the selected strategies using the taxonomy from behavioral change techniques (Michie et al., 2013). Across these two studies, the only common implementation barrier identified was the *environmental context and resources* domain. A contrast between the implementation strategies selected in Chapter 4 to those selected by Taylor et al. (2013) revealed that both studies identified the same behavioral change techniques to resolve barriers within this domain (see comparison in Table 8 below). This provided preliminary support that a practice-led approach did not limit the selection of implementation strategies. Obviously, this finding will need to be further investigated. A good practice to support this type of comparison is through a consistent use of the same implementation framework and taxonomy, which will ensure results from different studies can be compared (Proctor, Powell, & McMillen, 2013).

In summary, the studies in this dissertation used a practice-based research approach to investigate outcome measurement within the real-world practices of SLPs. Overall, this generated four main practical recommendations for the Ontario PSL Program or other population-based outcome measurement initiatives. First, it is crucial to specify the intended purpose(s) of the collection of outcome data. Knowing what decisions will be made with the collected outcome data will inform not only the selection of an appropriate outcome tool, but also the way in which data should be collected (e.g., the need to collect baseline data or risk factors). Second, the purpose(s) of outcome

Table 8. Comparison of selected implementation strategies

	Taylor et al. (2013)	Chapter 4
Implementation goal	evidence-based nasogastric feeding tubes practice	an evidence-based outcome measurement tool
Targeted health professional	nurses, doctors	SLPs
Barrier (in TDF domain)	environmental context & resources	environmental context & resources
Example quote of barrier	“I believe that some of the problems come about where to document it...so it's getting the pH and where do you document that...”	“And then the other thing is, like I said, if they're on a block system, they may be due for it but they're not actually coming in till next week or two weeks from now for the program's not starting in 7 weeks, then they're just not gonna be within that 6 months period.”
Example quote of strategies	“Someone developed these catheter packs that have all the equipment you need. Could there not be an NG tubes pack with all the necessary equipment for everyone to follow in a specific order?”	“Change the schedule of FOCUS such that administration is timed to clinical appointments (e.g. assessment/intervention/discharge) rather than saying every 6 months”
Strategies selected (in behavioral change technique taxonomy)	Prompts/cues; Adding objects to the environment	Prompts/cues; Habit formation; Restructuring the physical environment

measurement should be relevant to clinical practice and should be clearly communicated to frontline clinicians, which can improve clinicians’ beliefs about the consequences of data collection. Third, frontline clinicians need to be informed, in a timely manner, of the consequences of (e.g., the decisions made based on) the outcome data they collected. Lastly, various barriers exist and are limiting clinicians’ ability to collect outcome data. Identifying strategies to resolve these barriers is crucial to improving the implementation of outcome measurement tools.

Implications for implementation science

Because this dissertation investigated issues related to the implementation of outcome measures, the results also have some implications for the implementation science literature. In accordance with recommendations for implementation science work, it was important for this dissertation to explicitly use theories, models, or frameworks (Eccles, Grimshaw, Walker, Johnston, & Pitts, 2005; Nilsen, 2015). Explicit use of theory is important for both empirical and practical reasons. For example, consistent use of theory offers standardized terminology and methodology to allow for the reproduction, comparison, and aggregation of results across studies (The Improved Clinical Effectiveness through Behavioural Research Group (ICEBeRG), 2006). Theory also allows for explicit prediction of causality, which can inform research or implementation design (Michie, Fixsen, Grimshaw, & Eccles, 2009). Currently, the inconsistent (and often lack of) explicit use of theory implementation research is limiting our ability to generalize research findings to resolve real-world implementation issues (Eccles et al., 2005). In the long term, the consistent use of theory will help clarify the effectiveness of different implementation interventions and generate more practical solutions (The ICEBeRG, 2006).

A major challenge in implementation science work is the choice of theory, because there are many theories available (Nilsen, 2015) and very limited guidance on how to choose them (Lynch et al., 2018). Generally speaking, theory selection is driven by the purpose of the study. For example, Ferlie and Shortell (2001) suggested that implementation interventions can operate at four levels (individual health professional, healthcare teams, organization offering care, larger health care system), so the choice of

theory depends on the level of intended change (Ferlie & Shortell, 2001). Moreover, practical considerations also influence theory selection (Lynch et al., 2018). An example of practice issues may be the availability of resources to support the application of a particular theory. Lynch et al. (2018) concluded that “it is important to acknowledge that there is no universally agreed-upon theory of successful implementation, nor empirical evidence about the relative advantages of one theoretical approach over another.” This suggests that there was no one *best* theory for the purpose of this dissertation (at least for the moment), but some theories may be more *appropriate* than others.

As discussed in Chapter 1, this dissertation followed the knowledge-to-action (KTA) process model, which outlined the steps involved in knowledge translation (Graham et al., 2006). KTA model is an example of a process model, which offers guidance on the temporal sequence of implementation activities (Nilsen, 2015). Under the KTA model, once implementation barriers and facilitators have been identified, intervention strategies should be selected accordingly to improve the implementation of a knowledge product. The identification of implementation barriers/facilitators and intervention strategies were guided by the Theoretical Domains Framework (TDF) and the affiliated behavioral change techniques. TDF is an example of a determinant framework, which helps specify the implementation factors (e.g., facilitators and barriers) and the relation of these factors to implementation outcomes (Nilsen, 2015).

The KTA model, TDF, and affiliated behavioral change techniques were chosen for several reasons. Theoretically, both the KTA model and the TDF have a strong empirical foundation. The KTA model was derived from a critical analysis of conceptual models within implementation science (Graham & Tetroe, 2007) and has been chosen by

the Canadian Institutes of Health Research to guide research design that aims to reduce the research-to-practice gap (Canadian Institutes of Health Research, n.d.). The TDF consolidated the knowledge from 33 theories related to human behavioral changes (Michie et al., 2005). The purposes of the KTA model and TDF align with the aims of this dissertation. The KTA model outlines steps to improve the implementation of a knowledge product (Graham et al., 2006). This is consistent with the aim of this dissertation, which was to improve the implementation of the FOCUS tool. The purpose of the TDF is to understand implementation factors at the level of healthcare providers (Atkins et al., 2017; Lynch et al., 2018). This is also consistent with the purpose of this dissertation, which sought to understand the facilitators and barriers affecting SLPs' ability to implement the FOCUS. Both the KTA model and TDF are action oriented, which means they offer guidance on practical ways to improve implementation. As a process model, the KTA has an action cycle, which outlines the steps necessary to bring research evidence into routine, sustainable clinical practice (Graham et al., 2006). The mechanisms of action between TDF domains and different behavioral change techniques have been investigated (Connell et al., 2018), which means identifying barriers using the TDF can inform the selection of implementation strategies.

There were also pragmatic reasons that directed the choice of KTA and TDF, as opposed to other suitable frameworks such as the Promoting Action on Research Implementation in Health Services framework (Rycroft-Malone, 2010), the Consolidated Framework for Implementation Research (Damschroder et al., 2009), or the Normalization Process Theory (May & Finch, 2009). First, the TDF offers many available, freely accessible online resources to assist novice implementation scientists.

This includes a published guide on how to apply the TDF in research (Atkins et al., 2017), an online tutorial, activities to familiarize users with each of the behavioral change techniques (Behaviour Change Technique Taxonomy project, 2020), and an interaction online tool to visualize the mechanisms of action between TDFs and behavioral change techniques (Theory & Techniques of Behaviour Change Project, n.d.). The well-defined constructs of the TDF and the behavioral change techniques make them particularly easy to use by novice learners (Lynch et al., 2018). Importantly, these frameworks were chosen because of our research team's experience and expertise in using the frameworks in the past (Moodie, Bagatto, et al., 2011; Moodie, Kothari, et al., 2011).

There are inherent limitations to the results outlined in this dissertation associated with our choice of frameworks. One particular limitation is that the TDF and behavioral change techniques were specifically designed for identifying barriers and facilitators at the level of individuals (in our case, clinicians). This means that we were unable to systematically investigate or address implementation barriers that exist at broader levels of the health care system (e.g., at the level of the Ontario PSL Program). To explore implementation factors across multi-level systems, other frameworks, such as the Consolidated Framework for Implementation Research would be more appropriate candidate.

Implication for practice-based (or integrated knowledge translation) research

This dissertation prioritized stakeholders' engagement during the research process. A major benefit of this practice-based (or integrated knowledge translation) research approach is that it takes into consideration values, experience, preferences, and determinants to implementing change in clinical practice, which has the potential of

bridging the evidence-to-practice gap (Gagliardi, Kothari, et al., 2016; Graham & Tetroe, 2009; Moodie, Kothari, et al., 2011). Findings from this dissertation provided further support for the value of practice-based research approaches. In Chapter 2, clinicians' experiences were crucial because they provided us a way to identify predictors of communicative participation outcomes when there was a lack of evidence. Clinicians' experiences were used to guide the predictor analysis in Chapter 2 and results demonstrated a significant correlation between one predictor that clinicians thought to be important and the communicative participation outcomes of late-to-talk children. In Chapters 3 and 4, barriers SLPs experienced with the collection of FOCUS data, and stakeholders' values and preferences, provided a way for this dissertation to identify a list of implementation strategies that were barriers-targeted and feasible in the real-world. The next step is to carefully evaluate the effectiveness of these proposed implementation strategies.

There are also drawbacks to a practice-based research approach (Gagliardi, Berta, et al., 2016; Oliver, Kothari, & Mays, 2019). The experience of conducting this dissertation research echoed some of the reported pitfalls of this research approach. For example, we found a mismatch in expectations between stakeholders and researchers in terms of timeline for the collaboration. For example, in Chapter 4, there was a time lag between the brainstorming phases of implementation interventions and the sorting and rating phase due to a need to transcribe and analyze the interview data with clinicians. During this time, some changes in personnel within the Ontario PSL Program, as well as a loss of interest in some of our stakeholders, resulted in reduced participation during different stages of research. Also, some of the stakeholders were concerned that

publishing the results of the prioritized list of implementation strategies may imply those changes would be made available quickly, setting up unrealistic expectations amongst clinicians. Furthermore, the sustainability of this partnership is also dependent on extrinsic factors such as funding and political climate. For example, during the course of this dissertation, there was a change of Provincial government, which resulted in a renewed negotiation of research priorities between our team and the Ontario PSL Program.

