Evidence for the Treatment of Co-occurring Stuttering and Speech Sound Disorder

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Speech Language Pathology

Rachael Unicomb, BSPH(Hon)
STATEMENT OF ORIGINALITY

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to the final version of my thesis being made available worldwide when deposited in the University’s Digital Repository **, subject to the provisions of the Copyright Act 1968.

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__________________________________________________________

Rachael Unicomb, PhD Candidate
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We miss you always.
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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>APP-R</td>
<td>Assessment of Phonological Processes – revised</td>
</tr>
<tr>
<td>BC</td>
<td>Beyond-clinic</td>
</tr>
<tr>
<td>CAQDAS</td>
<td>Computer assisted qualitative data analysis software</td>
</tr>
<tr>
<td>CI</td>
<td>Credible interval(s)</td>
</tr>
<tr>
<td>CS</td>
<td>Connected speech (speech sample)</td>
</tr>
<tr>
<td>DEAP</td>
<td>Diagnostic Evaluation of Articulation and Phonology</td>
</tr>
<tr>
<td>EBP</td>
<td>Evidence-based practice</td>
</tr>
<tr>
<td>E3BP</td>
<td>Evidence-based practice (3-tiered Dollaghan model)</td>
</tr>
<tr>
<td>ENT</td>
<td>Ear, nose and throat specialist</td>
</tr>
<tr>
<td>DCM</td>
<td>Demands and capacities model</td>
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<tr>
<td>GT</td>
<td>Grounded theory</td>
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<tr>
<td>ICF</td>
<td>World Health Organization’s International Classification of Functioning, Disability and Health</td>
</tr>
<tr>
<td>LP</td>
<td>Lidcombe Program</td>
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<tr>
<td>LBDL</td>
<td>Lidcombe Behavioural Data Language</td>
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<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
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<tr>
<td>PACT</td>
<td>Parents and children together therapy</td>
</tr>
<tr>
<td>PCC</td>
<td>Percent consonants correct</td>
</tr>
<tr>
<td>PCI</td>
<td>Parent-child interaction therapy</td>
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<td>PICO</td>
<td>Patient-intervention-comparison-outcome framework</td>
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<td>Parental verbal contingencies</td>
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<td>RC</td>
<td>Reliable change</td>
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<td>RCT</td>
<td>Randomised controlled trial</td>
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<td>SDCS</td>
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<td>SE</td>
<td>Scale estimate</td>
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<td>SLP</td>
<td>Speech Language Pathologist</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<td>---------------------------------------------------------------------------</td>
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<tr>
<td>SR</td>
<td>Severity rating(s)</td>
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<tr>
<td>SSD</td>
<td>Speech sound disorder</td>
</tr>
<tr>
<td>STS</td>
<td>Syllable-timed speech</td>
</tr>
<tr>
<td>SW</td>
<td>Single-word (speech sample)</td>
</tr>
<tr>
<td>VRCS</td>
<td>Verbal response-contingent stimulation</td>
</tr>
<tr>
<td>WC</td>
<td>Within-clinic</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>ICF-CY</td>
<td>World Health Organization’s International Classification of Functioning, Disability and Health – Children and Youth Version</td>
</tr>
<tr>
<td>WNL</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>%SS</td>
<td>Percentage of syllables stuttered</td>
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ABSTRACT

Stuttering and speech sound disorder are communication disorders that may co-occur in young children. Both disorders alone can negatively impact individuals across their lifespan. For this reason, when either disorder occurs in isolation, best practice supports the need for early intervention.

Although these two disorders do co-occur, little is known about how best to provide intervention for young children with this comorbidity. There is one previous study investigating a treatment approach for co-occurring stuttering and speech sound disorder that was published over 20 years ago by Conture, Louko and Edwards (1993). These researchers suggested that the two disorders be treated concurrently using predominantly indirect treatment approaches for the stuttering and the speech sound disorder, with treatment goals embedded within each other (or blended). There have also been several guidelines published in the surrounding literature which draw from the research of Conture and colleagues and/or are based on clinical experience and expert opinion.

Since Conture et al. (1993) initially published their findings, there have been greater advances in the research into the treatment of each disorder in isolation. Many of the treatment approaches are supported by high levels of research evidence for both stuttering and speech sound disorder, and are direct in nature. Speech-language pathologists have reported using these direct approaches. Some examples of these include the Lidcombe Program for early childhood stuttering, and minimal pairs therapy for speech sound disorder. Little is known, however, about how clinicians should manage the two disorders when they co-occur in light of these treatment advances. Further, there is no research indicating whether or not treating stuttering and speech sound disorder concurrently using direct approaches to intervention would be efficacious.

The overall purpose of this thesis was to consider the current evidence for the management of young children presenting with co-occurring stuttering and speech sound disorder, and to establish further scientific evidence to help guide treatment practices with this caseload in the future. In order to achieve this, several aims were established. The first aim was to investigate and describe how clinicians are currently
managing this caseload of young children. The second aim was to investigate whether stuttering and co-occurring speech sound disorder could be treated concurrently using direct treatment approaches that are supported by high levels of evidence, and whether this could be done in a safe, efficient, and efficacious manner. That is, to determine the presence (or not) of emerging evidence of treatment effect.

The first study in this thesis was qualitative in nature and used semi-structured in-depth interviews to explore the management practices of 13 Australian speech-language pathologists. Five major themes were derived from analysis of the data. The core theme was identified as ‘clinical reasoning’ and highlighted that many of the participants noted a need for more up-to-date treatment guidelines when working with children who have co-occurring stuttering and speech sound disorder. They also reported confusion when deciding on a service delivery method for this caseload, due to the paucity of available evidence. Although the majority of these speech-language pathologists stated that they would treat this caseload serially, some noted that doing so might compromise use of the window period for early intervention. They also noted that treating serially may cause financial burden on some families, and cause lack of motivation and/or risk ‘therapy burn-out’ for the parent and/or the child if treatment progressed for a long period.

The results of the abovementioned findings informed the next study in this thesis, a Phase I clinical trial (single case studies) that involved five preschool aged participants. A Phase I clinical trial was considered an appropriate methodology because a further aim of this thesis was to thoroughly document and develop a treatment protocol for the treatment of co-occurring stuttering and speech sound disorder. All participants underwent concurrent intervention for both stuttering and speech sound disorder using direct treatment approaches. For the stuttering, all were treated with the Lidcombe Program as manualised. Direct treatment for the speech sound disorder was individualised based on analysis of each child’s sound system. Four of the five children completed Stage 1 of the Lidcombe Program. This thesis detailed a new method of analysis that measures statistical and reliable change in individuals. Using this method, all children in the Phase I clinical trial showed statistically significant improvements in outcome measures for both disorders from pre-treatment to 12 months post commencement of treatment. The one child who did not complete the Lidcombe
Program exhibited statistically significant improvements in the primary outcome measure for speech sound disorder from pre-treatment to 12 months post commencement of treatment. Caution was exercised when designing the research protocol for these children, due to the anecdotal reports of negatively impacting either disorder when using direct treatment approaches. Therefore, the research design was non-experimental in nature (descriptive case studies), and subsequently no causal inference can be concluded from the results. However, the positive findings of the study highlight the need for further research to be conducted on more children in order to start building on the limited evidence base in this area. These preliminary findings indicate that young children with co-occurring stuttering and speech sound disorder may be treated using direct treatment approaches in a concurrent manner in some instances. Treating in this way may be more cost and time-efficient for both speech-language pathologists and families alike. Treating the disorders in this way may also address the crucial need for early intervention in both disorders.
CHAPTER 1

Co-occurrence of Stuttering and Speech Sound Disorder:

An Introduction
Stuttering

Stuttering is a communication disorder that involves the flow of speech being interrupted by dyfluencies of the speech mechanism (Onslow, Packman, & Harrison, 2003). These dysfluencies, identified as unambiguous stuttering moments, can be described using a behaviourally based taxonomy (Packman & Onslow, 1998; Teesson, Packman, & Onslow, 2003). In three descriptive categories, these moments of stuttering are classified as repeated movements, fixed postures and/or superfluous behaviours (Teesson et al., 2003).

Repeated movements can occur on partial syllables (e.g., “c-c-c-can I have a drink please?”), whole syllables (e.g., “how-how-how do I get to the shop?”) or multi-syllables (e.g., “or I-or I-or I-or I could do that one”). Fixed postures can occur with or without audible airflow, and result in the articulatory mechanism being fixed in place for a varying length of time. Fixed postures with audible airflow are perceived as an inappropriate elongated production of a sound. The prolonged sound can further be classified as voiced (e.g., “mmmmmmmmum”) or voiceless (e.g., “ssssssssssso”). If this occurs with no audible airflow, the speaker is perceived to be stuck on a word, with the sound being ‘blocked’. Superfluous behaviours are not part of the speaker’s intended utterance and can be either verbal or non-verbal. Verbal superfluous behaviours may involve the use of an excessive number of fillers (e.g., “oh like-because-like-I-um-because-like-um-I really wanted to go overseas”). Non-verbal superfluous behaviours often accompany repetitions or fixed postures. Examples include facial tics, grimaces, and unusual head and/or torso movements (Teesson et al., 2003).
Epidemiology of Stuttering

**Cause.** The cause of stuttering currently remains unknown (Guitar, 2014), although many theories and hypotheses have been proposed. Some theories have considered the possibility of a deficit in cognitive and linguistic processing contributing to the cause of stuttering. The Neuropsycholinguistic Theory is one example proposing that fluent speech relies on both linguistic and extralinguistic components operating in synchrony to generate the output of speech (Perkins, Kent, & Curlee, 1991). The neural systems driving these processes are known as the signal (the system responsible for linguistic processing) and symbol (the system responsible for providing syllabic framework) systems. Stuttering is thought to be the result of asynchrony between these two systems. Another linguistic theory, the Covert Repair Hypothesis (Kolk & Postma, 1997), proposes that when there are excessive errors in a person’s phonetic plan, covert self-attempts to correct them are made, resulting in stuttering.

Other models incorporate the view that the disorder is caused by a number of factors working together (multifactorial models). One example is the Demands and Capacities Model (Starkweather & Gottwald, 1990). According to this model, children stutter when demands for fluent speech exceed their capacities in certain domains such as cognition, language, speech motor control, and emotional aptitude.

Some models theorise that stuttering is related to speech-motor control. One example is the Interhemispheric Interference Model (Webster, 1986). In this model, speech and language mechanisms are typically lateralised in the left hemisphere, and in people who do not stutter, there is an assumption of normal right hemisphere function. For people who stutter, it is theorised that the left hemisphere is more susceptible to
interference from the right hemisphere, and in that way, less efficient and effective, consequently resulting in stuttering (Webster, 1986).

Where some models attempt to explain stuttering from the perspective of speech-motor control, others describe it as a deficiency in the self-regulation of speech-motor activity (Onslow, 2004). These theories are known as systems control modelling and include the Sensory-motor Modelling Theory (Neilson & Neilson, 1987), the Neuroscience Model (Nudelman, Herbrich, Hoyt, & Rosenfield, 1989), and the Syllable Initiation Theory (Packman, Code, & Onslow, 2007). To highlight an example of systems control modelling, the Syllable Initiation Theory (which evolved from another model known as the Variability Model) proposes that stuttering is a result of a deficit in the supplementary motor area of the brain, resulting in difficulty initiating syllables.

More recent research proposes that stuttering is most likely caused by physical factors related to the neural processing governing speech-motor control. Studies in support of such a view have utilised brain imaging in adults, adolescents, and older children who stutter. Neuroanatomical studies have indicated that the planum temporale (involved with auditory processing) in people who do not stutter is larger in the left hemisphere. Yet in adults who stutter, this structure is larger in the right hemisphere, or symmetrical with the left hemisphere (Foundas, Bollich, Corey, Hurley, & Mehilman, 2001). Foundas and colleagues (2001) also found that adults who stutter have differences in the gyri in parts of the brain involved in speech and language production. Other neuroanatomical differences have been found in people who stutter, and are associated with various white and grey fibre tracts. Less dense white fibre tracts in parts of the brain governing speech motor control in the left hemisphere have been found in both children and adults who stutter, (Chang, Erickson, Ambrose, Hasegawa-Johnson, & Ludlow, 2008; Sommer, Koch, Paulus, & Buchel, 2002), and increases in grey and
white fibre tracts in the right hemisphere were also found in older children who stutter (Beal, Gracco, Brettschneider, Kroll, & DeNil, 2012).

Other studies have investigated neurofunction in adults who stutter. These studies have found over-activation in right hemisphere and mid-brain structures (Brown, Ingham, Ingham, Laird, & Fox, 2005; Watkins, Smith, Davis, & Howell, 2008), as well as under-activation in brain structures involved in auditory and speech motor function (Brown et al., 2005).

Although these studies hold promise for finding the exact nature and cause of stuttering, the majority have been conducted on adults who stutter, as conducting brain imaging studies on very young children has proved an ethical challenge for researchers. A recent study utilising non-invasive magnetoencephalography aimed to investigate the lateralisation of brain activity in a language-related task in 12 young children who stuttered close to their age of onset (mean age 50.8 months) and 12 matched controls. Analysis revealed that during this task, brain activation was predominantly lateralised to the left hemisphere, with no differences between the groups. These results support the theory that findings of abnormal lateralisation in adults who stutter may be a result of compensatory mechanisms in the brain as a result of chronic stuttering (Sowman, Crain, Harrison, & Johnson, 2014).

There is also belief that genetic factors may be involved in the causation of stuttering, but the precise nature of this genetic involvement is not known at this time (Bloodstein & Ratner, 2008; Guitar, 2014). It has also been reported that environmental factors may also influence developmental stuttering. Of note is that stuttering may be seen to coincide with particular environmental factors in a child who is predisposed to stutter, yet these factors alone are not considered to cause the stuttering (Guitar, 2014).
In summary, the cause of stuttering remains unknown, yet studies have indicated that there may be certain neuroanatomical differences between those who stutter and those who do not, and these differences may be observed in adults and older children who stutter. However, more research is needed to ascertain whether these differences are present at the onset of stuttering in early childhood. Abnormal neurofunction has also been observed in both adults and children who stutter, with the most recent research indicating that this may be due to neurological compensation as stuttering becomes chronic. Further, genetic factors may also be involved in the cause of stuttering. Many researchers have established various theories in an attempt to demonstrate causation. These theories have had a significant influence upon the development of the many treatment approaches available for stuttering.

**Incidence and prevalence.** Prevalence is a measure determining the number of cases of a disorder that currently exist within a population. Measuring the prevalence of stuttering can be difficult due to the wide range of data collection methods, the ages of participants under study, and differences in definitions of the disorder (Guitar, 2014). In an extensive review of epidemiological studies related to the prevalence of stuttering, Bloodstein and Ratner (2008) found that across various countries, the prevalence of stuttering in school-aged children was around 1%.

Incidence is a measure of how many people have stuttered at some point throughout their life. Incidence studies are also subject to the methodological variances noted above, and some reports have estimated the incidence of stuttering at around 5% (Andrews et al., 1983; Mansson, 2000). More recently, Reilly et al. (2009) challenged these findings. Using prospective, longitudinal methodology, Reilly and colleagues followed 1,619 children recruited for the Early Language in Victoria Study. The parents of 158 of the children involved in this study called to report the onset of stuttering by
the age of 3 years. Of these, 8.5% of cases had a diagnosis of stuttering confirmed by a trained clinician, placing the cumulative incidence by the age of 3 years much higher than some of the earlier findings.

More children are reported to stutter in the preschool years than at school-age (Bloodstein & Ratner, 2008; Reilly et al., 2013; Reilly et al., 2009; Yairi & Ambrose, 1999a, 2005). Although there may be a number of reasons to account for this, one consideration may be around natural recovery from stuttering.

**Natural recovery.** The onset of stuttering typically occurs between the ages of approximately two and five years, a period marked by substantial language acquisition, and may be sudden or gradual (Yairi & Ambrose, 1999a). Once stuttering has commenced, children may naturally (or spontaneously) recover without the need for any formal treatment. In the majority of cases, this occurs within approximately two years post-onset of stuttering. However, it has been reported that gradual natural recovery may also occur up to three to four years post-onset (Yairi & Ambrose, 1999a). Natural recovery has been widely researched, yielding findings that vary from approximately 20% to 90% (Andrews & Harris, 1964; Ingham, 1983; Mansson, 2000; Yairi & Ambrose, 1999b; Yairi, Ambrose, & Niermann, 1993). More recent research has approximated the rate of natural recovery to be between 60% and 80% (Kalinowski, Saltuklaroglu, Dayalu, & Guntupalli, 2005), however these findings have been challenged by the aforementioned prospective community cohort study of 1,619 children aged 4-years (Reilly et al., 2013). This study found that only 6.3% of the children who stuttered had naturally recovered within 12 months post-onset of stuttering.

Clinicians cannot know which children will go on to require intervention for their stuttering, though much research has been dedicated to looking at possible
predictors of natural recovery (Ambrose, Cox, & Yairi, 1997; Yairi & Ambrose, 1999a, 2005; Yairi, Ambrose, Paden, & Throneburg, 1996). The findings of this research indicated that predictive factors for natural recovery included the child’s age at onset. Children who commence stuttering after approximately three and a half years have less chance of natural recovery (Yairi et al., 1996). Gender also plays a role, with more females than males reported to recover naturally (Yairi et al., 1996). Genetic factors are also a consideration, in that family history of natural recovery may be a predictive factor of recovery versus persistence (Yairi et al., 1996). Duration of the stuttering since onset is also a known predictive factor. The longer a child stutters, the less likely they are to recover naturally. Further, some linguistic variables including poor phonological skills can predict which children are less likely to naturally recover (Ambrose et al., 1997; Yairi & Ambrose, 1999a, 2005; Yairi et al., 1996).

**Gender ratio.** Males are more likely to stutter than females (Reilly et al., 2013). Yairi and Ambrose (2005) reported this gender ratio as 2:1 close to the age of onset. This ratio increases with age, being 3:1 when children commence schooling and 5:1 as they move into adulthood (Bloodstein & Ratner, 2008). While it is unclear why more males stutter than females, it is likely that genetics may play a part, as does the fact that more females may naturally recover than males (Guitar, 2014).

**The Impact of Stuttering on the Individual**

The World Health Organization (WHO) developed a framework known as the International Classification of Functioning, Disability and Health (ICF) where a person with a disorder is considered both as an individual and as part of their environment (World Health Organization, 2001). This framework takes into account an individual’s abilities, considering not only their body structures and functions but also their activity and participation levels. An individual’s barriers and facilitators to participation are also
considered under contextual and environmental factors. In 2007, WHO published a distinctive framework for children with consideration that the above factors may differ for children and adults. This framework is the International Classification of Functioning, Disability and Health – Children and Youth version (ICF-CY) (World Health Organization, 2007). The ICF is a useful tool to promote consideration of the experiences of people who stutter (Yaruss & Quesal, 2004) and how much they may be affected by external and internal factors. These factors can be considered by clinicians to enable observation of clients’ experiences in a more holistic manner.

It is essential for speech-language pathologists (SLPs) to be aware of the impact of stuttering on an individual, even at a young age. In the preschool years, children who stutter may elicit negative responses from their peers which in turn may affect social interactions. Peer responses in reaction to stuttering were recorded during an observation of free-play sessions in a preschool environment of four young children who stuttered (Langevin, Packman, & Onslow, 2009). Although the majority of the responses were judged to be neutral or positive, negative response in peers included interruption, confusion, walking away, and/or ignoring the child(ren) who stuttered. Parents of children who stuttered have also reported that their children may be prone to social withdrawal and frustration (Langevin, Packman, & Onslow, 2010).

For any child, particularly at school-age, those subject to teasing and bullying can endure long-lasting psychological consequences. It has been reported that children who stutter are at higher risk of being exposed to such negative treatment from their peers (Blood & Blood, 2004, 2007). These experiences may affect a child’s or adolescent’s outlook on life in general as well as their levels of self-esteem (Blood et al., 2011). Adolescents who stutter also report being teased in the school setting (Cream, Packman, Onslow, & Quine, 2008). Retrospective reports from adults who stutter have
highlighted that the majority recalled being bullied at school, which in turn impaired their ability to establish adult friendships (Hugh-Jones & Smith, 2010; Mooney & Smith, 1995).

Adults who stutter have been found to be more at risk of mental health issues including personality disorder, social phobia, generalised anxiety disorder, mood disorder and major depression (Iverach, Jones, et al., 2009; Iverach, O'Brian, et al., 2009; Stein, Baird, & Walker, 1996). Stuttering has also been reported to affect educational attainment. For example, children who stutter are more likely have poorer academic achievement at school (Blood, Blood, Tellis, & Gabel, 2001). A significant negative relationship has also been found between severity of stutter and highest educational achievement attained (O'Brian, Jones, Packman, Menzies, & Onslow, 2011). This in turn may have an effect on an individual’s vocation. Klein and Hood (2004) surveyed adults who stutter and found that over two thirds of the participants felt that stuttering hindered their employment opportunities. The survey revealed that many of the participants turned down job roles due to stuttering and felt that their stuttering affected workplace performance.

In summary, the long term consequences of stuttering can be severe for individuals. This highlights the need for early and effective treatment in order to ameliorate these potential long-term consequences.

**Timing of Treatment for Early Childhood Stuttering**

Although many young children who commence stuttering in the preschool years recover naturally without the need for formal treatment, some require intervention. Stuttering becomes less tractable with advancing age and if left untreated, has the potential to become chronic (Bloodstein & Ratner, 2008). Due to the potential impact of chronic stuttering noted above, it is commonly accepted that stuttering treatment should
commence in the preschool years. Despite this, it has been reported that SLPs often face a dilemma when deciding whether to commence treatment, or to wait for natural recovery to occur (Onslow & Packman, 1999). Clinicians are required to weigh up what is currently known about the nature of stuttering, particularly in relation to natural recovery, with what is known about treating children immediately after their stuttering onset at a young age (Onslow & Packman, 1999). There are other factors, however, that should not be ignored. These may include the impact of the stuttering on the child as well as on the immediate family. Consideration should be given to anxiety levels as well as any other facilitative factors and barriers in the surrounding environment, with particular reference to the ICF and ICF-CY. Research has supported effective treatment in the preschool years (detailed in Chapter 2), and early intervention is considered crucial and best practice. The dilemma faced by clinicians is simple – it is impossible to predict which children will naturally recover, and the longer the decision to provide treatment is left, the longer the delay in the provision of effective intervention.

Speech Sound Disorder

Speech sound disorder (SSD) is defined as “a significant delay in the acquisition of articulate speech sounds” (Lewis et al., 2006, p. 1294) and occurs when the typical mistakes that children make while learning to speak persist past age-appropriate norms (American Speech-Language Hearing Association, 2014). Speech sound disorder is an umbrella term encompassing primary disorders of speech sounds (that is, articulation and phonological deficits), and disorders of speech sounds caused by organic factors (for example, childhood apraxia of speech or cleft palate) (Williams, McLeod, & McCauley, 2010). Errors of articulation refer to the motoric (phonetic) ability required to produce speech sounds. Phonological speech sound errors are rule-based and linguistic (phonemic) in nature. For example, the way our sounds are organised in the
mind and subsequently output. Speech sound disorder can occur in isolation or can co-
occur with other disorders, including stuttering.

There are several classification systems that have been developed to describe
SSD based on different theoretical perspectives. Three of the classification systems
viewed as the most useful in the research and/or clinical domains have aetiological,
descriptive-linguistic or psycholinguistic processing underpinnings (Waring & Knight,
2012).

A system applicable in research contexts is known as the speech disorders
classification system (SDCS) (Shriberg, 1994; Shriberg et al., 2010). The SDCS was
developed over several decades, and details eight subgroups of children with SSD. The
majority of these subgroups are proposed to have originated as a result of possible
interactions between genetic and environmental factors. The exception to this is residual
speech errors on /s/ and /ɹ/¹, which is believed to be impacted solely by environmental
influences (Waring & Knight, 2012). The speech disorders classification system is
useful for researchers to describe SSD in terms of diagnosis, prognosis and aetiology.

One psycholinguistic processing system postulates that the acquisition of speech
sounds that follows a typical developmental pattern relies on the use of an intact speech
processing system (Stackhouse & Wells, 1997). According to this model, errors are
caused by a breakdown somewhere in this system. Further, it is proposed that
intervention should specifically target the area of breakdown (Waring & Knight, 2012).

There is also a descriptive-linguistic classification system that is reported to be
the most applicable in a clinical setting (Waring & Knight, 2012). This system contains
five subgroups of SSD that are linguistically testable and can be differentially diagnosed

¹ This thesis utilises the phonemic transcription system detailed by Mitchell and Delbridge (1965)
based on the specific deficits (Dodd, 2005; Dodd & McCormack, 1995). The
descriptive-linguistic system is the most clinically useful for diagnosis and intervention.

Though these three types of classification systems contain differences, a
similarity they share is that each identifies three broad subgroups: articulatory,
phonological, and speech-motor processing/planning deficits. This thesis discusses the
nature of SSDs in reference to these three broad subgroups from this point forward.

Epidemiology of Speech Sound Disorder

Cause. Speech sound disorder is heterogeneous in nature. One explanation for
this heterogeneity relates to underlying causation of the impairment. For the majority of
children with SSD the cause is unknown. For the remaining children, the cause is
known and often secondary to other disorders (Waring & Knight, 2012). Examples
include impairments in cognition (e.g., Down syndrome), neurological disorders (e.g.,
cerebral palsy), structural anomalies (e.g., cleft lip/palate), and hearing impairment.
Some literature has investigated the causal factors related to the risk of developing a
SSD. Harrison and McLeod (2010) investigated risk and protective factors that related
to both speech and language impairment in young Australian children. They analysed
existing data from 4,983 pre-kindergarten aged children (age range 4;3 to 5;7 years)
recruited for a government-funded community cohort study, called Growing Up in
Australia – The Longitudinal Study of Australian Children (Sanson et al., 2002). Risk
and protective factors were identified via various methods of parent and teacher report,
as well as language assessment scores. Examples of identified risk factors included male
gender, children having ongoing hearing difficulties, and those with a reactive
temperament. Examples of protective factors included a more persistent and social
temperament, as well as improved maternal psychological well-being.
Prevalence. Figures for the prevalence of SSD vary widely in the literature. Law, Boyle, Harris, Harkness, and Nye (2000) conducted a systematic review investigating the prevalence of speech and language delay in children and found that for speech delay only, the range was reported between 2.3% and 24.6%. This variation could be explained by methodological issues, varying use of classification systems and differences in normative data employed across the reported studies. Current figures of prevalence estimate that SSD affects 10-15% of the population (Williams et al., 2010).

As well as SSD being a highly prevalent condition in the preschool years (Law et al., 2000), children with SSD are reported to constitute a large portion of the caseload of SLPs (Broomfield & Dodd, 2004; Denne, Langdown, Pring, & Roy, 2005; Mullen & Schooling, 2010).

Although the prevalence of SSD is noted as being substantial, there are reports that the speech of many children remediates with age, and some of the prevalence literature has supported these findings. For example, in a large community sample of 639 three-year-old children, prevalence for SSD alone was reported as 15.6% (Campbell et al., 2003). In comparison, a study using a four-step process to determine the prevalence of SSD in children from kindergarten to year six found a much lower prevalence. McKinnon, McLeod, and Reilly (2007) analysed a sample of 10,425 Australian primary school students and found the prevalence for SSD to be 1.06%. Such marked differences between the younger and school-aged children could be attributed to speech sound impairments resolving with age, but may also be due in part to methodological issues such as sample size and procedural rigour. When a SSD resolves with age, this process has been termed “normalisation” in the surrounding literature.
Normalisation. Like stuttering, SSD has a high incidence of reported natural recovery, that is, recovery without the need for formal intervention. Studies investigating “natural history” or “normalisation” of SSD have yielded varying results. Law et al. (2000) conducted a systematic review of studies relating to the natural history of speech and language impairment. Inclusion criteria for studies were that the design was prospective and longitudinal in nature, and that there should be no mention of participants receiving formal intervention. Of the studies included by Law and colleagues, three were specific to the normalisation of SSD and were analysed in terms of cases that persisted to have impairment past the longest follow-up point in the studies. Follow-up points for these studies were widely spaced at 6 months, 5 years and 28 years. Median persistence across the three studies was 50% (range 22-54%), indicating that at least 50% of the children followed up had most likely recovered naturally without the need for intervention. Although the rate of normalisation for SSD may be substantial, there are reports that some children with SSD do not normalise and the SSD therefore continues well into the school years and beyond (Leitão & Fletcher, 2004; Roulstone, Miller, Wren, & Peters, 2009).

The Impact of Speech Sound Disorder on the Individual

Due to reported correlation between SSD and poorer academic performance, it is considered optimal to provide intervention for SSD during the preschool years. Various reports suggest that children with SSD have poorer performance in reading, mathematics, comprehension, spelling and phonological awareness skills (Denne et al., 2005; Gierut, 1998; Holm, Farrier, & Dodd, 2008; Leitão & Fletcher, 2004; Rvachew & Grawburg, 2006). Further, it has been reported that if children are not treated for SSD before reaching school-age they may have difficulties across several areas for up to 28
years. These findings were documented in the review of natural history studies previously mentioned that followed up an untreated group of children with SSD (Law, Boyle, Harris, Harkness, & Nye, 1998).

A more recent systematic review investigating children from birth to 6 years of age found the following variables associated with having a SSD: literacy issues; difficulties with phonological awareness and processing; difficulties with cognitive skills that include attention, thinking, memory and reasoning; difficulties with mathematical abilities; pragmatic difficulties; an association with gross motor abilities that affect manual dexterity; difficulties forming social relationships with peers and teachers; lowered self-esteem and self-perceptions; increased risk of leaving school early; employment difficulties; parent and/or sibling report of feeling guilt, anxiety and protectiveness towards the child with SSD (McCormack, McLeod, McAllister, & Harrison, 2009).

One of the more commonly investigated associations is the link between SSD and literacy ability. Children with speech sound difficulties persisting past school-age are reported to be at risk for literacy problems compared to children with typically developing speech (Nathan, Stackhouse, Goulandris, & Snowling, 2004a; Rvachew, 2007). There is also mounting evidence to suggest that SSD with an underlying phonological (as opposed to articulatory) deficit may have an even more negative impact on literacy ability (Leitão & Fletcher, 2004). Phonological processing is the use of auditory speech sound-structure perception when one processes oral and written language (Wagner et al., 1997). Phonological awareness is the ability to access and manipulate these sound structures of spoken language, and can be indexed by a number of phonological processing tasks (Rvachew & Grawburg, 2006). Rvachew and
Grawburg found that children with SSD are at significant risk for delays in development of phonological awareness skills and, subsequently, in literacy. The research has implicated phonological processing as the primary candidate linking speech and literacy difficulties (Holm et al., 2008). There has also been emerging evidence of a genetic link between SSD and literacy (Rvachew, 2007; Smith, Pennington, Boada, & Shriberg, 2005; Stein et al., 2004). Some children with SSD have limited phonological awareness abilities and subsequent literacy difficulty, but not all (Leitão & Fletcher, 2004). However, just having a history of SSD in the preschool years can place a child at increased risk of literacy difficulties (Peterson, Pennington, Shriberg, & Boada, 2009). It is therefore of great importance that assessment and intervention for SSD be provided to children in the preschool years. As with stuttering, the ICF-CY (World Health Organization, 2007) is a useful framework for SLPs to consider the impact of a SSD on young individuals in a holistic manner.

**Timing of Treatment for Speech Sound Disorder**

As previously highlighted, provision of early intervention for SSD is crucial. Research has established that there may be a critical window for successful intervention in children with SSD, that being before the child reaches 5 years of age (Bishop & Adams, 1990; Nathan et al., 2004a). Bishop and Adams described the Critical Age Hypothesis as when children with persisting SSD have difficulties past the age when they start learning to read (around 5;6 years). If this occurs, then these children will have poorer literacy outcomes than their peers. Further support for the Critical Age Hypothesis was reported by Nathan et al. (2004) that compared children with persisting SSD to age-matched controls, and found that children aged 6;9 years with persisting SSD performed more poorly than the controls on measures of literacy.
Intervention in the preschool years for SSD can yield successful results (Law, Garrett, & Nye, 2003). Many treatment approaches are available for SSD. In a recent narrative review of the research surrounding phonological intervention approaches alone, Baker and McLeod (2011) identified 46 distinct treatment approaches. In practice, clinicians use an eclectic mix of approaches to SSD intervention (Lancaster, Keusch, Levin, Pring, & Martin, 2010). Chapter 2 explores some of these treatment approaches in more detail, along with evidence from the scientific literature supporting them.

The Co-occurrence of Stuttering with Speech Sound Disorder

A body of research has aimed to examine the co-occurrence of stuttering with other communication disorders. One study reported that 44% of children who stuttered exhibited at least one additional form of communication and/or non-communication disorder, such as a language disorder or an attention disorder (Arndt & Healey, 2001). Stuttering has been reported to frequently co-occur with disorders of phonology and language (Anderson & Conture, 2000; Arndt & Healey, 2001; Bloodstein & Ratner, 2008; Louko, Edwards, & Conture, 1990; St Louis & Hinzman, 1988; Yaruss & Conture, 1996; Yaruss, LaSalle, & Conture, 1998). It is most commonly reported in the literature that 30-40% of children who stutter also have a concomitant SSD (Conture, Louko, & Edwards, 1993; Louko, 1995; Melnick & Conture, 2000; Ratner, 1995; Wolk, 1998; Wolk, Blomgren, & Smith, 2000).

Studies of the co-occurrence of SSDs among children who stutter can be divided into distinct groups dependent on the type of methodology employed (Louko, 1995). The first methodology used to study this population relied on data collection via parent or speech-language pathologist (SLP) report. One common method used to obtain these
data was the implementation of a survey design. Since 1980, a number of survey studies have investigated the co-occurrence of stuttering and SSDs (Arndt & Healey, 2001; Blood, Ridenour Jr., Qualls, & Scheffner Hammer, 2003; Blood & Seider, 1981; Nippold, 2004b). These surveys have yielded rates of co-occurrence between 16% and 45%. Blood and Seider (1981) surveyed 358 elementary school-based SLPs from 31 US states. Respondents were asked to provide information on children who stuttered aged 14 years and younger. It was found that 16% of children who stuttered on the respondents’ caseloads also exhibited a co-occurring articulation disorder, and that articulation difficulties co-occurred with stuttering more frequently than any other communication disorder.

Arndt and Healey (2001) surveyed a random sample of 241 SLPs from 10 US states, asking how many school-aged children on their caseloads exhibited a concomitant phonological and stuttering disorder. The SLPs were also asked how confident they were treating these concomitant disorders. Arndt and Healey (2001) defined the terms *stuttering* and *phonological disorder* as determined by the relevant state’s criteria. Of the 467 children who stuttered considered by the respondents in this study, 32% were identified as having a co-occurring phonological disorder. The wide variety of measures used to determine the occurrence of both stuttering and phonological disorders, as well as the variations in State eligibility criteria, may have accounted for the high percentage of co-occurrence found. The data reported on in this study was taken from a wide age range of children (3 to 20 years of age), which may also account for the large percentage of reported co-occurrence.

In 2003, Blood and colleagues conducted another survey of 1,184 school-based SLPs in the US. The SLP participants were randomly selected from the American
Speech Language and Hearing Association mail-out list. The research examined the percentage and frequency of male and female children who stuttered with co-occurring speech, language, and non-speech-language disorders. For each child identified as stuttering, their SLP was asked to complete a separate data sheet that further explored co-occurring disorders, treatment choices (group versus individual treatment), and frequency/duration of therapeutic sessions. This study found that of the children who were identified as stuttering, 46.2% also exhibited co-occurring speech sound (articulatory and/or phonological) disorder. Speech sound disorders were reported as the most frequent communication disorder co-occurring with stuttering. Co-occurring communication disorders were found to be significantly higher in males than females. Blood and colleagues further reported that the children who had a concomitant communication disorder received treatment for a mean of 23.4 minutes, 2.04 times per week. Once again, the age range of the children in this study was wide (5 to 18 years), potentially influencing the high frequency of co-occurrence found.

Among the reviewed survey studies of co-occurring stuttering and SSDs, only one included children in the preschool-age range (Arndt & Healey, 2001). Given the estimated high rates of natural recovery in stuttering, it is reasonable to question the rates of co-occurrence found in the surveys that included school-aged children, as methodological issues may result in over-estimation. Only one of these studies asked participants to report individual data for each child who stuttered (Blood et al., 2003), asking participants to gain this information directly from their client files. The accuracy of information relating to co-occurring disorders might be called into question if survey participants were not asked for specific detail based on client files for each child on their caseload who stuttered. Reporting of past events in retrospective research can introduce recall bias and be a threat to internal validity (Hassan, 2005).
Other methods have been employed to study the co-occurrence of a SSD in children who stutter, including retrospective file audits from client case files (Van Riper, 1971, 1982; Yaruss et al., 1998), as well as direct observation studies (Louko et al., 1990; Ratner, 1998; Riley & Riley, 1979; Ryan, 1992; St Louis & Hinzman, 1988; St. Louis, Murray, & Ashworth, 1991; Thompson, 1983).

In 1971, Van Riper reported on four different tracks (types) of stuttering development. To be included in track II, a child who stuttered was also described as displaying delayed speech and language, having articulatory difficulties as well as other evidence of organic involvement. From a file review based on longitudinal observations of individual cases, Van Riper (1982) reported that 25% of the children who stuttered could be classified under his track II criteria.

Yaruss, LaSalle and Conture (1998) conducted a retrospective file audit on children who were referred to a SLP clinic following caregiver concerns relating to fluency. The participants under observation in this study had a mean reported age of 54.7 months, and were administered an extensive battery of speech and language assessments. The authors reported that 37% of the participants assessed presented with a concomitant phonological disorder. In a review of that article, one researcher has noted there may be reason to caution these findings as approximately only half of the children in this study were referred for fluency intervention (Nippold, 2001).

Of the four direct observation studies conducted since 1990, two have noted co-occurring stuttering and SSD (Louko et al., 1990; St. Louis et al., 1991). Louko et al. (1990) conducted direct assessment of preschool aged children who stuttered, matched with fluent controls, and found that 40% of the children who stuttered exhibited disordered phonology compared to 7% of the matched controls. St Louis et al. (1991)
observed school-aged children and reported that 42% of children who stuttered had a co-occurring phonological disorder. Both these direct observation studies reported substantial figures of co-occurrence of stuttering and SSDs, although they employed different assessment protocols. Louko et al. (1990) analysed the data taken from spontaneous speech samples whereas St Louis et al. (1991) administered the Goldman Fristoe Test of Articulation (Goldman & Fristoe, 1968), a single-word naming test. Caution must be used when interpreting the findings of these studies, as more thorough examination of a child’s phonological system may yield different results. When using a spontaneous speech sample alone, children are free to talk about whatever they choose, and may therefore fail to produce certain consonants and consonant clusters (Nippold, 2002). Although it is appropriate to verify the existence of a SSD from a lengthy spontaneous speech sample, it is also considered optimal to do this in addition to a single-word naming test that includes all English consonants and clusters in appropriate word positions (Morrison & Shriberg, 1992).

In summary, research examining the co-occurrence of stuttering and SSD has yielded varying results. This is likely due to a number of factors including research design, and definition criteria. Though it has been most commonly reported that around 30-40% of children who stutter also have a co-occurring SSD (Gregg & Yairi, 2007; Nippold, 2004b), without the support of evidence from prospective epidemiological studies, the exact incidence of co-occurrence for the two disorders remains uncertain.

The Nature of Speech Sound Disorders in Children Who Stutter

While findings vary in relation to how often stuttering and SSD co-occur, there can be little doubt that disorders of speech sounds do coexist in some children who stutter. To that end, some researchers have aimed to examine a potential relationship
between stuttering and phonology (Sasisekaran, 2014). Reviews of this literature have found that the link between stuttering and phonology, if any, remains uncertain (Nippold, 2002; Sasisekaran, 2014). These reviews reported little evidence to support such a relationship. Yet the topic remains of great interest to researchers and clinicians alike, as there is currently minimal research detailing how best to treat a child who presents with a stutter and a co-occurring SSD.

Study of the sound errors and patterns of young children who stutter and also exhibit a SSD is one way in which researchers have aimed to observe a potential interaction. Many researchers have sought to describe this information, using a variety of methodologies.

Some research analysed the speech of young children who stutter using a sound-by-sound approach. That is, they categorised speech sounds into errors of substitution, distortion and/or omission (Louko, 1995). Two studies reporting on this in school-age children who stuttered noted that the most frequently occurring error category were sound substitutions in word-initial position (St Louis & Hinzman, 1988). These findings were later replicated in a second study where a small group of school-age children who stuttered were randomly selected for further analysis without taking their stuttering severity into account. Findings indicated that speech sound substitutions were the most frequently occurring in the word-initial position (St Louis & Hinzman, 1988; St Louis, Murray, & Ashworth, 1991). Both studies reported on data from a wide age range of school-aged participants (6;8 to 17;5 years) and the specific nature of the substitution errors were not reported. Given that a child’s speech sound system should almost resemble an adult’s by the youngest age reported, this would have been an interesting variable on which to report and reflect.
Later studies used a linguistically based (phonological) framework to describe the nature of speech errors using relational or phonological process analysis. This form of analysis compares the child’s speech to the adult form. Phonological processes are sound errors that can affect entire sound classes rather than individual sounds, and are reported as speech sound error patterns (Baker, 2004). To illustrate this, fricative sound classes may be realised as plosive sound classes. For example, a child might realise the word “fish” as “tish”, and “van” as “ban”.

Findings from some of these studies have reported no significant difference in the number of phonological processes exhibited in general by young children who stutter and their fluent peers (Louko et al., 1990). In another study investigating young children with disordered phonology who stutter and their fluent peers with disordered phonology, more similarities than differences were observed in phonological production (Wolk & Edwards, 1993). Wolk and Edwards also found that children who stuttered tended to exhibit more atypical phonological processes such as glottal replacement and velarisation. Children who stuttered and had disordered phonology were observed to display more fixed postures with audible airflow than those without disordered phonology. Some common phonological processes observed in children who stutter included gliding of liquids, vocalisation and cluster reduction (particularly s-cluster reduction) (Louko et al., 1990; Melnick & Conture, 2000; Wolk & Edwards, 1993). Cluster reduction occurred more significantly in children who stutter compared to children who do not (Louko, Edwards & Conture, 1990). There was methodological variation in these studies. Some analysed the data from single-word naming tests alone, or from conversational speech samples alone. No studies provided thorough analysis of the data using both of these methods.
Another line of investigation into the relation between stuttering and phonology has led researchers to report on the specific scores obtained in various formal assessments of speech sound production in children who stutter. Some research provided scores from assessments based on articulation errors. Articulation was tested using the Arizona Articulation Proficiency Scale (Barker Fudala & Reynolds, 1986), and analysed the articulation scores obtained from two groups of children, those who stuttered and those who did not stutter. No significant differences were found between these two groups on scores of articulation proficiency (Ryan, 1992). Other studies that have used the “Sounds in Words” subtest of the Goldman Fristoe Test of Articulation – 2 (Goldman & Fristoe, 2000), which is norm-referenced, have achieved similar results. Anderson and colleagues implemented this assessment on two groups of children, those who stuttered and those who do not, and found that both groups scored above the 20th percentile, and were therefore within normal limits (WNL). Overall, the children who did not stutter scored significantly better than those who did not (Anderson & Conture, 2000; Anderson, Pellowski, & Conture, 2005). However, for the 2005 study, children who did not stutter and scored below the 20th percentile on assessment measures were excluded from the study, but not the children who stuttered. Therefore the group differed in two dimensions – presence of stuttering and scores on outcome measures. This study was replicated in 2009, with similar results (Coulter, Anderson, & Conture, 2009).

Another group of researchers have analysed the data obtained from a phonologically based assessment, the Assessment of Phonological Processes – Revised (APP-R) (Hodson, 1986). This assessment provides mean percentage of phonological error scores. The studies utilising this assessment primarily aimed to identify the phonological factors that may or may not predict stuttering persistence and recovery,
however in some cases comparisons were made with matched controls who did not stutter (Paden, Ambrose, & Yairi, 2002; Paden & Yairi, 1996; Paden, Yairi, & Ambrose, 1999; Yairi et al., 1996). Paden and Yairi (1996) found that children whose stuttering persisted scored more poorly than matched controls and exhibited more age-inappropriate phonology. It was also found that children whose stuttering persisted lagged behind phonologically despite their increasing age, showing a reverse trend from that normally expected. Following on from this, Paden et al. (1999) analysed the scores of children in two groups, those whose stuttering persisted and those who recovered. The persistent group exhibited poorer phonological ability, but the path of their phonological development was found to be similar to that of their fluent peers which was in contrast to their earlier findings. Twice as many participants in the persistent group scored over 40% on consonant clusters, leading the researchers to suggest that the performance on cluster reduction of children soon after onset may be an important indicator of chronic stuttering. Investigating these findings in a longer-term follow up study, Paden et al. (2002) examined participants who stuttered at one year after initial assessment and then a year later. Participants were again allocated into persistent and recovered groups. The mean difference in phonological scores between groups at the 1 year follow-up was no longer significant. Again in contrast to their original findings, those whose stutter persisted exhibited more phonological improvement than those who would recover.

The findings from the above three studies indicate that perhaps age-inappropriate cluster reduction in children who stutter might predict stuttering persistence. The phonological development pattern of children who stutter does not appear to differ significantly from that of their fluent peers, although it may occur at a slower rate in the short-term. The phonological process scores obtained from the APP-R
evaluate the 10 most common speech errors that present clinically. A more extensive phonological analysis, alongside a conversational speech analysis of phonological processes may have yielded more detailed results. The types of cluster reduction errors were not noted in the results of these studies. Further, all of the above studies reported on findings from different measures of phonological and articulation assessments, some of which were administered some time after the age of stuttering onset. Seeking detailed analysis of phonological skills in conjunction with level of dysfluency, Gregg and Yairi (2007) analysed children no more than 6 months after their onset of stuttering. Twenty eight children who stuttered, with an age range of 25 to 38 months, were administered the APP-R to obtain phonological deviation (error) scores. The children were allocated into one of four groups: mild stuttering/no phonological difficulty; severe stuttering/no phonological difficulty; stuttering/mild phonological difficulty; stuttering/moderate phonological difficulty. There were no statistically significant differences between the stuttering of children with mild and moderate phonological deviations and between the phonological skills of children with severe and mild stuttering (Gregg & Yairi, 2007). The authors reported that this research lent support to the belief that the two disorders of fluency and phonology did not appear to be related.

Another way in which researchers have attempted to investigate the interaction between stuttering and phonology is to report on the correlation between phonological errors and stuttering frequency. Some research has investigated whether stuttering may be influenced by the phonological difficulty of words (e.g., later developing sounds, complex syllable shapes including clusters, multisyllables). This research has found that the frequency of stuttering in speech with phonological errors was not significantly different than that without phonological errors (Wolk et al., 2000) and that the highest proportion of words that were disfluent were words that were considered not
phonologically difficult (Throneburg, Yairi, & Paden, 1994). A further significant finding was that stuttering on clusters with phonological errors occurred more often than on clusters without phonological errors. Specific consonant cluster types were not reported, thus it is unknown whether more complex cluster types were stuttered upon more frequently (Wolk et al., 2000). A case study of a 4 year old child who stuttered documented findings that were in contrast to these studies (Caruso, Ritt, & Sommers, 2002). The results of this case study indicated that words containing speech sounds that were consistently misarticulated by the child had a greater probability of being produced dysfluently. Of interest is that the results of the child’s original assessment battery were provided, and although the child displayed some sounds in error, his percentile ranks for both the “Sounds in Words” subtest on the Goldman Fristoe Test of Articulation (Goldman & Fristoe, 1968) and the Kahn-Lewis Phonological Analysis (Khan & Lewis, 1986) placed him WNL (at 16 and 24 respectively), albeit at the lower end of the same range.

The phonological encoding skills of children and adults who stutter have also been studied extensively using tasks that include priming procedures, rhyme judgment, non-word repetition and phoneme monitoring skills. A review of these studies has found their results to be ambiguous (Sasisekaran, 2014).

In summary, there is some evidence to suggest that when children who stutter and have SSD are compared with children who have SSD in isolation, there appear more similarities than differences in the types of error patterns found. Children with the disorders co-occurring may evidence the following age-inappropriate phonological processes: cluster reduction (particularly s-cluster reduction), vocalisation and gliding of liquids. Atypical processes in children who stutter are more frequent in nature compared
to their fluent peers and examples included glottal replacement and velarisation. In relation to phonological development, it has been found that children with a persistent stutter display lower scores on assessment, and while their phonological development still follows the same path as typically developing children, it may be slower than expected in the short-term. Children with a persistent stutter show poorer scores on consonant cluster production, which may be an indicator of chronic stuttering soon after onset. Although the majority of this research remains equivocal, it is possible to conclude that the degree of phonological difficulty does not influence whether or not a word is stuttered upon. The exception may be cluster production, in that clusters that are produced in error have been found to have a higher frequency of stuttering.

**Treatment of Co-occurring Stuttering and Speech Sound Disorder**

Despite the fact that stuttering and SSD can co-exist, very little empirical research has focused on treatment approaches when this occurs. Consequently little is known about the clinical management of the two co-occurring disorders. However, there is a small amount of survey studies that have investigated issues around current practice with this caseload.

In a study previously described, Arndt and Healey (2001) primarily investigated the co-occurrence of stuttering and SSD. Arndt and Healey investigated the ways in which SLPs treated the disorders when they co-occurred. Their survey, administered to participant SLPs, included a framework for service delivery previously described by Ratner (1995, 1998) who nominated several specific approaches in an effort to ease clinical decision-making with regard to service delivery. These approaches were that the two disorders be treated either in a blended, cyclic, sequential, or concurrent manner. Ratner explained that a blended treatment approach involves treating both disorders.
simultaneously within each session, where intervention goals are blended into the same activities. Cyclic approaches involve treating one disorder in isolation for a period before treating the other disorder for the same amount of time, and this continues in a cyclic pattern. A sequential approach is the complete treatment of one disorder to a pre-determined level of recovery, followed by treatment of the other disorder. Finally, a concurrent approach treats both disorders discretely but at the same time, for an equal amount of time, focusing on the lowest linguistic demands (Ratner, 1995). In their survey, Arndt and Healey (2001) found that the majority of SLPs favoured a blended approach to treatment, simultaneously treating stuttering and phonology within the same session, using activities where treatment goals were combined. The authors did not explore which specific type of treatment(s) was used by clinicians, or why the selection of a blended treatment approaches was preferred.

A mail-based survey of 2,000 SLPs nationwide in the US received responses from 1,184 participants (Blood et al., 2003). The primary aim of the survey was to determine the percentage of co-occurrence in children who stutter with other disorders including speech, language and non-speech related disorders. However, the survey also investigated frequency and length of treatment sessions as well as service delivery options. Of the children represented by this survey who were being treated for both the stuttering and the co-occurring disorder, the majority were treated in a blended manner as previously described. The type of treatment(s) used was not reported.

Another survey study recruited SLPs based in the US at a State professional conference (Nippold, 2004b). One hundred and twenty seven participants were asked for their views on when they believed the treatment of stuttering should commence, and whether they were more likely to provide treatment for a child who stuttered if that
child had an additional communication disorder. Participants were also presented with a hypothetical case history of a 4-year-old child who stuttered and displayed a concomitant phonological disorder. The participants were asked to discuss their treatment management if this was a child on their caseload. Specifically, they were asked to comment on the following: whether they would only treat the stuttering, whether they would only treat the phonological disorder, or whether they would treat both disorders. The survey did not examine the specific treatment approach that the clinicians would use to treat the disorder of stuttering or phonology in the hypothetical 4-year-old. The responses indicated that 59% of clinicians believed that treatment for stuttering should begin in the preschool years. One third of the participants indicated they were more likely to provide treatment for a child who stuttered if the child had an additional communication disorder. When asked which concomitant disorder they would treat, 83% of the participants said they would treat both the stuttering and the phonological disorder and, although no rationale was requested, some clinicians commented that focusing on the phonological disorder could indirectly improve the stuttering. Specific service delivery methods were not investigated further.

Evidence supporting the treatment of co-occurring stuttering and SSD is scarce. One scientific study exists and was conducted by Conture and colleagues in 1993. They investigated the efficacy of treating stuttering and phonology in a blended manner. This study will be critiqued in more detail in Chapter 2. Aside from this research, the remaining evidence comes in the form of guidelines and recommendations based on clinical experience and expert opinion.

Wall and Myers (1995) proposed that if the SSD was mild in nature and did not affect the child’s overall intelligibility, it might be addressed once the child’s fluency
became more stable. However, if the child was unintelligible, clinicians might be reluctant to work on the SSD for fear that this could worsen the fluency, although Wall and Myers believed this to be an empirically unsupported notion. Wall and Myers suggested that if treatment for the SSD was warranted, it could be incorporated into the fluency treatment in a blended manner. They proposed that treatment needed to be well planned for the individual and provided at a cautious pace, utilising sounds and stimuli that were motorically easy to produce. In this way, the authors suggested, intervention must not place excessive demands on the child. Further, the authors reported that stuttering could be addressed simultaneously using clinician-modelled fluency-shaping techniques such as utilising a slower speaking rate, gentle articulator contact and voicing onset, as well as lowered vocal volume.

Ratner (1995) discussed the use of concurrent versus sequential service delivery with co-occurring fluency and phonological disorder. Making reference to the study conducted by Conture et al. (1993), Ratner stated that treatment for stuttering and SSD may be carried out concurrently, but advised that caution should be taken to avoid direct correction of the speech sound errors. Consideration was also given to whether treatment goals should be blended or discrete in nature.

Wolk (1998) also proposed guidelines for treating children between the ages of 4 and 7 years of age who presented specifically with co-occurring stuttering and phonological disorder. These guidelines were again predominantly based on the work of Conture et al. (1993), as well as extensive clinical experience. Wolk proposed that both disorders should be addressed as a priority due to the need for early intervention. Wolk also proposed that intervention could be delivered either sequentially or simultaneously, but acknowledged that clinical decision-making around service delivery method was
challenging due to the lack of related scientific evidence available. Wolk’s guidelines included the use of indirect treatment approaches for the phonological disorder using a phonological process approach in a group setting rather than individual treatment. Direct fluency treatment was recommended, using fluency-shaping techniques such as reduced speech rate, soft contact of articulators and elongation of vowel sounds. Wolk stated that parental involvement was crucial to success and this could be achieved by having the parents observe the clinician working with their children either covertly or overtly, as well as being provided with fluency shaping strategies for use in the home environment. More recently, Byrd and colleagues have published a book chapter detailing similar procedures (Byrd, Wolk, & Lockett Davis, 2007).

In contrast to these guidelines, others have discussed treatment approaches with consideration of more recent treatment evidence that has been published in relation to the direct treatment of stuttering. One guideline proposed that there should be no reason to avoid direct interventions for both the SSD and the stuttering (Nippold, 2004a). Nippold stated that direct treatment approaches should be a consideration when planning for the management of this caseload, particularly in light of the minimal evidence suggesting an interaction between stuttering and phonology in general.

Along similar lines, another author proposed guidelines recommending a serial (i.e., sequential) form of delivery for the two disorders (Guitar, 2006). Guitar recommended that, when using a specific direct fluency intervention known as the Lidcombe Program (LP) (described in Chapter 2), only the stuttering should be treated until the child reached a particular point in this intervention. That point was after very low-levels of stuttering had been maintained by the child for a period of time. Guitar recommended that only after that point should treatment for the SSD commence. He
further recommended that when the SSD was severe, intervention might commence with targeting the SSD first before the fluency. However, it has been noted that a serial form of service delivery might not be ideal, in that delaying intervention for either disorder could compromise the optimal window for intervention (Ratner, 1998).

**Summary**

Stuttering and SSD are common communication disorders identified during the preschool years. When these disorders occur in isolation, each has the potential for long-lasting negative effects on an individual. If left untreated, stuttering has the potential to become chronic and the negative implications of this may span a lifetime in some individuals. Similarly, a child with a SSD that is not treated before they reach school-age may risk difficulties across many areas of their education, particularly in literacy. The impact of having a SSD can also be long-lasting. Though it has yet to be investigated, the impact may be even more significant when a person has both the disorders co-occurring, particularly when these disorders have been found to co-occur at a significant rate (Gregg & Yairi, 2007; Nippold, 2004b).

Undoubtedly, early intervention for both these disorders in isolation is considered crucial and best practice. Further, when the disorders do co-occur there may be even more reason to intervene early given that poor phonological skills may predict stuttering persistence. Yet when these disorders co-occur, there is little evidence detailing a treatment approach. The evidence that does exist largely comprises of guidelines based on expert opinion and clinical expertise. The majority of these guidelines recommend a service delivery approach that is concurrent in nature, with blended treatment goals. Indirect treatment approaches for both disorders are also largely recommended, drawing on one source of empirical evidence dated more than 20
years ago (Conture et al., 1993). Since that time, the treatment literature surrounding both stuttering and SSD in isolation has evolved, many advocating the use of direct approaches and supported by high levels of evidence. Nippold (2004a) suggested that there may be no need to avoid using direct treatment approaches when working with this co-occurring caseload, particularly as there has been little evidence found to support an interaction between stuttering and phonology. In fact, one way to further investigate the interaction between stuttering and phonology would be to assess a child’s sound system before and after intervention using direct treatment approaches (Nippold, 2002; Rousseau, Packman, Onslow, Harrison, & Jones, 2007).

Although several studies have investigated how SLPs treat co-occurring stuttering and SSD, they were primarily survey studies that have come from the US and have not taken into account the perspectives of clinicians from other countries who may use different intervention techniques to address the two disorders. These survey studies did not go into detail around decision-making related to this caseload, but it is known that when it comes to these decisions, clinicians may be confused (Nippold, 2004b). Such confusion could relate to the paucity of empirical evidence available addressing this caseload, and/or that there was anecdotal evidence that treating either disorder may worsen the other (Wall & Myers, 1995).

Therefore, the confusion appears to focus around which treatment approach(es) to use to address these co-occurring disorders, and also which approach to service delivery to take. When considering these guidelines and recommendations as a whole, clinicians are left to make a number of decisions. Should treatment for the two disorders be direct or indirect? Should one disorder be treated before the other, and if so, which should be addressed first? Alternatively, should treatment occur for both disorders at the
same time, and where this is the case, should the treatment goals be discrete or combined (blended) in nature?

To commence these inquiries, the following chapter details a literature review of treatments for early childhood stuttering and SSDs, first in isolation and then when they co-occur. Chapter 2 aims to establish best practice treatment approaches for the two disorders by reviewing and critiquing the available evidence. Such information is relevant to the choice of treatment approaches investigated later in this thesis.
CHAPTER 2

Evidence for Treatment of Stuttering and Speech Sound Disorders
Introduction

As highlighted in Chapter 1, treatment approaches for stuttering and treatment approaches for SSD in young children have been the focus of much research. However, there is little scientific evidence and few guidelines regarding treatment when these two disorders co-occur. In 2002, Nippold stated, “perhaps the most pressing topic for research concerns the clinical management of children who stutter and have a co-occurring phonological disorder” (p. 107).

Clinicians have an ethical and professional responsibility to deliver best practice to their clients. Evidence-based practice (EBP) is a concept that is embedded in clinical practice to ensure that the treatment clinicians deliver is both ethically sound and efficacious. However, barriers to effective assessment of the evidence for communication disorders may exist. One of these barriers is undoubtedly a paucity of information for a particular caseload.

This chapter discusses the concept of EBP and evaluates the research evidence for treatment of stuttering and SSD when the disorders occur in isolation and when they co-occur.

Evidence-based Practice

Evidence-based practice has been defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996, p. 71.). This definition was originally proposed for consideration in the field of medicine. However, there has been a move to consider EBP across other areas of healthcare delivery since that time, including speech-language pathology. In their original definition, Sackett and his colleagues stated that implementing EBP was the act of combining clinician
expertise with the scientific research (1996). From there, it was further recognised that
evidence can also be found in another source, the clients themselves, and the original
definition was updated to reflect this change (Dollaghan, 2007). A more inclusive
definition therefore states that EBP “requires the integration of the best research
evidence with our clinical expertise and our clients’ unique values and circumstances”
(Strauss, Richardson, Glasziou, & Haynes, 2005, p. 1.).

Subsequent to this revised definition, Dollaghan (2007) agreed that although
implementing EBP should incorporate evidence from all of these sources, there still
appeared to be a strong focus on the scientific research which may weaken emphasis on
the other elements. Dollaghan (2007) suggested a new framework to highlight the equal
importance of all three elements of the EBP framework, using the abbreviation E3BP as
a way to ensure constant engagement with all available evidence sources. Dollaghan
(2007) therefore extended the above definitions with this revised framework in mind,
stating that E3BP is the “conscientious, explicit, and judicious integration of 1) best
available external evidence from systematic research, 2) best available evidence internal
to clinical practice, and 3) best available evidence concerning the preferences of a fully
informed patient” (p. 2). An important consideration to this framework is clinical
expertise. Dollaghan noted that clinical expertise should not be viewed as a separate
compartment of the model, but is what is required of a professional to assess, evaluate and
implement all three arms of the E3BP model. In this way, clinical expertise is viewed as
the binding factor holding all the other components together. Dollaghan’s (2007)
components of the E3BP model are now discussed in further detail.

The external evidence. This is also referred to as the current best evidence
sourced from systematically conducted research. Clinicians must be able to locate the
scientific evidence relevant to the caseload with which they are working. Dollaghan (2007) noted that this is a multi-stepped process that optimally commences with formulating clinical foreground questions pertaining to the client. Locating specific evidence may be a laborious task without having a well-formed and specific clinical question on which to base searches. Therefore, Dollaghan recommended the patient-intervention-comparison-outcome (PICO) process as a framework for constructing these initial questions. An example PICO question a SLP might ask, relevant to the caseload of children with co-occurring stuttering and SSD, might be:

In children with co-occurring stuttering and SSD (P), does implementing the Lidcombe Program (I) first (i.e., before SSD treatment) (C) lead to an improvement in speech sound production (O)?

Asking specific clinical questions such as this is a starting point from which SLPs can begin their search for surrounding external evidence.

The external evidence can be sourced from library databases, peer-reviewed journals, relevant professional association documents, and results of reviews conducted by formal review groups. Speech-language pathologists then need to be able to critically evaluate this source of evidence, assessing the quality of the research, which is the rigour surrounding the methodology (Baker & McLeod, 2011). Critical review involves many aspects including determining whether or not the research paper has a defined aim and question to be answered; whether the measures used are reliable and valid; and whether, using relevant measures of analysis, statistical significance has been proven. Speech-language pathologists also need to assess the research design and related aspects, including whether or not randomisation and controls were employed. By engaging in this process, SLPs establish the credibility of the external evidence (Baker
The research design employed for scientific research studies can be graded to allow such appraisal to take place. Grading enables SLPs to evaluate stronger versus weaker levels of evidence. Many frameworks have been proposed to allow such grading to take place. A common framework often employed in Australia is one proposed by the National Health and Medical Research Council (NHMRC) (2009), summarised in Figure 2.1. The NHMRC (2009) has published guidelines that enable clinicians to grade evidence levels according to study design. The guidelines can deal with research for different clinical purposes including intervention, assessment, diagnosis, prognosis and causal factors (National Health and Medical Research Council, 2009). The framework provides a hierarchy of evidence levels from strongest to weakest level of design. Level I is considered the gold standard of intervention study designs – a systematic review of all the randomised controlled trials (RCT) for a specific intervention type. In contrast, level IV is considered the weakest level of evidence – case studies/series whereby a single group of participants are all subject to the same intervention under study. In these designs, outcome measures are typically taken either post-intervention or pre- and post-intervention (National Health and Medical Research Council, 2009). Each level in this hierarchical structure represents a reduction in the risk of bias as the type of study design changes up the scale.

Another framework commonly employed is that used by the American Speech-Language Hearing Association and adapted from the Scottish Intercollegiate Guidelines (American Speech-Language Hearing Association (ASHA), 2004) wherein the highest level of evidence (Ia) is graded as a meta-analysis of more than one RCT, and the lowest level (IV) allocated to expert opinion in various forms. A summary of the ASHA (2004) and NHMRC (2009) frameworks is provided in Table 2.1.
*RCTs = Randomised controlled trials

**Figure 2.1.** Hierarchy of evidence levels from strongest to weakest proposed by NHMRC (2009) guidelines.

<table>
<thead>
<tr>
<th>Level</th>
<th>ASHA</th>
<th>Level</th>
<th>NHMRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia</td>
<td>Meta-analysis of &gt;1 RCT</td>
<td>I</td>
<td>Systematic review of RCT’s</td>
</tr>
<tr>
<td>Ib</td>
<td>RCT</td>
<td>II</td>
<td>RCT</td>
</tr>
<tr>
<td>IIa</td>
<td>Controlled study – no randomisation</td>
<td>III-1</td>
<td>Pseudo-RCT (e.g., alternative allocation method)</td>
</tr>
<tr>
<td>IIb</td>
<td>Quasi-experimental study</td>
<td>III-2</td>
<td>Controlled study – no randomisation</td>
</tr>
<tr>
<td>III</td>
<td>Non-experimental studies (correlational and case studies)</td>
<td>III-3</td>
<td>Uncontrolled trials</td>
</tr>
<tr>
<td>IV</td>
<td>Expert opinion</td>
<td>IV</td>
<td>Case studies</td>
</tr>
</tbody>
</table>
Another framework under which scientific research can be evaluated considers the nature or phase of inquiry that the paper gives evidence for (Baker & McLeod, 2011). One such example for determining research phase of inquiry was proposed by Robey (2004). Robey’s framework applies to clinical trial research specific to studies related to disorders of communication. A clinical trial is defined as “any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects on health outcomes” (World Health Organization, 2014, para. 5). Rather than focus on grading levels (as in the abovementioned system), this five-phased model discusses the various stages of development of clinical trials in a systematic manner, enabling clinicians to categorise them based on trial outcomes (Robey, 2004). Central to Robey’s five-phase model are the ideas of intervention efficacy and effectiveness. The efficacy of an intervention approach refers to evidence that manipulation of the independent variable(s) had a statistically significant effect on the dependent variable(s) under rigorously controlled experimental conditions (Robey, 2004). In contrast, intervention effectiveness refers to whether or not the intervention in question had an impact on the population under less controlled, real-world conditions. In other words, did the intervention have an impact on the population when it was delivered by actual clinicians to their clients as opposed to researchers and participants in lab-type environments? Although effectiveness is of most interest to clinical SLPs, Robey pointed out that in order to establish initial safety of interventions, efficacy is a necessary precursor to effectiveness trials. Summarised in Table 2.2, Robey’s five-phase model commences with Phase I trials.
Table 2.2
Robey’s (2004) five-phase model for the development of clinical trials

<table>
<thead>
<tr>
<th>Phase</th>
<th>Aim(s)</th>
<th>Design(s)</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| Phase I | Identify therapeutic effect  
  Preliminarily describe treatment protocols  
  Determine population  
  Estimate dosage | Single case  
  Small group  
  Retrospective | Efficacy |
| Phase II | Larger numbers than Phase I  
  Further determine efficacy and effect size for moving to clinical trial  
  Refine target population  
  Refine dosage  
  Refine treatment protocol  
  Develop treatment manual | Single case  
  Small group  
  Controls employed | Efficacy |
| Phase III | Clinical trial phase  
  Efficacy testing on large numbers  
  Establish internal validity | RCTs | Efficacy |
| Phase IV | Establish external validity  
  Real-world clinical population  
  Explore new (sub-) populations  
  Variations to treatment protocol  
  Variations to service delivery | Single case or group studies of clinical clients with or without controls | Effectiveness |
| Phase V | Evaluate cost-effectiveness in health-care settings | - | Effectiveness |

**Challenges to evaluation of evidence.** There are suggestions that evaluating the external evidence may pose difficulties for SLPs (Brackenbury, Burroughs, & Hewitt, 2008). Yet, engaging with the external evidence is necessary, particularly in preparation for working with an unfamiliar caseload, or when wanting to update their knowledge base in a specific area of interest. Speech-language-pathology is part of a scientific discipline where lifelong learning is a prerequisite skill for providing ethical service to those with communication disorders (Brown, Hill, Copley, Rose, & Cartmill, 2014).
Indeed, lifelong learning is a standard against which SLP students in Australia are assessed for the duration of their degree and at entry level into the profession (Speech Pathology Australia, 2011). However, one study has found that there may be barriers to SLPs engaging with the external evidence (Brackenbury et al., 2008). When assigned an unfamiliar clinical caseload, on average, experienced clinicians took between 3 and 7 hours to source the relevant information required after formulating a PICO question. Paucity of information and sourcing stronger levels of evidence were other barriers, where clinicians sourced most information from individual or small group studies rather than from systematic reviews. Other suggested barriers to sourcing external evidence may be lack of access, low strength of skills required to perform critical evaluation, failure to view some of the efficacy research as generalizable to clinical practice, and overall lack of time available to conduct relevant searches.

In recognition of findings that accessing and evaluating external research is a time-consuming and often arduous task, Onslow and colleagues (2008) drew on the recommendations of field-related experts (Bloodstein, 1995; Bothe, Davidow, Bramlett, & Ingham, 2006; Conture & Guitar, 1993; Curlee, 1993; Ingham, 1984; Ingham & Riley, 1998; Starkweather, 1993) to develop a method for evaluating the nature of the external evidence specific to the field of stuttering, to ease the burden of work for SLPs. Drawing on these guidelines and recommendations, Onslow and colleagues defined a clinical trial in stuttering intervention as one whereby the study is prospective in nature, delivers an entire treatment as manualised, outcomes are measured at least once pre-treatment and once post-treatment (with the post-treatment occurring no sooner than 3 months), and where outcomes are measured on samples gathered independent of the treatment and beyond the clinic (Onslow, Jones, O'Brian, Menzies, & Packman, 2008). Onslow and colleagues developed a simple, user-friendly, three-phase taxonomy of the
development of clinical trials for stuttering research that was designed primarily to take into account issues of quality and to acknowledge that “all clinical trials evidence is not equal” (Onslow et al., 2008, p. 404). The three phases of this model are summarised in Table 2.3. Of note is that this framework does not include the level of phase trials evaluating effectiveness.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Aim(s)</th>
<th>Design(s)</th>
<th>Participants</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>Preliminarily investigate new treatment Establish safety Determine dosage Develop treatment protocol Preliminary evidence of treatment effect</td>
<td>Single case Small group Prospective</td>
<td>Determined arbitrarily &lt;10</td>
<td>Efficacy</td>
</tr>
<tr>
<td>Phase II</td>
<td>Continued monitoring of safety and viability Estimation of treatment effect</td>
<td>Small group Can be RCTs Replication by independent groups not essential Prospective</td>
<td>&gt;10</td>
<td>Efficacy</td>
</tr>
<tr>
<td>Phase III</td>
<td>Gold standard clinical trial Robust estimation of effect sizes Comparison to treatment or control group</td>
<td>Always RCTs Prospective</td>
<td>Range from fewer than 100 to 1000s</td>
<td>Efficacy</td>
</tr>
</tbody>
</table>
The internal evidence: Best internal evidence from clinical practice.

Dollaghan (2007) suggested that internal evidence supplements external research because it provides consideration of application of the external evidence to specific individuals.

Baker and McLeod (2008) outlined two important elements to consider when reviewing internal evidence: client factors and clinician factors. Client factors considers the client in relation to the ICF or ICF-CY (World Health Organization, 2001, 2007). Consideration of the client’s body structure and function, activity and participation levels, environmental and personal factors can be taken into account (Baker & McLeod, 2008). Clinician factors relate to clinical experiences and results from previous interventions that may be sought via analysis of clinical outcome data and compared to the external research or to the results gained by professional colleagues (Baker & McLeod, 2008).

The clients’ preferences. Dollaghan’s (2007) third component in the E³BP model refers to client (patient) preferences. Dollaghan stated that including clients in decisions related to their own care is acting in a highly ethical manner, as it ensures that clients are fully informed in matters relating to costs and associated risks and/or benefits of intervention. Further, such action respects their right to autonomy and beneficence. Clients should also be provided with any reasonable options where appropriate, and should have the right to choose between various efficacious intervention approaches (Wampold, Lichtenberg, & Waehler, 2005).

The focus of the next section in this chapter is concerned with the external evidence specific to stuttering and SSD. The scientific research is explored in relation to these two disorders as they occur in isolation. This external evidence is evaluated and
graded using the relevant frameworks as described above. For the stuttering related 
research the clinical trial criteria of Onslow et al. (2008) are applied, as well as the 
NHMRC’s (2009) levels of evidence. For the SSD, the NHMRC’s (2009) levels of 
evidence are applied. As detailed in Chapter 1, there is a paucity of external evidence 
when the two disorders co-occur, and this section also evaluates the surrounding 
external evidence when this is the case.

**Evidence for Treatment for Stuttering in Young Children**

Following is a critical review of the external evidence for stuttering treatments 
for young children (i.e., preschool-aged). The treatment approaches for early childhood 
stuttering has been described in three broad categories: indirect, direct and mixed 
approaches (Trajkovski et al., 2009). This chapter reviews the more recently published 
approaches that fall into these categories. A more extensive (though not exhaustive) list 
of some of the treatment approaches is provided in Table 2.4, alongside evaluation of 
whether or not they can be classified as a clinical trial under Onslow et al.’s (2008) 
criteria and their level of evidence under the NHMRC’s (2009) guidelines.

**Table 2.4**

*Evaluation of evidence levels for direct, indirect and mixed treatments of early 
childhood stuttering using Onslow et al. (2008) and NHMRC (2009) frameworks*

<table>
<thead>
<tr>
<th>Intervention Type</th>
<th>Treatment Approach</th>
<th>Reference</th>
<th>Clinical Trial Phase</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Indirect</em></td>
<td>Group play therapy</td>
<td>Wakaba (1983)</td>
<td>n/a</td>
<td>Level IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Follow-up data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>unavailable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teaching and facilitating mother-child interaction</td>
<td>Wyatt (1969)</td>
<td>n/a</td>
<td>Level III-3</td>
</tr>
<tr>
<td></td>
<td>therapy</td>
<td>Follow-up data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>unavailable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention Type</td>
<td>Treatment Authors</td>
<td>Duration</td>
<td>Evidence Level</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>----------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>Parent focused treatment</td>
<td>Yaruss, Coleman, and Hammer (2006)</td>
<td>n/a</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outcome measures not obtained on samples from both within and beyond clinic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demands and Capacities Model</td>
<td>Franken, Kielstra-Van der Schalk, and Boelens (2005)</td>
<td>n/a</td>
<td>Level III-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Entire treatment protocol not delivered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent-child interaction therapy</td>
<td>Millard, Nicholas, and Cook (2008)</td>
<td>Phase I</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Millard, Edwards, and Cook (2009)</td>
<td>Phase I</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td>Direct Comprehensivestuttering program</td>
<td>Kully and Boberg (1991)</td>
<td>n/a</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of beyond-clinic data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency rules program</td>
<td>Runyan and Runyan (1986)</td>
<td>n/a</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of beyond-clinic data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syllable-timed speech</td>
<td>Coppola and Yairi (1982)</td>
<td>n/a</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of beyond-clinic data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trajkovski et al. (2009)</td>
<td>Phase I</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trajkovski et al. (2011)</td>
<td>Phase II</td>
<td>Level III-3</td>
<td></td>
</tr>
<tr>
<td>The Lidcombe Program</td>
<td>Onslow, Costa, and Rue (1990)</td>
<td>Phase I</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Phase</td>
<td>Effectiveness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>---------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harrison, Wilson, and Onslow (1999)</td>
<td>Phase I</td>
<td>Level IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilson, Onslow, and Lincoln (2004)</td>
<td>Phase I</td>
<td>Level IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O'Brian, Smith, and Onslow (2014)</td>
<td>Phase I</td>
<td>Level IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rousseau et al. (2007)</td>
<td>Phase II</td>
<td>Level III-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lewis, Packman, Onslow, Simpson, and Jones (2008)</td>
<td>Phase II</td>
<td>Level II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miller and Guitar (2009)</td>
<td>Phase II</td>
<td>Level III-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jones et al. (2005)</td>
<td>Phase III</td>
<td>Level II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jones et al. (2008)</td>
<td>Phase III</td>
<td>Level II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O'Brian et al. (2013)</td>
<td>Effectiveness study</td>
<td>Effectiveness study</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mixed**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Study</th>
<th>Phase</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschool fluency development program</td>
<td>Culp (1984)</td>
<td>n/a</td>
<td>Level III-3</td>
</tr>
<tr>
<td>Intensive stuttering therapy program</td>
<td>Hasbrouck et al. (1987)</td>
<td>n/a</td>
<td>Level IV</td>
</tr>
</tbody>
</table>

Lack of beyond-clinic data
Indirect Treatments for Early Childhood Stuttering

Indirect treatments for early childhood stuttering aim to facilitate fluency by seeking to adjust a person’s environment rather than working directly on changing their speech patterns (Trajkovski et al., 2009). A review of the two most recently published interventions will be provided below, The Demands and Capacities Model (DCM) (Franken et al., 2005) and Parent-child Interaction Therapy (PCI) (Millard et al., 2009; Millard et al., 2008).

Parent-child interaction therapy. Designed for children up to 7 years of age, in this approach stuttering is acknowledged by both children and their caregivers and the program is designed to be tailored to meet the individual needs of families (Millard et al., 2008). The primary aim of the program is to empower caregivers to become effective and confident managers of their child’s fluency levels. The initial assessment and case history involves thorough evaluation of the many factors thought significant in the development of the child’s stuttering. These include speech, language, fluency, socio-emotional awareness, and impact of the stuttering. Assessment of all of these factors plays a role in the direction of treatment for the child. Caregiver involvement is essential and through identification and strengthening of fluency facilitation skills, caregivers learn how to naturally support and reduce fluency in the child’s environment (Kelman & Nicholas, 2008). Treatment involves six weekly sessions conducted within the clinic, followed by 6 weeks of home-based sessions where skills are consolidated in a more natural environment.
Millard, Nicholas and Cook (2008) conducted a study of the PCI on six preschool children aged between 3;3 and 4;10 years and their parents. The study was conducted in three phases and the primary outcome measure, percentage of syllables stuttered (%SS), was gathered from parental play-based video recordings conducted in the home in each of the three phases. Phase one involved a no-treatment baseline lasting 6 weeks. Phase two was the active treatment phase lasting 12 weeks (6 weeks of weekly clinic visits followed by 6 weeks of home-based treatment). Phase three was the follow-up phase whereby child and caregivers attended the clinic at 3, 6 and 12 months post-treatment (Millard et al., 2008). Only four of the six families participated in the full follow-up phase. By the end of the treatment phase, four of the six children had significantly reduced stuttering with both parents. Another child had a significant reduction with only one parent, and the remaining child did not make significant reductions in fluency levels until a direct treatment program was implemented. In 2009, Millard, Edwards and Cook conducted a further study with 10 children aged 3;7 to 4;11 years who were allocated into either a treatment condition or a waiting list condition. The six children who participated in the treatment underwent the same phases as described above with the exception of a 12 month follow-up. The primary outcome measure of stuttering frequency (percentage of stuttered words) was gained from video recordings of the parents playing with the child in the home setting at each phase. All six children showed significant reductions in stuttering frequency over the period of the entire study and for four children, this reduction was directly associated with the two treatment phases. Both of the above studies are evidence of Phase I clinical trials (Onslow et al., 2008) and level IV case studies (NHMRC, 2009).