Future directions of this dissertation

One of the future directions of this dissertation project is to use the evidence- and practice-informed implementation strategies identified in Chapter 4 to guide the planning of an implementation intervention in the Ontario PSL Program. We plan to engage stakeholders to create a concrete and feasible implementation plan. During the implementation intervention phase, we also plan to carefully study the effectiveness of the selected implementation strategies in resolving the practice barriers.

An immediate challenge for us is that stakeholders suggested a range of strategies (i.e., different behavioral change techniques) to resolve a particular practice barrier. For example, prompts/cues, habit formation, and restructuring physical environment had all been suggested to resolve barriers within the environmental context and resources. If all of these implementation intervention strategies happen at once, it may be difficult to understand the relative contribution of each behavioral change technique (Taylor et al., 2013). On the other hand, however, there are reasons to use a multifaceted implementation intervention, because a combination of implementation strategies has

been argued to be more effective (Boaz, Baeza, & Fraser, 2011; Campbell & Douglas, 2017; Johnson & May, 2015; Michie et al., 2013).

At the moment, there is no ideal way of resolving this challenge. Perhaps the best approach is to maximize our transparency in the implementation intervention planning and reporting stages, so that when more implementation intervention studies are available, the aggregated analysis of these studies will offer insights into the complex mechanism of action of implementation strategies (Powell et al., 2019). The implementation literature offers an abundance of reporting guidelines in this regard. We plan to specify, using standardized terminology and tools, (i) the complex intervention strategy (Michie et al., 2009); (ii) the implementation outcomes (Proctor et al., 2011); and (iii) the predicted mechanism of action each intervention strategy may have on the implementation outcomes (Lewis, Klasnja, et al., 2018; Powell et al., 2019; Williams, 2016).

Conclusions

This dissertation investigated the communicative participation outcome measurement initiative within the Ontario PSL Program. Currently, the collected outcomes data offers a way to demonstrate intervention effectiveness and to understand some predictors of children's outcomes. Barriers within practice, however, are currently impeding SLPs' capacity and motivation to fully implement the FOCUS into clinical practice. This dissertation identified some practical implementation strategies through balancing the perspectives of relevant stakeholders and considering best-available evidence. Beyond implications for the Ontario public health system, the findings and

methodology from this dissertation may be used to improve outcome measurement within the speech-language pathology profession and other healthcare systems.

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Appendices

Appendix 1. Predictors of children's' outcomes

The following risk factors are collected by SLPs in the *Target Word* program (Earle & Lowry, 2011; Earle, 2015). On the online survey, SLPs were presented with this list of risk factors and were asked to select and rank the five predictors they felt most influenced children's communicative participation outcomes following the *Target Word* program.

	Number of participants with this risk factor	Number of SLPs who selected this risk factor	Average ranking by SLPs [†]
Limited vocabularies, with few verbs	60	10	2.8
Family history of speech/language/learning difficulties	50	6	2.8
Parent interaction style ^a	36	12	3
Quiet as a baby	30	1	5
Language stagnation to date	22	13	3.2
Delayed or restricted sequenced pretend play	19	4	3.8
Recurrent otitis media	16	2	4
Prematurity	13	0	N/A
Child has active medical condition	12	0	N/A
Not imitating verbal models	12	17	2.6
Mild receptive language delay	12	2	2
Limited variety of consonant sounds	11	7	3.1
Reduced quality of babbling as an infant*	8	0	N/A
Target Word program attendance	7 ^b	9	2.9
Child has difficult temperament	6	3	4.3
Concerns about social skills	6	5	2.2
Reduced variety of representational gestures	5	8	3.7
Continues to be quiet now*	4	11	3.2
Number of children in home	4	0	N/A
Parental mental health	4	0	N/A
Significant parental stress	4	1	4
Social economic status	4	0	N/A
Significant sibling concerns	3	0	N/A
Child was exposed to toxins in utero	2	2	5
Difficulty coordinating gesture plus verbal with communicative intent*	2	6	2.7

Parental education	2	1	3
Parental cognitive limitations	2	0	N/A
Difficulties in other areas of motor development*	1	0	N/A
Frequent preferred speech motor movements during word attempts*	1	2	1
Verbal productions are variable*	1	0	N/A
Single parent	1	0	N/A
Poorly differentiated vowels*	0	2	3
Marital discord	0	1	5
34. Others, please specify: _____		0	N/A

[†] SLPs provided a ranking for each of the 5 risk factors that they selected (1 = strongest predictor of children's functional communication outcomes, 5 = 5th strongest predictor). The average ranking across all SLPs who selected the risk factor is presented here.

^a In the *Target Word* program, SLP observed parents' interaction with their child and indicated the predominant role(s) played by the parents in the interaction. These roles included: tuned-in, director, mover, helper, watcher, tester, entertainer. In consultation with the SLP who offered the *Target Word* program in our study, we operationalized an *at risk* parent interaction style to be director (i.e. parents who give a lot of commands) and tester (i.e. parents who ask many testing questions). In our predictor analysis, parent interaction style was entered as a binary variable (i.e. *at risk* vs *not at risk*)

^b The attendance of parents was collected for the *Target Word* program. We operationally defined *at risk* attendance to be parents who attended less than 50% of the *Target Word* program.

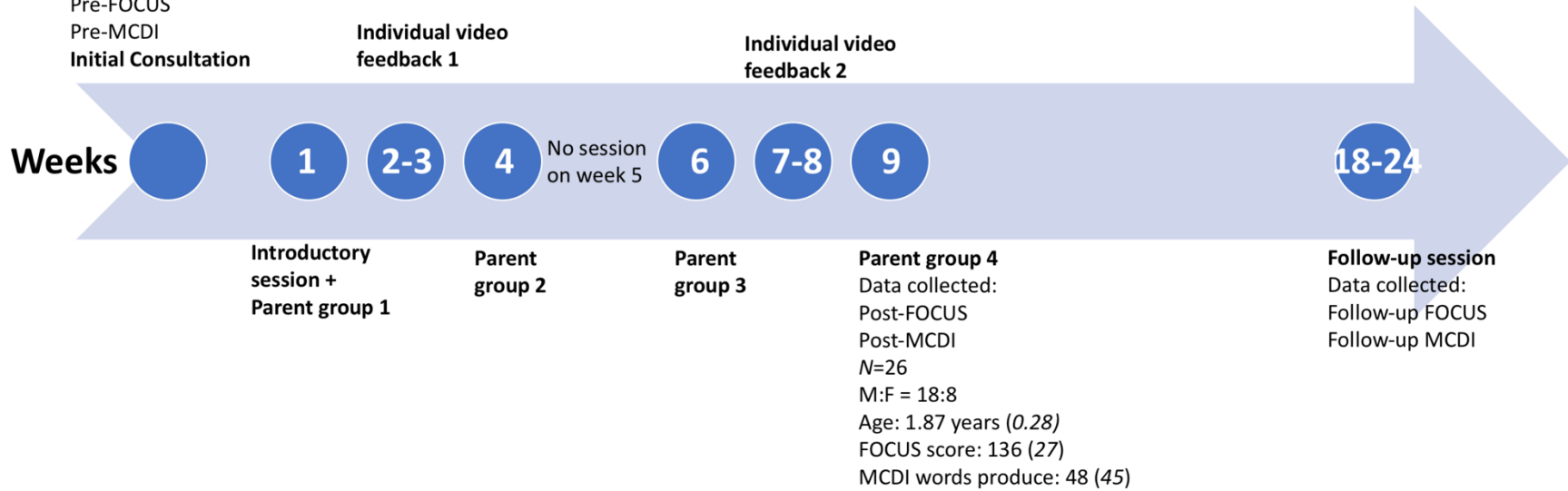
* Only available for children who participated in 4th edition of the *Target Word* program (i.e. N = 19)

Appendix 2. Target Word program timeline

Third Edition Target Word Program

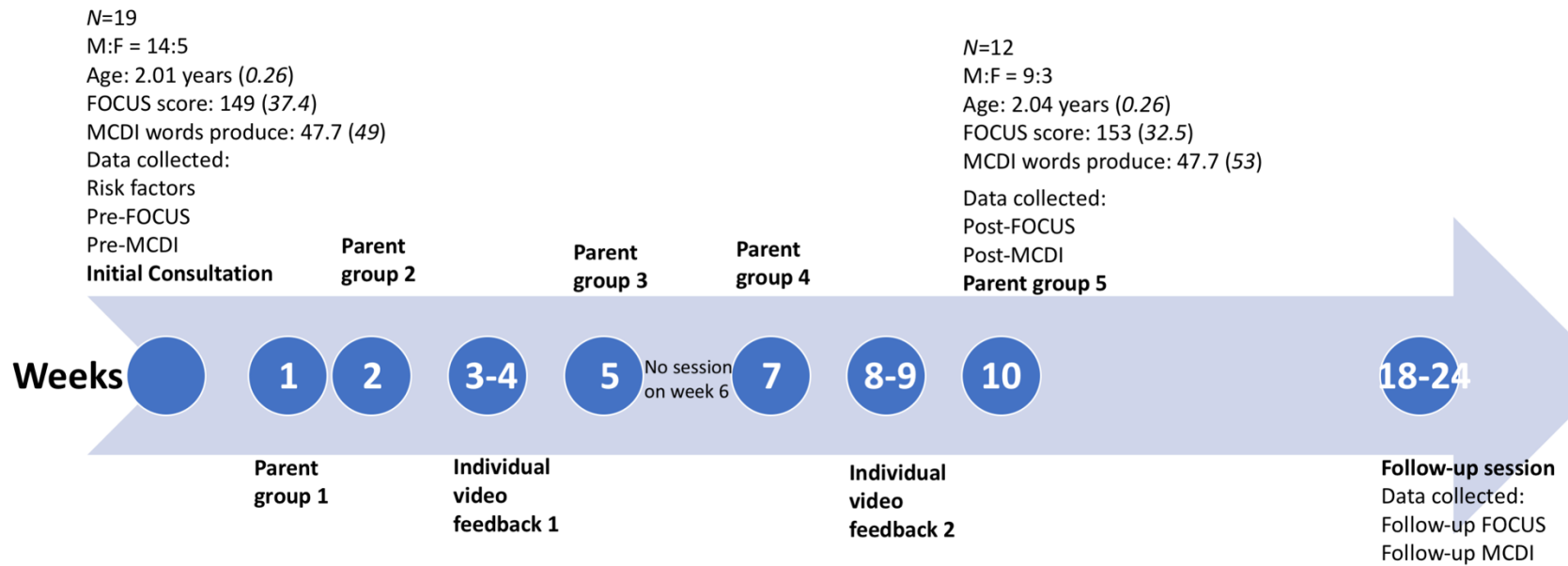
N=57
 M:F = 37:20
 Age: 2.68 years (0.31)
 FOCUS score: 143 (31)
 MCDI words produce: 49 (52)

Data collected:
 Risk factors
 Pre-FOCUS
 Pre-MCDI



Appendix 2 (cont.)

Fourth Edition Target Word Program



Appendix 3. Characteristics of children who participated in the Third and Fourth editions of the Target Word program.

	3 rd Edition Target Word program <i>n</i> = 57	4 th Edition Target Word program <i>n</i> = 19	<i>p</i>
Child-specific characteristics (pre-intervention)			
Gender [†]	M=37; F=20	M=14; F=5	.481
Age	1.90 (0.31)	2.01 (0.26)	.194
Goals for the Target Word program [†]			.881
Noisy	2	0	
Imitation	19	4	
Single words	18	3	
Word combinations	16	2	
Missing	2	10	
FOCUS total score	143 (31) <i>n</i> =44	150 (37) <i>n</i> =15	.503
Number of words spoken	49 (52) <i>n</i> =49	50 (50) <i>n</i> =18	.064
Number of words understood	231 (96) <i>n</i> =49	183 (107) <i>n</i> =18	.939
Post-intervention outcomes			
Changes in FOCUS score	43 (38)	37 (24)	.627
Changes in number of words spoken [‡]	58 (63) <i>n</i> =34	47 (24) <i>n</i> =15	.390
Changes in number of words understood	48 (33) <i>n</i> =34	62 (45) <i>n</i> =15	.219
Post-consolidation outcomes			
Changes in FOCUS score	70 (53) <i>n</i> =31	57 (91) <i>n</i> =5 ^a	.648

[†]Chi-square tests were used for these categorical variables

[‡]Leven's test of Equality of Variance was used to verify that no continuous variables violated the assumption of equal variance for the independent sample t-test comparisons. Only one variable (Changes in number of words spoken from pre-to-post, $p = 0.043$) violated this assumption, and we reported the p-value with adjustment for this variable.

^aThis small *n*-size was due to the fact that most of the re-assessment appointments for these children occurred on a later date than the period for which we had ethical approval to extract data from the clinical charts.

Appendix 4. Results from linear mixed effect models

Mixed effects modeling with a maximum likelihood estimator was used to predict average change in FOCUS scores across the three assessment points. Multiple models were tested, and the best fitting model was one where both slope and intercept were allowed to vary randomly, with an unstructured covariance matrix. The fit of this model was confirmed with a likelihood ratio test (relative to a simpler and a more complex model), and the Bayesian Information Criterion.

Fixed effects included an intercept (predicted average FOCUS score at assessment point 1) and slope (predicted rate of growth in FOCUS scores with each subsequent assessment). The random effects included terms for child, intercept, and slope and accounted for an interaction between slope and intercept. Regression coefficients and predicted versus raw FOCUS scores at the three assessment points are presented below.

	Coefficients	SE	95% CI	<i>p</i>
Fixed effects				
Intercept (predicted score at first assessment)	113.52	6.00	101.77 – 125.29	< 0.01
Slope (growth in FOCUS scores between assessments)	32.32	4.05	24.4 – 40.2	< 0.01
Random effects				
SD Intercept	21.27	12.18	6.92 – 65.36	
SD Slope	22.94	3.97	16.3 – 32.2	
Intercept/Slope interaction	-0.51	0.25	-0.84 – 0.10	
SD Residual	23.67	2.92	18.58 – 30.15	

Model 2 Predicted versus raw FOCUS scores by assessment timepoint

Assessment timepoints	Predicted <i>n</i>	Predicted FOCUS Scores (fitted)	Actual <i>n</i>	Actual FOCUS scores
Pre-intervention	76	147.9 (45)	59	144.5 (33)
Post-intervention	76	189.3 (45)	39	182.9 (44)
Follow-up	76	213.6 (45)	23	207.0 (62)

Pairwise t-tests were conducted using predicted FOCUS scores. Predicted average FOCUS scores differed significantly between pre- and post-intervention, $t(75) = -1500000$, $p < 0.001$, between pre-intervention and follow up, $t(75) = -1600000$, $p < 0.001$, and between post-intervention and follow-up, $t(75) = -5300000$, $p < 0.001$.

Appendix 5. Interview guide

1. Tell me about yourself and your role in the PSL Program.

- How long have you worked in the program?
- What is the program region that you work in? Tell me about the region.
- What kind of caseload do you have?
- Do you work in a team?

2. Tell me a little bit about the FOCUS, how is it administered at your clinic?

Example follow-up prompting questions:

- Start from the beginning, when do you administer the FOCUS?
- At what sessions do you administer the FOCUS?
- Can you tell me more about the assessment session? Who is involved, how long is an assessment session?
- Do you re-administer the FOCUS? When do you re-administer the FOCUS?
- Thinking about the steps in collecting the FOCUS, who is involved?
 - do you use the parent/clinician form?
 - Who gives out the FOCUS/explains the FOCUS?
 - Who collects it? When?
 - Who enters/submits the data to the Ministry? When?
- Tell me what happens after that (e.g., receiving the FOCUS forms from parents, entering scores into database)?
- How long does it typically take to complete the FOCUS?

3. Right now, are there any things that has enabled or helped you with collecting and submitting the FOCUS regularly?

Example follow-up prompting questions:

- Can you elaborate on that? Why do you find that helpful?
- Are there anything else that has been helpful to you?

4. What are some challenges/ barriers to the collection and submission of the FOCUS?

Example follow-up prompting questions:

- And that is a barrier because...? Why is that a challenge?
- Can you tell me more about that (e.g., the programming of your clinic)?
- Are there other challenges?

Appendix 6. TDF coding manual

TDF domains	What to look for in transcript	Sample Quote:
1 Knowledge		
Awareness of the FOCUS and related processes, including procedural knowledge, online resources, user manual, evidence etc	Statements that shows having/not having/wanting/needng knowledge of the FOCUS/ specific items of the FOCUS	So I guess the one thing I will say is sometimes, sometimes I'm not sure when to give it, when is tricky between the 6 months period, where I am like I can give it to them now like three or four months, but then when they go on a break and come back it will be seven or eight months. So is it better to do it sooner or later? So I guess that's sometimes something that keeps me from knowing when to give it, or if I'm giving it too much or not enough? Because I'll be unsure, should I give it at the four months and the 8th month, or just?
Synonyms: Knowledge (including knowledge of condition /scientific rationale), Procedural knowledge, Knowledge of task environment	Statement of knowledge (or the lack of) about the rationale behind doing outcome measure/FOCUS	
2 Skills		
SLPs' ability/ proficiency/ perceived control over completing/collecting the FOCUS.	Statements that shows the use/acquisition of/desire to learn skills/ techniques regarding the use of the FOCUS tools	And there are questions on the sheet that's like, if the child in an early language environment and you checked off 0 days or 2.5 days or more than 2.5 days. Honestly sometimes, especially earlier on, I would complete the assessment and then realized I didn't have some of these specific questions. And I wonder if those are some questions that can be included on the FOCUS form that the family could fill out? Where do I'm not at zero day 0.5 to 2.5 are they another question is are they receiving therapy with non-PSL SLPs, and that's another one that the family can be checking off.

Synonyms: Skills, Skills development, Competence, Ability, Interpersonal skills, Skill assessment, Practice	Statements related to SLP using/developing interpersonal skills that relates to FOCUS completion	
	Statements related to SLP's language ability/ reading competency / ability to understand the items and choices on the FOCUS (Parent's ability should be coded under belief about consequences)	
3 Professional/Social Role & Identity		
Impacts from completion of FOCUS on the behaviors/beliefs/qualities that define role of SLP	Statements that shows whether completing outcome measures/FOCUS is considered a part of SLP's role, within their scope of practice	I think the big hindrance is the fact that, for me, I administered it, or I was expected to administer it through a rural program where I don't see the families frequently. So filling that out can eat into therapy time. And so that can be a bit of a, you know, it's tough to say "okay, I'm gonna take half this session, you see me every 3 months, and we're gonna fill this out together." Some of the families that needs to do it together.
Synonyms: Professional identity, Professional role, Social identity, Identity, Professional boundaries, Professional confidence, Group	Statements that shows that completing outcome measures/FOCUS may contradicts/enhance the perceived role of the SLP	

identity, Leadership, Organisational commitment		
4 Beliefs about Capabilities		
An opinion formed regarding SLP's own ability to complete/ collect the FOCUS across situations (e.g. even when challenges emerge)	Statements relating to ability/inability to complete the FOCUS	But I wouldn't say it's extremely onerous or anything but I would say that generally here people are very good at bringing in the FOCUS, I don't ever have a problem with it.
Synonyms: Self-confidence, Perceived competence, Self-efficacy, Perceived behavioural control, Beliefs, Self-esteem, Empowerment, Professional confidence	Statement regarding a perceived level of control over their ability to do the FOCUS	
5 Optimism		
SLP's level of confidence regarding implementation of FOCUS	Statements specific to SLPs feeling regarding the likelihood of FOCUS being done	None available
Synonyms: Optimism, Pessimism, Unrealistic optimism,		

<p>Inclusion/Exclusion Rules: "Optimism" relates to SLPs' confidence of the data collection process of the FOCUS. If the statement refers to SLPs' confidence in the usefulness of the collected FOCUS data, code under "Beliefs about consequences".</p>		
6 Beliefs about consequences		
<p>Expected outcomes related to implementation of FOCUS</p>	<p>Statements that mentioned any (or the lack of) anticipated consequences/impact about doing the FOCUS (positive or negative) - to themselves, the client, the parents, government, system etc</p>	<p>So I think that if we're communicating this to different areas and being clear as to when it's supposed to happen, but again, paired it with my previous comments of looking at, okay what are they using the information for and what would be sort of the minimum number of times that we could administer it to give the most valuable information. Because then, if clinicians understood, okay this is what they've chosen as the main times then we would know 'okay' we could incorporate it into our different checklists, and our workflows, and that's when it would be done. But we would know it's being done for a purpose and at a specific time.</p>
<p>Synonyms: Beliefs, Outcome expectancies, Characteristics of outcome expectancies, Anticipated regret, Consequents</p>		