Demands and capacities model. This indirect treatment approach is based on the assumption that stuttering occurs when the demands for fluency exceed the child’s
capacity to speak fluently (Gottwald & Starkweather, 1999). The demands and capacities are said to exist across four domains: speech motor capacity, linguistic, emotional and cognitive (Franken et al., 2005). The treatment therefore is aimed at simultaneously reducing the demands and enhancing the capacities across these four domains. This treatment is delivered by the child’s parents who are advised to speak more slowly, allowing the child more time to process and speak, thereby reducing demands in the speech-motor domain.

Franken et al. (2005) compared the DCM approach to a more direct form of stuttering intervention, the Lidcombe Program (LP) (described later in this Chapter). Twelve children were randomly allocated into the DCM condition (mean age 4;2 years), and 11 children into the LP condition (mean age 4;3 years). Pre-treatment outcome measures (%SS) were obtained from speech samples gathered at home during natural parental conversations. Treatment was conducted for up to 12 weeks but ended sooner if program criteria were met. Post-treatment data were collected in the same manner as pre-treatment, and obtained immediately after the treatment ceased. For both treatment conditions, stuttering significantly decreased from pre- to post-treatment, with no significant differences found between treatment types. The children in the DCM condition had a mean reduction in %SS from 7.9%SS to 3.1%SS, and the children in the LP condition had a mean reduction in %SS from 7.2%SS to 3.7%SS (Franken et al., 2005). This study was not considered a clinical trial under the Onslow et al. (2008) framework as the entire treatment program was not delivered, and there was a lack of follow-up outcome measures.

Direct Treatments for Early Childhood Stuttering
Direct approaches involve openly addressing the child’s speech production (Trajkovski et al., 2009). A review of the two most recently published interventions will be provided below, Syllable Timed Speech (also known as Rhythmic Speech Training) (Trajkovski et al., 2011), and the Lidcombe Program (Jones et al., 2005).

**Syllable timed speech.** This technique involves teaching syllables spoken in time to a beat (usually aided by a metronome) and produced with minimal variation in stress from syllable to syllable (Trajkovski et al., 2009).

Coppola and Yairi (1982) conducted the investigation of the use of syllable timed speech (STS) with pre-school aged children. Using a metronome, STS was delivered to three participants aged 3 to 5 years. Five phases occurred in this study: pre-treatment, treatment (three, 45 minute sessions for 5 weeks), post-treatment, rest-period (6 weeks immediately post-treatment) and follow-up (immediately after the rest-period). The primary outcome measure, frequency of stuttering per 100 syllables, was measured within the clinic at pre, post, and follow-up occasions. All children showed considerable reductions in fluency at follow-up, although one child had an increase in stuttering when conversing with a parent immediately post-treatment. Keeping time to the metronome was troublesome for the two youngest participants, as was the participants’ overall motivation to participate (Coppola & Yairi, 1982). This study did not rate as clinical trials evidence (Onslow et al., 2008) due to lack of outcome measures obtained on samples beyond the clinic.

To simplify treatment, Trajkovski and colleagues (2006, 2009, 2011) conducted this treatment on preschool aged children in a non-programmed manner implementing parent-training. Based on promising findings across two Phase I and one Phase II clinical trials, Trajkovski et al. (2011) implemented STS with 17 preschool-aged
children. Of these, eight children with a mean age of 3.8 years completed the treatment. Treatment was conducted in two distinct stages. During the first stage, regular clinic appointments were required to master, practise and maintain the taught techniques. The second stage was reached after obtaining less than 1% SS after two consecutive fortnightly visits. During this stage, clinic visits and home treatment were gradually withdrawn. Outcome measures were obtained both within and beyond the clinic at pre-treatment, entry to the second stage of the program, 6 and 12 months after completion of stage two of the program. The eight children reached stage two in a mean of 12.4 weeks. The mean stuttering reduction from pre-treatment to 12 months post-treatment was 96%, a clinically significant result. Although there was a large effect size, as no controls were employed, the study could not account for the possibility of natural recovery in children of this age who stutter.

The Lidcombe Program. This intervention approach was derived from a behavioural treatment known as verbal response-contingent stimulation (VRCS). Research surrounding VRCS delivered to people who stutter dates back decades (Flanagan, Goldiamond, & Azrin, 1958). Verbal response-contingent stimulation is based on the principles of operant conditioning which focus on the use of either punishment or reinforcement to decrease or increase a behaviour. Early research using VRCS on preschool-age children who stutter showed promising results (Martin, Kuhl, & Haroldson, 1972; Reed & Godden, 1977) and subsequently led to the development of the world’s most widely researched intervention approach for early childhood stuttering today, the LP (Onslow et al., 2003). A treatment conducted in two distinct stages (Stage 1 and Stage 2), the LP was developed and manualised by researchers in Australia (Onslow et al., 2003). Atoretical in nature, this program relies on the principles of operant conditioning whereby the primary change agent is parent-delivered verbal
contingencies for both stuttered and stutter-free speech, resulting in an improvement in fluency. These contingencies are delivered in the child’s natural environment. Although the premise behind delivering these verbal contingencies essentially relies on the parent providing direct and specific correction of the child’s stuttering, research has shown no adverse psychological effects on the child as well as no impact on the parent-child relationship subsequent to LP delivery (Woods, Shearsby, Onslow, & Burnham, 2002). Originally designed for preschool children under 6 years of age, the LP may also be efficacious in some school-aged children (Koushik, Shenker, & Onslow, 2009; Lincoln, Onslow, Lewis, & Wilson, 1996). Research has indicated that the LP has a positive impact on children over and above what can be attributed to natural recovery (Harris, Onslow, Packman, Harrison, & Menzies, 2002), the effects of which have been maintained in the long-term (Lincoln & Onslow, 1997; Lincoln et al., 1996; Miller & Guitar, 2009). A full description of how the program is conducted is provided in Chapter 4.

The LP has evidence of Phases I, II, and III clinical trials (Onslow et al., 2008). Four Phase I clinical trials have demonstrated large effect sizes in the reduction of stuttering (Harrison et al., 1999; O'Brian et al., 2014; Onslow et al., 1990; Wilson et al., 2004). Similarly, four Phase II clinical trials have reported a 90% reduction in stuttering (Jones et al., 2008; Lincoln & Onslow, 1997; Onslow et al., 1994; Rousseau et al., 2007). Two Phase III clinical trials have been conducted (Jones et al., 2005; Lewis et al., 2008), the results of which indicated that a child who has received the LP has approximately 7.7 higher odds of reaching low stuttering compared to a child who has not received this program. Finally, a study has been conducted demonstrating the outcomes of the effectiveness of the LP in Australian community clinics that may be akin to outcomes demonstrated in clinical trials evidence (O'Brian et al., 2013). The
external evidence surrounding the Phase III clinical trials (Onslow et al., 2008) are reviewed below.

A RCT was conducted by Jones et al. (2005), who aimed to establish how efficacious the delivery of the LP was compared to a control group. Twenty-nine children were initially recruited into the experimental condition, although two participants dropped out. Twenty five children were recruited into the non-treatment condition (control) and five of these dropped out. The children were aged between 3 and 6 years. The primary outcome measure, %SS, was obtained from audio-recorded beyond-clinic samples at pre- and 9-months post-randomisation. For the treatment group, %SS at pre-treatment and at follow-up were 6.4 and 1.5 respectively compared to the control group whose %SS were 6.8 and 3.9 respectively, establishing an effect size of 2.3%SS. This decrease in stuttering was found to be significantly greater than what would be attributed to natural recovery or no treatment.

Subsequent to the above, Jones et al. (2008) conducted a further study involving some of the original participants to investigate the long-term effects of the LP. Twenty of the original 29 participants in the experimental condition, and eight of the original 25 participants in the control group were included for long-term follow-up. Of the 20 children who were followed up, at a mean of 5 years post-randomisation, 80% had maintained levels of less than 1%SS or were not stuttering at all. Of the remaining four participants, one did not complete the stuttering treatment, and the other three were found to have relapsed. The long-term success rate for the children in this study who experienced the LP was measured at 86%.

Mixed Treatments for Early Childhood Stuttering
Mixed treatments for early childhood stuttering involve a combination of direct and indirect procedures. One example, Fluency Facilitation (Jones-Prus, 1980) will be described below.

**Fluency facilitation.** Jones-Prus (1980) investigated mixed treatment procedures. Participants recruited were five children aged from 4 to 8 years. Four of these were treated twice weekly for half-hour sessions, and all were treated in a mean of 27 sessions over a period of 4.5 months. For all participants, treatment terminated once they reached the criterion of maintaining 98% fluency in conversation for a minimum of six sessions. Indirect procedures involved providing an emphasised model of fluent speech back to the child after a stuttered utterance, rather than correcting it. Known fluency facilitation techniques were implemented, including choral speaking, singing, and the use of prolonged speech. More direct techniques involved the use of STS to the beat of a metronome, and regulated breathing. The stimuli presented to the participants involved a hierarchy of responses to increase motor planning. Participants were measured pre- and post-treatment using the Stuttering Severity Instrument (Riley, 1971). Pre-treatment, the children’s stuttering severity ranged from mild-moderate to severe, and post-treatment it ranged from very mild to mild (Jones-Prus, 1980). This study does not meet the criteria of a clinical trial according to Onslow et al., (2008) due to the lack of data collected beyond the clinic, and insufficient follow-up.

**Summary of Treatments for Early Childhood Stuttering**

Treatment approaches for early childhood stuttering fall broadly into three categories: those that are direct, indirect, and mixed in nature. Twenty-six studies have been graded in terms of the level of evidence they represent under the NHMRC’s (2009) guidelines, and range from case studies to RCTs (see Table 2.4). Using the Onslow et
al. (2008) taxonomy, 15 of these were also classed as clinical trials evidence. A review of these studies has highlighted that the majority of high-level external evidence involved direct treatment approaches for early childhood stuttering. Only one treatment approach was supported by Phase III clinical trials (Onslow et al., 2008) and RCTs (NHMRC, 2009), the Lidcombe Program. Further, the effectiveness of this approach has been established through a series of studies conducted in Australia by the program’s developers, and by independent researchers in New Zealand, Germany, North America and the UK (Koushik, Hewat, Shenker, Jones, & Onslow, 2011; O'Brian & Onslow, 2011). Arguably, the LP is considered current best practice for treatment of stuttering in preschool-age children.

Evidence for Treatment of Speech Sound Disorder

Baker and McLeod (2011) conducted a rigorous narrative review specific to intervention programs for children with a phonological impairment, the review spanning a 30-year period. They identified 134 studies, and of these noted 46 distinct treatment types with 23 of these described in more than one publication. A summary of these 23 approaches can be seen in Figure 2.2, which also details the number of studies identified for each approach. The great majority of these approaches seek to directly modify the child’s speech sound production. Baker and McLeod compiled a summary of the 134 studies (two of which were systematic reviews) and provided an evaluation of their nature, credibility and quality. When considering the nature of these studies, Baker and McLeod noted that the research surrounding SSD did not typically follow the hierarchical phases of inquiry often found in the research for other communication disorders (e.g., stuttering). Consequently, the authors noted that models such as those proposed by Robey (2004) were not easily implemented (Baker & McLeod, 2011).
Baker and McLeod therefore examined the nature of the 134 studies in their narrative review in a dichotomous manner, considering whether the studies were either efficacy or effectiveness studies. They found that the majority of the papers were studies of efficacy. Baker and McLeod evaluated the 134 studies for credibility using the framework described by ASHA (2004) previously detailed in Table 2.1. The studies reviewed detailed evidence ranging level Ia to level IV, with the majority being either quasi-experimental designs or non-experimental case studies. Of the 23 intervention types described in more than one publication, 10 were graded as RCTs. These included: minimal pairs therapy, morphosyntax therapy, traditional articulation therapy, modified cycles, SAILS combined with speech production training, phonological awareness intervention, intervention based on psycholinguistic principles, whole language intervention, developmental goal approach and naturalistic intervention. The majority of these 10 are direct treatment approaches. Although SLPs will often employ an eclectic mix of treatment approaches to treat SSD (Lancaster et al., 2010), a recent survey of 231 Australian SLPs has identified the eight most commonly used (McLeod & Baker, 2014). These were auditory discrimination training, minimal pairs, cued articulation, phonological awareness therapy, traditional articulation therapy, auditory bombardment, Nuffield Centre Dyspraxia Programme, and core vocabulary. Of these, minimal pairs, traditional articulation therapy and phonological awareness therapy were reported to be supported by high levels of external research in the aforementioned paper by Baker and McLeod (2011). These approaches are also examples of direct treatment approaches. This section of Chapter 2 will focus on reviewing two examples of these approaches, minimal pairs and traditional articulation therapy. Due to the large number of studies across both of these approaches, this chapter will focus on the evidence provided by RCTs.
Minimal pairs therapy. Investigating minimal pairs therapy, also known as minimal contrast therapy, Baker and McLeod (2011) reviewed 42 studies indicating its use, sourcing different levels of evidence. Suitable for children with mild-moderate severity of impairment, minimal pairs therapy is more appropriate to address a child’s errors if they are phonological rather than articulatory in nature (Baker, 2010). Thus, minimal pairs intervention falls under the banner of phonologically based approaches,
where the aim is to teach the child the function of sounds in a systematic manner and to highlight homonymy (Barlow & Gierut, 2002). The underlying theoretical framework for minimal pairs therapy has a linguistic basis, with explicit emphasis on phonemes and how they function to differentiate meaning in a given language. Minimal pairs are sets of words that highlight contrast in contextual positions within a word. These paired words differ by a single phoneme, and that difference changes the semantic meaning of the word (Barlow & Gierut, 2002). An example of this is illustrated by the words /kæp/ and /kæt/. Minimal pairs can be minimally or maximally contrasted based on the smaller units that make up a phoneme, or on major and nonmajor class distinctions. Minimal pairs may also highlight vowel contrast and cluster-singleton contrast (otherwise known as near-minimal pairs). In highlighting the feature differences of major and nonmajor class distinctions, the main premise behind this approach is to teach the differences in these contrasts across class distinctions in the expectation that the child will generalise this knowledge to untreated targets featuring the same contrasts (Barlow & Gierut, 2002). This intervention is applied to groups of sounds in a systematic manner.

There are many variations to the conventional minimal pairs treatment that was proposed by Weiner (1981). In the earlier version of the approach, a child is presented with word pairs that consist of the sound in error along with its corresponding target, and the paired words usually contain minimal feature differences. The procedures of one form of minimal pairs therapy are detailed in a later chapter of this thesis. In summary, the underlying principle involves the SLP presenting the paired words to the child, so that without specific phonetic instruction, the child learns that homonymous production of these pairs results in communicative semantic confusion (Barlow & Gierut, 2002; Weiner, 1981). Other variations to minimal pairs therapy include maximal
oppositions (Gierut, 1989), multiple oppositions (Williams, 2006) and treatment of the empty set (Gierut, 1989).

The 42 studies in Baker and McLeod’s (2011) narrative review were all examples that detailed a version most closely resembling conventional minimal pairs, and most studies combined some of the following techniques in applying this treatment: direct speech production tasks commencing at word level, auditory discrimination training, highlighting semantic confusion with homophonous productions of the paired words, teaching phonetic placement and feedback for phonetic accuracy, and parental involvement (Baker, 2010). The introduction of such procedures is evidence that the conventional minimal pairs therapy evolved since Weiner (1981) described it.

Dodd and colleagues conducted a RCT that compared minimal pair therapy (using pairs with minimally contrasting features) to the use of non-minimal pairs (maximally contrasting features). Nineteen children aged between 3;11 and 6;5 years were randomly allocated to one of the two treatment groups. The primary outcome measure was percentage of consonants correct (PCC) immediately post-treatment and again at 8-10 weeks following this. Individual targets were selected for each child based on the impact of phonological process use on their intelligibility, and non-developmental (atypical) patterns were targeted as a priority over developmental patterns. Twelve, 30-minute therapy sessions were offered to each participant that occurred once weekly. Paired sample t-tests were used to analyse the effect of each treatment on the child’s PCC scores pre- and post-treatment (regardless of intervention type) and the difference pre- to post was found to be significant. Across both conditions, all children’s PCC scores improved. In comparisons of the minimal and maximal
contrast treatment, no significant differences in progress were found across both of these approaches (Dodd et al., 2008).

**Traditional articulation therapy.** This motor-based approach to intervention (also known as the Van Riper method) for SSD was developed by prominent clinicians in the field in the early 1900s. A researcher, Charles Van Riper, combined and adapted these procedures to address disorders with a functional (articulatory) base and published them in 1939 (Bernthal, Bankson, & Flipsen Jr., 2013). This approach is still used widely within the speech-language pathology community, particularly with functional speech sound errors. In traditional articulation therapy, target sounds are unstimulable for the child in any context and errors, often residual in nature (such as /ɹ, l, s, θ, ð/ (Bernthal et al., 2013). The treatment of targets (goal attack) usually involves either a vertical or horizontal approach. A vertical goal attack strategy is where one target is practiced intensively until certain criteria are met before moving on to work on another target. A horizontal approach involves focusing on multiple targets at the same time (Kamhi, 2006). Typically, the correction of 1 or 2 sounds in error is addressed to a level of maintenance before addressing further errors (Bernthal et al., 2013) Although there has been some variation to the approach initially described by Van Riper, it was originally stated that:

*The hallmark of traditional therapy lies in its sequence of activities for: (1) identifying the standard sound, (2) discriminating it from its error through scanning and comparing, (3) varying and correcting the various productions until it is produced correctly, and finally, (4) strengthening and stabilizing it in all contexts and speaking situations.* (Van Riper, 1978, p. 179)
The traditional articulation therapy approach has a focus on perceptual training as an initial step (Bernthal et al., 2013), after which production training occurs with a focus on articulatory movement and placement of a sound. Treatment is conducted in a hierarchical manner whereby the sound is taught initially in isolation before progressing to increasingly complex linguistic contexts and generalising to conversation (Bernthal et al., 2013). This is in contrast to phonologically based treatments where treatment begins at word level. In the traditional articulation therapy approach, unstimulable sounds are taught in isolation if possible, with facilitative contexts kept in mind for those sounds that do not lend themselves to teaching in this manner (e.g., stops and glides) (Bernthal et al., 2013). Actual therapeutic procedures therefore involve teaching phonetic placement, perceptual training, drill activities and drill-play activities. A full description of the procedures involved in traditional articulation therapy is given in Secord (1989) and detailed in Chapter 4 of this thesis.

Pamplona, Ysunza, and Espinosa (1999) carried out a RCT to assess whether motoric or phonologically based treatment reduced the total time taken to treat compensatory articulation errors in children with cleft palate. Twenty-nine participants were randomly allocated either into a group receiving traditional articulation therapy (control) or a group receiving generic phonological therapy (active). Median ages in the control and active groups were 54 and 55.5 months respectively. Treatment was delivered twice weekly for 60 minutes per session. The dependent variable was time taken in months to correct the compensatory errors. For the control group receiving motoric treatment, this occurred in a mean of 30.07 months. For the active group receiving phonological treatment, time taken to correct the compensatory errors was 14.5 months. A *t*-test revealed that this difference in time taken to remediate the speech errors across treatment approaches was significant. Other studies have also reported that
a phonological approach to treatment may see greater gains in shorter periods of time, however this may not be the case for residual errors such as lateral production of /s/ for example. In a study of treatment targeting /s/ production, traditional articulation therapy was compared to minimal pairs therapy that involved conceptual listening tasks only. Non-random assignment allocated 18 children with ages ranging from 3;6 to 6;10 years into one of the two conditions. Among other errors, all children exhibited some form of error involving /s/. Employing a multiple-baseline across subjects design, participants were paired into either condition as they entered the research. The results found that those in the traditional articulation group showed greater gains in correct production of /s/ and that this occurred for all participants in this group. For the minimal pairs group, gains only occurred for some participants, and only if the /s/ sound was initially present in their inventory (Powell, Elbert, Miccio, Strike-Roussos, & Brasseur, 1998).

**Treatment target selection.** Throughout the literature related to target selection in SSD treatment, there is a focus on the need for more effective and efficient target selection to achieve the optimal goal of any SSD intervention – system-wide generalisation. There are several approaches to target selection, however the two that are most often compared are those that take a developmental (most knowledge) approach and a complexity (least knowledge approach). A *least knowledge approach* to target selection involves the choice of more complex sound targets that are considered later developing, more marked, and have implicational relationships (i.e., fricatives implying stops, clusters implying singletons, etc.), sounds in high-frequency words or low-density neighbourhoods, sounds that are non-stimulable, sounds that are excluded from a child’s inventory, and use pairs that differ by major class and maximal feature distinctions (Gierut, 2001). Gierut provided a full review of all the literature supporting
this argument and concluded that the use of a least knowledge approach facilitates the greatest amount of change in a child’s sound system (2001, 2007).

In contrast to this, a most knowledge approach allows clinicians to work in a typically developmental order, which is in the order that each sound should be acquired. This is done under the premise that children see early success and do not become unmotivated by intervention, and that the acquisition of earlier-developing sounds serves as a building block for later-developing sounds (Rvachew & Nowak, 2001). Rvachew and Nowak conducted a randomised controlled trial with 48 preschool aged children (mean age 50 months). The participants had a diagnosis of moderate or severe phonological delay and were allocated into two groups and provided treatment targeting either early-developing or stimulable (most knowledge) sounds, or later-developing non-stimulable (least knowledge) sounds. The children in the most knowledge group successfully learned 38% of their targets as opposed to the least knowledge group who had success in 17% of their targets. Both groups, however, acquired an average of 2.5 phones to their sound inventory. This evidence contrasted what has been found in the least-knowledge literature, although definitions of complexity may account for some of the differences observed. Overall, these authors recommended prioritising the use of earlier-developing sounds to achieve the most gains, but stated that the use of later-developing sound targets may be appropriate in some cases (Rvachew & Nowak, 2001).

Following this study, Rvachew and Bernhardt (2010) re-analysed the data of six participants involved in the aforementioned RCT, with a specific focus on more or less complex targets relating to affricates which were found to be absent from their phonemic inventory. Targets were selected that were considered more complex than affricates (liquids) or less complex than affricates (fricatives, glides, nasals and stops).
Following initial assessment, participants underwent 6 weeks of treatment before being re-assessed. All three children in the less complex target group gained new phonemes into their inventories, whereas only one child in the more complex group did the same (but the phoneme gained was an untreated target). The other two children in the more complex target group showed no progress at all from pre- to immediately post-treatment. The authors concluded that their results were in line with the findings of the previous RCT (Rvachew & Nowak, 2001), and that choosing less complex targets in an attempt to stabilise and extend the existing sound system produced greater gains than choosing more complex targets.

Summary of Treatments for Speech Sound Disorder

There are many available intervention approaches with which to treat SSD in young children. Among the 134 studies identified in a recent narrative review, 46 types of intervention were identified, with 23 of these described in more than one publication, with varying levels of evidence (Baker & McLeod, 2011). The approaches supported by the highest levels of evidence, RCTs are largely direct in nature. McLeod and Baker (2014) reported the eight most commonly used intervention approaches by 231 Australian SLPs and amongst them were direct treatments supported by high level evidence including traditional articulation therapy and minimal pairs. Studies that have compared minimal pairs with traditional articulation therapy have generally found that greater gains in shorter periods of time can be had when using a phonological (systemic) approach to intervention. However, when errors were residual in nature (e.g., lateral /s/ etc.), the traditional articulation therapy approach achieved greater gains for participants.
Evidence for Treatment of Co-occurring Stuttering and Speech Sound Disorder

Only a single paper to date provides evidence for the treatment of children with comorbid stuttering and SSD. Conture et al. (1993) conducted a pilot study recruiting eight children allocated into two groups. Group one consisted of four boys who all stuttered and presented with disordered phonology (mean age 69.7 months). Group two were three boys and one girl all of whom stuttered (mean age 71.5 months). Treatment was provided to the children weekly in 45-minute sessions occurring over the course of one university calendar year, with no treatment provided during semester breaks. Treatment sessions were provided in a group format. The treatment procedures for the stuttering-only group used mostly indirect strategies that included modelling speech to the children without physical tension and at a slower speech rate, as well as the use of conversational rules (e.g., allowing others to talk without talking over the top of them, and turn-taking). Treatment for the stuttering and phonology group involved the same strategies as previously discussed to treat the stuttering and also used an indirect approach to treat the phonology, avoiding direct sound training. This involved the use of auditory bombardment, modelling correct sound production, and reinforcement of correct sound production in a phonological-process framework (common processes exhibited by the group were addressed in a cyclic manner). The stuttering and speech sound goals were blended into the same activities. In this way, service delivery was considered concurrent rather than serial in nature. Parents were provided with some training in a separate group while the children received treatment. The aim of the parent training was to provide information about stuttering, disordered phonology and typical speech development. The parent group also allowed caregivers to discuss any concerns in a safe environment and to provide strategies for changing speech and language behaviour in the home. After the parent group sessions concluded, parents were either
invited to observe or participate in their child’s group session. Overall stuttering frequency decreased for three of the children in the stuttering-only group; but one child had an increase of 42% in stuttering frequency. Only half of the disordered phonology group had a decrease in stuttering frequency; the other half increased their stuttering levels. The children in the disordered phonology group exhibited a decrease of at least 25% in phonological process usage. However, three of the four children in this group showed an increase in the usage of some of the targeted processes, including interdental and lateral productions of targets, and for one subject, at least one process exhibited no change (Conture et al., 1993). Due to the small numbers involved in the research, generalisation of the results is difficult. It is also impossible to state how much of the reductions in fluency and phonological processes were attributable to the various therapeutic methods without the use of controls. Future research in this area could allocate children with stuttering and disordered phonology into three groups: treatment for stuttering only, treatment for phonology only, and combined treatment for stuttering and phonology. This study was a between-subjects design without randomisation, and therefore is evaluated as a level III-2, comparative study with concurrent controls (NHMRC, 2009).

Summary

This chapter has highlighted the need to use EBP when considering an approach to intervention for children with a communication disorder. For stuttering as it occurs in isolation in early childhood, there is convincing evidence to support the use of the LP, a direct intervention approach. For the treatment of SSD, there are a wide range of approaches for SLPs to choose from. Some of the more commonly used treatment approaches that are supported by high levels of evidence include traditional articulation
therapy and minimal pairs. However, when stuttering and SSD co-occur, there is a paucity of scientific evidence to support clinical decision making. Of concern is that SLPs may be relying heavily on expert opinion and/or internal evidence (that is, their own clinical experience with this population). They may also be providing intervention that is based on one piece of scientific evidence published over 20 years ago using outdated treatment approaches. Further research is therefore required firstly to establish what treatment approaches are currently being used for this co-occurring caseload and why. Secondly to provide additional support for treatment decisions based on external evidence for this population.

As highlighted in Chapter 1, there are several options to service delivery to consider when working with children who have comorbid stuttering and SSD. With early intervention considered crucial for both disorders, how should a clinician proceed when there are two distinct communication disorders involved, both with the potential to greatly impact on a child in many areas of their life? Chapter 3 explores this clinical dilemma in more detail, and seeks qualitative evidence from clinicians who currently work with this caseload around the management of these children.
CHAPTER 3
Co-occurring Stuttering and Speech Sound Disorder:
A Qualitative Exploration of Current Practice and Perceptions
Introduction

The previous chapters highlighted several key issues related to the evidence surrounding the treatment of these co-occurring disorders. Firstly, early intervention is considered crucial for both disorders to avoid potential negative consequences. Secondly, a review of the surrounding guidelines noted several options of service delivery and intervention for treating this caseload, (i) treat both disorders in a serial manner using indirect intervention approaches, (ii) treat in a serial manner using direct intervention approaches, (iii) treat concurrently using indirect intervention approaches, and (iv) treat concurrently using direct intervention approaches. Thirdly, when concurrent approaches are considered, treatment goals may be either blended or discrete. To date, only one of these options is supported empirically: concurrent service delivery using indirect methods of intervention to treat both disorders, with blended treatment goals (Conture et al., 1993).

In Chapter 2 a review of the current evidence for treatment of stuttering and SSD found that direct treatment approaches are the most likely candidates for best practice status. The Lidcombe Program has the highest level of evidence of being an effective and efficacious treatment of stuttering in preschool-age children. Many therapeutic approaches for SSD are supported by some empirical evidence, the majority of these approaches being direct in nature. Only one source of external evidence exists for the treatment of co-occurring stuttering and SSD, and this was published over 20 years ago and reported outcomes of outdated treatment approaches.

Although there appeared to be consensus among clinicians that when a child had concomitant stuttering and SSD both disorders should be addressed (Nippold, 2004b), disparity existed among them as to which disorder should be the main focus of treatment. A call for research-based outcomes relating to the clinical management of
these co-occurring disorders was put forward over a decade ago (Nippold, 2002). It seems timely to return to this much-needed call for research given the treatment for the two disorders in isolation has evolved in recent years. It is essential to learn more about current practice for this caseload, information that in turn may guide future efficacy studies and clinical decision making in the area.

The study presented in this chapter (henceforth referred to as Study 1) uses qualitative research methods to explore Australian SLP’s current perceptions and practices related to the treatment of co-occurring stuttering and SSD. The results of this study have been published in a peer-reviewed international journal (Unicomb, Hewat, Spencer, & Harrison, 2013).

**Introduction of the Methodology: Grounded Theory**

A qualitative research design was chosen as the framework for this explorative study of current community practice and perceptions in Australia surrounding the management of children with co-occurring stuttering and SSD. The chosen design was considered appropriate given the paucity of information in the subject area, and is considered a useful tool for issues that are poorly represented in the literature (Camic, Rhodes, & Yardley, 2003).

Grounded theory (GT) methodology was selected as it allows for thorough exploration of social processes (such as therapeutic decision-making) from the viewpoints of participants (Yun-Hee, 2004). Grounded theory is a popular qualitative methodology and has been defined as an approach whereby “the researcher attempts to derive a general, abstract theory of a process, action, or interaction grounded in the views of participants in a study” (Creswell, 2003, p. 14). Using this methodology provides an inductive rather than deductive framework for analysis, where researchers
are aiming not to test a given hypothesis but to derive meaning directly from the data itself (Hodkinson, 2008).

As a qualitative methodology, GT was introduced in the 1960s by two sociologists who published their research into patients’ level of awareness of dying in hospitals, and how this affected social interactions (Glaser & Strauss, 1965, 1967, 1968). Using this framework, Glaser and Strauss (1967) demonstrated a way of systematically analysing data to generate a theory product that was grounded in the data. Having initially published jointly, these two researchers parted ways; each continued refining GT and subsequently published their separate thoughts on this methodology (Corbin & Strauss, 2008; Glaser, 1978, 1992; Strauss & Corbin, 1990, 1998). The result of their division led to two differing, distinct versions of the methodology, although several core components are shared. Glaser (1992) kept in alignment with the original version, whereas Strauss and Corbin (1990) detailed further refinements to the methodology. The following features are considered integral to GT and underlie both versions: the use of constant comparison; simultaneous data collection and analysis (via coding mechanisms); the use of memo writing to aid analysis; and the use of theoretical sampling methods (Charmaz, 2006; Cooney, 2010; Elliott & Lazenbatt, 2005). The present study incorporated all these features and each of these key terms will be now defined.

**Constant comparison.** This process is considered the crux of GT (Strauss & Corbin, 1998), and is synonymous with the methodology (Walker & Myrick, 2006). Comparisons are made continuously and simultaneously throughout the entire period of data collection, coding and analysis. The aim of constant comparison is to examine emerging ideas and to further refine the theory development process. Possible constant
comparisons include: comparing transcript with transcript; comparing the same actions across different individuals; comparing emerging categories with other categories; comparing event by event; comparing one person’s data at different time periods within the same data set; comparing newly gathered data and ideas with previously collected data for those concepts and ideas (Charmaz, 2010). The manner in which constant comparison was used in this study is detailed in a later section of this chapter, entitled application of the method.

**Concurrent data collection and analysis.** Another feature central to GT is that as data are collected, analysis occurs simultaneously, in an iterative manner. For this study, data collection involved conducting telephone interviews. Once an interview was complete, the researcher generated a transcript and commenced the analysis (coding) process. While the coding of one or more transcripts occurred, more interviews were conducted and transcripts generated, allowing constant comparison of one participant’s ideas to others.

**Memo writing.** Another crucial part of the GT methodology process, this procedure involves the creation of a memo by the researcher which is defined as “the researcher’s record of analysis, thoughts, interpretations, questions and directions for future data collection” (Strauss & Corbin, 1998, p. 111.). There is no required set of procedures for writing such memos. They may be written as free-form thoughts or as succinct bullet-points. Charmaz (2006) noted that memo writing should occur early in the research process and that thereby researchers could engage with their data and explore their own related ideas. Memos are not intended for public viewing and are often written informally, with little concern for language style. Memos can be written relating to the participants themselves and also to the codes and concepts emerging from
their data. In this study, the researcher created memos relating to each participant, and also to the open codes and emerging categories. Samples of participant and coding memos are provided in Appendices A and B respectively.

**Theoretical sampling.** This strategy employed by researchers using GT is not to be confused with purposive sampling whereby the aim may be to increase representativeness of a sample or generalizability of data. The aim of theoretical sampling is to seek out participants in order to obtain further data to understand more about emerging categories (Charmaz, 2006; Skeat & Perry, 2008). The process is emergent in nature, and the researcher’s ideas (recorded in relevant theoretical memos) help guide the next step in this process. An example of how this might occur may be to deliberately select further participants based on the researcher’s ideas surrounding an emerging concept. Alternatively, a researcher may decide to re-interview previous participants with these ideas in mind. The application of theoretical sampling in this study is discussed in a later section of this chapter, entitled sampling.

Though there are similarities in the two versions of GT, there are also distinctions separating them. One noted difference is related to the use of literature. Strauss and Corbin (1998) encouraged the use of the literature to augment GT methodology. For the purposes of a research dissertation, engaging with the literature before commencement of candidature is an essential and unavoidable component. Another difference found between the versions of GT is the way in which the core category (theme), the concept central to the resulting theory, is identified (Mills, Bonner, & Francis, 2006). Strauss and Corbin (Strauss & Corbin, 1998) outlined specific procedures through which this process can occur. Corbin and Strauss (2008) further defined the use of GT as a proposed set of guidelines by which researchers could
determine flexible ways to use the methodology to best suit their specific needs (Cooney, 2010). It has been recognised that techniques derived from GT may also serve to produce rich descriptions grounded from participant data, rather than generate a theoretical product, a view that is in alignment with the aims of the research study described in this chapter (Cooney, 2010; Skeat & Perry, 2008). The predominant difference separating the two versions of GT lies in how the data are analysed. Strauss and Corbin (1998) outlined three steps: open, axial and selective coding. Further description of some of these terms is provided in a later section of this chapter, as they constitute an important process in the application of the method used in Study 1.

Before qualitative researchers use a GT methodology, it is considered essential that they align themselves with one of the variations of the approach, and in doing so should engage with the relevant literature available (Corbin & Strauss, 2008; Glaser, 1992; Strauss & Corbin, 1998). Similarly, when considering a new project, researchers must situate themselves within a certain knowledge claim or paradigm that underpins their chosen methodology and design. Knowledge claims are those philosophical assumptions that researchers make around how they will best explore the phenomenon of interest and how they position themselves as researcher within their study (Creswell, 2003). Traditional GT is said to have philosophical roots in symbolic interactionism (Aldiabat & Le Navenec, 2011), whereas the flexibility of the Strauss and Corbin variation lends itself to a philosophical stance in constructivism (Corbin & Strauss, 2008; Strauss & Corbin, 1998). When stating a constructivist knowledge claim, researchers seek to describe how and why things occur, based on participants’ views and understandings of the phenomenon in question (Creswell, 2007; Liampittong, 2010). Constructivism allows researchers to position themselves as authors who describe meaning from the participants’ viewpoints on the phenomenon of interest
(Mills et al., 2006). Therefore, this researcher aligned with the GT methodology as refined by Strauss and Corbin (Corbin & Strauss, 2008; Strauss & Corbin, 1998) and Study 1 is therefore underpinned by a constructivist knowledge claim. This supports the study’s aim, to explore and describe current practice perceptions amongst Australian SLPs working with a specific caseload.

**Application of the Method**

**Sampling.** Recruitment was conducted using sampling techniques that are common in qualitative research designs. Purposive sampling is often undertaken by researchers employing GT methodology, particularly when information is lacking in a specific area and/or population. This type of recruitment is considered appropriate for obtaining information-rich results; participants may be selected because of certain shared characteristics that make them knowledgeable in the subject matter. In this way, the research described in this chapter employed typical purposive sampling techniques. Snowball sampling, another form of purposive sampling, was also used in Study 1. Recruits are asked to refer potential participants to the study who might wish to contribute similar useful knowledge. Recruitment took place between November 2011 and February 2012. Emails were sent to all the members of two national paediatric interest groups, the Victorian Stuttering Interest Group and the New South Wales Preschool Interest Group, as well as two major member network groups, the Speech Pathology Australia private practice member network and the Asia-Pacific Educators Collaboration in Speech-Language-Pathology network. Advertisements were also placed in Speech Pathology Australia e-newsletters at a State branch and national level, asking interested participants to contact the researcher directly. When the researcher was contacted via any of the abovementioned avenues, potential participants were sent
an information statement and consent form and asked to return the consent form if they wished to participate and to arrange a suitable time for the interview to take place. After the researcher had interviewed several participants, it became evident that the majority of participants reported that they were either specialist stuttering clinicians or they had a preference in stuttering. In an attempt to address this and to obtain a more rounded viewpoint on the subject matter, theoretical sampling was therefore employed. Recruitment then took place via the Yahoo e-group, *Phonological Therapy*. This group had been set up for clinicians, researchers and students with specific interest in childhood SSDs.