Inclusion/Exclusion Rules: "Optimism" relates to SLPs' confidence of the data collection process of the FOCUS. If the statement refers to SLPs' confidence regarding the usefulness of the collected FOCUS data, code under "Beliefs about consequences".		
7 Reinforcement		
Rewards/punishments (tangible/intangible) contingent on the implementation of FOCUS	Statement describing any incentives related to completion of the FOCUS/ punishment related to not completing the FOCUS	None available
Synonyms: Rewards/Incentives (proximal / distal, valued / not valued, probable / improbable), Incentives, Punishment, Consequents, Reinforcement, Contingencies, Sanctions		
8 Intentions		

A conscious effort to act in certain ways (e.g. to complete the FOCUS), relate to stages of change model	Statements that describes the presence/absence of intentions/motivation of administering the FOCUS	It seems sometimes like it's just I'm doing this to do this.
Synonyms: Stability of intentions/ inclination, Stages of change model, Transtheoretical model and stages of change		
9 Goals		
Mental representations of what the SLP wants to achieve, related to setting goals and prioritizing regarding the implementation of the FOCUS.	Statements that shows that the SLP has envisioned/quantified a goal/ talked about the lack of goals regarding the FOCUS	When I... you know... because... after the coordinators meetings and whatever. manager comes back and shows us all the different you know how many are being done and all of that because it is a deliverable.
Synonyms: Goals (distal / proximal), Goal priority, Goal / target setting, Goals (autonomous / controlled), Action planning, Implementation intention		
10 Memory, attention and decision processes		

SLP's ability to retain information on, and attend selectively to aspects of the environment	Statements relating to SLPs making a conscious decision on doing/not doing FOCUS	And sometimes I'll forget. In terms of getting that 6 month at the appropriate time.
Synonyms: Memory, Attention, Attention control, Decision making, Cognitive overload / tiredness	Statements relating to a time/situation that the SLP remembered or forgot to do the FOCUS	
11 Environmental context and resources		
Circumstances within the SLP's environment that has impacts on SLP's ability to collect/complete the FOCUS (e.g., impacting skills development, independence, social competence...)	Statements that describes the practice context around FOCUS administration	I guess if they [the parents] didn't bring one [the FOCUS] in, and then it is a complex kids, and that you're pressed with time, then sometimes it could be an issue just because it takes time to fill out.

<p>Synonyms: Environmental stressors, Resources / material resources, Organisational culture /climate, Salient events / critical incidents, Person x environment interaction, Barriers and facilitators</p>		<p>So the steps from the parent filling out the paper form, to the point it gets to input it to the ministry, there are a lot of steps. That's why the clinicians find this challenging. If it was like "yeah sure, I'll have the parents do that and then it's out of my hair, I'm just sending it on". But there's so many steps because you have to send it to do the data element, put it together, give it to someone to score it, then they bring it back to you, then you have to record it in the EMR and then you have to send it back to someone who is going to input it into the ISCIS and the turnaround time there then becomes an issue with us not meeting our ministry deliverable because we're doing these FOCUS's but they're not getting it in on time. So all this wasted work essentially.</p>
<p>Inclusion/Exclusion rule: Inclusion/Exclusion Rule: "Behavioral Regulation" includes system put in place by the SLP themselves. If the system in place was organizational (e.g. by the workplace/by the government), code under "Environmental Context & Resources"</p>		
<p>12 Social influences</p>		
<p>Interpersonal relationships that influence SLP's thoughts</p>	<p>Statement that describes a behavioural or mental modification/adjustment related to FOCUS completion</p>	<p>Because I still... when we used to have give it to little 12 months olds, there are so many times that they are picking not at all like my child. And I can still think of some older children who are still significantly... you know if they are not at a developmental level of</p>

and behaviors related to FOCUS	as a result of interaction with peers/patients.	18 months then I feel like we are asking them a lot of questions that their child is still not capable of showing. And I am very good at recognizes that it encompasses non-verbal as well, you know there was even a criticism recently in a group discussion someone was saying about the CFCS and I said well... no no no I think that's okay you know remember its not verbal communication, they don't have to be able to do that through speaking is through all the modalities. So it's not a verbal, non-verbal thing for me more a developmental age and whether or not they are that significantly cognitively impaired are we risking the fact that I am going to make the parents feel bad answering some of these questions about their child.
Synonyms: Social pressure, Social norms, Group conformity, Social comparisons, Group norms, Social support, Power, Intergroup conflict, Alienation, Group identity, Modelling		
13 Emotions		

SLP's feelings, affects towards the FOCUS.	Statements that describes that the SLP experiencing an emotional (and related behavior) reaction towards the FOCUS.	So I feel like it's easy for me to do in a sense that I can sure.... I can hand it to the parents and I have them do it and I submit it. But I don't feel good about it. And that's where I have a problem, I don't feel good handing this to a parent when there is like take those kids who are severely behind in every areas communication and maybe they have another diagnoses maybe they don't, maybe they are going to get one. And you have these 34 questions and you get the form back and the parents have checked not at all like my child or cannot do at all for almost all 34 questions. So that's really hard to see as a clinician or as a person, because you already know how that parent feels and I feel like its hitting them over the head with it.
Synonyms: Fear, Anxiety, Affect, Stress, Depression, Positive / negative affect, Burn-out		
14 Behavioral regulation		
Actions/system in place that aims directly to change/ adjust/monitor the completion of FOCUS.	Statements that shows the SLP has a system or process in place/wants a system that can provide audit or feedback on their completion of the FOCUS	But I always have a copy on me during the assessment, so if they didn't bring in their own, they can fill it out during that time.
Synonyms: Self-monitoring, Breaking habit, Action planning	Statements that describe a conscious effort to ensure the behaviour is carried out	

<p>Inclusion/Exclusion Rules: 1. "Behavioral Regulation" includes system put in place by the SLP themselves. If the system was put in place at an organizational level (e.g. by the workplace/by the government), code under "Environmental Context & Resources" 2. If the clinician is saying that she has already formed a habit of doing the FOCUS, code as "skills" (i.e., the SLP has developed the competency to administer the FOCUS regularly). "Behavioral Regulation" relates to SLPs developing ways to break free from an old habit (i.e., not having to do the FOCUS).</p>		
Coding Steps:		
1. Begin with reading & re-reading the interview		

<p>transcript to understand the SLT's frame of mind, practice environment. Make sense of the data.</p>		
<p>2. Read a segment of text from the transcript. The length of the segment would vary depending on how the SLT responded to the question. Try to identify a manageable segment of text, and limit to one idea per segment as much as possible.</p>		
<p>3. Interrogate the segment of text. Make sure it is a description of facilitator/barrier to the data collection process of the FOCUS tools. Do not code if the SLT is describing the facilitators/barriers to other processes (e.g., scoring, use) related to the FOCUS tool.</p>		
<p>4. Break compound segments into smaller chunks so that each chunk represents one idea only.</p>		

<p>5. Extract the main message from the segment of text (rephrase in your mind if necessary). Then search the domains of the TDF to find one that is most appropriate to describe the SLT's perspective.</p>		
<p>6. Do not code the same segment of text into two different domains. Extract the best fit domain. Use the context from the interview to help understand what the facilitator/barrier was in the SLT's mind.</p>		
<p>7. If the SLT also surveyed their colleagues and reported the facilitators and barriers from their SLT colleague, code those as well.</p>		

Appendix 7. Facilitators & barriers per PSL Program region

TDF constructs	Region 1		Region 2		Region 3		Region 4	
	Facilitators (+)	Barriers (-)	+	-	+	-	+	-
Knowledge		1						1
Skills		1						1
Professional/Social Role & Identity				1				1
Beliefs about capabilities	1		1					1
Optimism								
Beliefs about consequences	1	1		1		1		1
Reinforcement								
Intentions	1				1		1	
Goals								
Memory, attention and decision processes		1		1				1
Environmental context and resources	1	1	1	1	1	1	1	1
Social influences	1			1				1
Emotion								1
Behavioral regulation	1		1		1		1	

Appendix 7 (cont.) Facilitators & barriers per PSL Program region

TDF constructs	Region 5		Region 6		Region 7		Region 8		Region 9		Region 10		Region 11		Region 12		Region 13	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Knowledge						1				1								
Skills		1					1				1	1			1	1		
Professional/Social Role & Identity		1				1		1										
Beliefs about capabilities		1		1							1							1
Optimism																		
Beliefs about consequences	1	1				1		1		1		1		1	1	1		1
Reinforcement																		
Intentions	1				1				1									
Goals																		
Memory, attention and decision processes			1	1								1		1				1
Environmental context and resources	1	1	1	1	1	1		1	1	1	1	1		1	1	1	1	1
Social influences	1	1		1				1								1		1
Emotion																		1
Behavioral regulation	1		1		1		1				1		1			1	1	

Appendix 7 (cont.) Facilitators & barriers per PSL Program region

TDF constructs	Region 14		Region 15		Region 16		Region 17		Region 18		Region 19		Region 20		Region 21		Region 22		Region 23	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Knowledge		1						1							1	1				
Skills		1		1																1
Professional/Social Role & Identity													1							1
Beliefs about capabilities	1			1		1								1						1
Optimism																				
Beliefs about consequences						1		1		1		1	1	1		1	1	1		1
Reinforcement																				
Intentions	1			1						1										
Goals																				
Memory, attention and decision processes		1						1	1											
Environmental context and resources	1	1	1	1	1	1	1	1		1		1		1	1	1	1	1		1
Social influences	1	1				1						1				1				1
Emotion										1										
Behavioral regulation	1	1	1		1		1				1		1				1		1	

Appendix 7 (cont.) Facilitators & barriers per PSL Program region

TDF constructs	Region 24		Region 25		Region 26		Region 27		Region 28		Region 29		Region 30	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Knowledge						1							1	
Skills										1			1	
Professional/Social Role & Identity						1								
Beliefs about capabilities	1		1		1	1				1				
Optimism									1					
Beliefs about consequences		1			1	1	1	1	1	1				1
Reinforcement														
Intentions	1													
Goals	1													
Memory, attention and decision processes			1	1		1		1				1		1
Environmental context and resources		1	1	1	1	1	1	1		1	1	1	1	1
Social influences		1				1		1		1		1		1
Emotion						1				1				
Behavioral regulation	1		1		1	1	1	1	1		1		1	

Appendix 8. Good Reporting of A Mixed Methods Study checklist

Guideline	Section: page
Describe the justification for using a mixed-methods approach to the research question	Background: p.92-93
Describe the design in terms of the purpose, priority and sequence of methods	Background: p.92-93 Methods: p.93-102
Describe each method in terms of sampling, data collection and analysis	Methods: p.93-102
Describe where integration has occurred, how it has occurred and who has participated in it	Methods: p. 93-102
Describe any limitation of one method associated with the present of the other method	Discussion: p.113-115
Describe any insights gained from mixing or integrating methods	Discussion: p.115-116

Reference: O'Cathain A, Murphy E, Nicholl J. The quality of mixed methods studies in health services research. *J Health Serv Res Policy*. 2008;13(2):92-98.

Appendix 9. Member check survey to SLPs

Thank you for participating in our telephone interview in late 2018 and for sharing your views and ideas about the FOCUS and how to improve its implementation. During our interview, we asked you to brainstorm ideas to improve both the collection and submission of data. As a group of 37 SLPs you generated 90 different suggestions. After the interview, you also helped us sort those 90 suggestions into categories. Based on the way you and other SLPs sorted the suggestions, we identified 6 different categories to summarize and describe SLPs' suggestions. After the suggestions were sorted, we asked you (the SLPs) to rate both the importance and feasibility of the suggestions that were given. Members of the FOCUS research team, and Ministry representatives were also asked to rate the feasibility of the suggestions from their perspectives. As a final step in our research process, we are requesting your input one last time. First, we would like you to review the categories we identified and tell us whether they accurately represent your ideas for improving implementation of the FOCUS in the PSL Program. Second, we would like to review the suggestions that were rated as important by SLPs and as feasible by SLPs, the FOCUS research team and the Ministry and tell us whether you agree with the way they are prioritized. This should take approximately 10-15 minutes to complete. Thank you for sharing your expertise with us!

I agree to participate (1)

Step 1: Below you will see a summary of the categories we identified based on the 90 suggestions to improve implementation of the FOCUS given by SLPs. Category titles, definitions, and select examples of suggestions are presented.

Category 1: Resources-

Definition- providing additional financial and personnel support

Example suggestions -(i) hire more SLPs; (ii) provide more funding for clerical support

Category 2: Communication-

Definition- share information with frontline staff and maintain an ongoing communication between the Program and SLPs

Example suggestions -(i) share what is done at the ministry level to look at program effectiveness using the FOCUS; (ii) share information on how other agencies/clinicians are using FOCUS data clinically

Category 3: FOCUS administration fidelity-

Definition- improve the consistency with which the FOCUS is introduced to parents, scored, interpreted and used to support clinical practice

Example suggestions -(i) create a poster/visual display that explains purpose of FOCUS; (ii) make sure FOCUS scores can support functional/clinically-related activities

Category 4: FOCUS administration logistics-

Definition- facilitate the process of FOCUS data collection, as well as modify the administrative schedule of the FOCUS

Example suggestions -(i) offer an electronic fillable FOCUS form (e.g. on tablet/iPad/online/laptop); (ii) re-examine the frequency and timing at which FOCUS should be completed

Category 5: FOCUS user-friendliness for parents-

Definition- improve clarity, readability and literacy level of the FOCUS so that it is easier for parents to complete

Example suggestions -(i) improve readability of the FOCUS (e.g. increase the font size and bubble size, shading the items); (ii) simplify the wordings of FOCUS items so they are appropriate for parents' reading level

Category 6: FOCUS comprehensiveness-

Definition- ensure the FOCUS is applicable and appropriate for all children and families-

Example suggestions -(i) make sure FOCUS items apply to all families; (ii) have separate section for items that are verbal communication vs other forms of communication

Click [HERE](#) (this contains a link to a document containing the concept map (i.e. Figure

2) and a full list of suggested strategies (i.e. Supplementary 2) to see the full list of statements in each category.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Q1. The labels represent the statements in each category	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q2. The definitions represent the statements in each category	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q3. These 6 categories are accurate categorization of the 90 suggestions made by SLPs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4. Do you have any comments about the category labels?

Q5. Do you have any comments about the definitions provided for each category?

Q6. Do you have any comments about the categories?

Step 2: After your interview, we asked you to rate how important and feasible the 90 suggestions offered by SLPs were. For the most part, the things that were rated as important by SLPs were also rated as feasible (e.g., SLPs thought improving the user-friendliness of the FOCUS was both important and feasible). In order to ensure the approaches to improving implementation of the FOCUS are effective, it was also important to ensure that things that were perceived as being important and feasible by SLPs were also perceived as being feasible from the perspectives of the FOCUS research team and the Ministry. Members of the FOCUS research team and the Ministry were therefore also asked to rate the feasibility of SLPs' suggestions. Some of the suggestions that were important and feasible by SLPs were also rated as feasible by representatives from the research team and Ministry, but some were seen as not being feasible either by the Ministry or the FOCUS research team. We have identified a list of 14 suggestions that were rated as highly important by SLPs, and feasible from the perspectives of all stakeholders. We have also prioritized the list of suggestions beginning with the one rated highest on importance and feasibility (see Table below). Next to each suggestion, we provide a numerical value of importance (averaging the rating by SLPs) and feasibility (average ratings from the FOCUS research team and the Ministry). These ratings range from 0 (not important/feasible at all) to 5 (extremely important or feasible).

Priority	Strategies	Importance	Feasibility	Reported Benefits
1	Offer an electronic fillable FOCUS form (e.g. on tablet/iPad/online/laptop)	4.1	4.5	Improves data collection/submission environment
2	Share what is done at the ministry level to look at program effectiveness using the FOCUS	4.1	4.4	SLPs will know what happens to the FOCUS data they collect and submit
3	Make translations of FOCUS available	4.1	4.4	The data collected from FOCUS will be clinically valid
4	Improve readability of the FOCUS (e.g. increase the font size and bubble size, shading the items)	4.1	4.3	Improves data collection/submission environment
5	Make sure FOCUS scores can support functional/clinically-related activities (e.g. helping clinicians form goals)	4.1	4.1	SLPs will know how they can use the FOCUS data in their practice
6	Offer a way for FOCUS to be completed and submitted by parents at home e.g. online/over the phone	4.1	4	Improves data collection/submission environment
7	Keep the dialogue open with SLPs to see what can be improved/ changed	4	4.3	Research on the FOCUS will incorporate clinical expertise, and be more relevant to practice
8	Provide a way that automatically calculates scores/statistics of FOCUS (including change scores from the last FOCUS and the subscale scores)	4.2	3.8	Improves data collection/submission environment
9	Make sure FOCUS is valid even if different parents/caregivers/SLPs are completing them	3.9	4.6	The data collected from FOCUS will be clinically valid
10	Create an electronic system that streamlines all administration of FOCUS (e.g. can see all FOCUS of the same child in tabs)	3.9	3.5	Improves data collection/submission environment
11	Share successful research findings with the use of FOCUS (specify the details of the intervention and how FOCUS data was collected)	3.8	4.8	SLPs will know how submitted FOCUS data was used in clinical research
12	Change the schedule of FOCUS such that administration is timed to clinical appointments (e.g. assessment/intervention/discharge) rather than saying every 6 months	3.8	3.3	Improves data collection/submission environment
13	Remove the need to transfer FOCUS score by having an app that connects FOCUS data to the ministry (i.e. remove the need to transfer paper to electronic format)	3.8	3.5	Improves data collection/submission environment
14	Provide more timely feedback about FOCUS outcomes to SLPs (rather than at PSL meetings only)	3.7	4.3	SLPs will know what happens to the FOCUS data they collect and submit

Do you agree...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Q7. with the prioritization?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q8. with the benefits of each suggestion?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Note: if the respondent selected “Strongly disagree” or “Somewhat disagree” to the prioritization, they will be asked to prioritize the list of 14 strategies.

Q9. Do you have comments about the benefits of each suggestion?

Results from survey

$n = 25$ clinicians, $n = 4$ researchers and $n = 3$ representatives from PSL Program

	Q1. Category labels	Q2. Category definitions	Q3. Categories	Q7. Prioritization	Q8. Benefits
Strongly Agree	30%	33%	33%	37%	57%
Agree	60%	63%	53%	60%	43%
Neither agree nor disagree	7%	0%	10%	0%	0%
Disagree	0%	0%	0%	3%	0%
Strongly Disagree	3%	3%	3%	0%	0%

Participants made few comments to the open-ended questions. Seven participants made comments to Question 4 (regarding the category label chosen). Their responses are summarized below. However, since the level of agreement amongst respondents has exceeded our *a priori* threshold of consensus (i.e. 85%), we did not make changes to the category labels.

Summary of written response to Question 4:

- $n = 4$ suggested alternative labels to Category 6: FOCUS Comprehensiveness. Suggested labels include: FOCUS applicability/ appropriateness/ inclusiveness for all clients/families
- $n = 2$ recommended using one word only as category labels
- $n = 1$ recommended using “caregivers” instead of “parents” in category 5 label.

Appendix 10. Concept mapping categories and statements

Category	Statements
1. Resources	
	Cancel the FOCUS
	Reduce clinician's case load
	Hire more SLPs
	Provide funding for postage and returning envelopes
	Provide more funding for clerical support for ISCIS data entry
	Allow satellite sites (i.e. CTCs) to access ISCIS and FOCUS scores
	Provide guidance/ protocol on how to best collect FOCUS in situations when it is difficult to reach family (e.g. at discharge, between therapy blocks, if family doesn't return FOCUS)
	Specify an acceptable range of duration between FOCUS administrations (i.e. clarify if FOCUS is still valuable to the ministry if re-administered beyond 6 months)
	Emphasize that it is ok to use the clinician form
	Provide more information online regarding how to submit FOCUS
	Provide trainings (e.g. case studies), so SLPs can practice completing the FOCUS consistently
	Encourage CTC/ PSL sites to share their process of collecting the FOCUS
2. Communication	
	Provide more information online regarding the CFCS levels
	Share what is done at the ministry level to look at program effectiveness using the FOCUS
	Share information on how other agencies/clinicians are using FOCUS data clinically
	Provide more timely feedback about FOCUS outcomes to SLPs (rather than at PSL meetings only)
	Keep the dialogue open with SLPs to see what can be improved/ changed