**Participants.** Thirteen SLPs from four states and one territory of Australia were recruited for Study 1. All 13 participants were female. To protect their identities they were assigned pseudonyms. The participants’ years of experience working as SLPs ranged from approximately one to over 16 years. Some participants found it difficult to give a precise number of years working in the profession due to having taken periods of leave throughout their career, such as maternity leave. Approximately 85% of the participants worked in private practice. Several reported that they worked dual roles across different services, but those participants reported they drew largely from their experiences as private clinicians when contributing to this survey. These particular clinicians were designated in this research as private clinicians, because reporting their other workplaces could have rendered them identifiable. Further demographic and workplace details specific to each participant can be found in Table 3.1. Seven of the 13 participants mentioned that they had undertaken further training in the area of stuttering as a postgraduate, specifically LP workshop training. Three participants identified themselves as specialist clinicians in the area of stuttering.
Table 3.1
Demographic details of speech-language-pathology participants

<table>
<thead>
<tr>
<th>Name*</th>
<th>General clinical experience (years)</th>
<th>Stuttering clinical experience (years)</th>
<th>Primary work setting</th>
<th>Workplace state</th>
<th>Lidcombe Program workshop training</th>
<th>Specialist in stuttering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alison</td>
<td>&gt;16</td>
<td>&gt;16</td>
<td>PP – metropolitan</td>
<td>VIC</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Belinda</td>
<td>4-6</td>
<td>1-3</td>
<td>PP – metropolitan</td>
<td>ACT</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Cathy</td>
<td>1-3</td>
<td>1-3</td>
<td>PP – metropolitan</td>
<td>NSW</td>
<td>Unknown</td>
<td>No</td>
</tr>
<tr>
<td>Danielle</td>
<td>Unknown</td>
<td>1-3</td>
<td>PP – metropolitan</td>
<td>VIC</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Faith</td>
<td>7-9</td>
<td>7-9</td>
<td>CH – metropolitan</td>
<td>QLD</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Gabriella</td>
<td>10-12</td>
<td>10-12</td>
<td>PP – metropolitan</td>
<td>NSW</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Hayley</td>
<td>13-15</td>
<td>13-15</td>
<td>PP – rural/remote</td>
<td>QLD</td>
<td>Unknown</td>
<td>No</td>
</tr>
<tr>
<td>Isabella</td>
<td>1-3</td>
<td>1-3</td>
<td>PP – metropolitan</td>
<td>NSW</td>
<td>Unknown</td>
<td>No</td>
</tr>
<tr>
<td>Jennifer</td>
<td>&gt;16</td>
<td>10-12</td>
<td>PP – metropolitan</td>
<td>VIC</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Kaitlyn</td>
<td>&gt;16</td>
<td>13-15</td>
<td>PP – regional</td>
<td>QLD</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Lauren</td>
<td>&gt;16</td>
<td>7-9</td>
<td>PP – rural/remote</td>
<td>NSW</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Megan</td>
<td>&gt;16</td>
<td>&gt;16</td>
<td>CH – rural/remote</td>
<td>SA</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Natalie</td>
<td>&gt;16</td>
<td>&gt;16</td>
<td>PP – metropolitan</td>
<td>QLD</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

PP, private practice; CH, community health; NSW, New South Wales; VIC, Victoria; ACT, Australian Capital Territory; QLD, Queensland; SA, South Australia.

* The names of the SLPs are pseudonyms.


**Data collection.** The data used for Study 1 consisted of verbatim transcriptions of semi-structured telephone interviews. Semi-structured interviews are well suited to GT studies as they allow questions to be pre-determined based on the phenomena of interest, yet also allow the researcher flexibility to digress and improvise based on the story emerging from a participant (Strauss & Corbin, 1990).

Semi-structured interviews were also considered appropriate for Study 1 as little was known about the research area in question. Semi-structured interviews typically rely on the use of an interview guide – a pre-determined list of questions created by the researcher based on previous literature review. However, the guide can be modified, so that the researcher is not bound by a particular sequence of questions or by the content of the guide itself. For Study 1, the sections in the guide were not necessarily addressed
in a specific order, and if particular sections/categories did not naturally emerge during the course of the discussions, the interviewer probed for responses accordingly. Similarly, if new categories not listed in the guide were identified by participants, these were probed for in subsequent interviews. A copy of the interview guide used in Study 1 is provided in Appendix C.

The interviews were all conducted between November 2011 and February 2012. As stated above, this was an iterative process such that on any day that an interview was conducted, the researcher could also be working on transcribing data and coding of other interviews. Participants living in the Newcastle or Sydney region were offered either face-to-face or telephone interview options, and participants outside those areas were only offered telephone interviews. Although it is recognised that conducting interviews in person is optimal for reasons surrounding rapport building and observation of participants’ nonverbal cues (Minichiello, Madison, Hays, Courtney, & St John, 1999), because of logistical constraints telephone interviews were the most viable option in most cases. All participants took the option of a telephone interview. Participants nominated a time and date that best suited their schedule for the interviews to take place, therefore minimising interference with their daily routines. The researcher made all telephone calls from a landline in the University of Newcastle’s Speech Pathology Clinic. This phone was located within the clinic’s sound-proofed room to minimise background interference. Participants were also encouraged to choose a suitable location for the telephone call that would also minimise background interference. The telephone calls were recorded using a Sony ICD-PX820 digital audio-recording device and an ACS (Jabra 752-0880-02-01) telephone recording jack. The mean interview duration was 34 minutes (SD = 10.5, range = 22–61 minutes).
Recruitment continued until theoretical saturation occurred. In qualitative research projects it is often not initially possible to state how many individuals need to be sampled. In general, as was the case for this study, sampling continues on an ongoing basis until theoretical saturation is reached. This is where similar themes begin to recur and no new themes or information are being obtained from the data (Skeat & Perry, 2008).

**Data analysis.** In qualitative research, this process is described as an arduous and repetitive process (Buchanan & Jones, 2010). Computer-assisted qualitative data analysis software (CAQDAS) has been developed to aid this process. One example of such software is NVivo (QSR International Pty Ltd, 2011). This program, used in the current research, assists in the analysis, storage and retrieval of qualitative data (including interview data). Some advantages of using CAQDAS include the capacity to handle large volumes of data. As GT relies on constant comparison, the continuous manual sorting through paper-based transcripts can become onerous. Another reported advantage of using CAQDAS is that the entire data analysis process becomes systematic and thus transparent, enhancing the rigour of qualitative studies (Gibbs, 2002). Others have argued that this systematic process takes away the essence of a GT design whereby researchers should truly immerse themselves and engage with their data (Charmaz, 2006). In contrast to this viewpoint are reports that freeing researchers from the laborious task of manual sorting and coding actually allows them to focus solely on conceptual processing of the data (MacDonald & Schreiber, 2001).

QSR NVivo (Version 9) was used in Study 1 for all data management, collection and analysis. This version was updated in 2014 to Version 10, but that version was used solely for the purpose of viewing previously generated data/memos/reports during the
writing-up stage of this thesis. The digital audio interview files were downloaded straight into the NVivo software and saved in each individual participant’s case node (their individual storage containers within the software). Transcription of the interview data took place directly within the software. NVivo has a media tool that allows audio playback within the program, with functions to control the speech output rate for ease of transcription. In this way, the transcript was typed straight into the software and synced with the corresponding timeframe on the actual audio file. Each interview was transcribed verbatim using standard conventions (Edwards & Lampert, 1993) as detailed in Table 3.2.

Table 3.2
Description of transcription conventions used for interview data

<table>
<thead>
<tr>
<th>Transcription convention</th>
<th>Convention description</th>
</tr>
</thead>
<tbody>
<tr>
<td>::</td>
<td>Extended sound or syllable (e.g. bu:t)</td>
</tr>
<tr>
<td>((</td>
<td>Some transcript deliberately omitted or clarifying previously spoken information (e.g. “And they said it ((the cat)) was fine”)</td>
</tr>
<tr>
<td>. .</td>
<td>Indicates a pause of more than half a second</td>
</tr>
<tr>
<td>. .</td>
<td>Indicates a pause of half a second or less</td>
</tr>
<tr>
<td>[ ]</td>
<td>Non-speech sounds (e.g. [laughs]) that either interrupt or overlay speech, and indication of interjections by another speaker that do not interrupt original speaker’s utterance</td>
</tr>
<tr>
<td>?</td>
<td>Rising intonation</td>
</tr>
<tr>
<td>( )</td>
<td>Unclear passages of audio</td>
</tr>
<tr>
<td>I:</td>
<td>Indicates start of turn for interviewer</td>
</tr>
<tr>
<td>R:</td>
<td>Indicates start of turn for respondent</td>
</tr>
<tr>
<td>=</td>
<td>Indicates overlap of speaker utterances</td>
</tr>
<tr>
<td>(“”</td>
<td>Indicates regularisation (e.g. gonna (“going to”))</td>
</tr>
<tr>
<td>-</td>
<td>Indicates a truncated word</td>
</tr>
</tbody>
</table>

Line-by-line coding took place directly within each participant’s transcript (described below). This software has the capacity to apply coding density and colour-code stripes, a tool whereby the researcher can view which codes have been applied to
what data. Participant attributes and memos were created and also linked directly to participants’ individual case nodes. Coding reports and coding memos were also created within this software, and could be exported to a Microsoft Word file for further use. The efficiency of this program enabled the researcher to focus on the conceptual analysis of the data.

**Coding.** The first stage of data analysis in a GT study is coding. Coding in qualitative research is an iterative process where researchers immerse themselves in the data. Data are fractured and subsequently organised into categories and themes so that rich descriptions and/or theories may be generated. Analysis consisted of three main stages, all of which were carried out concurrently. These stages were open, axial and selective coding. Figure 3.1 illustrates the procedures for the coding methodology applied in Study 1 and as described by Strauss and Corbin (1998). In this research, analysis commenced immediately after the first interview, and continued as each subsequent interview was concluded, consistent with GT methodology (Corbin & Strauss, 2008). As new codes were identified, previous transcripts were revised and coded accordingly. Similarities and differences were sought using constant comparison between transcripts, codes, categories, and incidents throughout the analysis process. Analysis was further aided by memo-writing to record the researcher’s ideas and impressions. An example of a memo created for this project in relation to coding is provided in Appendix B.
Open coding. Often referred to as initial coding, the beginning of the analysis process commenced with the researcher thoroughly engaging with the data through word-by-word, line-by-line analysis. A thorough process, this involves splitting or fracturing the data apart to view the formation of ideas. Often done informally, the aim of this initial process is to name and describe phenomena naturally occurring in the data. Although a researcher may have some codes already in mind, the underlying principle of GT is to allow ideas to arise from the data itself. One hundred and sixty four initial open codes were identified from the data transcripts in Study 1. A copy of these codes (also known as free nodes in NVivo) is provided in Appendix D. Table 3.3 shows an example of the early open coding process in this study.
Table 3.3

Open coding example from excerpt of participant interview transcription

<table>
<thead>
<tr>
<th>Alison</th>
<th>Open coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Um look on occasion we might treat them concurrently but I have to say the ones I've treated concurrently have been language children not these speech sound children because I think that kids with the speech sound problems have got enough to worry about to get the sounds right, um rather than having to worry about stuttering on top of that [Interviewer: yes], fluency on top of that so it tends to be more that if the problem, speech sound issues were such that they needed addressing, they would probably be addressed with priority, um but I, it's really difficult to generalise because I don't see a lot of them. Um, you know, I mean I don't want to sort of inflate or make your results look odd, um, I mean do we do it? Sometimes you know the kids who have a burst of therapy and then, if they're unintelligible, there's no question that the speech sounds would be worked on first.”</td>
<td>Concurrent stuttering and language therapy</td>
</tr>
<tr>
<td></td>
<td>Impact of speech sound disorder</td>
</tr>
<tr>
<td></td>
<td>Rationale for serial</td>
</tr>
<tr>
<td></td>
<td>Timing – speech sound disorder first</td>
</tr>
<tr>
<td></td>
<td>Prioritisation</td>
</tr>
<tr>
<td></td>
<td>Experience – speech sound disorder less</td>
</tr>
<tr>
<td></td>
<td>Timing – speech sound disorder first</td>
</tr>
</tbody>
</table>

Axial coding. The next stage in the coding process concerns the way in which the previously split-apart data is reconsolidated (Saldaña, 2009). In reassembling the data, the number of initial codes naturally reduces. Axial coding enables relationships to be formed inductively between codes and categories in a systematic manner. To achieve this, the use of a coding paradigm is encouraged (Strauss & Corbin, 1990, 1998). This paradigm suggests that the researcher consider the categories in terms of conditions, contexts, action/strategies and consequences arising from them. Open and axial coding may take place simultaneously, as was the case in Study 1. Initial axial coding was conducted by March 2012 and further revised in July 2012, the culmination of which reduced the open codes to preliminary categories. These preliminary axial coding structures are detailed in Appendix D. Further analysis of these axial codes refined that...
list to five overriding parent themes: *multifaceted assessment, workplace challenges, weighing up the evidence, direct intervention, and clinical reasoning* (selective coding structure detailed in Appendix D). The development of this coding structure is highlighted in Table 3.4, which shows the progression of how the open codes developed from descriptions of feelings, processes and phenomena to categories that linked similar codes together. From there the parent themes were developed from a more conceptual perspective. Table 3.5 similarly shows this development, with specific examples from interview transcripts.

**Table 3.4**
*Example of initial coding structure*

<table>
<thead>
<tr>
<th>Initial open codes</th>
<th>Preliminary categories</th>
<th>Parent theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental concern</td>
<td>Involving the parents</td>
<td>Multifaceted assessment</td>
</tr>
<tr>
<td>Parental priorities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Availability</td>
<td>Workplace challenges</td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stutter becomes chronic</td>
<td>External evidence factors</td>
<td>Weighing up the evidence</td>
</tr>
<tr>
<td>Family history of stutter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of onset stutter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metaphon</td>
<td>SSD programs</td>
<td>Direct intervention</td>
</tr>
<tr>
<td>Multiple oppositions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional articulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timing considerations</td>
<td>Serial delivery</td>
<td>Clinical reasoning</td>
</tr>
<tr>
<td>Coping – children and parents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How was therapy delivered</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Parent theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental concern</td>
<td>Involving the parents</td>
<td>Multifaceted assessment</td>
<td>“I guess a big part of my um assessment process is involving the parents in sort of what their concerns are, and I must admit these children that are coming through with stuttering and speech sound disorders or language disorders, the parents are really very concerned I guess about the stuttering” (Cathy)</td>
</tr>
<tr>
<td>Cost</td>
<td>Availability</td>
<td>Workplace challenges</td>
<td>“I usually work with people on a fortnightly basis.....financial reasons and my ability to find a weekly appointment are the two main reasons for this” (Natalie)</td>
</tr>
<tr>
<td>Stutter becomes chronic</td>
<td>External evidence factors</td>
<td>Weighing up the evidence</td>
<td>“my preference would be to just ignore it for as long as possible until the stuttering is well under control because I totally acknowledge that my bias is with the stuttering and the fact that I see the stuttering as having the potential to remain and get worse whereas generally I think articulation will diminish whether treated or not” (Jennifer)</td>
</tr>
<tr>
<td>Multiple oppositions</td>
<td>SSD programs</td>
<td>Direct intervention</td>
<td>“I've started to try something else or if I have tried for about 6 months or so a still very slow program this is probably when I would get all those multiple opposition things to come in. Um and to prioritise what sounds to target first” (Belinda)</td>
</tr>
<tr>
<td>Coping – children and parents</td>
<td>Concurrent delivery</td>
<td>Clinical reasoning</td>
<td>“I didn't think there was. I think I did um the stuttering for the first session, and then brought in the speech sounds the next one, so they weren't having to remember too much all at once. [Interviewer: yeah]. Um but, no, I didn't find that they were getting confused between the two types of treatment” (Cathy)</td>
</tr>
</tbody>
</table>
Figure 3.2 details the process of development for one of the parent themes, *multifaceted assessment*, further highlighting the axial coding process.

![Diagram of Parent theme and example categories]

**Parent theme:** Multifaceted assessment

**Example preliminary categories:**
Involving the parents, differential diagnosis, timing of assessment, assessment measures, nature of the disorder(s)

**Example open codes:**
Parental concern, parental priorities, parental choice, severity stuttering, severity speech sound disorder, apraxia vs stuttering, assess all at initial, assess based on presentation, refer to another SLP, percent syllables stuttered, percent consonants correct


**Selective coding.** The final stage in the analytical process, as previously shown in Figure 3.1, is the identification of a core category, which usually takes the form of a gerund. The core category is the one which has emerged most prominently and naturally within the data. Strauss and Corbin (1998) detailed the following criteria for selecting the core category:

1. The core category must be central and form a relationship with all other categories.
2. The core category must appear often in the data, so that in the majority of instances, this theme underlies the other coding taken place.

3. The relationship between all categories formed by the core concept is logical and has not been forced upon the data.

4. As the relationship between the core category is established with the other categories, so the explanatory power of the theory (if that was the aim of the study) develops.

5. It is able to explain the variation found within the data.

The core category in this study fulfils the Strauss and Corbin (1998) criteria as it formed a direct relationship with all of the other parent themes found. It was the theme that was most naturally prominent in the interview data, and had explanatory power for variations found in the participant descriptions.

As previously discussed, the hallmark of GT methodology involves constant comparative analysis that occurs during the entire coding process (Charmaz, 2010). In Study 1, transcripts were constantly compared against each other for similarities and differences. Codes and categories were compared continuously throughout the entire process as well. Emergent categories were compared against other categories, and participant episodes were compared with the recounts of others.

Rigour

Rigour in qualitative research is synonymous with other terms, including trustworthiness and credibility. Often such terms are used with qualitative data in the same manner that reliability or validity are used with quantitative data (Corbin & Strauss, 2008). The main aim of reporting on rigour is to ensure that the research
product is an accurate expression of the participants’ experiences and that there is transparency around the processes leading to reported outcomes.

**Transparency.** In this research, transparency was observed by thoroughly and descriptively reporting all aspects of the study: design, methodology, methods and results. (Mantzoukas, 2004) stated, “Fundamental to the whole process and the end product of the research is the portrayal of what is being studied. The more illustrative, explanatory, and sophisticated this portrayal is, the more extended or applicable the acquired knowledge becomes” (p. 994). This was achieved in the current study by the following: stating the underpinning philosophical and theoretical perspectives that informed this research; detailing the aims of the study and the locations/times in which it took place; providing a thorough description of data collection and analysis, with supporting documentation; specifying exactly how and on what basis participant recruitment occurred; providing the results (later in this chapter) in a detailed and contextual way utilising a significant amount of the participants’ quotes so that their presence could be felt by the reader; stating the role and positioning of the researcher and; including the participants in the analysis and review processes (methods detailed below).

**Researcher role.** All the research described in Study 1 was carried out by the author of this thesis (i.e., the researcher), who undertook all recruitment, data collection, transcription, analysis and interpretation of results. For a GT methodology with a constructivist knowledge claim, this was considered appropriate. If another researcher had analysed the same data, different results might have been produced from another perspective. In turn, this would have influenced the themes that arose from the data and the resultant findings. Although the results detailed further in this chapter have come from the researcher’s perspective, they are still grounded in the data of the actual
participants. The researcher is a qualified SLP with 7 years’ experience working with a pediatric caseload. She has worked in an early intervention setting, an educational setting, and in private practice. Having worked with young children who stutter, the researcher frequently came across children who had co-occurring communication disorders, including SSDs. Therefore, the researcher came to the study with her thoughts and ideas relating to this caseload. It was important for the researcher to be mindful of this aspect, so as not to impose these ideas onto the emerging data or to compare them with her own experiences. Implementation of methods to ensure rigour of study quality further safeguarded against such imposition of ideas.

**Peer debriefing.** Another method of ensuring that the research was rigorous was to involve other people in certain aspects of the analysis. An audit trail was kept of open codes and, as they merged into categories and themes, regular discussions occurred between the researcher and her primary supervisor to establish consensus on these and the final emerging themes. Peer debriefing (Creswell, 2003) was another method used to enhance the rigour of this research. This process occurred in two stages and involved the use of a reviewer independent to the research. This reviewer was a SLP who specialized in adult impairments and who was a current doctoral student in post-traumatic brain injury. This reviewer had used and published qualitative procedures and was well versed in the application of GT methods. Stage one of peer debriefing involved the researcher giving the reviewer a portion of the participant transcripts to allow generation of the reviewer’s list of open codes (Appendix E). The reviewer was then provided with a list of the open codes on the same portion of transcript as generated by the researcher, and the two were compared. This process ensured that the emerging codes accurately reflected the participants’ data and also facilitated the suggestion of new codes that might have been overlooked. When new codes were
suggested, discussions were had with the entire research team until consensus was reached. Stage two involved giving emerging categories from the axial coding process to the reviewer. The reviewer was asked to group like open codes into related categories or to suggest other categories if needed to assist this process (Appendix F). In this stage, there was 94% agreement between the reviewer and the researcher’s coding/category structure. Once again, any differences were discussed until consensus was reached.

**Member checking.** Finally, to further enhance rigour, the participants were asked if they wished to review their own interview transcripts to identify any errors or misrepresentations. Further, participants were encouraged to extend on or to add information they felt relevant after having read their own transcripts. Any additional information was added to the transcripts and coded in the same manner as described above. This process is commonly known as member-checking. Participants were also asked if they wished to be provided a description of the final themes that had emerged from the data as a part of the member-checking process. Ten of the 13 participants agreed to participate in the member-checking process. Four participants did not respond to the researcher once their transcripts were provided. Five participants believed the provided transcripts were an accurate portrayal of their interview. One participant wanted to expand further on a point made previously in their transcript. This was provided by way of email to the researcher. The text from this email was subsequently added to the participant’s transcript and analysed accordingly by the methods previously described.

**Ethical Considerations**

Ethical approval for Study 1 was approved in October, 2011 by the University of Newcastle’s Human Research Ethics Committee (approval identification number H-
One key ethical consideration for this project included protecting participants’ rights to confidentiality. This was particularly pertinent because participants within the profession in Australia might have been identifiable on the basis of some information provided in their interview data. The researcher took due care to remove any identifying details relating to participants’ specific places of work. Workplaces were coded generally, for example being labelled as either private practice, community health, or teaching institutions. Pseudonyms were assigned to the participants upon entry into the study, and were subsequently used in the resulting publication. When transcribing interview data, the researcher was careful to delete any names mentioned by the participants, which included names of clinicians, their peers and their clients. Another key consideration was that participants were also offered no promise that they would personally benefit in any way by taking part in this research. Further, to show respect towards the participants and to ensure transparency in the process, the researcher offered participants the choice to be involved in the process of member-checking (as previously described). During the member-checking process, participants were also asked to remove any information they felt was potentially identifiable from their own transcripts, or that they felt uncomfortable with in general. Finally, all research in Study 1 was conducted with the participants’ full informed consent. They were advised that at any time they could withdraw their consent without question or implication.

Findings

Five themes emerged from the analysis of the participants’ data. These included one core theme that formed a direct relationship with all four of the other parent themes.
The core theme was the one that was the most naturally prominent in the interview data, and had explanatory power for variations found in the participants’ data.

**Theme 1: Multifaceted assessment.** The first theme emerged when participants discussed their many layers of consideration when they assessed children with co-occurring stuttering and SSD. Timing of assessment, service delivery, priorities, diagnosis, and assessment measures were all factors for the clinicians to consider upon assessment of this caseload.

Describing how assessment initially proceeded, one clinician self-identified as a specialist stuttering clinician, would routinely informally observe for concomitant disorders while assessing fluency. If issues with speech sounds were suspected, she would refer to a colleague for formal analysis of the sound system. All other participants identified with assessing both disorders themselves. The timing of these assessments was also a consideration for the participants. Two participants, both in metropolitan-based private practices, stated that they routinely assessed several areas of communication when a child initially presented to their clinic, with emphasis not only on fluency but also on speech and language. As Isabella stated,

> So when we do our initial assessments we pretty much look at everything, so we do the language assessment, the speech assessment and the stuttering assessment if they start stuttering and we become aware of that.²

Two others said that they would typically defer assessment of the SSD until they believed the stuttering was more stable, as Danielle said,

> I don’t work on those two things together so I will say to the parents, if that ((the SSD)) is something that you’re still concerned about once we’ve finished with the

² Throughout this thesis, the portions of participant transcripts used are written verbatim as spoken by the participants
stuttering treatment, then we can do some assessment and work on that but we
won't do that until we've finished the stuttering treatment.

The majority of the participants would assess both fluency and speech sounds upon
initial assessment, once it had been established that both disorders may be present. This
may have been mentioned by the parent(s) during case history taking. However, several
participants reported it was quite common for parents to refer their child to treatment
with knowledge of presence of just one or the other disorder. Kaitlyn stated,

Probably less often they come in for just the stuttering in fact often if they
present with both ((disorders)), the parents haven't even been aware of the
stuttering. Um . . particularly with kids who are very unintelligible.

Hayley observed the contrary,

Yeah this little boy got referred; parents were concerned about the stuttering.

When he first came for an assessment, um, I did the stuttering evaluation on him
and I noticed that he was also making speech errors so I also did the
articulation assessment on him.

When making decisions around assessment priorities, almost all the participants
mentioned involving the parents. Because more than one disorder was involved, a major
assessment consideration for these clinicians was to take their cues from the parents, as
explained by Faith,

I guess a big part of my assessment process is involving the parents in, sort of,
what their concerns are.

There was much discussion from all participants relating to the parents of these
children. The majority of participants mentioned that with this caseload of children,
parents appeared to be more concerned about stuttering than the SSD. Alison stated,
The parents are most concerned about the stuttering...... parents of course often hear the stuttering and hear that as the most significant problem.

This was also discussed by Faith, who stated that even when the two co-occurring disorders were present in their children, parents’ main concern appeared to be around the stuttering,

I must admit these children that are coming through with stuttering and speech sound disorders or language disorders, the parents are really very concerned I guess about the stuttering.

Participants discussed their views about the possible reasons why the stuttering might be of most concern to these parents. Gabriella stated that the stuttering was possibly the more obvious disorder to parents,

Yes, and I think it would probably be the stuttering more than the speech because I think that they um, I think the stuttering is probably more noticeable to them than the speech. Sometimes I think, I don't think that parents can pinpoint that their ...I think they know that there's an overall speech problem but because they probably don't recognise the errors the way that they can recognise the stuttering, they may not feel that it's as severe

Isabella also thought that perhaps stuttering as a disorder was more widely recognised in the community,

So stuttering seemed to be the big one, cos ("because") people know about stuttering, I think is part of it.
Many commented on the fact that this parental concern about the stuttering could have aroused feelings deeper than concern, such as anxiety. This was discussed by Hayley and Kaitlyn, respectively,

But it was his stuttering that concerned his parents so I just needed to check on that for them to help allay their fears and everything that they have around stuttering.

Usually we start with the speech sound assessment first, particularly when parents aren't aware of the dysfluency and then you know . . . the stuttering is much more scary I think for parents than speech sound problems.

Participants were asked to detail how they went about physically assessing both the stuttering and the SSDs. From these discussions, it emerged that 10 of the 13 assessed the disorders discretely, with the remainder assessing stuttering and SSDs simultaneously across one or more tasks. For example, one mentioned doing a formal picture naming task to assess speech sounds at a single-word level, but then asking the child to talk more about the stimulus items to probe longer utterances for both fluency assessment and speech sounds at a conversational level. Table 3.6 details the measures used by the participants to assess stuttering and SSDs, and the number of participants who mentioned each measure.
Table 3.6
Assessment measures for stuttering and SSD mentioned by participants

<table>
<thead>
<tr>
<th>Type of measure/instrument</th>
<th>Stuttering</th>
<th>Speech Sound Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of syllables stuttered</td>
<td>11</td>
<td>Diagnostic Evaluation of Articulation and Phonology (Dodd, Crosbie, Zhu, Holm, &amp; Ozanne, 2003)</td>
</tr>
<tr>
<td>Severity rating scales</td>
<td>5</td>
<td>Goldman Fristoe Test of Articulation (Goldman &amp; Fristoe, 1968)</td>
</tr>
<tr>
<td>Description of types of stutters</td>
<td>5</td>
<td>The Articulation Survey (Atkin &amp; Fisher, 1996)</td>
</tr>
<tr>
<td>Description of secondary behaviours</td>
<td>1</td>
<td>Informal observation</td>
</tr>
<tr>
<td>Case history</td>
<td>7</td>
<td>Unpublished speech assessments</td>
</tr>
<tr>
<td>Informal observation</td>
<td>2</td>
<td>Single picture naming tests (unspecified)</td>
</tr>
<tr>
<td>Report from significant others in child’s life</td>
<td>1</td>
<td>Connected speech samples</td>
</tr>
<tr>
<td>Psychological assessment</td>
<td>2</td>
<td>Percentage of consonants correct based on informal assessment</td>
</tr>
<tr>
<td>Observation of oral movement patterns</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

\*n= number of participants who discussed this measure

Various issues related to diagnosis were discussed by several participants. There was discussion around the observed nature of the SSD when it co-occurred with stuttering. Ten participants mentioned the possible underlying aetiology of the SSD as either phonological or articulatory in nature (or both). Two participants discussed the possibility of the SSD relating to a motor-speech disorder such as childhood apraxia of speech. Some mentioned specific phonological processes they might typically have observed in this caseload of children. The following phonological processes were mentioned from most to least frequent: stopping (n=8), fronting (n=8), gliding (n=5), cluster reduction (n=2), consonant harmony (n=2) and deaffrication (n=1). The topic of differential diagnosis emerged in several discussions. Trying to differentiate stuttering from childhood apraxia of speech was mentioned as a challenge for some, not only by the SLPs themselves but also by other professionals. Kaitlyn mentioned this in the context of a referral from a paediatrician,
Um . . the paediatrician unfortunately diagnosed the stuttering as verbal dyspraxia . . several times

Natalie spoke on this subject from her perspective as a very experienced clinician, relating it to some of the core behaviours that define the disorders in isolation,

*He just looks at you blank and the mouth is open and you think "what's that?" Is it a grope, a block, or word finding?*

**Theme 2: Workplace challenges.** The next theme emerged continuously throughout the data, as the participants discussed some of the site-specific service provision and workplace issues they needed to consider when working with children who had co-occurring stuttering and SSD. For the majority, this added another level of complexity for consideration, as these clients did not fit into the “norm” of their typical caseloads.

The first layer of discussion was related to availability of SLP services. The majority of the participants again took a family-centred view when discussing this issue. For example, as the majority worked in private practice settings, the cost of treatment and family financial situations was a major consideration. This was discussed by almost all of those practising privately, and highlighted by Belinda,

*I've been seeing him on a fortnightly basis for about an hour for one session, because mum has financial issues.*

Gabriella related this family-centred consideration specifically to the treatment program she used and also detailed a strategy she implemented in an attempt to overcome this issue,

*With Stage 2 ((of the LP)), yeah, I guess it sort of depends because of the . . with private because cost becomes a factor and because they're coming for their session for their Stage 2 and I've found sometimes it was harder for parents to*
want to come for their Stage 2 appointments and I mean I think by the time we
got to week 8, I often didn't charge them to come anyway just so that they would
continue to come.

Although the cost of treatment to the parents was often viewed as a potential challenge
when working with this caseload, Jennifer offered an interesting and opposing view to this,

So I've generally, in private practice where people are paying a lot of money, I
find them very motivated because they're kind of there cos ("because") they
wanna be there.

Another logistical factor that participants considered was actual time spent in treatment.

Danielle considered this from both a parent and service-provider perspective,

Because situations change over time and sometimes you're seeing these young
children for fluency therapy for periods of up to a year, parents’ schedules
change. So they may not necessarily be available to come in at times when
you're available.

Several participants mentioned availability specific to different workplace settings. In
private practice, availability might not be as constrained as it was in other services.

Gabriella discussed this in a positive light,

In private practice so it was a little bit easier to see children um, on more of a
weekly basis.

Others mentioned that in their workplace they were restricted by cut-off points for
treatment services based on a child’s age. Faith, a clinician working in community
health in Queensland mentioned,

When they turn five they go to prep in Queensland, so that sort of is the cut-off
in the service that I work for.
“Prep” is a full-time program offered in Queensland in place of pre-school offered in other States. In the context of service availability in the school setting for this caseload, some participants mentioned that fluency treatment may be viewed as a lower priority as highlighted by Kaitlyn and Megan respectively,

*The schools don't touch fluency much at all.....Because it's not considered um...to impact on their education.*

Well no that's a bit of a gap. And I say that with some disbelief really that it's been maintained for so long. But basically because it's sort of not bread and butter I suppose or the general consensus or the um the wording is that they are a low priority because it ((stuttering)) does not affect their performance in the school curriculum which I think is probably stretching it a bit the wrong way but anyway that's how um they've justified not being involved. Also because you know ah best practice influence has sort of been geared towards um you know these intensive ((stuttering)) programs in the past and um sort of very structured approach. Again they've been able to say well we can't justify that type of service with our um specialist education setting service.

The next main point of discussion that emerged was focused on workplace restrictions. One particular constraint mentioned was waiting lists for public health services. This was a phenomenon recognised by the private clinicians, as highlighted by Belinda,

*Normally you know there is a forever waiting list ((for public health services)).*

However, Faith stated that in some community health settings this waiting list period might not be applied to certain populations,
But for children who stutter, we have a priority system in my service, so they get picked up straight away.

Waiting lists aside, due to the ever-increasing demand on the public health system, some services have had to limit the number of treatment sessions they offer a child with a communication disorder. Services may implement “blocks” of treatment to children as either one-offs or in a cycled manner. This was the case in Faith’s workplace, yet here again she stated that although this system was in place for the majority, when it came to children with stuttering, it could be altered,

We’re limited in terms of the, I guess the number of sessions in a cycle. So we do eight sessions in a cycle of therapy and then they generally get a break from therapy which can be anywhere between about 6 to 8 weeks and then they can come back for another cycle of therapy, but children can have as many cycles as they need until they go to Prep and then that's when our service cuts out, and then the Education Department speech pathologists pick them up from there.

....so that's the one different thing, if there is a child with stuttering, they don't enter into our cycles program.

Some of the private clinicians discussed the need to provide a quality service based on value-for-money and specialist expertise. Alison summarised both of these points,

I see myself as specialising in stuttering and for that reason. . . I think that the parents get very good value from me for treatment for the stuttering . . but I wouldn't really take their money privately for treatment for the speech sound disorder. I refer them to a colleague who would work on that and we would look at what we would do when in terms of balancing the stuttering and the other problem.
Perhaps because of some of the issues detailed above, there was a strong focus in the data around collaboration between services, as noted by Belinda,

> If I’m doing the stuttering which the public, very often they can't do, when I'm doing the stuttering, they would do the speech sounds.

**Theme 3: Weighing-up the evidence.** The next major theme to emerge concerned decision-making processes specific to the management of clients who had co-occurring stuttering and SSD. Grouped into three separate categories within this theme, the variables discussed associated closely with the E³BP (Dollaghan, 2007) model of evidence-based practice. As such, they were coded as external evidence, internal evidence or client values, and aligned respectively with the three arms of Dollaghan’s model.

**External evidence.** When making clinical decisions to manage this caseload, two thirds of the participants related to the available scientific research for stuttering. Factors such as stuttering age of onset were considered, as highlighted by Cathy,

> I think the onset time of the stuttering wasn't too long ago.

The length of time the child had been stuttering was similarly discussed, as seen in Belinda’s transcript,

> if the child has been stuttering for more than 6 months.

Natural recovery of stuttering was mentioned by many. Megan related to this,

> Because there's a very high incidence of natural recovery with littlies isn't there? I mean that's what the data says so I find that generally they're fine.

Tractability of stuttering was also a consideration, particularly if the two disorders were considered in isolation, as it had been reported that stuttering becomes harder to treat with advancing age. Cathy summarised this,

> Probably firstly their age. Because, if you were, or if any child was starting to
get a bit older, we know that stuttering is harder to get rid of.

Treatment decisions were also made based on the child’s family history of stuttering, as Cathy stated,

*Given the ((family)) history, I decided that it might be beneficial to treat the stuttering first and the mother agreed.*

Although the majority of participants could easily relate their management decisions for the treatment of the stuttering to the surrounding external evidence for this disorder, the findings were different in relation to the SSD. Only two participants mentioned any external evidence relating to SSDs. Jennifer referred to the normalisation of SSDs,

*I see the stuttering as having the potential to remain and get worse whereas generally I think articulation will diminish whether treated or not.*

Danielle referred to the use of typical childhood speech sound developmental data when she made treatment decisions,

*I certainly will say to parents look if it's not distressing him and it's not distressing you, or it's not distressing the child and it's not distressing you, then let's leave this for, you know I might leave it for 6 months leeway after you know the norms say in the artic survey.*

**Internal evidence.** There was discussion in the data relating to clinical preferences for treatment, which were predominantly based on training base and level of experience. Several clinical factors were also mentioned as leading to participants’ decision-making processes relating to this caseload. Some clinicians mentioned having a higher level of expertise in one disorder than the other. Most often this was specific to specialising in stuttering rather than SSDs. This is described by Alison and then Jennifer,
People see me very much as a stuttering expert;

For about the last 12 years I've worked with people who stutter of all ages.

Some clinicians made decisions based on their higher level of exposure to one disorder than the other. Cathy stated,

So I've seen mmm only a few children who stutter.

This was the case with SSDs also, where Alison noted,

I really don't see a lot of those children ((with SSD)).

Another consideration for some participants related to the management of these children based on their own level of training. Many mentioned specific training programs for both disorders. Regarding stuttering, for example, Faith reported,

My experience is I've done formalised training in the LP and commonly carry that out as my treatment of choice for the preschool children and have been using that sort of sporadically throughout my 8-year career.

Formal training in SSDs was also mentioned, as Belinda stated,

And then with the speech sounds I look at whether it's an articulation issue or a phonology issue. I based on, I use Caroline Bowen's things alot. I've been to her PACT and CAS workshop so . .

Aside from clinical experience, expertise and training, other clinical factors relating to the child were given consideration. These factors included the child’s age, cognitive ability, appropriateness for treatment, level of schooling, intelligibility, language ability and social impact of the disorder on the child. Cathy’s commentary highlighted a number of these factors,

Because, if you were, or if any child was starting to get a bit older, we know that stuttering is harder to get rid of [Interviewer: mmm], so that would be a first
thing. And the next thing is intelligibility. So yeah, how severe the speech sound problems are, how hard they are to understand in conversation probably also, how it's impacting the child so, if they came and said that you know they were getting teased because of the speech sound disorder, then that might be brought forward more than someone who wasn't.

Client preferences. All participants mentioned involving the parents in some way when making decisions around the management of their child. For most, this began with the initial assessment and continued through to making decisions about the timing of service delivery. Cathy highlighted this,

Yep, so I guess the, a fourth thing would be what the parents want to do, so with one of them, the parents have said no they wanted to do both of them at the same time. The stuttering and the sounds, so we did that. Um . . I guess I'd always mention to the parent at the start you know, he is, they're stuttering, we could start treatment now but you know the reasons why we might wait are this this and this, so check with them which order they wanted to do it in, and if they wanted to do them at the same time.

Similarly, Faith explained,

I think it's probably, I think my service provider would be happy with whichever way we decided to do it, but yeah I guess I tend to make that clinical judgement based on what the parental goals are.

Theme 4: Direct intervention. This theme grouped together all of participants’ discussions relating to their specific treatment programs of choice when treating clients who had co-occurring stuttering and SSD. In doing so, several similarities and differences emerged. Most of participants mentioned the use of direct treatment
approaches for both disorders. The majority of treatment approaches mentioned by the participants were supported by scientific research related to the disorders in isolation.

For the stuttering, 12 of the 13 participants stated that they used the LP (or variations of it). However, some participants mentioned the use of other stuttering treatment programs, either in addition to the LP or as stand-alone approaches. These choices were determined by clinical goals and clinician training levels. Figure 3.3 details the types of training program identified and the number of participants that mentioned them.