	Share successful research findings with the use of FOCUS (specify the details of the intervention and how FOCUS data was collected)
	Communicate the purpose, value and importance of outcome measures such as the FOCUS
	Clarify what it means when FOCUS score drops between successive administrations
	Encourage the use of FOCUS locally (e.g. encourage the use of FOCUS to understand the effectiveness of a specific program that a PSL site/ clinic offers)
	Provide evidence to show that the FOCUS reflects child's progress rather than just parents' understanding of their child's communication
	Examine if FOCUS is useful across all populations, if not, cut-down the need for administration of the FOCUS in populations that it is not sensitive to
	Have a pop-up verbal prompt that provides feedback about the intervention when a significant change on FOCUS score was made.
	Make sure FOCUS is valid even if different parents/caregivers/SLPs are completing them
3. FOCUS administration fidelity	
	Offer case examples in user manual on how to score for Level 4-5 kids or children who can complete a skill reliably but in restricted ways (e.g. children can concentrate on tasks at hand, but only for a handful of preferred tasks)
	Provide a blurb of how FOCUS can be introduced to parents by the SLP
	Keep the clinician form available, so clinicians can complete the FOCUS forms for families with DD kids
	Have FOCUS set up so that major changes on specific FOCUS items are flagged
	Clarify if the different translations of FOCUS are interchangeable (e.g. if family started with the English FOCUS, can you switch to another language later?)
	Make sure FOCUS scores can support functional/clinically-related activities (e.g. helping clinicians form goals)
	Create a poster/visual display that explains purpose of FOCUS (to be placed in clinic waiting area)
	Create a video about FOCUS to be displayed on TV

4. FOCUS administration logistics	
	Have FOCUS collected only on a portion of SLPs caseload (quality over quantity)
	Have a reminder system that automatically notifies SLP when 6 months is up
	Re-examine the frequency and timing at which FOCUS should be completed
	Set a specific date where FOCUS needs to be completed for everyone (i.e. date not dependent on the child)
	Change the schedule of FOCUS such that administration is timed to clinical appointments (e.g. assessment/intervention/discharge) rather than saying every 6 months
	Allow longer time between re-administration of FOCUS and the ministry will need to provide norming data for longer than 6 months)
	Have more time for assessment/re-assessment sessions so families can fill in the FOCUS with the clinician
	Remove the need to transfer FOCUS score by having an app that connects FOCUS data to the ministry (i.e. remove the need to transfer paper to electronic format)
	Submit FOCUS at initial assessment as well so that it reflects the baseline of the child before any tips/ strategies were discussed with parents
	Streamline FOCUS reporting with other organizational required paperwork (e.g. what intervention was recently provided is usually already entered somewhere else in the organizational system)
	Provide a way that automatically calculates scores/statistics of FOCUS (including change scores from the last FOCUS and the subscale scores)
	Create an electronic system that streamlines all administration of FOCUS (e.g. can see all FOCUS of the same child in tabs)
	Have a data completeness checking system so that missed items on FOCUS will be detected real-time
	Have a setting on the online FOCUS form so families won't be allowed to book an assessment/obtain a transition to school report until they have completed the FOCUS
	Modify the existing excel scoring template (i.e. the one that allows you to see change over time), so that there is no need to click to transition between part 1 and part 2 (i.e. you can enter item scores all in 1 column)

	Make FOCUS easier for handscoring so clinicians can see score on each subcategory (e.g. social communication)
	Offer a way for FOCUS to be completed and submitted by parents at home e.g. online/over the phone
	Offer an electronic fillable FOCUS form (e.g. on tablet/ipad/online/laptop)
5. FOCUS user-friendliness for parents	
	Reword/clarify items on FOCUS that seem very similar to parents
	Simplify the wordings of FOCUS items so they are appropriate for parents' reading level
	Improve readability of the FOCUS (e.g. increase the font size and bubble size, shading the items)
	Provide percentages next to the rating choices on FOCUS to assist parents' understanding (e.g. like my child 50% of the time)
	Provide a pictorial rating scale (e.g. from sad to smiley face)
	Reduce the number of choices on the rating scale
	Simplify the wordings of the rating scale on the FOCUS
	Give real-life examples of what is considered , "communication" on the front page
	Make FOCUS items shorter (i.e. less wordy)
	Provide examples within the FOCUS items
	Have a consistent rating scale for part 1 and part 2 of FOCUS
	Make translations of FOCUS available
	Reword items on the FOCUS that do not apply to all clients (e.g. "my child will sit & listen to stories" doesn't apply to wheel-chair bound clients rather use wordings such as "My child can share a book")
	Make it clear to parents the distinction between "communicating" and "talking" (particularly at initial assessment)
	Provide the rationale of FOCUS for parents on parent FOCUS form (i.e. not on a separate information sheet)
	Design FOCUS in a way such that it is easy to see if parents are concerned with particular area

	Provide tips on guiding parents through difficult FOCUS items (e.g. My child can communicate effectively with other children- what if parent didn't have opportunity to observe?)
	Add an option "No opportunities"/ "Not applicable" to the rating scale
	Have a version of FOCUS where parents can click to listen to the items (i.e. having a way for FOCUS to be read to parents).
	Have a more interactive FOCUS
	Offer FOCUS only to clients above certain mental age (i.e. rather than chronological age of 18 months+)
	Increase the minimum age of the FOCUS (e.g. to 24months), when the items on FOCUS is more appropriate
	Redesign the FOCUS so that parents can fill in identifying information of the child (e.g. demographic information, if child is attending daycare)
6. FOCUS comprehensiveness	
	Have separate section for items that are verbal communication vs other forms of communication
	Have more general items on the FOCUS rather than asking child's ability in specific situations (e.g. with peers)
	Make sure FOCUS items apply to all families (e.g. if child is not attending daycare, parents report not being able to speak to child's ability to interact with peers)
	Make the items on FOCUS more specific & objective (e.g. items about confidence of child are subjective)
	Make an alternative FOCUS form for functional but not verbal communication
	Have a different FOCUS for different age ranges (e.g. <2.5 years vs above)
	Have more items relevant to skills at earlier developmental level
	For children with multiple needs/young in mental age/developmentally delayed, provide an option for parents to complete a shorter form (e.g. a checkbox that says FOCUS is inappropriate, a way to indicate minimal changes have been made in the past year)
	Have some items not weighted on the FOCUS total score for children who have complex needs
	Make the items on FOCUS reflect other modes of communication (e.g. AAC)

	Have more items sensitive to small incremental changes in children at CFCS levels 4-5 who have complex needs/ who are severely delayed/ low functioning/ pre-intentional
	Make FOCUS items more specific to things that clinicians can observe and report on
	Include more items on FOCUS that look at skills targeted in therapy (e.g. receptive language)
	Clarify what is being measured in each FOCUS item (e.g. "My child gets upset when other children don't understand")
	Shorten the FOCUS by conducting more research and limiting to only items sensitive to change
	Test the readability of FOCUS with many families including lay person, parents of children with typical development, multilingual families, ESL families, etc.

Appendix 11. Prioritized implementation strategies and their mechanisms of action on the reported barriers

Suggested Implementation Strategies	Associated Barriers (in TDF domains) ¹	Example Quotes (from interview with clinicians)	Relevant Behavioral Change Technique ²	Known Mechanism of Action ³	Based on the known Mechanism of Action, is the suggested implementation strategy a potentially effective technique to resolve the practice barrier?	How may the strategies resolve the barrier?
Category: Communication						
Share what is done at the ministry level to look at program effectiveness using the FOCUS	Beliefs about consequence	Yeah so, I know you were talking about, those are some of the barriers or challenges that I feel, and just from other people telling me about how they feel about the FOCUS and	Information about social & environmental consequences	Knowledge; Beliefs about consequence; Attitude towards behavior	Yes	When clinicians are provided information about the impact of their behavior (i.e., collection of the FOCUS data) on the PSL Programs at the province (i.e., social and environmental consequence), it may increase clinicians' beliefs

	<p>you know, I do think it would be great if there are outcome measures that you know, show that we're continuing to make a significant progress, or outcomes with these clients but the other thing with the FOCUS is that it hasn't, we haven't gotten any feedback about how it's being used as a province so I think that some of the therapists</p>		<p>about the consequence of collecting data and change their attitude towards data collection,</p>
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		<p>who are using it are frustrated in a sense that we don't know, we're spending so much time and energy submitting these scores and we don't really know what they're being used for.</p>				
<p>Keep the dialogue open with SLPs to see what can be improved/ changed</p>	<p>Beliefs about consequence</p>	<p>Well, I mean keep the dialogue open because you are talking to your first line personnel. You have to keep asking these questions and keep changing you know where</p>	<p>Problem solving (also include elements of Review behavior goals and Review outcome goals)</p>	<p>Goals; Beliefs about capacities; Behavioral regulation</p>	<p>No</p>	<p>The current available evidence does not suggest that scheduled review of the behavior/outcomes of the behavior, or problem-solving will resolve the clinicians' lack of beliefs about the consequences of their behaviors.</p>

	<p>you are headed. Just keep being flexible and don't be afraid of changing things I would say and not just use a tool just for us... not for all kinds of populations. Or that's designing for us properly, I believe the FOCUS was a tool designed not for us. Its something that's used for, I don't know if I am right or remember this right, I thought that</p>			<p>This intervention alone is likely ineffective.</p>
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	<p>for different kinds of populations like people with disorders like motor disorder and delays. So I think that's maybe partially be the issue. There a lot of more work to be done, and that's not a bad thing. We need to keep working for speech and language, that's very good, very positive we need to have researchers like you trying these things and</p>				
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		<p>even thinking differently about it. That's how I see it anyway.</p>				
<p>Make sure FOCUS is valid even if different parents/caregivers/SLPs are completing them</p>	<p>Beliefs about consequence</p>	<p>I think you would have the problem of if one parent brought the child, and you're like oh well your wife filled it out last time, so you have to take it to her and have her fill it out, I think that would be a really hard to</p>	<p>Information about social & environmental consequences</p>	<p>Knowledge; Beliefs about consequence; Attitude towards behavior</p>	<p>Yes</p>	<p>Providing clinicians with information about the interrater reliability, and the usefulness of the FOCUS data when provided by different individuals (i.e., social/environmental consequences) may increase clinicians' beliefs in the consequence of</p>

		<p>get the FOCUS back then, if were always doing that. so i feel like that one is unavoidable in that sense, because it's not always going to be the same parent that brings it so I think it does interfere with the reliability of the results.</p>				<p>their behavior (i.e., collecting FOCUS data from different caregivers).</p>
<p>Share successful research findings with the use of FOCUS (specify the details of the intervention and how FOCUS data was collected)</p>	<p>Beliefs about consequence</p>	<p>The ministry could maybe alert us to PSLs that have success stories that used the FOCUS to measure before and after particular</p>	<p>Information about social & environmental consequences</p>	<p>Knowledge; Belief about consequence; Attitude towards behavior</p>	<p>Yes</p>	<p>When clinicians are provided examples of the impact of their behavior (i.e., collection of the FOCUS data) on understanding the effectiveness of different interventions (i.e., social and</p>

		intervention types. For example, the new motor speech treatment protocol and then uhm... present that you know, user distribution list to share one region's success story with FOCUS on a specific intervention type so that we can try to replicate it in our individual areas.				environmental consequence), it may increase clinicians' beliefs about the consequence of collecting data and change their attitude towards data collection,
Provide more timely feedback about FOCUS outcomes to SLPs (rather than at PSL meetings only)	Beliefs about consequence	I think another thing is a lack of feedback from the process. It seems	Saliency of consequences and Feedback on outcomes of behavior	Belief about consequence; Perceived Susceptibility or Vulnerability	Yes	Providing clinicians with a timely (or immediate) feedback may help emphasize the outcomes of

	<p>sometimes like it's just I'm doing this to do this. Like it didn't really feel like I got information back quick enough. I think it was in the year I worked for the CTC, I think once we got kind of a summary of the, of the FOCUS results of like the district, and to me that didn't feel like enough of an immediate return, that we needed like a, kind of maybe... For me</p>		; Feedback process		<p>their behavior (i.e., collection of the FOCUS data), which in turn, may improve clinician's beliefs about the consequence of their behavior.</p>
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		anyway, more immediate feedback.				
Category: Administration Fidelity						
Provide a way that automatically calculates scores/statistics of FOCUS (including change scores from the last FOCUS and the subscale scores)	Environment al context & resources	Yeah, the old FOCUS spreadsheet scoring sheet before it changed to 34, the 50, because the way that the Excel sheet was, it would calculate the change from FOCUS 1 to whatever FOCUS you're doing, but to me, that wasn't even a relevant calculation	Restructurin g the [physical] environment	Environment al context & resources; Behavioral cuing	Yes	Providing a way to for the collection of FOCUS data over the phone (i.e., modifying the physical environment of FOCUS data collection), may facilitate clinician's behavior (i.e., collecting FOCUS data from families who live in remote locations).

		<p>because it wasn't even going back to the previous one, it was going back to the very first FOCUS that was ever done and now the new scoring sheet, it doesn't have that automatic calculation from spreadsheet to spreadsheet, so the only way you would know is if you did the calculations yourself.... it [having scores automatically calculated]</p>			
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		would save me one step				
Offer an electronic fillable FOCUS form (e.g. on tablet/iPad/online/laptop) ⁴	Environmental context & resources	Well I think that if it was something electronic, then we have to consider confidentiality, but, a way that we could get it to the person that needs to fill it out like in an electronic way, if it were on the iPad or something like that, but you could also email it and have	Restructuring the [physical] environment	Environmental context & resources; Behavioral cuing	Yes	Offering an electronic form (i.e., restructuring the physical environment) as an alternative way for parents to complete the FOCUS may remove an existing barrier in the environment (i.e., clinicians trying to collect FOCUS data from parents during assessment/therapy session time where parents

		parents return it in a way that would still be confidential. Often time, parents, by the time it comes to filling it out, they're chasing after their kids a lot of times, like it's a lot for them to do				may be distracted by their children).
Offer a way for FOCUS to be completed and submitted by parents at home e.g. online/over the phone ⁴	Environment al context & resources	yea I could see it [having the option to submit from home] being quite useful for the families that are so remote, I don't normally see them like I always... If	Restructurin g the physical environment	Environment al context & resources; Behavioral cuing	Yes	Providing a way for families to complete the FOCUS forms at home (i.e., modifying the physical environment of FOCUS data collection), may remove a current barrier in clinicians' environment

		<p>they're there, then I have them fill it out, if they're not there, I usually send it home with a note and a return envelope. Sometimes they are returned but more often than not, they are not.</p>				<p>(i.e., not being able to visit families living in remote areas).</p>
<p>Create an electronic system that streamlines all administration of FOCUS (e.g. can see all FOCUS of the same child in tabs)</p>	<p>Environmental context & resources</p>	<p>Well what I was thinking is something where you can have each instance of the FOCUS all on one document. So, you might have the identifying information</p>	<p>Restructuring the physical environment</p>	<p>Environmental context & resources; Behavioral cuing</p>	<p>Yes</p>	<p>Offering an electronic system that improves the ease of data access (i.e., restructuring the physical environment) as an alternative way for parents to complete the FOCUS may remove an existing barrier in the</p>

	<p>on one tab for example, and it just remains and you can update it each time and then maybe each individual FOCUS is a separate tab. Um, so you can see each FOCUS you never lose the score ,you never lose the date of when the previous FOCUS happened, you never lose the identifying information or the fact that the family speaks</p>		<p>environment that is limiting clinician's ability to complete the behavior (i.e., clinicians trying to collect FOCUS data from parents during assessment/therapy session time where parents may be distracted by their children).</p>
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		Spanish and English, or whatever and that's always there and somewhere super easy that you can come back. Because currently we don't store the FOCUS data electronically, on our share drive so it does mean storing it a different way.				
Change the schedule of FOCUS such that administration is timed to clinical appointments (e.g. assessment/intervention/discharge) rather than saying every 6 months	Environmental context & resources	And then the other thing is, like I said, if they're on a block system, they may be due for it but they're not actually coming in till	Prompts/cues; Habit formation	Memory; Environmental context & resources; Behavioral cuing	Yes	Introducing a definite environmental cue (i.e., mandating the collection of FOCUS at specific clinical appointments) may help remove

		next week or two weeks from now for the program's not starting in 7 weeks, then they're just not gonna be within that 6 months period.				the environmental barriers that is currently limiting clinicians' performance of the behavior (i.e., not being able to contact parents to collect FOCUS data).
Remove the need to transfer FOCUS score by having an app that connects FOCUS data to the ministry (i.e. remove the need to transfer paper to electronic format)	Environmental context & resources	So if they're sending it to someone to score, and we're getting it back recording it on the electronic health record and then it gets sent, in order to be sent over to the ministry, it was really confusing and time consuming.	Restructuring the physical environment	Environmental context & resources; Behavioral cuing	Yes	By having an app that transfer FOCUS scores from the clinicians to the ministry database (i.e., modifying the physical environment of data collection), it may remove the current environmental barrier (i.e., reducing the steps it takes) for clinicians to complete the behavior (i.e.,

		A lot of clinicians said that they really would like to have FOCUS set up on an iPad and have it to be in a way that is done and you can actually score it right there and send it to the ministry right there.				collecting FOCUS data).
Other categories						
Improve readability of the FOCUS (e.g. increase the font size and bubble size, shading the items)	Environmental context & resources	I just find that I have families that will miss questions just because of how small everything is. Or just like the way it looks, like if there was way we	Problem Solving and Restructuring the physical environment	Behavioral Regulation; Belief about Capabilities; Environmental context & resources; Behavioral cuing	Yes	Clinicians analyzed and identified a barrier that is limiting their ability to collect data from the FOCUS (i.e., parents submit partially completed FOCUS forms due to poor

		could like shade every other question or something just so it... there is a lot of little bubbles on there.				readability of the form). Clinicians recommended strategies to improving the readability of the FOCUS (i.e., modifying the physical environment of the data collection process), which may provide clinicians better resources to collect FOCUS data.
Make translations of FOCUS available	Beliefs about consequence	The actual FOCUS itself has not been translated except in French. So, its very unfortunate, because if the parent doesn't have English or French as a primary	Restructuring the physical environment	Environmental context & resources; Behavioral cuing	Yes	Offering translated versions of the FOCUS forms (i.e., modifying the physical environment) may help increase the environmental resources available for clinicians to

		literacy based language its really hard for them to get that right.				collect FOCUS data from families who cannot read English or French.
Make sure FOCUS scores can support functional/clinically-related activities (e.g. helping clinicians form goals)	Beliefs about consequence	So the old outcome measure, it wasn't just the interview there was another... there was the severity rating scale. A combination of the two I find and I feel like a lot people will agree but I could be wrong. They [the old outcome measure] helped guide my choices for goals for	Information about social & environmental consequences	Knowledge; Beliefs about consequence; Attitude towards behavior	Yes	Informing clinicians of the clinical uses of the collected FOCUS data (i.e., the social and environmental consequences) may help increase their beliefs about the consequence of their behavior (i.e., collecting FOCUS data).

		therapy, versus the FOCUS as I have admitted to really doesn't play a role in that.				
<p>¹ Definitions of TDF constructs [12]</p> <p>Beliefs about consequences: Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation. Constructs include: beliefs, outcome expectancies, characteristics of outcome expectancies, anticipated regret, and consequents.</p> <p>Environmental context & resources: Any circumstance of a persons' situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour. Constructs include: environmental stressors, resources/material resources, organizational culture/climate, salient events/critical incidents, person x environment interaction, barriers and facilitators.</p>						

2. **Behavioral Change Techniques** [31]: This is a list of 93 specific components (or the “active ingredients”) of an intervention designed to change/modify/regulate behavior.

Information about social and environmental consequences: Provide information (e.g. written, verbal, visual) about social and environmental consequences of performing the behavior. Note: consequences can be for any target, not just the recipient(s) of the intervention

Problem solving: Analyze, or prompt the person to analyze, factors influencing the behavior and generate or select strategies that include overcoming barriers and/or increasing facilitators

Review behavior goals: Review behavior goal(s) jointly with the person and consider modifying goal(s) or behavior change strategy in light of achievement.

Review outcome goals: Review outcome goal(s) jointly with the person and consider modifying goal(s) in light of achievement.

Feedback on outcomes of behavior: Monitor and provide feedback on the outcome of performance of the behavior

Salience of consequences: Use methods specifically designed to emphasize the consequences of performing the behavior with the aim of making them more memorable (goes beyond informing about consequences)

Restructuring the physical environment: Change, or advise to change the physical environment in order to facilitate performance of the wanted behavior or create barriers to the unwanted behavior (other than prompts/cues, rewards and punishments)

Prompts/cues: Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behavior. The prompt or cue would normally occur at the time or place of performance

Habit Formation: Prompt rehearsal and repetition of the behavior in the same context repeatedly so that the context elicits the behavior

3. **Mechanism of action** [32]: These are 26 known processes through which behavior change techniques impact implementation barriers to result in changes in practice behaviors.

4. Clinicians recommended retaining both of these implementation strategies as one emphasizes an electronic version of the FOCUS form (which can be completed when parents are in the clinic e.g., in the waiting area) while the other emphasizes the completion of the FOCUS form at home.