![Figure 3.3](image)

*ELU = Extended Length of Utterance
GILCU = Gradual Increase in Length and Complexity of Utterance
SITO = Self Imposed Time Out
Note: Westmead Program was also referred to as Syllable Timed Speech by participants*

*Figure 3.3. Stuttering treatment programs identified by participants used with preschool children who stutter and have a speech sound disorder.*

The participants also mentioned the specific types of SSD program they used when working with this caseload, the majority of which are supported by external evidence (see Figure 3.4). Four of the participants discussed speech sound target selection for this caseload. Of these, only one discussed this in light of more recent
target selection criteria such as implicational relationships based on theories of markedness. Belinda described this below,

... and to prioritise what sounds to target first. So she ((Caroline Bowen)) did talk about you know that voiceless would imply the voiced, and fricatives would imply, or something like that, because fricatives imply the stops, so that's how I set the goals when I pull out the sounds for the speech sound therapy.

The other three participants who mentioned target selection of speech sounds all drew from traditional target selection criteria, choosing to work in a developmental sequence, as stated by Danielle,

We'll only treat the sounds that are age-appropriate because I think we need to give them the benefit that there's a reason that children don't acquire certain sounds at certain times.

![Bar chart showing speech sound intervention approaches used with children who have a SSD and also stutter.

PACT = Parents and Children Together

Figure 3.4. Speech sound intervention approaches identified by participants used with children who have a SSD and also stutter.
Core theme: Clinical reasoning. Clinical reasoning has been defined as a process whereby professionals engage in complex decision-making in order to achieve positive client-related outcomes (Hoffman, Bennett, & Del Mar, 2010). This nonlinear process involves collecting and processing information, identifying problems, constructing goals and providing intervention to achieve these goals, evaluating outcomes, and reflection of the entire process. In order to engage in this process, Hoffman and colleagues stated the need to gather information from many sources. This theme emerged as the core theme, as it underpinned all the information given in the previously discussed themes. During the process of clinical reasoning for these children, the participants’ drew on many variables that were associated with the aforementioned themes, highlighting the relationships between all five themes. Throughout each of the other themes, clinicians were using every available piece of information to hand, and collaborating with clients, parents and other professionals to engage in this process of clinical reasoning. The fact that there was a paucity of evidence surrounding the treatment of comorbid stuttering and SSD was considered a clinical dilemma by many of the participants. This was most notably obvious when participants discussed trying to decide on the best method of service delivery. This was summarised by Natalie and Belinda respectively,

But you just think . . I still haven't got a clear-cut . . I have got a clear-cut sense of what I want to work on. I want to work on the fluency first. But every time they ((the children)) present you've got to evaluate if that's still the right thing to do. I'd love some guidelines that helped me structure it better;

I don’t feel comfortable that I do the speech sounds first.
Thus, method of service delivery appeared to be the underlying source of clinical dilemma for the majority. Participants described their two distinct methods of preferred service delivery as either concurrent or serial in nature. They also gave rationales for their choice of either of these methods. A “serial treatment” code was assigned if participants stated that they would treat either the stuttering or the SSD first and separately. Treatment of either of these disorders would continue to a level of recovery before treating the other disorder. A code of “concurrent treatment” was assigned if participants stated that they would treat the SSD alongside the stuttering. Ten of the participants provided intervention serially, one participant always delivered concurrently, and two participants stated that they would use either a serial or a concurrent approach with this caseload.

**Serial treatment.** Of the ten participants who described using a serial service delivery approach, nine reported using the LP or variants of it. Thus if the stuttering was treated first by these participants, they would generally not proceed with treatment for the SSD until the child was in Stage 2 of the LP. Gabriella detailed this, explaining that once the child was in Stage 2 of this program (the maintenance phase) she would introduce the SSD treatment, but would continue to monitor and withdraw the stuttering treatment,

_They still came, I think they still came weekly because then we were working on the speech so we didn't do the speech based on their, however many weeks it was with the Stage 2 of the Lidcombe, we still continued to see them each week and one of those weeks might have been the stage 2 session and the other might have been the speech. But if it was a Stage 2 session we'd still do speech within that Stage 2 session._
Isabella described a similar process, actively treating the stuttering alone until she considered it more stable in Stage 2 of the LP before commencing SSD treatment. All who mentioned the same process made note of actively monitoring the stuttering while this occurred,

\begin{quote}
So it tends to be more . . as far as actual giving therapy, we tend to be more speech sound focused in that Stage 2 point but still doing a lot of interaction with the parents in terms of how the stuttering is going.
\end{quote}

The 10 participants each detailed their rationales for a serial form of service delivery and their responses varied widely. For this reason, the responses are summarised in Table 3.7, with relevant examples directly from the data.
Table 3.7
Participants’ rationales for choice of serial service delivery

<table>
<thead>
<tr>
<th>Reason(s) discussed</th>
<th>Example supporting quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental concern</td>
<td>“I guess my reasoning behind that is these parents are always coming into the clinic with the stuttering in the forefront of their mind, that’s their main concern...so I guess I try and work with the parents around stuttering being their main concern” (Faith)</td>
</tr>
<tr>
<td>Session time constraints</td>
<td>“Yep I guess the decision being that when I did the Lidcombe training, they said that you needed the hour session so I couldn’t fit in both speech and the stuttering in the hour” (Gabriella)</td>
</tr>
<tr>
<td>Severity of disorder(s)</td>
<td>“I did want to really just focus on the fluency with the first little girl...she was quite severe, so that’s what we did first” (Lauren)</td>
</tr>
<tr>
<td>Anecdotal evidence</td>
<td>“I have anecdotally heard from other clinicians that when you do work on the two at the same time...that it just doesn’t work, that you will find that fluency will go backwards, at the expense of artic” (Danielle)</td>
</tr>
<tr>
<td>Working on one disorder to facilitate the other</td>
<td>“If I treat the speech sounds, sometimes the fluency tends to get better on its own” (Hayley)</td>
</tr>
<tr>
<td>Not working on two motor activities at the same time</td>
<td>“I just don’t think it’s a good idea to work on two motor activities at the same time” (Danielle)</td>
</tr>
<tr>
<td>Stuttering tractability</td>
<td>“Sometimes I do ruminate over that decision, but I end up...because of that time window that we’ve got for the fluency, I just choose fluency” (Natalie)</td>
</tr>
<tr>
<td>Delivering two forms of therapy confusing for child, parent, and/or clinician</td>
<td>“It seems to take time for parents to get the hang of that ((stuttering therapy)) as it is...without adding speech sound and phonological feedback and all those sorts of things into the process as well” (Isabella); “It's just too many balls to juggle. I figure how can I get the parents to do it if I'm having trouble. And how can this kid do it if I can't figure it out” (Natalie); “I can't handle it...” (Belinda); “I don't feel comfortable that I do speech sounds first” (Belinda); “I don't want the question raised, is it because we're doing both of those things and am I doing the wrong thing as a therapist. I don't want the parent to be going 'oh well we're not really progressing'. I guess, and also for myself, like is it going to be less effective? Like the sort of fear of – is it going to be less effective because I'm working on something else at the same time? Am I just confusing them by doing too much all at once?” (Isabella); “We just don’t know enough about this group of kids” (Natalie); “but every time they present you've got to evaluate if that's still the right thing to do. I'd love some guidelines that helped me structure it better” (Natalie)</td>
</tr>
</tbody>
</table>

Many of the participants discussed their thoughts on parental and/or child responses to serial service delivery with particular reference to the stuttering being treated first. Serial treatment was thought to have either a positive or negative impact on families. Some expressed the view that after spending a substantial amount of time in stuttering treatment, children lost interest and motivation in the overall treatment process. It was felt that this could in turn negatively impact on the subsequent treatment for the SSD. Others commented that it was not only the child who was at risk of becoming unmotivated with continuing treatment. This was discussed in terms of home-based treatment and clinical attendance by Faith,

*And I must admit in the cases that I have in mind, once we've had that stuttering under control a little bit more and perhaps entering into phase ((two)) or maintenance phase, when we start treating the speech sound disorders, I have actually found that their attendance to clinic hasn't been as great as what it has been when we've been treating the stuttering.*

One participant reported that a serial form of service delivery placed a financial burden on some families.

In contrast to these views, other participants expressed their belief that in some cases, serial delivery had a positive impact on the therapeutic experience for families. Alison stated that parents who had actually gone through the process of stuttering treatment first became more experienced home-clinicians by the time they reached SSD treatment. This consequently had a positive impact on the treatment process,

*I mean the beauty of it is the parents are well “theraped” you know, they sort of know what's involved in working with their child.*

Jennifer stated that she believed serial treatment was motivating for parents as they had
seen their child’s previous success in stuttering treatment,

*I think parents are pretty motivated then because they are, they've seen success with treatment and they are very pleased with the stuttering improvement and then they are seeing the potential that the phonological disorder might be treated in the same amount of time, you know that it might respond as quickly.*

Having discussed how serial treatment might impact on families, some participants also discussed how they as clinicians felt about delivering treatment in a serial manner as opposed to concurrent treatment. Many expressed uncertainty with delivering concurrently, being unable to manage treatment in this way, and fear of being accountable for lack of progress in the child. As Natalie explained,

*But you just think . . I still haven't got a clear cut . . . I have got a clear cut sense of what I want to work on, I want to work on the fluency first. But every time they present you've got to evaluate if that's still the right thing to do.*

Several participants mentioned they felt unable to deliver treatment in a concurrent manner. Belinda said,

*I can't handle it (concurrent service delivery)).*

Similarly, Natalie discussed the same issue,

=It's just too many= balls to juggle I figure how can I get the parents to do it if I'm having trouble. And how can this kid do it if I can't figure it out.

Isabella raised the issue of being questioned about her clinical decision-making should she choose to work concurrently,

*I don't want the question raised, is it because we're doing both of those things and am I doing the wrong thing as a therapist, like I don't want the parent to sort of be going oh well we're not really progressing*
Talking about treatment outcomes when using a serial delivery approach, three participants explained that a serial treatment approach had been successful for their clients with co-occurring stuttering and SSD. However, these clinicians also reported their belief that intervention appeared to take longer than expected.

Dosage was another factor that was raised by several of the participants who treated serially. Four mentioned seeing their clients for LP treatment fortnightly. One participant stated she saw her clients for a weekly half-hour LP clinic visit during Stage 1 of the program. Although all clinicians mentioned adhering to the LP Stage 2 schedule as manualised, they mentioned keeping to either fortnightly or weekly appointments for the SSD in Stage 2 regardless.

**Concurrent treatment.** Three participants reported having treated comorbid stuttering and SSD concurrently using direct intervention approaches. Their rationales for doing so varied, and were largely focused on parental choice, severity of impairment, and/or the potential impact of either disorder(s) on the child. Another rationale related to working in a rural and/or remote workplace setting, where client services were not easily accessible. These rationales are listed with supporting quotations in Table 3.8.
Table 3.8
Participant rationales for choice of concurrent service delivery

<table>
<thead>
<tr>
<th>Reason(s) discussed</th>
<th>Example supporting quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental choice</td>
<td>“so check with them [the parents] which order they wanted to do it in, and if they wanted to do them at the same time” (Cathy)</td>
</tr>
<tr>
<td>Severity and impact of disorder(s)</td>
<td>“if the stuttering is really obvious and it's you know, like in the moderate to severe sort of range, then that would be an indication to do both of them at the same time” (Hayley)</td>
</tr>
<tr>
<td>Rural and remote settings</td>
<td>“We used to fly to [remote town]...so the preschool might have done a little bit with the sounds and the parents might have concentrated a little bit more with the stuttering therapy, but the child will still be getting both at the same time. So it wasn't maybe ideal, but I guess that's what we sort of thought was best at the time” (Gabriella)</td>
</tr>
</tbody>
</table>


One of the three participants detailed how she structured concurrent service delivery.

Cathy described,

*I did the stuttering for the first session, and then brought in the speech sounds the next one, so they ([the parents]) weren't having to remember too much all at once.*

The three participants noted that their session goals were discrete, that is, they did not blend stuttering and SSD goals into the same activities. They also typically dedicated an equal amount of time within the session to each disorder. The participants were asked to describe how long their concurrent sessions generally lasted. One stated approximately 45 minutes, and the other two said their total session time (i.e., including both stuttering and SSD treatment) was approximately 30 minutes. Neither of these two participants reported any difficulties relating to sessional time constraints.
As with the participants who treated in a serial manner, these three participants perceived that there was no negative impact on parents and/or children when two types of treatment were delivered concurrently. Cathy reported,

_I didn't find that they ((the parents and children)) were getting confused between the two types of treatment._

The three participants who treated concurrently all stated that they had seen positive clinical outcomes using this form of service delivery. Responses varied about how long the participants felt treatment using this form of service delivery took. One said that she thought the intervention time seemed longer than expected. One had not noticed any impact on time taken in treatment, and the other felt that the overall time taken seemed less than expected.

**Summary**

One aim of this thesis was to investigate and describe current management of children with co-occurring stuttering and speech sound disorder. This qualitative study achieved this aim by exploring the current practices and perceptions of clinicians working in the field with this caseload. The study revealed four major themes underpinned by the core theme “clinical reasoning”.

All participants described their process of clinical reasoning, many noting the paucity of external evidence related specifically to the population of interest. The clinicians used available information related to the case, aligning closely with the E³BP model.

The clinical dilemma that appeared to face many of these participants concerned the method of service delivery, not the type of treatment, for this caseload. The majority of participants used direct treatment approaches for both disorders basing this decision
on the best available external evidence for treatment of each disorder presenting in isolation. Discussion of the issue of service delivery for this caseload produced the most variation in the data. The majority of the clinicians reported treating this caseload in a serial manner, where one disorder was treated to a certain level of recovery before treating the next disorder. Whether treatment was provided in a serial or a concurrent manner, the rationales for service delivery varied widely among participants. Reductions in both stuttering and SSD were reported by clinicians using both methods of service delivery. Despite reported anecdotal evidence to the contrary, those treating concurrently all experienced positive clinical outcomes for their clients. As discussed in Chapter 2, the only external evidence from the scientific literature concerning treating this caseload detailed the use of indirect treatment approaches to treat stuttering and SSD concurrently when they co-occurred. The participants in this study were well aware of the window periods in which to treat either disorder in isolation, and similarly were aware of the ramifications of not providing early intervention for either disorder, yet some expressed feelings of uncertainty in general around this caseload, highlighting the integral need for more research in the area. As Natalie said,

*We just don’t know enough about this group of kids.*

As Nippold (2002) indicated, there is a crucial need to develop the evidence base in this area. Concurrent service delivery might be one way of addressing the window period for early intervention in both disorders. The next chapter explores a concurrent method of service delivery in an attempt to build upon the evidence-base for this population, using direct treatment approaches that are well supported by up-to-date external evidence.
CHAPTER 4

Concurrent Treatment for Co-occurring Stuttering and Speech Sound Disorder:

Phase I Clinical Trial Methods
Introduction

Chapters 1 and 2 have highlighted that early intervention is essential and best practice for both stuttering and SSD, and that there is a paucity of evidence to guide best practice when providing intervention for this population. In a profession espousing evidence-based practice, this lack of information has contributed to a dilemma for clinicians faced with management decisions for this caseload, as detailed in Chapter 3. Chapter 3 presented results of a qualitative research project (Study 1) that involved interviews with experienced SLPs who reported working frequently with this caseload. The results highlighted that the SLPs were confident in choosing appropriate treatments for this population but remained unsure about the mode of service delivery.

There appear to be two main options for clinicians to consider in relation to service delivery: either to treat this caseload in a serial or a concurrent manner. Although there is no scientific evidence to support a serial method of service delivery, the majority of clinicians in Study 1 reported they do so, with positive outcomes. However, treating serially may minimise the crucial window period for treatment on which both stuttering and SSD depend. A small number of participants in Study 1 noted that they may treat this caseload concurrently, with positive outcomes. There is one study detailing scientific evidence to support this service delivery approach, however it was conducted over 20 years ago using treatment methods that are arguably outdated, given the advances in the surrounding literature for stuttering and SSD. With this in mind, an opportunity exists to investigate whether or not best-practice direct treatment approaches can be implemented concurrently in a safe, efficient and effective manner. Published guidelines and expert opinion have stated that if clinicians want to attempt concurrent treatment using direct interventions, careful planning and consideration
should take place beforehand, given what is both known and unknown about stuttering in isolation and also when it co-occurs with SSD (Sasisekaran, 2014; Wall & Myers, 1995).

The study presented in the following two chapters (Study 2) investigates the treatment of co-occurring stuttering and SSD and details a new method of service delivery using direct treatment approaches supported by high-level research. Intervention was concurrently delivered in each session to the young children participating in this study, using discrete session goals. This chapter outlines the research methods and methodology employed for this Phase I clinical trial.

**Study Design**

Using the Onslow et al. (2008) criteria, this study was considered a Phase I clinical trial as participant numbers were below 10 and the main aim of the study was to conduct preliminary investigation of the safety and viability of a new method for treating young children with co-occurring stuttering and SSD. This study was also considered a descriptive longitudinal case study, which is classified as level IV evidence using the NHMRC (2009) framework. Single case study methodology falls under the broad banner of single case research which also includes single case experimental designs. Although the terms are often used interchangeably, the two designs are notably different. Examples of single case experimental designs include multiple baselines, withdrawal/reversal, and alternating treatments. By comparison, single case study designs (as was employed in this study) allow for thorough observation and reporting of research outcomes when treating individuals and, like Phase I clinical trials, are the most appropriate when developing new methods of treatment. By providing comprehensive detail about the cases in this Phase I clinical trial (Study 2), this thesis
further aimed to document and develop a treatment protocol, and to determine the presence (or not) of emerging evidence of treatment effect.

Ethics

Ethical clearance was obtained from the University of Newcastle’s Human Research Ethics Committee to implement this Phase I clinical trial. Approval for the study was granted on June 6, 2012 (approval identification number H-2011-0383). A variation to this submission was subsequently sought to allow the survey of information from listeners familiar with the participants. This variation was approved on February 23, 2013. Recruitment for the trial commenced in August 2012 at the University of Newcastle’s stuttering clinic.

Recruitment

The participants were recruited using purposive sampling methods, and were selected specifically because they shared certain characteristics (Schofield & Jamieson, 1999), those being their dual diagnoses of stuttering and SSD. All participants were recruited from the University of Newcastle stuttering clinic’s waiting list for intervention. The children on this waiting list had been previously assessed by the clinical team working at this unit, had a subsequent diagnosis of stuttering, and were deemed eligible for treatment. As part of this clinic’s assessment protocol, children also underwent language and speech screening to identify other potential areas of communication difficulty. Although this clinic only provided stuttering treatment, other identified issues were referred on to alternate appropriate service(s) for further assessment and/or treatment in those areas. Initial contact was made by a clinician working within the university clinic who was not a part of the research team. Potential participants were identified from the clinic database by this clinician who phoned the
relevant caregiver(s) and provided preliminary basic information about the research protocol. The caregiver(s) was advised that their child might be eligible to take part in the research and if they were interested they were sent information statements or encouraged to contact the research team directly. The caregiver(s) was further advised that choosing not to contact the research team or not to take part in the research would not jeopardise their place on the clinic waiting list.

Once contact was established with the research team, an initial appointment was made with the researcher. At initial assessment, the researcher ensured parental written consent. As some participants were nearing school-age, they were considered potentially able to understand parts of the research protocol and as such, potentially vulnerable. Therefore, it was considered appropriate to involve some of these participants in discussions relating to what might be involved in taking part in the research (National Health and Medical Research Council, 2007). This was done with the use of a visual aid (Appendix G) and in this way participants’ consent was considered. Consent was gauged by the participants’ reactions to these discussions and their maturity levels. At initial appointments with the researcher, case history information was discussed again with caregivers for determination of change since being placed on the clinic wait list. Eligible participants commenced treatment in the order they were assessed, most children commencing within around four weeks of this initial assessment time.

**Participants**

The participants were six preschool children diagnosed with stuttering and SSD. All children were aged between 3;6 and 6 years. The median age of the group of children was 4;3 years (range 3;6 to 5;3 years). All children were diagnosed as
stuttering by consensus either between two SLPs or between one SLP and a caregiver (Bloodstein & Ratner, 2008, p. 9). Stuttering levels were required to be greater than 2%SS based on within-clinic evaluation and on the average of two separate beyond-clinic recordings gathered by the children’s parents. All children were diagnosed with SSD or delay if they presented with two or more age-inappropriate speech sound errors, or at least one atypical error, as assessed using a single-word naming test, the Diagnostic Evaluation of Articulation and Phonology (DEAP) (Dodd et al., 2003), and in conversational speech. Further to this, independent and relational analyses were conducted by the researcher to examine the child’s sound system and these were checked for agreement with a SLP peer who had over 20 years’ experience specialising in the treatment of SSD in young children. All participants and their primary caregiver(s) had a functional command of the English language. All children had hearing levels and oral motor structure and function that were found to be WNL. A receptive and expressive language screening assessment was implemented, the Preschool Language Scale – 4 Screening Test (PLS4 Screening Test) (Zimmerman, 2005). If this screener was not passed, a full standardised language assessment was administered, the Clinical Evaluation of Language Fundamentals: Preschool Edition – 2 (CELF-P2) (Wiig, Secord, & Semel, 2006). One child did not pass the initial language screener and subsequently scored WNL on the CELF-P2. The onset of each child’s stuttering was reported to have been at least 6 months preceding recruitment into the study. Further, no child had received treatment from a SLP for either stuttering or SSD within 12 months prior to recruitment. Given these criteria, one child was excluded from the study after initial assessment as oral-musculature examination revealed a significant tongue-tie, and a suspected sub-mucous cleft-palate. The need for further investigation was discussed with the parents and appropriate referrals were made. The
other five participants were retained for the entire treatment protocol and were able to provide data on all assessment occasions. Chapter 5 focuses on the results obtained from these five participants, each assigned pseudonyms for the purposes of readability, and to ensure their anonymity.

Data Collection

The researcher was responsible for all data collection and management. Data were collected by the researcher on all four of the primary assessment occasions: (i) pre-treatment (initial assessment), (ii) at entry into Stage 2 of the LP, (iii) 9 months after commencement of treatment, and (iv) 12 months after commencement of treatment. Stuttering process measures were also collected on a weekly basis to guide treatment goals and decision-making. Within-clinic speech samples were gathered at each of the four assessment occasions for both stuttering and SSD (conversational) measures. To obtain these samples (of no less than 300 syllables), the researcher engaged the participants in play-based discussion, setting up the same imaginative play scenarios at each occasion in an attempt to obtain similar word samples in conversation. These samples were recorded using a Tascam DR2D digital handheld recorder, and a Sennheiser EW112 lapel wireless microphone attached to the participant’s collar. This ensured quality recordings (using 16bit WAV format in stereo at a sampling frequency of 44.1KHz) to enable finer phonetic detail to be obtained where possible (MacWhinney, 2000). The participants’ parents were also asked to provide beyond-clinic speech samples at each assessment occasion. The parents were provided with Sony ICD-UX512F hand-held digital voice recorders and asked to gather two 10-minute speech samples, one of them speaking with their child in the natural home environment,
and the other with the child speaking with another familiar adult (e.g., the other parent, grandparent, teacher) outside of the home.

**Direct Treatments**

All assessment and treatment was undertaken at the University of Newcastle’s stuttering clinic by the researcher. The researcher had attended LP training provided by the LP Trainer Consortium (Australian Stuttering Research Centre, 2013), and had attended several other related professional development courses for SSD. She had also been a clinical educator for the University of Newcastle stuttering clinic, and was experienced in the assessment and treatment of children, adolescents, and adults who stutter. In addition, the researcher had a further 4 years’ experience as a generalist clinician, including experience in the assessment and treatment of children with SSD.

The researcher treated the participants for 9 months, but all still required some level of intervention after that time (see Chapter 5 for details). Therefore, time was spent ensuring that all participants were linked with other relevant services, and ready to be transferred once the 9-month period was complete, as per approved ethical guidelines. For the stuttering, all participants had remained in their current positions on the treatment waiting list at the stuttering clinic, and were therefore eligible to commence where they ceased treatment with the researcher, without a lag in service delivery. For the SSD, all except one participant were able to access private treatment, so relevant referrals were made and handover reports given to the clinicians to ensure continuity of goals and service. The other participant was placed on to the public sector health service waiting list for treatment of the SSD at the start of the research protocol, and had already been assessed by this service before the end of the 9-month treatment period, and was placed on to the waiting list for treatment services as a result.
The treatment of stuttering and SSD was delivered concurrently to each participant. Direct treatment approaches were used for both disorders, and session goals were discrete in nature. The following section details the treatment procedures that were common to all participants. Variations to these procedures due to the individual nature of each participant are outlined case-by-case in Chapter 5.

Although treatment for the disorders took place by other services between the 9 and 12-month assessment occasions, the researcher was responsible for assessment and data collection at the 12-month occasion. Therefore, prior to handing over to the other services as described above, an assessment session was made with the researcher to ensure data collection took place.

**Stuttering treatment.** All participants undertook the LP for stuttering, as manualised (Onslow et al., 2003; Packman et al., 2011). As previously discussed, the LP is delivered by the parents who carry out the treatment at home in the child’s natural environment.

There are several major components of the LP. The first is application of parental verbal contingencies (PVC) to the child’s stutter-free and stuttered speech. These contingencies are verbal comments delivered to the child in structured and unstructured conversations and are essential to the program to control the stuttering (Packman et al., 2014). There are five essential types of PVC as listed in Table 4.1. Usually delivered in a ratio that ensures a positive experience for the child, contingencies for stutter-free speech are dominant throughout the treatment process. There are also two optional types of PVC, namely praise delivered to children if they spontaneously self-correct, or if they accurately evaluate their own speech. However, 

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3 Due to the timing of data collection for Study 2, the author used the LP procedures as set out in the 2011 version. The current (2014) version no longer includes %SS as a compulsory weekly measure.
these are not essential, nor is there an expectation that a child produce these responses. Parents were trained to accurately and appropriately deliver verbal contingencies in a manner that was individualised to ensure this aspect was comfortable and enjoyable for them and their children. The parents were initially instructed to deliver contingencies for stutter-free speech during structured conversations. As treatment progressed, the introduction of contingencies for unambiguous stuttering was introduced, also in some unstructured conversations. The parents were advised to initially do 10-15 minutes of structured treatment per day with the child, although as the child progressed some treatment in unstructured conversations was delivered concurrently, eventually progressing to the delivery of treatment entirely in unstructured situations (Packman et al., 2011).

Table 4.1
*Examples of parental verbal contingencies used in the Lidcombe Program*

<table>
<thead>
<tr>
<th>Contingencies for stutter-free speech</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Praise</td>
<td>“I really liked your smooth talking there”</td>
</tr>
<tr>
<td></td>
<td>“Hey that was awesome. You said that very smoothly”</td>
</tr>
<tr>
<td></td>
<td>“Great work, no bumps there”</td>
</tr>
<tr>
<td></td>
<td>“That was so smooth [with high-five or fist-bump]”</td>
</tr>
<tr>
<td>Request for self-evaluation</td>
<td>“Was that really smooth?”</td>
</tr>
<tr>
<td></td>
<td>“Did you just do any bumps then?”</td>
</tr>
<tr>
<td>Acknowledgment</td>
<td>“Smooth words there”</td>
</tr>
<tr>
<td></td>
<td>“No bumps”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contingencies for unambiguous stuttering</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgment</td>
<td>“A little bumpy”</td>
</tr>
<tr>
<td></td>
<td>“Some bumps there”</td>
</tr>
<tr>
<td>Request for self-correction</td>
<td>“Could you say <em>xxxx</em> again in a smooth way?”</td>
</tr>
<tr>
<td></td>
<td>“Can you try that one again for me without bumps?”</td>
</tr>
</tbody>
</table>
Another major component of the LP is the measures that are used to guide treatment goals and document therapeutic change. The first is a severity rating (SR) scale (Packman et al., 2011) that enables parents to measure the child’s stuttering in and out of the clinic. The scale ranges from 1-10, where 1 is no stuttering, 2 is extremely mild stuttering, and 10 is extremely severe stuttering. Typically, parents were asked to rate their child’s severity each day they were away from the clinic, and document it on a chart provided in hard copy. Parents were required to give an overall daily SR in most circumstances and to bring this with them to each clinic visit. These SRs formed the basis of a discussion between parent and clinician in each session and were used to guide and adjust future treatment goals. At the start of each clinic visit, the clinician conversed and/or played with the child to obtain a representative sample of the child’s speech and the parents and clinician had discussions about what SR they would each assign that conversation. This was done to again guide and document treatment progress, but also to ensure constant calibration of that measure between clinician and parent. Percentage of syllables stuttered (%SS) is an additional measure that was used in the LP in conjunction with SRs to guide the treatment process, however it should be noted that in the most recent version of the LP manual, this measure is considered optional (Packman et al., 2014). In the manner described above, %SS was gathered by the researcher on a representative speech sample at the start of each clinic visit.

The LP is conducted in two stages. Stage 1 is the active treatment phase, and it is in this phase that the parent and child attend the clinic on a weekly basis. The aim of Stage 1 is for the child to achieve zero or near-zero levels of stuttering. Typical clinic visit duration is between 45 and 60 minutes. For this study, average session length in Stage 1 for the stuttering component was 50.1 minutes (range 30-78 minutes).
The aim of Stage 2 is to maintain these low levels of stuttering over a long period of time. Stage 2 is reached when several criteria are met. The child must achieve weekly SRs beyond the clinic of 1s and 2s (with more 1s than 2s) for three consecutive weeks. As well, the child must achieve SR1 or SR2 within the clinic for those three weeks. Additionally, a %SS score below 1 must also be achieved for three consecutive clinic visits (Packman et al., 2011). Careful monitoring and maintenance strategies are required during Stage 2, as research has shown that although treatment with the LP can be successful, relapse can occur. Jones et al. (2008) found that approximately half of the children in their study showed signs of relapse up to 5 years after commencement of treatment. During Stage 2, weekly clinic visits systematically decrease on a fixed schedule, contingent on continued low levels of stuttering. At the same time, gradual withdrawal of the treatment agent (PVC) occurs. In Stage 2, parents and children attend clinic visits of approximately 30 minutes duration. In this study, the average Stage 2 appointment for the stuttering component was 35.7 minutes in length (range 20-51 minutes).

**Speech sound disorder treatment.** All participants received individualised treatment for SSD, the treatment determined according to the results of their independent and relational analyses conducted at both single-word and conversational levels. The two programs most frequently used were the traditional articulation approach, and minimal pair therapy. The average duration of the SSD component of each session was 29.7 minutes (range 20-48 minutes). Details of individual case profiles are provided in Chapter 5, along with the type of intervention provided. The participants were delivered intervention that was supported by research-based evidence.
**Traditional articulation therapy.** Participants who evidenced functional speech sound errors (for example, interdental or lateral lisp) were delivered traditional articulation therapy. The procedures used for this approach were in line with the description provided in Bernthal et al. (2013), using drill and/or drill play to implement these techniques. Treatment commenced with auditory discrimination tasks that involved the child distinguishing between the target sound and the sound in error, using activities such as sorting games, or physical games such as leapfrog. The child was then taught to produce the target sound in isolation, using a variety of methods such as phonetic placement, shaping, and facilitative contexts. Other cues were used as required and included metalinguistic and tactile cueing techniques. Once the child had established stable and consistent production of the target in isolation the sound was then taught in nonsense syllables in a variety of contexts including CV, VC, VCV, and CVC. Meaningful word production then began, commencing with monosyllabic words with the target in initial, final, and medial positions, before moving to more complex word forms such as multisyllabic and cluster forms. Once the child had mastered word level production, target sounds were taught in short carrier phrases before advancing to 4-word random phrases and subsequently sentence level production. Finally, activities probing for generalisation of the target sound at a conversational level took place. Some examples of the materials and games used for these activities were sound-cards, drill worksheets, stamp charts, reward chart apps, fishing games, pop-up pirate, board/token games (e.g. Artic Chipper Chat), and various articulation apps for iPad.

**Minimal pairs therapy.** In a review of the surrounding evidence supporting this type of intervention, Baker reported that although some variation occurred in the way minimal pairs were described and implemented across studies, two distinct versions of the approach were most often utilised and replicated. The participants who underwent
minimal pair therapy in this study followed the guidelines for meaningful minimal pair intervention (Baker, 2010). Conventional minimal pair or near minimal pair stimuli were used depending on the goal for each participant. Five paired words were chosen for each target, although these were often duplicated for use in certain activities (e.g., memory, snap, etc.). Once treatment for the SSD had commenced, initial session goals involved familiarisation of the paired words. This involved the clinician first presenting each paired word to the child, clearly stating the word(s) and describing it so that each word was repeated several times within an utterance. For example, the clinician would say “Here is a picture of a veil. This lady is getting married and she is wearing a veil. The veil is the beautiful flowing material that a bride wears on her head.” Emphasis was placed on the target and contrast phonemes in each pair. Following this initial presentation, the clinician then typically engaged the child in play-based familiarisation activities, such as a game of hide-and-seek during which, each time a child found a picture card, the clinician would reply with “You found the veil, well done! That’s the beautiful veil that the bride wears when she gets married. I wore a veil when I got married.” Once familiarisation had been achieved, a perception activity took place. This involved the clinician laying the 10 word-pair cards in front of the child and asking the child to point to or pick up each card that the clinician named. Once complete, the child was prompted to ask the clinician to point to or pick up the word-pairs one at a time (i.e., child became the teacher). In this activity, the clinician used semantic confusion if the child could not produce a contrast between the two word pairs. For example, if the child prompted the clinician to pick up the vest picture, but pronounced it as best, the clinician gave feedback such as “Did you mean the vest or the best picture? I have the best picture already here in my hand. Tell me which one you mean again.” If the child was still unable to articulate or approximate the target on further attempt, the clinician
gave instructional feedback (such as phonetic placement, tactile and metalinguistic cues as needed) until the child could produce a contrast. Once a contrast was achieved, the clinician praised the child by saying, “Yes, I understand which word you meant now, you meant the vest. Well done, you used your long, noisy bunny teeth sound.” Further sessions then focused on this production task in a variety of activities until the child achieved 90% accuracy of 100 trials of the target-sound word cards (Baker, 2010). Continued goals to further highlight contrast and work towards generalisation included activities in which production of the target-sound card was produced in a carrier phrase such as, “Here is the vest,” followed by carrier phrases containing both target sound and contrast sound, “Here is the vest and the best” (Flipsen Jr., Bankson, & Bernthal, 2013).

**Target selection.** Although there is undoubtedly substantial evidence supporting the use of more complex sound targets to facilitate effective change for SSD, no research has studied the impact of choosing complex targets when a child has a co-existing fluency disorder. Indeed, given that choosing more complex sound targets could effectively increase linguistic demand on a child, caution must be exercised when choosing speech sound goals for children with co-occurring disorders until this is explored further in research. One well-known theory of the cause of stuttering implicates the potential unhelpful effect of increasing linguistic demand beyond a child’s capacities (Starkweather & Gottwald, 1990). Some researchers exploring this issue in children with co-occurring stuttering and SSD (Sasisekaran, 2014; Wall & Myers, 1995) have expressed the need for showing caution when dealing with this caseload, and suggested that the most-knowledge approach to target selection (i.e., selecting sounds that are stimulable and early-developing) may be more appropriate than choosing complex, later-developing sound targets.
In line with this literature and in the attempt to exercise caution when planning for this caseload, a most-knowledge approach to target selection was utilised for this research. Participants’ targets were therefore developmental in nature, working from earliest to later acquired sounds, were stimulable, and used minimally contrasting word-pairs. When non-developmental patterns were observed (e.g., lateral lisp), these were also a target for treatment. When choosing SSD targets, this study utilised normative data consistent with the speech analysis software that assisted analysis (Grunwell, 1987, 1997).

<table>
<thead>
<tr>
<th>Typical Clinic Visit: Session Goals</th>
</tr>
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**Goal Set 1 (stuttering)**
- Visual schedule discussed with child
- Gather speech sample for stuttering process measures (%SS and calibration of clinician/parent SR)
- LP Stage 1 session format implemented
- Discussion of LP homework

**Goal Set 2 (SSD)**
- Parent/child redirected to change in session goals
- Review of SSD homework
- Individualised SSD therapy implemented
- Discussion of SSD homework

**End session**
- Reiterate home plan for stuttering and SSD
- Conclude with rewarding activity chosen by the child

*Figure 4.1.* Goal sets for each session during Stage 1, LP.

**Concurrent service delivery.** Although treatments for the stuttering and SSD were delivered concurrently (yet discretely within each session) to all participants, consideration was given to the fact that the treatment for the stuttering was a parent-delivered intervention that took place daily in the child’s natural environment.
Therefore, in the first two to three weeks of the protocol, treatment commenced with introduction of the LP alone to focus on parent training. Treatment for the SSD was then delivered concurrently from session two or three onwards. Treatment was conducted on a weekly basis (as per Stage 1 of the LP). Typical goal sets for each clinic visit during Stage 1 of the LP are shown in Figure 4.1 above; a full, detailed description of the structure of a typical Stage 1 visit in this study is in Appendix H.

During Stage 1 of the LP, treatment for the stuttering occurred in the first half of each clinic visit. Once the stuttering component was complete, the researcher directed both parent and child to a change in session goals and commenced treatment for the SSD. This process was assisted by the use of visual aids (Figure 4.2) to help the child stay on track and motivated. Free play on an iPad was used as a motivating reward for completion of each session, and parent and child were involved in selecting an appropriate app/game individually tailored to their preferences.

*Figure 4.2. Visual aid used to assist child’s progression through each clinic visit.*
In addition to treatment conducted in the home for stuttering each day, parents were also instructed to complete approximately 10 minutes of speech sound homework, and that this should be conducted separately to the LP. If parents were unable to complete both sets of homework on any given day, they were told to prioritise the LP treatment. Further, they were advised that when conducting LP treatment they were to avoid any instruction or comment on speech sound production, and vice versa.

**Research Protocol**

Once both types of intervention were being consecutively delivered within each session, the research protocol allowed for several outcomes. First, if the child was observed to be making slow progress with fluency treatment and had not reached Stage 2 of the LP after 22 clinic visits, service delivery was altered to the administration of the LP only (i.e., discontinuing the SSD intervention). Worldwide established benchmarks for the LP have shown that 90% of children reach Stage 2 of the LP between 11 and 22 clinic visits (Packman et al., 2014). Abandoning the SSD intervention for this reason occurred in one of the five cases, as will be further outlined in Chapter 5. An alternative outcome was that a child reached discharge criteria for the SSD during the treatment process, and in that instance, continued to receive the LP only as manualised and as described above. This outcome also occurred in one of the five cases. For the remaining three cases, weekly treatment for the SSD continued during Stages 1 and 2 of the LP. During Stage 2 of the LP, the stuttering treatment was only conducted at the manualised weekly increments provided the children continued to maintain low levels of stuttering. However, if the SSD still required intervention, this treatment continued on a weekly basis. Figure 4.3 illustrates this treatment progression according to the study’s treatment protocol.
Outcome Measures

Several types of data were collected in order to determine the outcome of treatment for both stuttering and SSD for each individual participant. Data were entered into a comprehensive spreadsheet which documented participant demographic information, dates of assessment occasions, dates of clinic visits, time taken for individual clinic visits, missed sessions, parental weekly and session SRs, session %SS, and primary outcome measures at all assessment occasions (outlined below) for all beyond- and within-clinic samples.