Curriculum Vitae

Name: Elaine Kwok

Education

Combined Master of Clinical Science & Doctor of Philosophy, Speech-Language Pathology/Health and Rehabilitation Sciences

Faculty of Health Sciences

Western University, London, Ontario, Canada. 2015-2020

Dissertation title: Ontario preschool speech and language services: Evaluation and optimization

Master of Science, Child & Youth Health

Faculty of Health Sciences

Western University, London, Ontario, Canada. 2011-2013

Thesis title: Auditory temporal processing in children with specific language impairment compared to same-age controls

Bachelor of Science, Honors, Molecular Biotechnology

Faculty of Science

Chinese University of Hong Kong, Hong Kong, China. 2007-2011

Thesis title: Functional genetics study of dyslexia susceptibility gene - KIAA0319

Peer-reviewed publications

Kwok, E., Moodie, S. T., Cunningham, B. J., & Oram Cardy, J. E. (2020). Selecting and tailoring implementation interventions: a concept mapping approach. *BMC Health Services Research*, 20, 1-13.

Kwok, E., Cunningham, B.J., & Oram Cardy, J. (2019). Effectiveness of a parent-implemented language intervention for late-to-talk children: A real-world retrospective clinical chart review. *International Journal of Speech-Language Pathology*, 1-11. doi:10.1080/17549507.2019.1584643

Cunningham, B. J., **Kwok, E.**, Earle, C., & Oram Cardy, J. (2019). Exploring participation and impairment-based outcomes for Target Word™: A parent-implemented intervention for preschoolers identified as late-to-talk. *Child Language Teaching and Therapy*, 35(2), 145-164. doi:10.1177/0265659019846931

Cunningham, B.J., **Kwok, E.**, Turkstra, L., & Oram Cardy, J. (2019). Establishing consensus among community clinicians on how to categorize and define preschoolers' speech and language impairments at assessment. *Journal of Communication Disorders*, 105925. doi:10.1016/j.jcomdis.2019.

Kwok, E., Oram Cardy, J., Allman, B., Allen, P., & Herrmann, B. (2019). Dynamics of spontaneous neural activity correlate with language ability in young children. *Behavioral Brain Research*, 359, 56-65. doi:10.1016/j.bbr.2018.10.024

Kwok, E., Joannis, M., Archibald, L. M., & Oram Cardy, J. (2018). Immature auditory evoked potentials in children with moderate-severe developmental language disorder. *Journal of Speech, Language and Hearing Research*, 1-13. doi:10.1044/2018_JSLHR-L-17-0420

- Kwok, E.,** Joanisse, M., Archibald, L., Stothers, M., Brown, H., & Oram Cardy, J. (2018). Maturation in auditory event-related potentials predicts language ability in children. *European Journal of Neuroscience*, *47*, 69-76. doi:10.1111/ejn.13785
- Kwok, E.,** Brown, H., Smyth, R., & Oram Cardy, J. (2015). Meta-analysis of receptive and expressive language skills in autism spectrum disorder. *Research in Autism Spectrum Disorders*, *9*, 202-222. doi:10.1016/j.rasd.2014.10.008
- Kwok, E.,** Dovigi, E., Eversole, L., & Dovigi, A. (2015). Pediatric oral pathology: a retrospective survey of 4,554 biopsies. *Pediatric Dentistry*, *37*(7), 546-549.
- Dovigi, E., **Kwok, E.,** Eversole, L., & Dovigi, A. (2016). A retrospective study of 51,781 adult oral and maxillofacial biopsies. *The Journal of the American Dental Association*, *147*(3), 170-176. doi:10.1016/j.bbr.2018.10.024

Policy-maker reports

- Oram Cardy, J., Binns, A., Cunningham, B.J., Sinos J., **Kwok, E.,** Coughler, C. (2019). Scientific support for OSLA's Three Key Points (Ontario Autism Program). 3 pages. Ontario Association of Speech- Language Pathologists & Audiologists.
- Daub, O., Johnson, A., Cunningham, B., **Kwok, E.,** Smyth, R., & Oram Cardy, J. (2017). *A response to concerns about the Preschool Language Scale-5th edition*. 6 pages. Ontario Ministry of Children and Youth Services.

Manuscripts under review

- Kwok, E.,** Moodie, S., Cunningham, B.J., Oram Cardy, J. (Submitted). Barriers and facilitators to the implementation of a preschool outcome measure - speech language pathologists' perspective. *American Journal of Speech-Language Pathology*
- Daub, O., Cunningham, B.J., Bagatto, M.P., Johnson, A.M., **Kwok, E.,** Smyth, R.E., Oram Cardy, J. (Revisions submitted) Adopting a conceptual validity framework for norm-referenced testing in speech-language pathology. *American Journal of Speech-Language Pathology*

Independent Research Support (Awarded)

- Project title: Ontario preschool speech and language services: Evaluation and optimization
Canadian Institute of Health Research (CIHR) Doctoral Research Award, 2017-2020
Role: Principal Investigator CAD \$105,000
- Project title: Impact of auditory processing on language development in children with autism spectrum disorders
Organization for Autism Research Graduate Research Grant, 2017-2018
Role: Principal Investigator USD \$2,000

Research Support (Under-review)

Project title: Partnering in practice-based research to improve speech-language pathology services for preschoolers

Canadian Institute of Health Research Planning & Dissemination Grant, 2020-2025

Role: Co-PI

CAD \$10,000

Academic Honors and Awards

- 2019 ASHA Pathways Program Trainee
- 2019 Banting Postdoctoral Fellowships University Nominee
- 2019 Career Enhancement Program Trainee Canadian Child Health Clinician Scientist Program
- 2018 Rising Researcher in Canadian Child Health Clinician Scientist Program
- 2017-18 Ontario Graduate Scholarship (CAD15,000), Western University *Declined in favor of CIHR Doctoral Research Award
- 2017 Faculty of Health Science Travel Award, Western University
- 2017 National Institute of Health Student Travel Award
- 2017 Speech-Language & Audiology Canada Professional Development Scholarship
- 2017-18 Ontario Graduate Scholarship (CAD15,000), Western University
- 2016 Vanier Canada Graduate Scholarships University Nominee
- 2016 Certificate of Recognition from Canadian House of Commons
- 2016 Finalist of Faculty of Health Sciences Graduate Scholarship Mentoring Program (CAD\$1000), Western University
- 2016 Symposium on Research in Child Language Disorders (SRCLD) Student Travel Award
- 2016 SAC Isabel Richard Student Paper Award 2016 (Doctoral Level)
- 2016 Faculty of Health Science Travel Award, Western University
- 2015-18 Western Research Graduate Scholarships (CAD\$19,000)
- 2010 Yasumoto International Exchange Scholarships (HKD\$10,000)
- 2009,11 Dean's Honors List, Chinese University of Hong Kong
- 2010 Ho Hing Kee Memorial Exchange Award
- 2009-10 ChungChi College Class Scholarship (HKD\$3,000)
- 2008-09 Robert Fu Memorial Scholarship for University (HKD\$25,000)

Selected Conference Presentations

- Kwok, E.,** Moodie, S., Cunningham, B.J. & Oram Cardy, J. (2019, November). *Facilitators and barriers to incorporating measures of children's communicative-participation outcomes into practice: SLP' perspectives.* Oral presentation at American Speech-Language-Hearing Association Annual Convention, Orlando, FL, Cunningham, B.J., **Kwok, E.,** & Oram Cardy, J. (2019, November). *Using practice-based research to develop a tool for classifying preschoolers' communication impairments in large-scale evaluations.* Oral presentation at American Speech-Language-Hearing Association Annual Convention, Orlando, FL.
- Kwok, E.,** Cunningham, B.J. Oram Cardy, J. (2018, October). *Exploring outcomes of Target Word™ - The Hanen® Program for Parents of Children Who are Late Talkers.* Invited oral presentation at the Hanen Center Lunch and Learn Webinar.

- Kwok, E.,** Moodie, S., Cunningham, B.J. Oram Cardy, J. (2018, June). *Speech-language pathologists' perspectives on environmental barriers and facilitators related to implementation of a preschool communicative outcome measure*. Poster presented at the Symposium on Research in Child Language Disorders, Madison, WI.
- Cunningham, B.J. **Kwok, E.,** Earle, C., & Oram Cardy, J. (2018, November). *A Parent-implemented intervention for Preschoolers identified as late talkers – program overview & intervention outcomes*. Oral presentation at ASHA Annual Convention, Boston, MA.
- Kwok, E.,** Oram Cardy, J. (2018 May). Evaluation of an Ontario Preschool Speech Language program for late-to-talk preschool children. Poster presented at the Canadian Child Health Clinician Scientist Program Annual Symposium, Toronto, ON.
- Kwok, E.,** Cunningham, B.J, & Oram Cardy, J. (2018, June). *Predicting response to intervention in late talkers: Expressive language versus communicative participation outcomes*. Poster presented at the 2018 Symposium on Research in Child Language Disorders, Madison, WI.
- Kwok, E.,** Cunningham, B.J, Earle, C., & Oram Cardy, J. (2018, May). *Effectiveness of Target Word™ - A language intervention for late talkers*. Poster presented at the 2018 Speech-Language and Audiology Canada Conference, Edmonton, AB.
- Kwok, E.,** Allen, S., Dovigi, E., & Oram Cardy, J. (2017, June). *Effectiveness of parent-directed language intervention for preschool children with autism: A meta-analysis*. Poster presented at the Annual Symposium on Research in Child Language Disorders, Madison, WI
- Kwok, E.,** & Oram Cardy, J. (2019, August). Auditory window of integration relates to language disorder: An event-related potentials study of children with autism spectrum disorder. Society for Neurobiology of Language Annual Meeting. Helsinki, FI.
- Kwok, E.,** Dovigi, E., Oram Cardy, J. (2018, August). *Receptive but not expressive language relates to age-equivalent of auditory event-related potentials in children with autism spectrum disorder*. Poster to be presented at Society for the Neurobiology of Language Annual Meeting, Quebec City, QC.
- Kwok, E.,** Oram Cardy, J., Allman, B., Allen, P., & Herrmann, B. (2017, November). *Resting state alpha oscillations correlate with language ability in young children*. Poster presented at Neuroscience 2017, Washington, DC.
- Kwok, E.,** Albakri, G., Wang, M., & Oram Cardy, J. (2017, May). *Delayed but not deviant developmental trajectories related to language impairment in children with autism spectrum disorder: Neural and behavioral evidence*. Poster presented at the International Meeting for Autism Research, San Francisco, CA.