**Treatment data.** These data were used to document progress for each case, to monitor adherence to research protocols, and to inform future treatment development. Further, these data were used to monitor each participant’s progress in treatment, and to guide the treatment process overall.

**Stuttering.** The treatment data for stuttering included %SS gained weekly within the clinic during Stage 1 of the LP, and then intermittently in line with Stage 2 of the LP scheduling of visits. Although collection of %SS is no longer a mandatory component
of the LP, it was considered relevant for this research study to ensure rigour of outcome measures. Parental recordings of daily SRs on a 10-point scale were also used during Stage 1 and Stage 2 of the LP. Similarly, the SRs assigned by the researcher at each clinic visit during initial conversations with the children were also recorded, both for the purposes of the research and to guide treatment progress. Descriptions of stuttering behaviours were also noted using the Lidcombe Program Behavioural Data Language (Teesson et al., 2003). Finally, the number of clinic visits taken to complete Stage 1 of the LP was also tallied.

*Speech sound disorder.* The treatment data for SSD included the number of speech sound errors used by each participant on each assessment occasion, as well as a description of these errors. The errors were interpreted as being age appropriate, delayed, or atypical in line with available normative information (Grunwell, 1987, 1997). Measures were gathered on conversational speech samples and at a single word naming test (DEAP) level. Further, the number of clinic visits taken to achieve observable outcomes was also recorded.

*Primary outcome measures.* The primary outcomes of this Phase I clinical trial were determined by examining the effect of direct, concurrent treatment of both stuttering and SSD on either disorder.

*Stuttering.* To examine stuttering frequency and severity, percentage of syllables stuttered (%SS) and SRs were used. These measures were gathered at the four assessment occasions, from beyond- and within-clinic speech samples as previously described. The high levels of correlation between the inter- and intra-judge data for both %SS and SR to measure stuttering severity has been documented previously by O'Brian, Packman, Onslow, and O'Brian (2004), who noted that although the two measures often
can be used interchangeably, if there is a relatively large proportion of repeated movement stutters, or a small proportion of fixed posture stutters then the use of both measures is optimal.

**Speech sound disorder.** To measure the involvement of the SSD, percentage of consonants correct (PCC) is a metric used to express the amount of consonants articulated correctly in a given sample of speech (Shriberg & Austin, 1997). This tool has been shown to be valid in the measurement of SSD in children aged 3 to 6 years in both clinical and research settings, and percentage results can be used to describe level of severity involvement using the descriptors mild, mild to moderate, moderate to severe, and severe. Percentage of consonants correct was calculated based on the result of a single-word naming test (DEAP) and a within-clinic conversational speech sample, that were recorded at all four assessment occasions. A component of the computer software program Computerized Profiling (Long, Fey, & Channell, 2006) was used to assist in this analysis, Profile in Phonology (PROPH). This program provides a comprehensive analysis of a child’s sound system based on the input sample, and calculates the child’s PCC, percentage of vowels correct, consonant and vowel inventory, analysis of variability, analysis of word shapes and stress patterns, as well as a phonological process analysis (Long et al., 2006). The researcher supplemented this with a manual analysis of the findings using a template designed specifically for independent and relational analysis (Baker, 2004).

**Inter-judge and intra-judge agreement.** Agreement for the primary outcome measures was dealt with using different methods from the relevant literature.

**Stuttering.** To establish inter-judge agreement for the stuttering measures, procedures similar to those of Jones et al. (2008) were followed. All within- and
beyond-clinic samples were rated for %SS and SR by the researcher as well as by an independent clinician who was blinded to all aspects of the research. In total, there were 59 samples with an average duration of 609 syllables (range 290-1772 syllables). The blinded observer was an SLP who specialised in the treatment of early childhood stuttering and had a well-documented history of high-levels of inter- and intra-judge agreement in other stuttering research projects. All 59 samples were rated with a two-button rating machine by both judges. The samples were presented to the blind observer in a random fashion. The interjudge agreement between these two observers for %SS was considered high-level using the Pearson correlation coefficient at $r=0.95$, as detailed in Figure 4.4. Interjudge agreement for SR was considered good at $r=0.88$, as detailed in Figure 4.5. Because clinical data were also reported on in this study, and given the high level of agreement between judges for %SS scores, both the researcher’s and the blinded observer’s scores are reported on in Chapter 5.

To establish intrajudge agreement, 10% of the samples were re-rated for both stuttering measures approximately six months after completion of the research protocol. Level of agreement was considered high for both measures of %SS and SR, at $r=0.99$, and $r=0.96$ respectively.
Figure 4.4. Pearson’s correlation coefficient for interjudge agreement of %SS.
Speech sound disorder. To establish interjudge agreement for PCC, methods similar to those used by Dodd et al. (2008) were employed. The same blinded observer re-transcribed (using broad phonemic transcription) 10% of the conversational and 10% of the single-word naming assessment samples presented in a random fashion. As the conversational samples were approximately 10 minutes in length, the blinded observer was asked to commence transcription for the conversational samples after 2.5 minutes of the audio had elapsed. The first 100 intelligible words were then transcribed phonemically. Point-to-point agreement was then calculated based on these transcriptions, and compared with the researcher’s transcriptions. Point-to-point agreement is a method whereby identical phoneme transcriptions between judges are coded as correct (Dodd et al., 2008). Point-to-point agreement of PCC has been found to be reliably adequate for research purposes (Shriberg & Austin, 1997), particularly when using broad phonemic transcription (Shriberg & Lof, 1991). Inter-judge agreement for
conversational and single-word naming assessment samples was considered good at 94% and 96% respectively. The majority of differences occurred relating to fricatives, for example where /f/ was produced in place of /θ/, which are often differences more readily observed by directly viewing articulatory position. However, as the blind rater had only audio samples to rate, such distinctions may have been difficult.

At each assessment occasion, as participants completed the single-word naming test assessment for SSD, the researcher phonemically transcribed data online. Immediately after each session was completed, the researcher similarly phonemically transcribed speech data from the recorded conversational samples. To establish intrajudge agreement, 10% of these samples were re-transcribed by the researcher 6 months after completion of the research protocol. Point-to-point calculations were good at 98% for both sample types. Due to the high levels of inter- and intrajudge agreement, the researcher’s transcriptions were used for all analyses involving PCC in Chapter 5, because she was able to observe visual placement of articulators and therefore these data were considered best able to accurately describe each participants’ sound systems.

**Familiar listener perceptions.** Other informal measures included a caregiver survey and a familiar listener survey (see Appendix I) to obtain qualitative information about their perceptions of the treatment process and the participants’ overall communication before and after the research protocol was implemented. These data were analysed descriptively and discussed in the case study results in Chapter 5.

**Data Analysis**

Analysis of single case research design is often faulted for being less rigorous and statistically powerful than larger experimental study designs (Yin, 2009). Further, because single case studies often employ small numbers, their results may not be
generalisable to the wider population (Newell & Burnard, 2011; Yin, 2009). Whilst single case experimental designs may employ various forms of visual analysis to detect trend, level and variability, single case study designs often rely on the use of descriptive statistics and detailed observations to document change (Newell & Burnard, 2011), as there is generally a lack of statistical tests available to infer significance of any outcomes reported. Statistical significance of documented results is a major consideration for any researcher, but when using single case study methodology and documenting change in an individual, clinical significance must also be considered. Clinical significance takes into account whether change seen in an individual is both statistically and reliably improved due to the experimental condition (e.g., the implementation of intervention). Following this, clinical significance also assesses whether or not the client exhibiting such changes can be seen as empirically comparable to typically functioning peers following this experimental treatment (Kendall, Marrs-Garcia, Nath, & Sheldrick, 1999). Clinical significance also takes into account whether the experimental condition has had an everyday effect on the individual as recognised and valued by self and others in the personal environment (Bothe & Richardson, 2011; Finn, 2003).

**Statistical analysis of single case studies using the reliable change index.** The Reliable Change (RC) index method, dealing with statistical and clinical significance in an individual, was proposed by Jacobson and Truax (1991), and can be used to measure primary outcomes in single case study research designs (Phase I clinical trials). This measure assumes a normal distribution and known population parameters, and is similar to a Z test. The application of the RC index occurs in a number of steps. The first step involves a comparison of the individual’s pre and post test scores ($x$) for statistical significance, using the formula:
Jacobson and Truax (1991) provided a method for determining the standard error of difference between the pre and post test scores, which relies on knowledge of test-retest measure reliability as well as standard deviation of test scores. Once calculated, if the observable difference in the RC index is equal to or greater than ±1.96, then the change in the individual is said to be significant at the level of .05.

The next step in Jacobson and Truax’s (1991) RC index method is determining the direction of such change in the individual (i.e., whether the condition worsened or improved). This is usually depicted visually, and an example is shown in Figure 4.6, where pre- and post-test pain scores are plotted. In this figure, the central unbroken line represents no change for the individual, and the broken lines either side of this represent the RC index scores of ±1.96. Data lying outside these dotted lines are those that have changed in a statistically reliable and significant manner.

![Figure 4.6](image_url)
The final step in the original RC method (Jacobson and Truax, 1991) addresses the issue of clinical significance, that is, whether the client has moved into the range considered normal compared to typically functioning peers. To assess this, a cut-off point must be calculated, and while Jacobson and Truax give several methods to obtain this calculation, it should be noted that knowledge of normal distributions that consider the typical and atypical population in question is essential for this step. The cut-off point is visualised using scatterplots as illustrated by Jacobson and Truax (1991, p. 19) where movement into the normal range and above the cut-off line is said to indicate recovery. This graph could also determine if a participant had regressed and moved into the atypical population.

As a form of analysis, the RC index is suited to smaller sample sizes such as those used in single case studies and Phase I clinical trials, but it could also be applied to studies involving larger numbers. Although the primary aim of using the RC index is to closely observe change within an individual (Zahra & Hedge, 2010), it is not without limitations (Speer, 2002). One such limitation that is specific to populations often studied in the discipline of speech-language-pathology is that it relies heavily on the knowledge of typical and atypical distribution scores in the populations in question (Bothe & Richardson, 2011; Lambert, Hansen, & Bauer, 2008; Zahra & Hedge, 2010), and as such utilises continuous data. Distribution scores for heterogeneous populations in speech-language pathology are often not readily available or located, and units of measurement are not always continuous. For example, as was the case for the primary outcome measures used in this study, production of either correct or incorrect consonants (PCC) and production of a syllable that is either stuttered or not stuttered upon (%SS) were considered categorical data with binary outcomes. In instances where the population distributions are either not normal or their shape is unknown, or where
the data are not continuous in nature, the RC index in its original form cannot readily be applied. Therefore, a modification to the reliable change index was required in order to analyse the primary outcome data used in this study for statistical significance. This new method of analysis is called reliable change using 95% credible intervals.

**Reliable change using 95% credible intervals.** The method of analysis used in this study to analyse the primary outcome measures of %SS and PCC was based on a modification to the original RC index (Jacobson & Truax, 1991) and uses 95% credible intervals (CI) to compare the differences between two proportions. Taking into account the categorical nature of the data, the binomial distribution was applied as the appropriate statistical model. The binomial distribution is discrete rather than continuous and is applied when (a) the number of trials \( n \) in an outcome is fixed; (b) those trials are independent of each other; (c) there are two possible outcomes obtainable in each trial; and (d) the probability of success in \( n \) trials is \( p \) (Agresti, 2002). The difference between two proportions is controlled by the sample size \( n \), and the proportion \( p \). For this study, \( n \) represented the number of total number of syllables in a sample or the total number of consonants in a sample, \( x \) represented the number of stutters or consonants correctly uttered, and \( p \) represented the proportion of those syllables that were stuttered upon (%SS) or consonants that were produced correctly (PCC), that is, \( p=x/n \). Using this revised method, the difference between proportions for the pre- and post-test scores for %SS and PCC could be obtained, and a Bayesian approach for determining the credible interval (CI) for these differences was used (Agresti & Min, 2005). This statistical model assumes that there is a true value for the difference in proportions but where that value lies is uncertain, due to the variability found in the data. Credible intervals, also known as Bayesian confidence intervals.
(Agresti & Min, 2005) provide a range in which that true but unknown value is expected to lie (Haskins, Osmotherly, Tuyl, & Rivett, 2014).

Where normally distributed data have a single and constant variability parameter, the variability under a binomial distribution changes as a function of the proportion, so when comparing two proportions the variability terms for each proportion would be different. A way around this would be to approximate the binomial distribution using the normal distribution; however, this is unsuccessful when the number of outcomes is low. For this study, an appropriate alternative was to use the Bayesian approach, as it was applicable without any modification across all values that \( n \) and \( p \) might take including cases where \( x \) and therefore \( p = 0 \) (as would be the case when stuttering decreases and the number of stutters reaches near-zero levels).

Therefore, the main differences between the original RC method (Jacobson & Truax, 1991) and this modification was that a binomial distribution was used, and that a single set of RC limits could no longer be applied to the whole range of values under study, as previously shown in Figure 4.6. In this modification, each pair of comparisons had its own set of RC limits (CIs) attaching to it, rather than to the central line of no change.

As with the original RC index method (Jacobson & Truax, 1991), this procedure had several steps, although for the purposes of this study, testing the statistical significance of the data obtained was focused on. The step of checking for clinical significance as previously described was not determined. This was largely because determining the cut-off point to enable such calculations was not possible due to lack of normative information available. This data analysis procedure therefore focused on inferring reliable and statistically significant change in individuals, and represented a
Step one involved plotting the proportions and their uncertainty values (95% CIs) for each individual at the separate assessment occasions. This step served as a quick visual check to ascertain a difference in scores, indicated by the amount of overlap of the error bars at each assessment occasion. In general, when the proportion of overlap of the error bars is a half or less, the findings are most likely to be statistically significant at the level of $p \leq .05$ (Cumming & Finch, 2005). This modified method involves estimating the difference between two proportions and the 95% CI for that difference. An example of this is shown in Figure 4.7, detailing the difference between pre- and post-treatment %SS scores for an individual who was not related to this study. This step would be similar to using a t-test for two groups of subjects, and was used to ascertain whether the difference between an individual’s scores was statistically significant or not (i.e. a reliable change).

To determine the confidence intervals for pre- and post-intervention %SS outcome for the example seen in Figure 4.7, the Bayesian method with beta distribution allowed for 95% credible intervals for the proportions to be calculated. Percentile points of 2.5 and 97.5 of the beta posterior distribution were used to determine the error bar (tail) limits, with the posterior being based on a binomial likelihood and conjugate beta prior with both parameters being equal to value 1 to give uniform prior distribution (Gelman, Carlin, Stern, & Rubin, 2004). In samples where the number of events ($x$) observed was zero or equal to the number of trials ($n$), the interval was calculated as one-sided, as per procedures detailed in the literature (Carlin & Louis, 1996, p. 119). As

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4 A tutorial detailing the use of this statistical analysis method has been submitted for publication with the Journal of Speech, Language and Hearing Research in December, 2014.
can be seen in Figure 4.7, the visible differences between scores appears at a glance to be a reliable change, as the error bars do not overlap from the pre- to post-assessment occasions (Cumming & Finch, 2005). This step contains the significance test used by the RC index but does not provide an informative graphical display to make it visually easy to assess the significance of the change for a number of clients. The next step in the modification to this method details how this was done for this study.

**Figure 4.7.** Example of step 1 in modified RC method, determining the difference in proportions – pre and post scores – for one individual using Bayesian method with beta distribution.

Step two involved testing the difference between two proportions (all participant data) for statistical significance using 95% CIs. To do this, a statistical code was applied that can be run using a freeware analysis package called ‘R’ (R Core Team, 2013). This software was downloaded from [http://www.r-project.org](http://www.r-project.org). The code used for this analysis was one which considers the difference between two proportions using a Bayesian approach, and was downloaded from [http://web.stat.ufl.edu/~aa/cda/R/bayes/](http://web.stat.ufl.edu/~aa/cda/R/bayes/). This code was directly copied and pasted into the R software and the key line to carry out analysis was `diffCI(x1,n1,x0,n0,1,1,1,1,.95)`. Post scores of the participants in this
study were inserted into the positions \((x_1, n_1)\) and pre scores inserted into the position \((x_0, n_0)\), where the difference was calculated as post-pre. In this string of code, the two pairs of 1s define the prior distributions for each proportion as the uniform distribution and the .95 is for the 95% probability level for the credible interval. If the data were such that improvement was denoted by a reduction in numbers (as seen in %SS), calculations were carried out so that the difference was negative. This code was replicated for each participant in the study, and for each primary outcome measure (%SS, PCC). Similarly, data were input to reflect comparison of proportions between various assessment occasions (i.e., pre to stage 2 of LP, pre- to 9-months post, pre- to 12-months post). Once the data were entered, the code was run to view the output results. Figure 4.8 details what the output results looked like after the code was run, using data unrelated to this study as an example. In this figure, the output proportion values highlighted in bold are given in the following order: pre-test proportion (pre), post-test proportion (post), difference calculated as (pre - post) test proportions (diff), lower credible limit (lcl), and upper credible limit (ucl). For a quick visual check, if the lcl and ucl do not contain zero, the difference between pre and post proportions is statistically significant at the .05 level, which is not the case in the example data shown in Figure 4.8.

```r
> # Subject 1
> x0=15; n0=400 # Pre scores (number of stuttered syllables, number of syllables)
> x1=10; n1=415 # Post scores (number of stuttered syllables, number of syllables)
> p0=x0/n0; p1=x1/n1 # Calculate the proportions at pre and post
> diff=p1-p0 # Difference in proportions as (post-pre)
> ci1=diffCI(x1,n1,x0,n0,1,1,1,1,.95) # 95% credible interval for the difference
```

*Figure 4.8.* Example of results output in R software for one set of data (unrelated to this study) for determining statistical significance between pre- and post-test scores.
The final step in the modification to the RC method involved plotting the credible intervals for each data point to visually assess statistical significance. Microsoft Excel was used to generate relevant scatterplots where the pre- and post-test proportions for individuals were plotted against each other, with a reference line indicating no change in scores from pre- to post-test. The upper and lower limits of the CIs were used to create error bars indicating the level of uncertainty in the difference between the two proportions. If the 95% CI bars did not cross the line of no change from pre to post, the change indicated by the data point in either direction was found to be statistically significant for that individual (i.e., a reliable change). An example of how this was graphed is given in Figure 4.9, using fictitious data unrelated to this study.

![Example Reliable Change Plot](image)

**Figure 4.9.** Example of RC scatterplot using 95% credible intervals with dummy data to show statistically significant and reliable change in the differences in proportions (pre- to post-treatment scores) for two subjects.

Data analysis for this study also employed the use of descriptive statistics and detailed observations to report on other changes for each individual.
**Overdispersion.** The reliable change index using 95% credible intervals, does not take into account whether or not the given data are overdispersed. Overdispersion occurs when there may be more variability in a given set of data than would be expected from the statistical model being used (Barron, 1992). When using the binomial distribution, a certain degree of variation is expected and is referred to as sampling variability, but additional variability can occur when the underlying population probability (proportion), instead of being a constant, changes for different trials. Several factors can cause data to be overdispersed, and these may be related to a missing variable(s) in the statistical model and/or the nature of the process generating the data (Hardin & Hilbe, 2007). When considering some of the data used in this thesis, specifically %SS, additional variability over and above the binomial distribution could be expected. Primarily, this source of variability may relate to the subjects themselves and the factors that influenced their stuttering levels. Stuttering is known to be a highly variable condition, particularly at pre-treatment and during the early stages of treatment. For any child, variation can be seen in the short term on any given day. For example, a child may begin the day with lower levels of stuttering severity when waking in the morning, and then might become unwell as the course of the day progresses. This in turn may affect the stuttering severity levels. Such variation can also exist within an individual over the long term, as stuttering is similarly known to be highly cyclic and can change from week to week or month to month. Such fluctuations can lead to variation that is over and above what is expected in the binomial model, thereby creating overdispersion. A further source of variation that must be considered can come from the professionals who are rating the data. This may occur internally or externally. If the ratings of one person are considered, this too may be subject to variables such as fatigue. Similarly, additional variation may occur when the data from more than one
rater is used for assessment. In this way, therefore, the statistical model may fail to take into account imperative explanatory predictors (i.e., variation of stuttering within each individual and the reasons these come about) (Hardin & Hilbe, 2007). This is an issue that needs to be addressed because if overdispersion is present in a given data set and ignored, then the statistical significance of any observed differences over time may be overstated. Although several alternative models to assess overdispersion exist (Hardin & Hilbe, 2007), this research involved checking the data utilising a quasi-binomial approach (Zuur, Ieno, Walker, Saveliev, & Smith, 2009). Under this model the scale estimate (SE) is determined by the ratio of the Pearson $\chi^2/df$. Under the binomial distribution, the SE is always defined to 1. Under the quasi binomial approach, the SE is inflated to account for the additional variability over that due to the binomial. The increase of the SE above 1 is an estimate of the degree of overdispersion and reduces the significance of effects relative to those that would be obtained without applying the SE. Zuur et al. (2009) concluded that in general, a SE greater than 1.5 (i.e., some overdispersion is present) may require some action to correct for this. Larger SEs (greater than 15) may warrant the utilisation of alternative models of analysis, for example, the use of the negative binomial distribution.

Summary

This chapter has detailed the methodology for a Phase I clinical trial investigating the safety and efficacy of a direct, concurrent treatment for children with co-occurring stuttering and SSD. The treatment protocol developed for use in this Phase I clinical trial has been thoroughly documented in this Chapter in accordance with one of the aims of this thesis. The treatment goals for the stuttering and SSD were discrete across each session, and also at home during home treatment and homework tasks.
This clinical trial provides evidence for the treatment of this caseload, the type of which has not been seen in the research literature for over 20 years. In line with current best-practice treatment approaches for both disorders in isolation, qualitative evidence from expert clinicians, and published guidelines, this study was carefully designed to ensure that the highest ethical standards were met in the delivery of treatment to each participant involved.

Chapter 5 provides detailed description of treatment with supporting data for each of the cases and presents the results of primary outcome measures, including measurement of statistical significance, using a new method of analysis of single case study research designs, the reliable change index using 95% credible intervals.
CHAPTER 5
Concurrent Treatment for Stuttering and Speech Sound Disorder:
Case Reports and Results of a Phase I Clinical Trial
Introduction

This chapter details the results of five preschool aged children that participated in direct, concurrent treatment for stuttering and SSD. Research design for this study met the criteria for a Phase I clinical trial as defined by Onslow et al., (2008). Under the NHMRC (2009) framework, this study was also classified as a level IV, descriptive longitudinal case study design. In the previous chapter, a new method for analysing the data derived from descriptive single case studies was described. This method is suitable for categorical data with binary outcomes. The primary outcome measures used for the single cases in this thesis, percentage of syllables stuttered (%SS) and percentage of consonants correct (PCC), are both examples of categorical data with binary outcomes. This chapter therefore provides the results of the data analysis from each of the five single cases who had comorbid stuttering and SSD.

For each case, background information is provided, outlining relevant demographic details. Information is then provided on each participant’s stuttering and speech sound inventory profile. Specific detail relating to each participant’s treatment goals, treatment approach(es) used, and therapeutic management is given before discussion of the results of the treatment data, primary outcome measures and perceptual measures. The reliable change index with 95% credible intervals was employed to analyse the primary outcome measures for statistically significant and reliable change of each individual’s primary stuttering and SSD data.

In the following section, each case is presented individually in sequence, followed by a summary of the results of the group overall, using reliable change index with 95% credible intervals data, and descriptive statistics. The chapter concludes with consideration of overdispersion for the cases in this study.
Case Study 1: BRAD

**Background information.** Brad was recruited into the research program at 4;1 years. Brad’s mother, Mrs X, stated that Brad spoke English only, lived with his parents and younger sibling, and that both parents were engaged in full-time work and/or study. The pregnancy and birth were reportedly unremarkable, and Brad’s motor and communication milestones were reported to be within the typical ranges. Brad had a history of otitis media with effusion managed by his general practitioner and no grommets had ever been in situ. Brad had received successful treatment for enlarged adenoids with no further intervention required. Mrs X reported Brad’s hearing test at birth was WNL, as was a hearing screener conducted by the pre-school one month prior to his entry into the study. Brad attended preschool 3 days per week, and was commencing kindergarten (i.e., his first year of formal schooling) the following year. Brad’s language ability was screened as described in Chapter 4. Brad achieved pass criterion for this screening with no further assessment required in this area.

Stuttering commenced at age 3 years. Mrs X reported an increase in frequency of stuttering behaviours since that time. Brad’s stuttering was reportedly exacerbated when he was excited, tired, talking at a faster pace, or when speaking with unfamiliar communication partners. There was no reported family history of stuttering. Prior to entering into the study, Brad had received no previous intervention from a SLP, however was currently on the waiting list for services within his local public health sector.

Mrs X responded to moments of stuttering by indicating that she could not understand Brad and requesting him to decrease his speech rate. A survey completed by Mrs X indicated her concerns prior to commencing the research protocol were that Brad
was unintelligible to unfamiliar listeners and that his overall communication opportunities were therefore restricted, particularly in the preschool context. She also reported that Brad became frustrated when people could not understand him, often leading to Brad “lashing-out” and withdrawing from social situations with peers. Brad’s father, Mr X, also completed a survey and reported he was frustrated that he could not understand Brad. Mr X noticed that Brad had difficulty with both stuttering and sound articulation. Both Mr and Mrs X reported that close family friends and family members also had difficulty understanding Brad.

In the preschool environment, Brad’s teacher commented that while he was always very eager to communicate, most people found him difficult to understand and that his peers would comment on this.

Pre-treatment profile of stuttering. Within and beyond clinic measures indicated that stuttering was mild (see Table 5.1). Brad’s moments of stuttering were characterised primarily by repetitions involving partial, whole and multisyllables. Occasional fixed postures with audible airflow were observed.

| Brad’s pre-treatment %SS within the clinic and the average of the beyond-clinic data |
|---------------------------------|---|---|
| Pre-treatment                   | WC | BC |
| Research clinician %SS          | 2.2% | 2.5% |
| Severity rating(s)              | 3   | 2, 3 |
| Blind rater %SS                 | 2.4% | 2.3% |
| Severity rating(s)              | 2   | 2, 3 |

Pre-treatment speech sound profile. Based on the samples gathered in both single-word naming test and conversational (connected speech) contexts, the severity of
Brad’s SSD was rated as mild-moderate (see Table 5.2) (Shriberg & Austin, 1997). Independent analysis revealed no issues related to word shape or stress patterns. Brad’s vowel inventory was age appropriate. Consonant inventory demonstrated /s, f, tʃ, dʒ/ were absent. Upon direct imitation, both the fricatives were stimulable whereas the affricates were not. Relational analysis demonstrated the presence of 13 speech sound errors, seven of which were considered delayed for Brad’s age (see Table 5.3). Two atypical errors were also noted.

Table 5.2  
**Brad’s PCC at pre-treatment, single-word and connected speech levels**

<table>
<thead>
<tr>
<th></th>
<th>Single-word naming test</th>
<th>Severity</th>
<th>Connected speech</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-treatment</td>
<td>75.5</td>
<td>Mild-mod</td>
<td>84.8</td>
<td>Mild-mod</td>
</tr>
</tbody>
</table>

Table 5.3  
**Phonological processes and/or speech errors used by Brad in single-word and connected speech at pre-treatment**

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velar assimilation</td>
<td>/dʒɪŋk/ &gt; /gwɪŋk/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Cluster reduction</td>
<td>/skweɪʃ/ &gt; /skweɪʃ/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Gliding</td>
<td>/ɪɛd/ &gt; /wed/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/ and/or /ð/</td>
<td>/θam/ &gt; /θam/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Backing</td>
<td>/θæm/ &gt; /kern/</td>
<td>Atypical</td>
</tr>
<tr>
<td>Final consonant deletion</td>
<td>/sθstɜʒ/ &gt; /nstɪʃ/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Velar fronting</td>
<td>/kʌt/ &gt; /tʌt/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Later stopping</td>
<td>/glævz/ &gt; /glæbz/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Glottal substitution</td>
<td>/sθstɜʒ/ &gt; /nstɪʃ/</td>
<td>Atypical</td>
</tr>
<tr>
<td>Weak syllable deletion</td>
<td>/tæmatɔu/ &gt; /matɔu/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Gliding of fricatives</td>
<td>/fɑrv/ &gt; /larv/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Early stopping</td>
<td>/sʌm/ &gt; /dʌm/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Interdental realisation of /s/ and /z/</td>
<td>/sʊɔ/ &gt; /bʊɔ/</td>
<td>Age appropriate</td>
</tr>
</tbody>
</table>
Overview of treatment. Brad commenced treatment at 4;3 years. Mrs X attended all clinic appointments and was the only caregiver providing treatment in the home environment. Stage 1 of the LP was commenced at the initial appointment, and after two clinic visits, direct treatment for the SSD also commenced concurrently (yet discretely) in the sessions. In the early stages of Brad’s treatment, Stimulability Intervention (Miccio & Williams, 2010) was applied as an adjunct to direct treatment targeting other goals, in order to facilitate unstimulable sounds.

A horizontal goal attack strategy for speech targets was utilised. Brad’s goals were determined based primarily on a developmental approach to target selection, parental concern, functionality and percentage of process usage. The following goals were targeted:

- Stopping /s, v/ – minimal pairs therapy
- /ʃ/ production – traditional articulation therapy
- Backing/fronting /k, g/ – minimal pairs therapy
- Cluster reduction – minimal pairs therapy
- /ʃ, ʒ/ production – traditional articulation therapy
- Gliding /ɹ/ – traditional articulation therapy/minimal pairs therapy

Upon completion of Stage 1 of the LP, weekly treatment for the SSD continued on a weekly basis and stuttering treatment continued at the increments stated in the LP treatment guide (Packman et al., 2011). At the 9-month assessment occasion, Brad was transferred to the University of Newcastle’s stuttering clinic for continued management during Stage 2 of the LP. This was subsequently completed without relapse and Brad has since been discharged from this service.
At the 9-month assessment occasion, Brad continued treatment for SSD with a private clinician. At the 12-month assessment occasion, Brad’s private clinician provided a brief written progress report as follows: /dʒ/ production was reported 100% accurate in conversation; production of /ʌ/ was reported as 70% accurate at sentence level. Treatment was continuing on later stopping (i.e., of /ð/), which was reportedly accurate to 80% at a sentence level. All other speech sounds/patterns were reported WNL.

**Results: Stuttering.** The following is a summary of Brad’s treatment and primary outcome data for stuttering.

**Treatment data.** Brad’s SRs were recorded daily by Mrs X in Stage 1 of the LP (see Appendix J). To illustrate these daily beyond-clinic SRs, a weekly average was calculated and is presented in Figure 5.1. These ratings also include weeks in which the participant did not attend the clinic for various personal reasons (e.g. illness, holidays). On these occasions, the parent was advised to continue taking daily SRs and email them to the researcher.

![Figure 5.1. The average of Brad’s beyond-clinic daily SRs in Stage 1 LP.](image-url)
Brad completed Stage 1 of the LP in 14 clinic visits (17 weeks) and at the final assessment, very low levels of stuttering was observed consisting of partial syllable repetitions. See Table 5.4.

**Primary outcome data.** Within-clinic and beyond-clinic %SS data are presented for both raters in Table 5.4. An average of the %SS from the two beyond-clinic samples is presented, but the SR scores for each of these two samples are given individually.

Table 5.4
*Brad’s %SS within the clinic and the average of the beyond-clinic data (all assessment occasions)*

<table>
<thead>
<tr>
<th></th>
<th>Assessment occasion one (Pre)</th>
<th>Assessment occasion two (Stage 2)</th>
<th>Assessment occasion three (9 months)</th>
<th>Assessment occasion four (12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WC</td>
<td>BC</td>
<td>WC</td>
<td>BC</td>
</tr>
<tr>
<td>Research clinician</td>
<td>2.2%</td>
<td>2.5%</td>
<td>0.9%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>3</td>
<td>2, 3</td>
<td>2</td>
<td>2, 2</td>
</tr>
<tr>
<td>Blind rater</td>
<td>2.4%</td>
<td>2.3%</td>
<td>1.9%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>2</td>
<td>2, 3</td>
<td>2</td>
<td>1, 2</td>
</tr>
</tbody>
</table>

Across both raters, Brad’s stuttering levels within and beyond the clinic were similar, and below 1%SS.

Credible intervals for these data across assessment occasions were determined using the Bayesian method with beta distribution (which allows calculations of 95% credible intervals for the proportions). Figures 5.2 and 5.3 display these calculations based on within- and beyond-clinic samples for the researcher. Figures 5.4 and 5.5 display the same results calculated from the blind rater’s data.
Figure 5.2. Bayesian method with beta distribution to determine credible intervals for Brad’s within-clinic %SS data for all assessment occasions (researcher).

Figure 5.3. Bayesian method with beta distribution to determine credible intervals for Brad’s average of beyond-clinic %SS data for all assessment occasions (researcher).
Figure 5.4. Bayesian method with beta distribution to determine credible intervals for Brad’s within-clinic %SS data for all assessment occasions (blind rater).

Figure 5.5. Bayesian method with beta distribution to determine credible intervals for Brad’s average of beyond-clinic %SS data for all assessment occasions (blind rater).

To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. As described in Chapter 4, this step involved testing the difference between two proportions, in this case between pre-treatment %SS data (assessment occasion one) and 12 months post-commencement of treatment data (assessment occasion four).
Figure 5.6 displays a scatterplot of the results of both raters’ within-clinic data. Analysis of both sets of data revealed that from assessment occasion one to four, there was a reliable change in stuttering levels as the error bars did not touch the line of equivalence. This change in %SS represented a statistically significant improvement, $p < .05$.

![Figure 5.6: Scatterplot of %SS within clinic for Brad (both raters)](image)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brad RC</td>
<td>2.24</td>
<td>0.42</td>
<td>-1.82</td>
<td>-3.68</td>
<td>-0.32</td>
<td>1.86</td>
<td>1.50</td>
</tr>
<tr>
<td>Brad BR</td>
<td>2.36</td>
<td>0.47</td>
<td>-1.88</td>
<td>-3.47</td>
<td>-0.66</td>
<td>1.58</td>
<td>1.22</td>
</tr>
</tbody>
</table>

*diff = Difference between pre and post figures  
*lcl = Lower Confidence Limit  
*ucl = Upper Confidence Limit

**Figure 5.6.** Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS within clinic for Brad (both raters).

Brad’s beyond-clinic data was analysed and graphed in the same manner as described above (see Figure 5.7). Analysis of both sets of data revealed that from assessment occasion one to four, Brad’s change in %SS was a statistically significant improvement, that is, a reliable change in stuttering levels for this individual, $p < .05$. 

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Figure 5.7. Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS beyond clinic for Brad (both raters).

**Results: Speech sound disorder.** The following is a summary of Brad’s treatment and primary outcome data for speech sound disorder.

*Treatment data.* From pre-treatment to 9-months post-commencement of treatment, Brad underwent treatment by the researcher for his SSD, over 25 clinic visits. At age 5;1 years, Brad’s sound error-pattern usage from assessment occasion one to four decreased from 13 to three (see Table 5.5). Two of the three remaining errors were considered delayed for Brad’s age and none were atypical. Brad’s consonant inventory was now complete.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brad RC</td>
<td>2.46</td>
<td>0.50</td>
<td>-1.95</td>
<td>-3.48</td>
<td>-0.78</td>
<td>1.52</td>
<td>1.18</td>
</tr>
<tr>
<td>Brad BR</td>
<td>2.30</td>
<td>0.51</td>
<td>-1.79</td>
<td>-3.08</td>
<td>-0.84</td>
<td>1.29</td>
<td>0.95</td>
</tr>
</tbody>
</table>
Table 5.5
*Phonological processes and/or speech errors used by Brad in single word and connected speech at 12 months post commencement of treatment*

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster reduction</td>
<td>/skwɛə/ &gt; /skɛə/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/ and/or /ð/</td>
<td>/θʌm/ &gt; /fʌm/</td>
<td>Age-appropriate</td>
</tr>
<tr>
<td>Gliding</td>
<td>/zɛbʌə/ &gt; /zɛbʌwʌ/</td>
<td>Delayed</td>
</tr>
</tbody>
</table>

**Primary outcome data.** The primary outcome measure for SSD was percent consonants correct (PCC) and a summary of the results of this measure at all four assessment occasions are presented in Table 5.6. Severity of involvement changed from mild-moderate at pre-treatment, to mild at 9 months after commencement of treatment. From assessment occasions three to four, PCC decreased marginally. From assessment occasions three to four, Brad’s severity of involvement remained within the mild range.

Table 5.6
*Brad’s PCC at all assessment occasions, single-word and connected speech levels*

<table>
<thead>
<tr>
<th>Percentage consonants correct (PCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-word naming test</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>1. Pre</td>
</tr>
<tr>
<td>2. Stage 2</td>
</tr>
<tr>
<td>3. 9 months</td>
</tr>
<tr>
<td>4. 12 months</td>
</tr>
</tbody>
</table>
To determine the credible intervals at all assessment occasions for PCC, the Bayesian method with beta distribution was applied, with the results displayed below. Figures 5.8 and 5.9 display these calculations based on a single-word naming test and connected speech data respectively.

**Figure 5.8.** Bayesian method with beta distribution to determine credible intervals for Brad’s PCC at single-word level.

**Figure 5.9.** Bayesian method with beta distribution to determine credible intervals for Brad’s PCC at connected speech level.
To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was used to determine the statistical difference. The difference between Brad’s PCC data at assessment occasions one and four was analysed for reliable and significant change. Figure 5.10 displays the results of this analysis with both single-word and connected-speech data on the same scatterplot. This analysis revealed that from pre-treatment to 12 months post commencement of treatment, Brad’s PCC improved, and this improvement was found to be statistically significant (i.e., a reliable change), \( p < .05 \). For Brad, this reliable change occurred at both the single-word naming test and connected-speech levels.

**Figure 5.10.** Modified RC method to determine statistical significance (reliable change) in SSD outcome measure of PCC in both single-word and connected-speech contexts for Brad.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>Icl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brad SW</td>
<td>75.54</td>
<td>93.62</td>
<td>18.08</td>
<td>9.69</td>
<td>26.18</td>
<td>8.38</td>
<td>8.11</td>
</tr>
<tr>
<td>Brad CS</td>
<td>84.80</td>
<td>96.65</td>
<td>11.85</td>
<td>5.85</td>
<td>18.02</td>
<td>6.00</td>
<td>6.17</td>
</tr>
</tbody>
</table>
Survey data. At assessment occasion three (9-months post-commencement of treatment), an informal survey was administered to Mrs X. This survey sought information about her feelings and attitudes towards Brad’s communication post-treatment, as well as the treatment process in general. This was considered an important aspect to explore, particularly as parents were required to conduct daily home practice for both stuttering and SSD. Descriptive responses as well as those on a 5-point Likert scale were given (see Appendix O). Mrs X reported that it was helpful to have the SSD and stuttering homework separated during the day. Mrs X felt that without this separation of targets/homework, Brad might have become confused. Mrs X reported feeling an initial lack of self-confidence when delivering treatment at home. This was in specific reference to the LP. Initially Mrs X felt that she might have been “doing the wrong thing”, but reported that her confidence in this aspect grew over time.

In his informal survey, Mr X reported that at 9-months post-treatment, Brad’s stuttering was almost non-existent and his articulation improved. Mr X also reported that Brad was more intelligible overall, and that other people had commented on the same. Mr X had also noted other changes in Brad, including increased confidence levels and that Brad was now willingly communicating across many environments.

In an informal questionnaire, Brad’s teacher commented that 9-months post-treatment, Brad was now observed to share his needs, wants, thoughts and feelings more clearly in the preschool environment. Brad’s teacher also commented that as a result of this increased communication, she had noticed Brad able to develop closer relationships with his peers as they were better able to understand him.

Summary of case 1: Brad. Analysis of Brad’s results revealed that both within and beyond the clinic, his stuttering had improved from pre- to post-treatment. These
findings were statistically significant and were indicative of a reliable change in this area for Brad. After successful completion of Stage 1 of the LP, Brad completed Stage 2 without relapse and was then discharged.

Analysis of the primary outcome measure for speech sounds, PCC, revealed a reliable change at both the single-word and connected-speech levels that was a statistically significant improvement from pre- to post-treatment. At the start of treatment, Brad had an incomplete consonant inventory, but by the end of the research protocol his inventory was complete. Brad’s sound error/pattern usage (which was mostly phonological in nature) decreased from 13 to three. Two of the remaining errors were considered delayed for Brad’s age. Although Brad was still exhibiting gliding, he was doing so infrequently, indicating that this process was in decline. Brad was continuing treatment with a private clinician for all residual speech errors.

Case Study 2: DANIEL

**Background information.** Daniel was recruited into the research program at 3;6 years. Daniel’s mother, Mrs Y, stated that Daniel spoke English only, lived with his parents and two older siblings, and that both parents were engaged in full-time work. Mrs Y reported that her job demanded long hours and frequent travel. Although Daniel’s birth was reportedly unremarkable, the pregnancy was complicated with Mrs Y acquiring gestational diabetes. Daniel spent some time after birth in the neonatal intensive care unit being monitored for blood-sugar levels and temperature control. His motor and communication milestones were reported to be within the typical ranges. Daniel had no other medical history or comorbid medical conditions. His hearing was tested at birth and again immediately prior to commencing the research protocol and
found to be WNL. Daniel attended preschool 5 days per week and was commencing kindergarten at the start of 2015. Daniel’s language ability was screened as described in Chapter 4. Daniel achieved pass criterion for this screening with no further assessment required in this area.

Stuttering commenced at 2;6 years. When the stuttering commenced, it was reportedly infrequent and characterised by sound repetitions. Since then, Mrs Y reported the stuttering frequency had increased with repetitions now occurring across sounds, words and phrases. Mrs Y also reported that other family members and friends had noticed Daniel stuttering. There was no previous history of stuttering in Daniel’s family, but a family history of SSD was reported. Daniel had been assessed by a private clinician prior to entering into the research protocol and was given a diagnosis of co-occurring stuttering and SSD. Although treatment was recommended, no intervention had been received prior to entering into this study. Daniel’s stuttering was reportedly exacerbated when he was tired and also when he became frustrated “getting stuck on his words”. Mrs Y reported that Daniel’s communication was affecting his confidence and that Daniel would withdraw from speaking situations.

Mrs Y responded to moments of stuttering by encouraging Daniel to stop what he was saying and to try again. Mrs Y also noted that other familiar listening partners such as family members or close friends would try to guess what Daniel was saying, or to talk for him. A survey completed by Mrs Y indicated her concerns prior to commencing the research protocol were Daniel’s lack of confidence in social and other communicative situations. Mrs Y reported that along with the increase in stuttering, she was also concerned about his articulation which sounded immature to her. Mrs Y was also concerned with the fact that Daniel was unintelligible to her and others. Daniel’s
grandmother also completed a survey and reported Daniel’s communication as “disjointed and difficult to understand”.

In the preschool environment, Daniel’s teacher commented that prior to commencing treatment, Daniel was stuttering constantly throughout the day and that his articulation was unclear. His teacher also noted that Daniel’s peers would not respond to his communication difficulties and that he had a tendency to be dominant in conversations and talk over the top of others.

**Pre-treatment profile of stuttering.** Within and beyond clinic measures indicated that stuttering was mild-moderate (see Table 5.7). Daniel’s moments of stuttering were characterised primarily by repetitions of partial, whole and multisyllables. Fixed postures both with and without audible airflow were also observed.

**Table 5.7**

*Daniel’s pre-treatment %SS within the clinic and the average of the beyond-clinic data*

<table>
<thead>
<tr>
<th>Pre-treatment</th>
<th>WC</th>
<th>BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research clinician %SS</td>
<td>3.9%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>3</td>
<td>6, 3</td>
</tr>
<tr>
<td>Blind rater %SS</td>
<td>2.1%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>3</td>
<td>5, 3</td>
</tr>
</tbody>
</table>

**Pre-treatment speech sound profile.** Based on the samples gathered in both single-word naming test and conversational (connected speech) contexts, the severity of Daniel’s SSD pre-treatment was rated as mild-moderate (see Table 5.8) (Shriberg & Austin, 1997). Independent analysis indicated no issues with word shape or stress patterns. Daniel’s vowel inventory was age appropriate. Consonant inventory
demonstrated /θ, l, θ/ were absent. Relational analysis demonstrated the presence of nine speech sound errors, three of which were considered delayed for Daniel’s age (see Table 5.9).

Table 5.8
Daniel’s PCC at pre-treatment, single-word and connected speech levels

<table>
<thead>
<tr>
<th>Percentage consonants correct (PCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-word naming test</td>
</tr>
<tr>
<td>Pre-treatment</td>
</tr>
</tbody>
</table>

Table 5.9
Phonological processes and/or speech errors used by Daniel in single-word and connected speech pre-treatment

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster reduction</td>
<td>/giou/ &gt; /gou/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Gliding</td>
<td>/iædi/ &gt; /weði/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/ and/or /ð/</td>
<td>/θŋ/ &gt; /ŋŋ/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Final consonant deletion</td>
<td>/baʊt/ /baʊ/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Early stopping</td>
<td>/soʊ/ &gt; /too/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Later stopping</td>
<td>/væŋ/ &gt; /bæŋ/</td>
<td>Age appropriate/borderline</td>
</tr>
<tr>
<td></td>
<td>/ðŋ/ &gt; /ðŋŋ/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Weak syllable deletion</td>
<td>/eʃfænt/ &gt; /ʃfænt/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Palatal fronting</td>
<td>/wɒʃ/ &gt; /wɒʃt/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Context sensitive voicing</td>
<td>/piz/ &gt; /biz/</td>
<td>Delayed</td>
</tr>
</tbody>
</table>

Overview of treatment. Treatment commenced at 3;6 years. Mrs Y attended all clinic appointments and was the only caregiver providing treatment in the home environment, which was individually tailored to suit the needs of this family. When Mrs Y was away on business, she conducted the stuttering treatment via Skype sessions. When work-related travel occurred it was always short-term in nature, involving Mrs Y
being away for one-to-two days at a time. On these occasions, Mrs Y was advised to prioritise the stuttering treatment. Stage 1 of the LP was commenced at the initial appointment and after two clinic visits, direct treatment for SSD also commenced concurrently (yet discretely) in the sessions.

A vertical goal attack strategy for speech targets was utilised at the start of the research protocol. Towards the end of the protocol as Daniel quickly progressed through his earlier targets, new goals were introduced horizontally. Daniel’s goals were decided in the manner previously described and are detailed below:

- Context sensitive voicing – minimal pairs therapy
- Stopping /s/ – minimal pairs therapy
- Final consonant deletion – minimal pairs therapy, metalinguistic techniques
- Stopping /v/ – traditional articulation therapy, minimal pairs therapy
- Weak syllable deletion – metalinguistic techniques

Upon completion of Stage 1 of the LP, weekly treatment for the SSD continued for five more clinic visits before Daniel met generalisation criteria for speech sound goals and was subsequently discharged from SSD treatment. All remaining errors at that time were considered age appropriate. During Stage 2, stuttering treatment continued at the increments stated in the LP treatment guide (Packman et al., 2011). At the 9-month assessment occasion, Daniel was transferred to the University of Newcastle’s stuttering clinic for continued management during Stage 2 of the LP, and monitoring for his speech sound production. This was subsequently completed without relapse and Daniel has since been discharged from this service. At the 12-month assessment occasion Mrs Y reported that Daniel was mostly stutter-free. Mrs Y could recall only one instance
since the 9-month assessment occasion when Daniel had stuttered on a sound when formulating a sentence. On that occasion, Mrs Y conducted a 10-minute structured LP treatment session in the home, which she reported effectively reduced the stuttering levels to zero again.

At the 12-month assessment occasion Mrs Y noted that previous therapeutic progress for speech sounds appeared to have been maintained, but she reported that he was still intermittently gliding on /l/, which was of concern to her. Mrs Y was advised that for Daniel’s age at that time (4;8 years), this process was still typical of normal speech sound development, but that should this continue to be a concern to her after Daniel reached the age of 5 years (Grunwell, 1987; McLeod & Bleile, 2003), she should seek re-assessment at that time.

**Results: stuttering.** The following is a summary of Daniel’s treatment and primary outcome data for stuttering.

**Treatment data.** Daniel’s SRs were recorded daily by Mrs Y during Stage 1 of the LP (see Appendix K). When Mrs Y was away, Daniel’s father recorded severity ratings. To illustrate these beyond-clinic daily SRs, a weekly average was calculated (see Figure 5.11). These ratings also included weeks when Daniel did not attend the clinic for personal reasons such as illness or being away on holidays which were reported via email.
Daniel completed Stage 1 of the LP in 15 clinic visits (18 weeks) and at the final assessment very low levels of stuttering were observed consisting of partial syllable repetitions and one instance of a fixed posture with audible airflow.

**Primary outcome data.** Within-clinic and beyond-clinic data are presented for the primary outcome measure for stuttering, percentage of syllables stuttered (%SS). Table 5.10 presents a summary of this primary outcome measure for each assessment occasion for both raters.

**Table 5.10**

*Daniel’s %SS within the clinic and the average of the beyond-clinic data (all assessment occasions)*

<table>
<thead>
<tr>
<th></th>
<th>Assessment occasion one (Pre)</th>
<th>Assessment occasion two (Stage 2)</th>
<th>Assessment occasion three (9 months)</th>
<th>Assessment occasion four (12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WC</td>
<td>BC</td>
<td>WC</td>
<td>BC</td>
</tr>
<tr>
<td>Research clinician</td>
<td>3.9%</td>
<td>4.3%</td>
<td>1.0%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>3</td>
<td>6, 3</td>
<td>2</td>
<td>1, 2</td>
</tr>
<tr>
<td>Blind rater</td>
<td>2.1%</td>
<td>3.2%</td>
<td>1.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>3</td>
<td>5, 3</td>
<td>2</td>
<td>1, 2</td>
</tr>
</tbody>
</table>
At the final assessment occasion across both raters, Daniel’s stuttering levels were similar, and below 1\%SS.

Credible intervals for these data across assessment occasions were determined using the Bayesian method with beta distribution (which allows calculations of 95\% credible intervals for the proportions). See Figures 5.12, 5.13, 5.14, and 5.15.

**Figure 5.12.** Bayesian method with beta distribution to determine credible intervals for Daniel’s within-clinic %SS data for all assessment occasions (researcher).

**Figure 5.13.** Bayesian method with beta distribution to determine credible intervals for Daniel’s average of beyond-clinic %SS data for all assessment occasions (researcher).
In order to analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. As previously described, the difference between two proportions (at assessment occasions one and four) was analysed (see Figure 5.16). Analysis of both sets of data revealed that
from assessment occasion one to four, there was a reliable change in stuttering levels. This change in %SS represented a statistically significant improvement, \( p < .05 \).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daniel RC</td>
<td>3.86</td>
<td>0</td>
<td>-3.86</td>
<td>-5.66</td>
<td>-2.27</td>
<td>1.80</td>
<td>1.59</td>
</tr>
<tr>
<td>Daniel BR</td>
<td>2.11</td>
<td>0.79</td>
<td>-1.31</td>
<td>-2.71</td>
<td>-0.07</td>
<td>1.40</td>
<td>1.24</td>
</tr>
</tbody>
</table>

*Figure 5.16.* Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS within clinic for Daniel (both raters).

Daniel’s beyond-clinic data was analysed and graphed in the same manner as described above (see Figure 5.17). Analysis of both sets of data revealed that from assessment occasion one to four, Daniel’s change in %SS was a statistically significant improvement, indicating a reliable change in stuttering levels, \( p < .05 \).
Results: speech sound disorder. The following is a summary of Daniel’s treatment and primary outcome data for speech sound disorder.

Treatment data. From pre-treatment to 9-months post-commencement of treatment, Daniel underwent treatment by the researcher for his SSD over 20 clinic visits. At age 4;8 years, Daniel’s sound error/pattern usage from pre- to post decreased from nine to three (see Table 5.11). None of these errors was considered delayed for Daniel’s age at that time. Daniel’s consonant inventory was now full.
Table 5.11
*Phonological processes and/or speech errors used by Daniel in single-word and connected speech at 12 months post commencement of treatment*

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gliding</td>
<td>/ædi/ &gt; /wɛdi/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td></td>
<td>/lɛgz/ &gt; /wɛgz/</td>
<td></td>
</tr>
<tr>
<td>Labiodental realisation of /θ/ and/or /ð/</td>
<td>/θɪŋ/ &gt; /fɪŋ/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Later stopping</td>
<td>/ðɛn/ &gt; /dɛn/</td>
<td>Age appropriate</td>
</tr>
</tbody>
</table>

**Primary outcome data.** The primary outcome measure for SSD was PCC, and a summary of the results of this measure at all four assessment occasions is presented in Table 5.12. Across all assessment occasions there was improvement in this outcome measure in both sampling contexts. Severity of involvement changed from mild-to-moderate at pre-treatment to mild at 12-months post-commencement of treatment in both sampling contexts.

Table 5.12
*Daniel’s PCC at all assessment occasions, single-word and connected speech levels*

<table>
<thead>
<tr>
<th>Percentage consonants correct (PCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single-word naming test</strong></td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>1. Pre</td>
</tr>
<tr>
<td>2. Stage 2</td>
</tr>
<tr>
<td>3. 9 months</td>
</tr>
<tr>
<td>4. 12 months</td>
</tr>
</tbody>
</table>
To determine the credible intervals at all assessment occasions for PCC, the Bayesian method with beta distribution was again applied, with the results visualised (see Figures 5.18 and 5.19).

**Figure 5.18.** Bayesian method with beta distribution to determine credible intervals for Daniel’s PCC at single-word level.

**Figure 5.19.** Bayesian method with beta distribution to determine credible intervals for Daniel’s PCC at connected speech level.
To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. The differences between assessment occasions one to four data were analysed for reliable and significant change (see Figure 5.20). This analysis revealed that from assessment occasion one to four, Daniel’s PCC improved, and this improvement was found to be statistically significant (i.e., a reliable change) in both sampling contexts, \( p < .05 \).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daniel SW</td>
<td>69.44</td>
<td>90.78</td>
<td>21.34</td>
<td>12.14</td>
<td>29.96</td>
<td>9.19</td>
<td>8.63</td>
</tr>
<tr>
<td>Daniel CS</td>
<td>81.55</td>
<td>96.32</td>
<td>14.77</td>
<td>8.35</td>
<td>21.36</td>
<td>6.42</td>
<td>6.59</td>
</tr>
</tbody>
</table>

*Figure 5.20.* Modified RC method to determine statistical significance (reliable change) in SSD outcome measure of PCC in both single-word and connected-speech contexts for Daniel.

**Survey data.** At assessment occasion three (9-months post-commencement of treatment), an informal survey was administered to Mrs Y, as previously described (see Appendix O for responses). Mrs Y reported that despite initially lacking confidence in
her ability to deliver treatment in the home, she found the process empowering, especially when she began to observe positive change in her child’s communication. As a full-time working parent, Mrs Y reported that she struggled at times to manage homework for both disorders. Mrs Y found it helpful that the researcher made efforts to individualise and tailor this aspect to suit the family’s busy lifestyle.

In her informal survey, Daniel’s grandmother reported that she felt Daniel’s overall communication to be much clearer post-treatment. She reported the fluency levels had decreased and that a reduction in Daniel’s levels of frustration was readily observable.

In an informal survey, Daniel’s teacher commented that post-treatment, Daniel’s communication appeared less stagnated, and that his sounds were becoming more intelligible. Daniel’s teacher could now understand sounds pronounced in all word positions. She also mentioned that Daniel spoke with a fast speech rate, and that as a result of this, at times his peers mentioned not being able to understand him. Daniel reportedly showed a small amount of frustration relating to this.

**Summary of case 2: Daniel.** Analysis of Daniel’s results revealed that both within and beyond the clinic, his stuttering had improved from pre- to post-treatment. These findings were statistically significant and were indicative of a reliable change. After successful completion of Stage 1 of the LP, Daniel went on to complete Stage 2 of the program as manualised and without relapse and was discharged for stuttering. Although it was noted on file that Daniel did not complete his last scheduled Stage 2 clinic visit as Daniel’s mother reported that finding a convenient time to schedule this was difficult, and she believed the stuttering to be well under control.
Analysis of the primary outcome measure for speech sounds, PCC, revealed a reliable change at both the single-word and connected-speech levels that was a statistically significant improvement from pre- to post-treatment. At the start of treatment, Daniel had an incomplete consonant inventory; at the end of the research protocol his inventory was complete. Daniel’s sound error/pattern usage (which was considered mostly phonological in nature) decreased from nine to three from pre- to post-treatment. None of the latter was considered delayed or atypical in nature for Daniel’s age at assessment occasion four. Daniel was discharged from SSD treatment while in Stage 2 of the current research protocol.

Case Study 3: FRANK

Background information. Frank was recruited into the research program at 4;4 years. Frank’s mother, Mrs Z, stated that Frank spoke English only, lived with his parents and an older sibling, and that both parents worked full-time as business owners. Although Frank was born via caesarean section, pregnancy history and subsequent birth were otherwise unremarkable. Frank’s motor and communication milestones were reported to be within the typical ranges. Frank had no other medical history or co-morbid medical conditions. Frank had a history of otitis media which had been successfully treated by an ENT with the insertion of grommets. The ENT had assessed Frank’s hearing six months prior to commencing the research protocol and was WNL. Frank attended preschool 2 days per week, and a nanny was employed for Frank’s care over the remainder of the working week. Frank was commencing kindergarten in the following year. Frank did not initially reach pass criterion on a language screener. A formal standardised assessment (as described in Chapter 4) was subsequently
administered. The results of the formal assessment indicated that Frank’s language abilities were WNL.

Stuttering commenced at 2;6 years. At onset, Frank’s stuttering was reportedly characterised by whole word repetitions which continued for approximately six months, following which, Frank’s stuttering remitted for one year. After that time the stuttering recommenced, Mrs Z observing the stuttering to be more frequent in nature than at onset with observable repetitions, blocks and prolongations of sounds. Frank’s stuttering was reportedly exacerbated when fatigued or feeling “angry”. Frank’s father had stuttered as a child, and had recovered without any intervention. Frank’s older sibling was undergoing treatment for SSD by a private clinician. This private clinician initially screened Frank’s communicative abilities, and found that he was stuttering and had a co-occurring SSD. A referral was consequently made to the University of Newcastle’s stuttering clinic for further evaluation, with no prior intervention received before entering into the research program.

Mrs Z responded to moments of stuttering by encouraging Frank to stop speaking and to think about what he was trying to say. At other times Frank would be encouraged to slow his speech rate. In an informal survey completed by Mrs Z, her concerns prior to commencing the research protocol were that unfamiliar listeners may not readily understand his wants and needs in other environments, particularly at preschool. Mrs Z also noted that the stuttering was affecting Frank’s interactions with his sibling. The stuttering was also reported to cause Frank frustration and an overall lack of confidence. Frank’s grandmother and uncle reported that he was difficult to understand. Frank’s father reported his son’s communication as “almost incomprehensible”.

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Pre-treatment profile of stuttering.** Within and beyond clinic measures indicated that the stuttering was moderate (see Table 5.13). Frank’s moments of stuttering were characterised by repetitions of partial, whole and multisyllables. Fixed postures both with and without audible airflow were also observed.

Table 5.13
_Frank’s pre-treatment %SS within the clinic and the average of the beyond-clinic data_

<table>
<thead>
<tr>
<th></th>
<th>WC</th>
<th>BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research clinician %SS</td>
<td>3.5%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>4</td>
<td>4, 4</td>
</tr>
<tr>
<td>Blind rater %SS</td>
<td>2.1%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>3</td>
<td>4, 4</td>
</tr>
</tbody>
</table>

Pre-treatment speech sound profile.** Based on the samples gathered in both single-word naming test and conversational (connected speech) contexts, the severity of Frank’s SSD was rated as mild-moderate (see Table 5.14) (Shriberg & Austin, 1997). Independent analysis indicated no issues related to Frank’s word shape or stress patterns. Frank’s vowel inventory was age appropriate. Consonant inventory demonstrated /θ, k, g, s, ɹ/ were absent. All of these sounds were stimulable except for the velars. Relational analysis demonstrated the presence of 10 speech sound errors, seven of which were considered delayed for Frank’s age. One atypical error was also noted (see Table 5.15).
Table 5.14
*Frank’s PCC at pre-treatment, single-word and connected speech levels*

<table>
<thead>
<tr>
<th></th>
<th>Single-word naming test</th>
<th>Severity</th>
<th>Connected speech</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-treatment</td>
<td>76.9</td>
<td>Mild-mod</td>
<td>78</td>
<td>Mild-mod</td>
</tr>
</tbody>
</table>

Table 5.15
*Phonological processes and/or speech errors used by Frank in single-word and connected speech at pre-treatment*

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster reduction</td>
<td>/bɾɛd/ &gt; /bɛd/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Gliding</td>
<td>/ɪnɡ/ &gt; /wɪŋ/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/ and/or /ð/</td>
<td>/θæm/ &gt; /fʌm/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Later stopping</td>
<td>/væn/ &gt; /bæn/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Weak syllable deletion</td>
<td>/dʒʌaf/ &gt; /ʃaf/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Palatal fronting</td>
<td>/sɒstʃ/ &gt; /ʃsiz/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Velar fronting</td>
<td>/ɡæl/ &gt; /dʒæl/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Palatisation</td>
<td>/sʔʃæl/ &gt; /ʃʃæl/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Alveolarisation</td>
<td>/fʌɪv/ &gt; /ʃʌɪz/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Lateral production of /s/</td>
<td>/sʌn/ &gt; /ʃʌn/</td>
<td>Atypical</td>
</tr>
</tbody>
</table>

**Overview of treatment.** Treatment commenced at 4;4 years. Mrs Z and his nanny attended all clinic appointments together as both were responsible for providing treatment in the home at various times throughout the day. This home-based treatment needed to be carefully adjusted to suit the family’s individual circumstances. It was mutually agreed that home treatment for the SSD should take place in the evenings when Mrs Z arrived home from work. At the commencement of Stage 1 of the LP, structured treatment for the stuttering took place primarily in the morning; therefore Mrs Z and his nanny had shared responsibility for this role, dependent on work...
commitments. Similarly, when stuttering treatment became more unstructured and was delivered at various times throughout the day, this was shared between the two caregivers. A high level of communication was required between Mrs Z and his nanny relating to home treatment and recording of daily SRs. A stuttering home-diary system was set up to be utilised daily by both Mrs Z and his nanny to ensure this process. This diary contained the following information: perceived SRs; periods of observed stuttering throughout the day and note of what Frank was doing at the time; whether stuttering home treatment was done and how; evaluation of home treatment sessions; and number of unstructured verbal contingencies provided throughout the day. During Stage 1 of the LP, this diary was brought to each session for discussion. Stage 1 of the LP commenced at initial appointment and after three clinic visits, direct treatment for the SSD was also commenced concurrently (yet discretely).

Frank’s sessions were kept shorter in length than those of some other participants’, as Frank often fatigued towards the end of longer sessions and consequently became noncompliant. For this reason, a vertical goal attack strategy for SSD was employed. However, if a speech sound goal was close to being achieved, another was introduced horizontally for a brief time. Frank’s SSD goals were decided in the manner previously described and are detailed below:

- Lateral production of /s/ – traditional articulation therapy
- Velar fronting /k, g/ – minimal pairs therapy, traditional articulation therapy
- Stopping /v/ – minimal pairs therapy
- Palatisation – minimal pairs therapy
Upon completion of Stage 1 of the LP, treatment for the SSD continued on a weekly basis and stuttering treatment continued at the increments stated in the LP treatment guide (Packman et al., 2011). At the 9-month assessment occasion, Frank was transferred to the University of Newcastle’s stuttering clinic for continued management during Stage 2 of the LP (he was up to his third Stage 2 scheduled visit at that time). Frank completed a further two Stage 2 sessions with this service before relapsing and being returned to Stage 1. Frank subsequently attended six more weekly Stage 1 visits before meeting Stage 2 criteria once more. Since re-entering Stage 2, Frank had no further relapse and was discharged from this service.

At the 9-month assessment occasion, Frank was transferred to a private clinician for continued management of his SSD. At the 12-month assessment occasion, Frank’s mother reported that since being discharged from the research protocol, Frank had received a further three intervention sessions for his SSD from the private clinician. No data from this service was available to report on at the time of writing this thesis.

**Results: stuttering.** The following is a summary of Frank’s treatment and primary outcome data for stuttering.

**Treatment data.** Frank’s SRs were recorded daily by his mother in collaboration with his nanny during Stage 1 of the LP (see Appendix L). To illustrate these beyond-clinic daily SRs, a weekly average was calculated and is presented in Figure 5.21. These ratings also included weeks when the participant did not attend the clinic for reasons such as illness or holidays. On such occasions, the parent was advised to continue to take daily SRs and email them to the researcher.
Frank completed Stage 1 of the LP in 17 clinic visits (19 weeks) and at the final assessment, very low levels of stuttering were observed consisting of partial and whole syllable repetitions.

**Primary outcome data.** Within-clinic and beyond-clinic data are presented for both raters (see Table 5.16). An average of the %SS from the two beyond-clinic samples is presented, but the SR scores for each of these two samples are given individually.

<table>
<thead>
<tr>
<th>Assessment occasion one (Pre)</th>
<th>Assessment occasion two (Stage 2)</th>
<th>Assessment occasion three (9 months)</th>
<th>Assessment occasion four (12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research clinician</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WC</td>
<td>3.5%</td>
<td>0.0%</td>
<td>0.2%</td>
</tr>
<tr>
<td>BC</td>
<td>3.7%</td>
<td>0.2%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4, 4</td>
<td>1, 1, 2</td>
<td>1, 2, 1</td>
</tr>
<tr>
<td>Blind rater</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WC</td>
<td>2.1%</td>
<td>0.7%</td>
<td>0.3%</td>
</tr>
<tr>
<td>BC</td>
<td>3.4%</td>
<td>0.5%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4, 4</td>
<td>2, 2, 1</td>
<td>2, 2, 1</td>
</tr>
</tbody>
</table>

Table 5.16
*Frank’s %SS within the clinic and the average of the beyond-clinic data (all assessment occasions)*

---

*Figure 5.21.* The average of Frank’s beyond-clinic daily severity ratings in Stage 1 LP.
At the final assessment occasion across both raters, Frank’s stuttering levels both within and beyond the clinic were similar, and below 1%SS.

Credible intervals for these data across assessment occasions were determined using the Bayesian method with beta distribution (which allows calculations of 95% credible intervals for the proportions). See Figures 5.22, 5.23, 5.24, and 5.25.

Figure 5.22. Bayesian method with beta distribution to determine credible intervals for Frank’s within-clinic %SS data for all assessment occasions (researcher).

Figure 5.23. Bayesian method with beta distribution to determine credible intervals for Frank’s average of beyond-clinic %SS data for all assessment occasions (researcher).
To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. As described in Chapter 4, this step involved testing the difference between two proportions (assessment occasion one and four) (see Figure 5.26). Analysis of the two sets of data revealed that from assessment occasion one to four, Frank’s change in
within-clinic %SS was statistically significant, indicating a reliable change in stuttering levels, \( p < .05 \).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frank RC</td>
<td>3.54</td>
<td>0.40</td>
<td>-3.14</td>
<td>-5.16</td>
<td>-1.41</td>
<td>2.02</td>
<td>1.73</td>
</tr>
<tr>
<td>Frank BR</td>
<td>2.08</td>
<td>0.57</td>
<td>-1.51</td>
<td>-2.68</td>
<td>-0.44</td>
<td>1.17</td>
<td>1.07</td>
</tr>
</tbody>
</table>

*Figure 5.26.* Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS within-clinic for Frank (both raters).

Analysis of Frank’s beyond-clinic data is graphed in Figure 5.27. Analysis of both sets of data revealed that from pre-treatment to 12 months post commencement of treatment, Frank’s change in %SS was a statistically significant improvement, indicating a reliable change in stuttering levels, \( p < .05 \).
**Figure 5.27.** Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS beyond-clinic for Frank (both raters).

**Results: speech sound disorder.** The following is a summary of Frank’s treatment and primary outcome data for SSD.

**Treatment data.** From pre-treatment to 9-months post-commencement of treatment, Frank underwent treatment by the researcher for his SSD over 20 clinic visits. At age 5;5 years, Frank’s sound error/pattern usage from pre- to post-treatment decreased from 10 to three (see Table 5.17). Two of the three remaining errors were considered delayed for Frank’s age. No atypical speech errors were observed and Frank’s consonant inventory was now complete.
Table 5.17

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palatal fronting</td>
<td>/sɒsɪzd/ &gt; /sɒsɪz/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/</td>
<td>/θɪŋ/ &gt; /fɪŋ/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Later stopping</td>
<td>/ðɛn/ &gt; /dɛn/</td>
<td>Delayed</td>
</tr>
<tr>
<td></td>
<td>/væn/ &gt; /bæn/</td>
<td></td>
</tr>
</tbody>
</table>

*Primary outcome data.* The primary outcome measure for SSD was PCC, and a summary of the results of this measure at all four assessment occasions is presented in Table 5.18. Across all assessment occasions there was improvement in this outcome measure within both sampling contexts. The most notable change was observed between pre-treatment and the 9-month assessment occasion. Severity of involvement changed from mild-moderate at pre-treatment to mild at the 12-month post-commencement of treatment occasion in both sampling contexts.

Table 5.18

*Frank’s PCC at all assessment occasions, single-word and connected speech levels*

<table>
<thead>
<tr>
<th>Percentage consonants correct (PCC)</th>
<th>Single-word naming test</th>
<th>Severity</th>
<th>Connected speech</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre</td>
<td>76.9</td>
<td>Mild-mod</td>
<td>78</td>
<td>Mild-mod</td>
</tr>
<tr>
<td>2. Stage 2</td>
<td>79.1</td>
<td>Mild-mod</td>
<td>88.7</td>
<td>Mild</td>
</tr>
<tr>
<td>3. 9 months</td>
<td>92.5</td>
<td>Mild</td>
<td>96.3</td>
<td>Mild</td>
</tr>
<tr>
<td>4. 12 months</td>
<td>94.2</td>
<td>Mild</td>
<td>98.9</td>
<td>Mild</td>
</tr>
</tbody>
</table>
To determine the credible intervals at all assessment occasions for PCC, the Bayesian method with beta distribution was again applied (see Figures 5.28 and 5.29).

![Figure 5.28](image1.png)

*Figure 5.28. Bayesian method with beta distribution to determine credible intervals for Frank’s PCC at single-word level.*

![Figure 5.29](image2.png)

*Figure 5.29. Bayesian method with beta distribution to determine credible intervals for Frank’s PCC at connected speech level.*

To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. The
difference between Frank’s PCC data at assessment occasions one to four were analysed for reliable and significant change (see Figure 5.30). This analysis revealed that from pre- to post-treatment, Frank’s PCC improved across both sampling contexts, and this improvement was found to be statistically significant (i.e. a reliable change), $p < .05$.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frank SW</td>
<td>76.92</td>
<td>94.20</td>
<td>17.28</td>
<td>9.32</td>
<td>24.80</td>
<td>7.96</td>
<td>7.52</td>
</tr>
<tr>
<td>Frank CS</td>
<td>78</td>
<td>98.91</td>
<td>20.91</td>
<td>14.85</td>
<td>26.85</td>
<td>6.06</td>
<td>5.94</td>
</tr>
</tbody>
</table>

*Figure 5.30.* Modified RC method to determine statistical significance (reliable change) in SSD outcome measure of PCC in both single-word and connected-speech contexts for Frank.

**Survey data.** At assessment occasion three (9-months post-commencement of treatment), an informal survey was administered to Mrs Z as previously described (see Appendix O). Mrs Z was happy with the success that her son had achieved in treatment, as well as the friendly environment provided by the researcher. Mrs Z reported no concerns in relation to the treatment protocol in general.
In her informal survey, Frank’s grandmother reported that Frank was more intelligible. She had also observed Frank to be happier in disposition and that he and his sibling were getting along better since completing treatment.

Frank’s father noted a substantial improvement in his son’s communication, and reported Frank to be more intelligible. He also reported that Frank was happier and less agitated. Frank’s father also reported that Frank would more readily engage in communication with unfamiliar partners, and could now converse on the telephone intelligibly.

Frank’s uncle reported that Frank was more intelligible and he noted a reduction in stuttering levels. He also believed Frank to be more self-confident since completing treatment.

**Summary of case 3: Frank.** Analysis of Frank’s results revealed that both within and beyond the clinic, his stuttering had improved from pre- to post-treatment. These findings were statistically significant and were indicative of a reliable change for Frank. After successful completion of Stage 1 of the LP, Frank had a relapse mid-way through Stage 2. He was returned to Stage 1 for six clinic visits before re-entering Stage 2 of the LP and has been subsequently discharged upon successful completion of the LP. At the 12-month assessment occasion, Frank’s mother reported that severity ratings were almost entirely 1s at home.

Analysis of the primary outcome measure for speech sounds, PCC, revealed a reliable change at both the single-word and connected-speech levels, which was a statistically significant improvement from pre- to post-treatment. Frank had an incomplete consonant inventory, but at the end of the research protocol his inventory was complete. Frank’s sound error/pattern usage (which was considered mixed
phonological/phonetic in nature) decreased from 10 to three from pre- to post-treatment, two of which were considered delayed in nature for Frank’s age at assessment occasion four.

**Case study 4: ELIJAH**

**Background information.** Elijah was recruited into the research program at 3;7 years. Elijah’s mother, Mrs Q stated that he lived with both parents and three siblings. Elijah’s father worked full-time and his mother part-time. English was the primary language in the home although Mrs Q also spoke to the children in her own native language to teach them key words in this language also. Elijah’s pregnancy and birth history were unremarkable. His motor milestones were reported WNL, but his mother noted a speech delay in both Elijah and one of his siblings. Elijah had no other medical history or co-morbid medical conditions. Upon initial assessment, it was observed that Elijah had excess saliva production and difficulties managing this. An oral musculature examination revealed no obvious anomalies. Further to this, Elijah was examined by his general practitioner who also noted no anomalies in relation to oral structure and function. Elijah appeared unaware of the sensation of his excess saliva production. His mother also reported that he still displayed excessive mouthing behaviours typically observed in younger children. A referral for an occupational therapy assessment was made. Elijah had no history of ear infection, and hearing was screened 6 months prior to entering the research protocol, the results WNL. Elijah attended preschool one day per week and was commencing kindergarten at the start of 2015. Elijah’s language ability was screened in the manner aforementioned. Elijah achieved pass criterion for this screening with no further assessment in this area required.
Stuttering commenced at 2;6 years. Mrs Q noted that at onset, Elijah was mostly disfluent at the start of words. Since onset, Mrs Q reported that stuttering appeared to have decreased in frequency, but made comment that she may had “just gotten used to it [the stuttering]”. Stuttering was exacerbated when Elijah was fatigued, excited or speaking quickly. There was no reported family history of stuttering. Elijah had received no prior intervention before commencing the research protocol.

Mrs Q responded to moments of stuttering by allowing him time to complete utterances without putting pressure on him to communicate. Elijah was reported to show no signs of awareness or frustration in relation to his stuttering. He was said to be a talkative and social child. In an informal survey completed by Mrs Q, her concerns prior to commencing the research related to her ability to deliver two different types of treatment at home and whether Elijah would be confused by this aspect also. Elijah’s father reported that he found his son unintelligible at times.

**Pre-treatment profile of stuttering.** Within and beyond clinic measures indicated that stuttering was moderate-severe (see Table 5.19). Elijah’s moments of stuttering were characterised by repetitions of partial, whole and multisyllables. Frequent fixed postures both with and without audible airflow were observed.

Table 5.19
___Elijah’s pre-treatment %SS within the clinic and the average of the beyond-clinic data___

<table>
<thead>
<tr>
<th></th>
<th>WC</th>
<th>BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research clinician %SS</td>
<td>14.6%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>7</td>
<td>7, 6</td>
</tr>
<tr>
<td>Blind rater %SS</td>
<td>9.5%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>8</td>
<td>7, 6</td>
</tr>
</tbody>
</table>
Pre-treatment speech sound profile. Based on the samples gathered in both single-word naming test and conversational (connected speech) contexts, the severity of Elijah’s SSD was rated as mild-moderate (see Table 5.20) (Shriberg & Austin, 1997). Independent analysis revealed no issues related to Elijah’s word shape or stress patterns. Vowel inventory was age appropriate. Consonant inventory demonstrated /θ, s, ʃ, tʃ, dʒ, ʒ/ were absent. These sounds were stimulable except for /dʒ, ʒ/. Relational analysis demonstrated the presence of nine speech sound errors, two of which were considered delayed for Elijah’s age and one atypical (see Table 5.21).

Table 5.20
Elijah’s PCC at pre-treatment, single-word and connected speech levels

<table>
<thead>
<tr>
<th>Percentage consonants correct (PCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-word naming test</td>
</tr>
<tr>
<td>Pre-treatment</td>
</tr>
</tbody>
</table>

Table 5.21
Phonological processes and/or speech errors used by Elijah in single-word and connected speech at pre-treatment

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster reduction</td>
<td>/baːd/ &gt; /bɛd/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Gliding</td>
<td>/lɪtal/ &gt; /wɪtal/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/ and/or /ð/</td>
<td>/θʌm/ &gt; /fʌm/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Later stopping</td>
<td>/tʃɛɑ/ &gt; /tɛɛ/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td></td>
<td>/dʒɛsi/ &gt; /deʃi/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Weak syllable deletion</td>
<td>/stʌɪbɛli/ &gt; /sɔbi/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Velar fronting</td>
<td>/kɪtɑ̃t/ &gt; /tɪkɑ̃t/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Stopping</td>
<td>/væn/ &gt; /æn/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Interdental /s/</td>
<td>/sʌn/ &gt; /θʌn/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Lateral production of /s, z, f/</td>
<td>/sʌn/ &gt; /θʌn/</td>
<td>Atypical</td>
</tr>
</tbody>
</table>
Overview of treatment. Treatment commenced when Elijah was 3;7 years. His mother attended all clinic appointments and was solely responsible for providing Elijah with home treatment throughout the day. Stage 1 of the LP was commenced at initial appointment; after two clinic visits, direct treatment for the SSD commenced concurrently (yet discretely) in these sessions.

At the commencement of treatment, goal attack strategy for speech sounds was vertical. This was due to Elijah’s lateral production of some consonants prominently impacting on his intelligibility. Further, this error was the one most concerning to Mrs Q. When Elijah was no longer producing sounds laterally, alveolar fricatives were being produced interdentally, which also impacted greatly on his intelligibility. This became the subsequent SSD goal for Elijah. Once sufficient progress was made towards this goal, other targets were introduced horizontally. The goals were decided upon in the manner previously described and are detailed below:

- Lateral production of /s/ – traditional articulation therapy
- Interdental production of /s, z/ - traditional articulation therapy
- Stopping /v/ – minimal pairs therapy
- Cluster reduction - minimal pairs therapy

Upon completion of Stage 1 of the LP, treatment for the SSD continued on a weekly basis and stuttering treatment continued at the increments stated in the LP treatment guide (Packman et al., 2011). At the 9-month assessment occasion, Elijah was transferred to the University of Newcastle’s stuttering clinic for continued management during Stage 2 of the LP. This was subsequently completed without relapse and Elijah had since been discharged from this service.
At the 9-month assessment occasion, Elijah was handed over to a private clinician for continued management of his SSD. At the 12-month assessment occasion, his mother reported that since being discharged from the research protocol, Elijah had received a further eight intervention sessions for SSD. No further information was available about his treatment progress, but his mother reported that she felt treatment was going well.

**Results: Stuttering.** The following is a summary of Elijah’s treatment and primary outcome data for stuttering.

**Treatment data.** Elijah’s SRs were recorded daily by his mother during Stage 1 of the LP (see Appendix M). To illustrate these beyond-clinic daily SRs, a weekly average was calculated and is presented in Figure 5.31. These ratings also include weeks where Elijah did not attend the clinic for reasons such as illness or holidays. On such occasions, the parent was still advised to take daily severity ratings and email them to the researcher.

*Figure 5.31. The average of Elijah’s beyond-clinic daily severity ratings in Stage 1 LP.*
Elijah completed Stage 1 of the LP in 22 clinic visits (27 weeks) and at the final assessment occasion, very low levels of stuttering was observed, consisting of partial and whole syllable repetitions.

**Primary outcome data.** Within-clinic and beyond-clinic data are presented for both raters (see Table 5.22). An average of the %SS from the two beyond-clinic samples is presented, but the SR scores for each of these two samples are given individually.

<table>
<thead>
<tr>
<th>Table 5.22</th>
<th>Elijah’s %SS within the clinic and the average of the beyond-clinic data (all assessment occasions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assessment occasion one (Pre)</td>
</tr>
<tr>
<td></td>
<td>WC</td>
</tr>
<tr>
<td>Research clinician</td>
<td>14.6%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>7</td>
</tr>
<tr>
<td>Blind rater</td>
<td>9.5%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>8</td>
</tr>
</tbody>
</table>

At the final assessment occasion and across both raters, Elijah’s stuttering levels both within and beyond the clinic were similar, and below 1%SS.

Credible intervals for these data across assessment occasions were determined using the Bayesian method with beta distribution (which allows calculations of 95% credible intervals for the proportions). See Figures 5.32, 5.33, 5.34, and 5.35.
Figure 5.32. Bayesian method with beta distribution to determine credible intervals for Elijah’s within-clinic %SS data for all assessment occasions (researcher).

Figure 5.33. Bayesian method with beta distribution to determine credible intervals for Elijah’s average of beyond-clinic %SS data for all assessment occasions (researcher).
To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. As described in Chapter 4, this step involved testing the difference between two proportions (assessment occasions one and four) (see Figure 5.36). Analysis of both sets of data revealed that from assessment occasion one to four, Elijah’s change in within-
clinic %SS was statistically significant, indicating a reliable change in stuttering levels, $p < .05$. Therefore these results show a statistically significant improvement in stuttering measures for Elijah.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elijah RC</td>
<td>14.58</td>
<td>0.22</td>
<td>-14.36</td>
<td>-17.44</td>
<td>-11.35</td>
<td>3.08</td>
<td>3.02</td>
</tr>
<tr>
<td>Elijah BR</td>
<td>9.52</td>
<td>0.23</td>
<td>-9.29</td>
<td>-11.25</td>
<td>-7.42</td>
<td>1.96</td>
<td>1.87</td>
</tr>
</tbody>
</table>

*Figure 5.36. Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS within-clinic for Elijah (both raters).*

Analysis of Elijah’s beyond-clinic data is graphed in Figure 5.37. Analysis of both sets of data revealed that from assessment occasion one to four, Elijah’s change in %SS was a statistically significant improvement, indicating a reliable change in stuttering levels, $p < .05$.  

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Results: Speech sound disorder. The following is a summary of Elijah’s treatment and primary outcome data for speech sound disorder.

Treatment data. From pre-treatment to 9-months post-commencement of the research, Elijah underwent treatment by the researcher for his SSD over 24 clinic visits. At age 4;8 years, Elijah’s sound error/pattern usage from pre- to post-treatment decreased from nine to five (see Table 5.23). Three of the remaining errors were considered delayed for Elijah’s age, but there were no remaining atypical errors. The occurrence of the interdental lisp (which was the error most affecting intelligibility) had decreased to only once in connected speech, but was still prominent at a single word level. Elijah’s consonant inventory was now complete and age appropriate.
Table 5.23
*Phonological processes and/or speech errors used by Elijah in single-word and connected speech at 12 months post commencement of treatment*

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palatal fronting</td>
<td>/fiŋ/ → /fiŋ/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Gliding</td>
<td>/ʌn/ → /wʌn/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Later stopping</td>
<td>/ðɛn/ → /dɛn/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Interdental /s, z/</td>
<td>/skul/ → /θkul/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Cluster reduction</td>
<td>/bɹum/ → /bum/</td>
<td>Delayed</td>
</tr>
</tbody>
</table>

**Primary outcome data.** The primary outcome measure for SSD was PCC, and a summary of the results of this measure at all four assessment occasions is presented in Table 5.24. The data revealed that minimal change occurred between assessment occasions one and two across both sampling contexts. There was improvement in PCC at a single word level from assessment occasion’s two to three. In connected speech there was a marginal decline in this measure from assessment occasion’s two to three. There was change in PCC from assessment occasions one to four, however data revealed that the majority of this change occurred between assessment occasions three and four in both sampling contexts.

Table 5.24
*Elijah’s PCC at all assessment occasions, single-word and connected speech levels*

<table>
<thead>
<tr>
<th>Percentage consonants correct (PCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Single-word naming test</td>
</tr>
<tr>
<td>Severity</td>
</tr>
<tr>
<td>Single-word naming test</td>
</tr>
<tr>
<td>Severity</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1. Pre</td>
</tr>
<tr>
<td>2. Stage 2</td>
</tr>
<tr>
<td>3. 9 months</td>
</tr>
<tr>
<td>4. 12 months</td>
</tr>
</tbody>
</table>
To determine the credible intervals at all assessment occasions for PCC, the Bayesian method with beta distribution was again applied, with the results visualised graphed (see Figures 5.38 and 5.39).

**Figure 5.38.** Bayesian method with beta distribution to determine credible intervals for Elijah’s PCC at single-word level.

**Figure 5.39.** Bayesian method with beta distribution to determine credible intervals for Elijah’s PCC at connected speech level.
To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. The difference between Elijah’s PCC data at assessment occasion one to four were analysed for reliable and significant change (see Figure 5.40). This analysis revealed that from pre- to post-treatment, Elijah’s PCC improved, and this improvement was found to be statistically significant, $p < .05$. This reliable change occurred both in the single-word naming test and at connected-speech levels.

![Figure 5.40. Modified RC method to determine statistical significance (reliable change) in SSD outcome measure of PCC in both single-word and connected-speech contexts for Elijah.](image)

### Survey data.
At assessment occasion three (9-months post-commencement of treatment), an informal survey was administered to Mrs Q in the manner previously
described (see Appendix O). Mrs Q reported being happy with Elijah’s fluency levels. She noted that Elijah had told her that he liked to talk now because “I don’t have any bumps and people can understand me”.

Elijah’s father reported increased intelligibility and that some sounds still required treatment. He also noted that Elijah rarely stuttered now, if at all. Elijah’s father also felt that Elijah was forming more improved relationships with peers as a result of treatment.

**Summary of case 4: Elijah’s.** Analysis of Elijah’s results revealed that both within and beyond the clinic, his stuttering had improved from pre- to post-treatment. These findings were statistically significant and were indicative of a reliable change for Elijah. After successful completion of Stage 1 of the LP, Elijah completed Stage 2 without relapse and was then discharged.

Analysis of the primary outcome measure for speech sounds, PCC, revealed a reliable change in both sampling contexts that was a statistically significant improvement from pre- to post-treatment. At the start of treatment, Elijah had an incomplete consonant inventory, but at the end of the research protocol his inventory was complete. Elijah’s sound error/pattern usage (which was considered mixed phonological/ phonetic in nature) decreased from nine to five from pre- to post-treatment, three of which errors were considered delayed for Elijah’s age at assessment occasion four.

**Case Study 5: AIDEN**

**Background information.** Aiden was recruited into the research program at 4;7 years. Aiden’s mother, Mrs A, stated that Aiden spoke English only, lived with his
parents and a younger (toddler) sibling, and that both parents were engaged in full-time employment. Aiden’s pregnancy and birth history were reportedly unremarkable.

Aiden’s motor and communication milestones were reported to be WNL. Aiden had no other reported medical history or co-morbid conditions. Aiden had no prior history of recurrent ear infections. Hearing was screened 3 months prior to entry into the study and reported WNL. Aiden attended long day-care 3 days per week and was commencing kindergarten the following year. Aiden’s language ability was screened in the manner aforementioned. Aiden achieved pass criterion on this screening and the need for further testing was not required.

Stuttering commenced at age 3;6 years. Mrs A reported that at onset, repetitious stuttering behaviours were the most predominant. Since onset, the stuttering had reportedly increased in frequency and severity, with fixed postures with and without audible airflow also observable. Stuttering was exacerbated with fatigue. A positive family history of stuttering was reported in Aiden’s family. His maternal grandfather stuttered without natural recovery. Aiden had had no prior assessment or intervention for either disorder before entering into the research protocol.

Mrs A responded to moments of stuttering by requesting Aiden to slow down and think about what he was saying. Aiden was aware of his stuttering and reported to become frustrated and angry when others could not understand him. Aiden was also reported to be socially withdrawn from his peers.

In an informal survey completed by Mrs A, her primary concern related to Aiden’s stuttering, particularly as formal schooling was commencing the following year. Mrs A was concerned about the social impact of the disorder in the school environment. Mrs A also noted concern around the potential for Aiden to be
uncompliant in the treatment process with her at home. She was also apprehensive about managing the delivery of treatment at home with her busy schedule.

**Pre-treatment profile of stuttering.** Beyond and within clinic measures indicated that stuttering was moderate (see Table 5.25). Aiden’s moments of stuttering were characterised by repetitions of partial and whole syllables. Fixed postures without audible airflow were also observed, although less frequently than the repetitions.

Table 5.25
*Aiden’s pre-treatment %SS within the clinic and the average of the beyond-clinic data*

<table>
<thead>
<tr>
<th></th>
<th>WC</th>
<th>BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research clinician %SS</td>
<td>4.2%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>4</td>
<td>6, 4</td>
</tr>
<tr>
<td>Blind rater %SS</td>
<td>1.2%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>2</td>
<td>6, 2</td>
</tr>
</tbody>
</table>

**Pre-treatment speech sound profile.** Based on the samples gathered in both single-word naming test and conversational (connected speech) contexts, the severity of Aiden’s SSD was rated as mild-moderate (see Table 5.26) (Shriberg & Austin, 1997). Independent analysis revealed no difficulties with word shape or stress patterns. Vowel inventory was age appropriate. Consonant inventory demonstrated /θ, s, tʃ, l/ were missing. These sounds were stimulable except for /tʃ/. Relational analysis revealed the use of seven speech sound errors, two of which were considered age appropriate. No atypical usage was evident (see Table 5.27).
Table 5.26  
*Aiden’s PCC at pre-treatment, single-word and connected speech levels*

<table>
<thead>
<tr>
<th></th>
<th>Percentage consonants correct (PCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single-word naming test</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>77.8</td>
</tr>
</tbody>
</table>

Table 5.27  
*Phonological processes and/or speech errors used by Aiden in single-word and connected speech at pre-treatment*

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster reduction</td>
<td>/skweɪ/ &gt; /skɛə/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Gliding</td>
<td>/mæbət/ &gt; /wæbət/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/ and/or /ð/</td>
<td>/θʌm/ &gt; /fʌm/</td>
<td>Age appropriate</td>
</tr>
<tr>
<td>Weak syllable deletion</td>
<td>/pætɛtəʊ/ &gt; /tɛtəʊ/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Deaffrication</td>
<td>/tʃɛə/ &gt; /ʃɛə/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Stopping /v/</td>
<td>/ɡlʌv/ &gt; /ɡlʌb/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Interdental /s/</td>
<td>/sɒk/ &gt; /θɒk/</td>
<td>Delayed</td>
</tr>
</tbody>
</table>

**Overview of treatment.** Aiden commenced treatment at 4;8 years. Aiden’s mother attended all clinic appointments and was solely responsible for providing Aiden’s home treatment throughout the day. Stage 1 of the LP was commenced at the initial appointment and after three clinic visits, direct treatment for the SSD also commenced concurrently (yet discretely).

A horizontal goal attack strategy for speech sounds was employed. The goals therefore were initially based on a developmental approach for the majority of the treatment protocol. Mrs A later expressed concerns relating to the interdental production of /s/ and the labiodental realisation of /θ/, and these were subsequently addressed accordingly. The following goals were therefore worked on for the duration of Aiden’s time in treatment in the research protocol:
• Stopping /v/ – minimal pairs therapy
• Cluster reduction – minimal pairs therapy
• Interdental /s/ – traditional articulation therapy
• Labiodental realisation of /θ/ – traditional articulation therapy, minimal pairs therapy

Aiden did not complete Stage 1 of the LP during his time enrolled in the research protocol. It was observed that Aiden was displaying some challenging behaviours toward his mother within the clinic soon after the protocol commenced. Mrs A reported that since the birth of his sibling, Aiden had displayed challenging behaviours at home and she was feeling increasingly anxious about this. Mrs A felt unable to cope with his behaviour and sought advice as this was having a direct effect on their interaction during the treatment process. Aiden was initially unwilling to comply with his mother when she attempted to implement structured treatment sessions. During these sessions, when his mother was asked to demonstrate structured treatment with him, Aiden demonstrated challenging behaviours directed at his mother. A number of sessions were subsequently discontinued. However, he was compliant with the researcher within the clinic. Referral for psychological and behavioural assessment was made. Aiden’s mother attended an initial appointment with a community based service for these issues during the research protocol. During this appointment, which she attended without Aiden, Mrs A was given positive parenting and coping strategies, and asked to report on progress after a period of time, after which a full psychological assessment of Aiden may be required. Aiden’s mother did not attend this service again during the research protocol.
Treatment for the LP was therefore tailored in a way that allowed daily completion in the home environment. This meant allowing Aiden greater control of the types of activities chosen for treatment, and providing structured feedback in a play-based manner, in line with his interests. General language facilitation and engagement strategies were also employed during these sessions (e.g., following Aiden’s lead, being down on his level etc.). Mrs A reported no difficulty engaging Aiden in the home practice for SSD. Positive parenting strategies were reportedly successful for some time before Mrs A reported that the challenging behaviours were re-emerging. Mrs A was urged to re-contact the community health team and to seek psychological assessment, but she was reluctant to engage in this process at that time.

In line with the treatment protocol, any participant who had not reached Stage 1 of the LP in 22 clinic visits required re-evaluation around ceasing treatment for one of the disorders. At clinic visit 21, in consultation with Mrs A, a decision was made to temporarily cease SSD treatment and to focus on the stuttering treatment. At the 9-month assessment occasion, Aiden was transferred to the University of Newcastle’s stuttering clinic for continued management of his stuttering using the LP. At the 12-month assessment occasion, Aiden was still in Stage 1 of the LP. His treating clinician at the university clinic had also recommended a full psychological assessment take place, due to the challenging behaviours that she was also observing. It was further recommended by the new clinician that Aiden and his mother take a break from stuttering treatment to avoid therapeutic “burn-out”, pending the results of the psychological evaluation. Aiden had commenced formal schooling prior to the 12-month assessment occasion. Aiden’s school counsellor had similarly requested a psychological evaluation as well as a cognitive assessment due to behaviours displayed
in the school environment. The results of these evaluations were not known at the time of writing this thesis.

For his SSD treatment, Aiden had previously been placed on the waiting list at his local public health sector. At the 12-month assessment occasion, Aiden was still on the waiting list for these services, but had been offered an assessment appointment.

**Results: Stuttering.** The following is a summary of Aiden’s treatment and primary outcome data.

**Treatment data.** Aiden’s SRs were recorded daily by his mother during Stage 1 of the LP (see Appendix N). To summarise these beyond-clinic daily SRs, a weekly average was calculated and is presented in Figure 5.41. These ratings also include weeks where Aiden did not attend the clinic due to illness or holidays. On such occasions, his mother was still advised to take daily SRs and email them to the researcher.

![Average of beyond-clinic weekly severity ratings - Stage 1](image-url)

*Figure 5.41. The average of Aiden’s beyond-clinic daily severity ratings in Stage 1 LP.*
At the 9-month assessment occasion, Aiden had undergone 28 Stage 1 LP clinic visits. At the 12-month assessment occasion, Aiden had undergone a total of 40 Stage 1 LP clinic visits. At the 12-month assessment occasion, Aiden’s stuttering was characterised by fixed postures with and without audible airflow, partial and whole syllable repetitions, as well as verbal and non-verbal superfluous behaviours.

**Primary outcome data.** Within-clinic and beyond-clinic data are presented for both raters (see Table 5.28). Note that although Aiden did not reach Stage 2 of the LP (assessment occasion two), data were collected instead at the time that the research protocol was abandoned. An average of the two beyond-clinic samples’ %SS is given, and the SRs of each of these samples are given individually.

Table 5.28
*Aiden’s %SS within the clinic and the average of the beyond-clinic data (all assessment occasions)*

<table>
<thead>
<tr>
<th></th>
<th>Assessment occasion one (Pre)</th>
<th>Assessment occasion two (Stage 2)</th>
<th>Assessment occasion three (9 months)</th>
<th>Assessment occasion four (12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WC</td>
<td>BC</td>
<td>WC</td>
<td>BC</td>
</tr>
<tr>
<td>Research clinician</td>
<td>4.2%</td>
<td>3.0%</td>
<td>4.2%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>4</td>
<td>6, 4</td>
<td>5</td>
<td>4, 2</td>
</tr>
<tr>
<td>Blind rater</td>
<td>1.2%</td>
<td>3.6%</td>
<td>2.9%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Severity rating(s)</td>
<td>2</td>
<td>6, 2</td>
<td>4</td>
<td>2, 2</td>
</tr>
</tbody>
</table>

Across both raters, Aiden’s stuttering levels had increased from assessment occasion one to four.

Credible intervals for these data across assessment occasions were determined using the Bayesian method with beta distribution (which allows calculations of 95% credible intervals for the proportions). See Figures 5.42, 5.43, 5.44, and 5.45.
Figure 5.42. Bayesian method with beta distribution to determine credible intervals for Aiden’s within-clinic %SS data for all assessment occasions (researcher).

Figure 5.43. Bayesian method with beta distribution to determine credible intervals for Aiden’s average of beyond-clinic %SS data for all assessment occasions (researcher).
To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. As described in Chapter 4, this step involved testing the difference between two proportions (at assessment occasion one and four) (see Figure 5.46). Analysis of both sets of data revealed that from pre- to post-treatment, Aiden’s level of fluency was
determined to have worsened. Only the blind-rater data indicated that this change was a statistically significant worsening, \( p < .05 \).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aiden RC</td>
<td>4.25</td>
<td>6.47</td>
<td>2.22</td>
<td>-1.39</td>
<td>5.89</td>
<td>3.62</td>
<td>3.67</td>
</tr>
<tr>
<td>Aiden BR</td>
<td>1.15</td>
<td>4.01</td>
<td>2.86</td>
<td>0.56</td>
<td>5.15</td>
<td>2.29</td>
<td>2.30</td>
</tr>
</tbody>
</table>

*Figure 5.46.* Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS within clinic for Aiden (both raters).

Aiden’s beyond-clinic data are graphed in Figure 5.47. Analysis of both sets of data revealed that from pre-treatment to 12 months post commencement of treatment, Aiden’s stuttering had worsened, but this result was only significant for the researcher’s data, \( p < .05 \).
**Figure 5.47.** Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS beyond-clinic for Aiden (both raters).

**Results: speech sound disorder.** The following is a summary of Aiden’s treatment and primary outcome data for speech sound disorder.

**Treatment data.** Before the research protocol was abandoned to treat the stuttering in isolation, Aiden had attended 17 sessions to address his SSD. At age 5;9 years, Aiden’s sound error/pattern usage from pre- to post-treatment decreased from seven to two (see Table 5.29). One of the remaining errors was considered delayed for Aiden’s age. Aiden’s consonant inventory was now complete.
Table 5.29
Phonological processes and/or speech errors used by Aiden in single-word and connected speech at 12 months post commencement of treatment

<table>
<thead>
<tr>
<th>Phonological process/speech errors</th>
<th>Example</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gliding (one instance only)</td>
<td>/klin/ &gt; /kwin/</td>
<td>Delayed</td>
</tr>
<tr>
<td>Labiodental realisation of /θ/</td>
<td>/θæŋkju/ &gt; /fæŋkju/</td>
<td>Age appropriate</td>
</tr>
</tbody>
</table>

**Primary outcome data.** The primary outcome measure for SSD was PCC, and a summary of the results of this measure at all four assessment occasions is presented in Table 5.30 Based on these data, across all assessment occasions there was improvement in this outcome measure within both sampling contexts.

Table 5.30
Aiden’s PCC at all assessment occasions, single-word and connected speech levels

<table>
<thead>
<tr>
<th>Percentage consonants correct (PCC)</th>
<th>Single-word naming test</th>
<th>Severity</th>
<th>Connected speech</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre</td>
<td>77.8</td>
<td>Mild-mod</td>
<td>86.7</td>
<td>Mild</td>
</tr>
<tr>
<td>2. Stage 2</td>
<td>83.1</td>
<td>Mild-mod</td>
<td>93.8</td>
<td>Mild</td>
</tr>
<tr>
<td>3. 9 months</td>
<td>90.6</td>
<td>Mild</td>
<td>95</td>
<td>Mild</td>
</tr>
<tr>
<td>4. 12 months</td>
<td>97.2</td>
<td>Mild</td>
<td>97.3</td>
<td>Mild</td>
</tr>
</tbody>
</table>

To determine the credible intervals at all assessment occasions for PCC, the Bayesian method with beta distribution was again applied, and the results graphed (see Figures 5.48 and 5.49).
To further analyse these data for statistical significance, the modified RC method using 95% credible intervals for the differences in proportions was applied. The differences between Aiden’s PCC data from assessment occasion one to four were analysed for reliable and significant change (see Figure 5.50). This analysis revealed that from pre- to post-treatment, Aiden’s PCC improved, and this improvement was
found to be statistically significant, indicating a reliable change, $p < .05$. This reliable change occurred in both the single-word naming test and in connected-speech.

![Figure 5.50. Modified RC method to determine statistical significance (reliable change) in SSD outcome measure of PCC in both single-word and connected-speech contexts for Aiden.](image)

**Survey data.** At the 9-month assessment occasion, an informal survey was administered to Mrs A in the manner previously described (see Appendix O). Mrs A reported that at the 9-month assessment occasion she appreciated the support and motivation given by the researcher to continue with home treatment. Mrs A also liked the individually tailored activities and ideas given to her that helped facilitate treatment for Aiden. Mrs A disliked the amount of work required on her part to complete home
treatment, specifically in relation to the LP. She found that this aspect was difficult with
the demands of her current lifestyle.

Summary of case 5: Aiden’s. Analysis of Aiden’s results revealed that both
within and beyond the clinic, his stuttering had worsened from pre- to post-treatment,
although this was found to be significant only on some occasions. In most instances,
Aiden’s stuttering had improved from pre-treatment to the 9-month mark. Fluency
levels decreased after handover to another service. Between the 9- and 12-month
assessment occasions, Aiden commenced formal schooling. His behaviour also began to
further deteriorate around this time, and both his treating clinician and school staff had
recommended psychological and cognitive assessment. Aiden’s stuttering treatment was
suspended pending the findings of the psychological review, as Aiden’s mother was
finding treatment implementation increasingly difficult due to his behaviour both within
and beyond the clinic.

Although the research protocol was abandoned (due to not reaching Stage 1 LP
within 22 clinic visits), analysis of the primary outcome measure for speech sounds,
PCC, revealed a reliable change at both the single-word and connected-speech levels
that was a statistically significant improvement from pre-treatment to 12 months post
commencement of treatment. At the start of treatment, Aiden had an incomplete
consonant inventory, but at the end of the research protocol his inventory was complete.
His sound error/pattern usage (which was considered predominantly phonological in
nature) decreased from seven to two from pre- to post-treatment, one of which was
considered delayed in nature for Aiden’s age at assessment occasion four.
Results: Group summary

The following section provides a summary of the descriptive and inferential statistics for each single case highlighted within this chapter. The purpose of this presentation is for ease of readability only, not to provide any statistical group comparisons. Due to the heterogeneous nature of the disorders in each of the single cases, group statistics (such as the comparison of means) are considered inappropriate. Table 5.31 summarises some of the key findings and demographic information for all five cases.

Table 5.31
Summary of demographic and descriptive information for the five single cases

<table>
<thead>
<tr>
<th></th>
<th>Brad</th>
<th>Daniel</th>
<th>Frank</th>
<th>Elijah</th>
<th>Aiden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of stuttering onset</td>
<td>3;0</td>
<td>2;6</td>
<td>2;6</td>
<td>2;6</td>
<td>3;6</td>
</tr>
<tr>
<td>Family history of stuttering</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Family history of natural recovery from stuttering</td>
<td>n/a</td>
<td>n/a</td>
<td>Yes</td>
<td>n/a</td>
<td>No</td>
</tr>
<tr>
<td>Severity of stuttering</td>
<td>Mild</td>
<td>Mild-moderate</td>
<td>Moderate</td>
<td>Moderate-severe</td>
<td>Moderate</td>
</tr>
<tr>
<td>Severity of SSD</td>
<td>Mild-moderate</td>
<td>Mild-moderate</td>
<td>Mild-moderate</td>
<td>Mild-moderate</td>
<td>Mild-moderate</td>
</tr>
<tr>
<td>Reached Stage 2 LP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Clinic visits to reach Stage 2 LP</td>
<td>14</td>
<td>15</td>
<td>17</td>
<td>22</td>
<td>n/a</td>
</tr>
<tr>
<td>Number of SSD sessions</td>
<td>24</td>
<td>20</td>
<td>20</td>
<td>24</td>
<td>17</td>
</tr>
</tbody>
</table>
**Primary outcome data for stuttering: within-clinic.** Analysis of the primary outcome measure for stuttering, %SS, on samples obtained within the clinic by the researcher revealed a significant improvement in fluency levels in all cases except one. As shown in Figure 5.51, Aiden’s fluency levels worsened, but not significantly. Analysis of the same samples by the blind rater again revealed that in all cases except one significant improvement in fluency levels occurred. Analysis of Aiden’s within-clinic samples by the blind rater revealed a worsened result that was found to be significant (see Figure 5.52).

![%SS Within Clinic - Researching Clinician](image)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>lcl</th>
<th>ucl</th>
<th>Lower bar</th>
<th>Upper bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brad BR</td>
<td>2.244</td>
<td>0.42</td>
<td>-1.82</td>
<td>-3.68</td>
<td>-0.32</td>
<td>1.86</td>
<td>1.51</td>
</tr>
<tr>
<td>Daniel BR</td>
<td>3.86</td>
<td>0</td>
<td>-3.86</td>
<td>-5.66</td>
<td>-2.27</td>
<td>1.80</td>
<td>1.59</td>
</tr>
<tr>
<td>Frank BR</td>
<td>3.54</td>
<td>0.40</td>
<td>-3.14</td>
<td>-5.16</td>
<td>-1.41</td>
<td>2.02</td>
<td>1.73</td>
</tr>
<tr>
<td>Elijah BR</td>
<td>14.58</td>
<td>0.22</td>
<td>-14.36</td>
<td>-17.44</td>
<td>-11.35</td>
<td>3.08</td>
<td>3.02</td>
</tr>
<tr>
<td>Aiden BR</td>
<td>4.25</td>
<td>6.47</td>
<td>2.22</td>
<td>-1.39</td>
<td>5.89</td>
<td>3.62</td>
<td>3.67</td>
</tr>
</tbody>
</table>

*Figure 5.51.* Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS within-clinic for all cases (researcher).
Primary outcome data for stuttering: beyond-clinic. Analysis of %SS data obtained from beyond-clinic samples by the researcher revealed that for all cases with the exception of Aiden, fluency levels statistically improved. In Aiden’s case, fluency levels worsened and this was found to be statistically significant (see Figure 5.53). Analysis of the same samples by the blind rater found that in all cases except Aiden, fluency levels statistically improved. This data found that Aiden’s fluency levels increased, but the increase was not statistically significant (see Figure 5.54).

Figure 5.52. Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS within-clinic for all cases (blind rater).
Figure 5.53. Modified RC method to determine statistical significance (reliable change) in stuttering outcome measure of %SS beyond-clinic for all cases (researcher).
Primary outcome data for speech sound disorder: single-word level.

Analysis of PCC data obtained from the single-word naming test context revealed that in all cases there was a statistically significant improvement in this outcome measure from pre- to 12 months post-treatment (see Figure 5.55).
Primary outcome data for speech sound disorder: connected-speech level.

Analysis of the PCC data obtained from connected speech samples again revealed that in all cases there was a statistically significant improvement in this outcome measure from pre- to 12 months post-treatment (see Figure 5.56).
Figure 5.56. Modified RC method to determine statistical significance (reliable change) in SSD outcome measure of PCC at the connected speech level.

**Overdispersion**

Process measures were taken on a weekly basis within the clinic during Stage 1 of the LP for all participants, and then intermittently during Stage 2 as clinic visits were systematically withdrawn. These measures included collecting SRs and %SS to guide and monitor the treatment process. These within-clinic measures were made solely by the researcher until assessment occasion three (which was 9-months post-commencement of treatment). The participants were transferred to another service for the management of stuttering between assessment occasions three and four, and process measures during this period were not available. At 12-months post-commencement of
treatment, these measures were gathered by the researcher. All %SS process data
gathered by the researcher within the clinic was used to illustrate whether or not
overdispersion occurred for the participants involved in this study. The variation in
these multiple measures on %SS was considered under the binomial distribution (where
the SE is equal to 1) and then assessed for overdispersion using a quasi-binomial
approach (see Table 5.32).

Table 5.32
Analysis of overdispersion on all participants clinical data – multiple measures of %SS
by the researcher

<table>
<thead>
<tr>
<th></th>
<th>Significance level : Binomial distribution (SE=1)</th>
<th>SE: quasi-binomial approach</th>
<th>Significance level: quasi-binomial approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brad</td>
<td>$p &lt; .001$</td>
<td>1.18</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Daniel</td>
<td>$p &lt; .001$</td>
<td>1.88</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Frank</td>
<td>$p &lt; .001$</td>
<td>1.24</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Elijah</td>
<td>$p &lt; .001$</td>
<td>3.79</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Aiden</td>
<td>$p &lt; .001$</td>
<td>2.77</td>
<td>$p = .04$</td>
</tr>
</tbody>
</table>

This further analysis of multiple measure of %SS was based on a generalised
additive model (GAM) for assessing whether there was evidence of change on multiple
measures of %SS data taken over time by the researcher for all five participants. Under
this model, the variations observed for Daniel, Aiden and Elijah’s were above what was
expected under a binomial distribution, as seen in Table 5.32 where the SE values were
above 1.5. However, when comparing the significance of these data, for all participants
except Aiden, this level of overdispersion did not create any noticeable change in the
significance levels, which stayed at $p<.001$ with and without the quasi-binomial
approach (i.e., they were still found to be highly significant). The overdispersion
adjustment for Aiden’s data had a greater impact, reducing the significance, but
although the finding was weaker, it was still significant \((p = .04)\). It should be noted that between the 9- and 12-month assessment occasions, no multiple measures were obtained and this may have impacted on these findings. However, as the majority of participants were in Stage 2 of the LP during this time, little variation in data was expected. Using this model, the adjustment applied utilising the quasi-binomial raised the possibility of correctly assessing the significance in the presence of overdispersion. However it must be acknowledged that these process measures of %SS are not of equal reliability, raising the issue of potential bias in these measures.

**Summary**

This chapter provided the results of five preschool aged children who participated in direct, concurrent treatment for stuttering and SSD. Research design was a Phase I clinical trial/case studies. A new method of analysis, reliable change with 95% credible intervals, was developed to measure statistical significance of the primary outcomes used in this study, %SS and PCC.

Four of the five participants successfully completed Stage 1 of the LP in 14, 15, 17 and 22 weeks respectively. All of these participants had subsequently completed Stage 2 of the program and been discharged at the time of writing this thesis. Analysis of %SS revealed that all four participants exhibited statistically significant improvement in fluency levels from pre- to post-treatment.

For the SSD, all five participants exhibited statistically significant improvement in PCC from pre- to post-treatment. One child met discharge criteria for SSD while enrolled in the research program.
The positive findings of this Phase I clinical trial provide further evidence for the treatment of co-occurring stuttering and SSD, in accordance with one of the aims of this thesis. Further, the findings lend support to the presence of emerging evidence of treatment effect. These results, combined with the findings of the qualitative study will be discussed in Chapter 6 in relation to their impact on clinical implications in the field of speech-language pathology. The limitations of both studies will also be detailed, and the chapter will conclude with a discussion on potential future directions that may be explored as a result of the research presented in this thesis.
CHAPTER 6

Treatment for Co-occurring Stuttering and Speech Sound Disorder:

Discussion
Introduction

The overall aim of this thesis was to consider the current evidence for the management of young children presenting with co-occurring stuttering and SSD and to establish further scientific evidence to help guide treatment practices in the future.

In Chapter 1, a review was conducted of the current evidence for the two disorders in isolation, as well as reviewing information about the impact of the two disorders in the long-term. Both disorders in isolation have the potential to impact a person negatively if not treated before school-age.

On reviewing the surrounding literature relating specifically to the treatment of these two disorders in Chapter 2, there was a lack of empirical evidence to support a treatment approach when the disorders co-occur. Only one study has documented outcomes based on treatment approaches that are considered outdated. The qualitative evidence presented in Chapter 3 of this thesis found that SLPs are unsure when making decisions around service delivery for this caseload. Some participants were choosing to treat the two disorders in a serial manner, using direct treatments for stuttering and SSD, and others taking a concurrent approach to service delivery. However, serial treatment of these two disorders may jeopardise this optimal window period for treatment.

Chapters 4 and 5 detail the development of a new treatment approach involving concurrent intervention for stuttering and SSD using direct treatments for both disorders. A Phase I clinical trial design was used in order to develop and describe new treatment protocols and to establish initial estimates of dosage. Another major aim of a Phase I clinical trial is to determine the initial effect of the new treatment (Onslow et al., 2008). Research design for the Phase I clinical trial was also considered level IV case studies (NHMRC, 2009). Single case study methodology often employs descriptive
statistics and can be criticised for lacking in statistical robustness. Therefore, a new method of statistical analysis for single case study methodology was devised, reliable change using 95% credible intervals for the differences in proportions.

Key Findings

Clinical reasoning for the management of co-occurring stuttering and speech sound disorder. The qualitative study conducted in Chapter 3 employed in-depth semi-structured telephone interviews to explore current practice in relation to the management of children with comorbid stuttering and SSD. The findings from the data collected from 13 Australian SLPs pinpointed several issues when working with this caseload. The core theme of this study identified the process of clinical reasoning used by the participants, as the participants drew from many factors to make decisions relating to this caseload. It was found that overall there appeared a clinical dilemma specifically around service delivery, although not for which treatment approach(es) to use. Several participants noted confusion around service delivery and were seeking more up-to-date guidelines. Some were not comfortable with the decisions they were making, due to the lack of relevant external evidence.

The concerns raised by some clinicians in this study reflect issues reported elsewhere. In 2002, Nippold highlighted a crucial need to develop the evidence-base for management when stuttering co-occurs with SSD. The data obtained in Study 1 have reiterated this call for research. Whilst there are some guidelines available, they are based on clinical experience and/or expert opinion (Byrd et al., 2007; Guitar, 2006; Nippold, 2004a; Ratner, 1995; Wall & Myers, 1995; Wolk, 1998). There is only one source of external evidence documenting treatment outcomes, which employed
treatment approaches that are out-of-date to address the disorders concurrently (Conture et al., 1993). A review of the surrounding literature provided in Chapters 1 and 2 of this thesis revealed that there are several options to choose from relating to treatment and service delivery. Treatment approaches may be either direct or indirect in nature. Service delivery may be conducted serially or concurrently, and if concurrent, then treatment goals within sessions can be embedded (i.e., blended) or discrete. Earlier survey studies have found that the majority of clinicians largely favoured indirect treatment approaches delivered concurrently with blended treatment goals (Arndt & Healey, 2001; Blood et al., 2003), likely based on the work of Conture et al. (1993) and subsequent related guidelines and expert opinion (Byrd et al., 2007; Ratner, 1995; Wall & Myers, 1995; Wolk, 1998). In recent years, much research has been conducted that supports direct treatment approaches for both disorders in isolation, as discussed in Chapter 2. Some authors have proposed a direct treatment approach for the co-occurring disorders (Nippold, 2004a; Wall & Myers, 1995). However Guitar (2006) recommended that careful planning was required if direct treatments were used for this caseload, and also that treating serially may be optimal. Yet serial service delivery may compromise the window for early intervention that is considered crucial for both disorders (Bishop & Adams, 1990; Bloodstein & Ratner, 2008; Nathan, Stackhouse, Goulandris, & Snowling, 2004b). Moreover, anecdotal reports discussed in Unicomb et al. (2013) and Wall and Myers (1995) have indicated that addressing one disorder alone may potentially exacerbate the other, or that addressing both disorders at the same time may be detrimental to either disorder. Taking into account all of this information relating to service delivery, it is unsurprising that confusion can exist among clinicians when making clinical decisions for this caseload (Unicomb et al., 2013).
The findings from Study 1 demonstrated that the majority of participants implemented intervention in line with Guitar’s (2006) guidelines using direct treatments to address both disorders serially. Some SLPs in this study who were using this approach cautioned that doing so could result in financial burden on families as well as increase the potential for therapeutic burnout (involving both clinicians and families). A number of participants also noted that treating serially appeared to be less efficient (i.e., took more time than expected). Concurrent service delivery may be one way of addressing these concerns and the need for early intervention. Three participants in Study 1 reported using a concurrent service delivery method which did not appear to exacerbate either disorder. Further, some participants discussed that treating in this way appeared to take less time than expected.

When engaging in clinical decision making for this caseload, all participants from Study 1 used many sources of evidence, in line with the E³BP model (Dollaghan, 2007). Internal evidence related to factors including clinical preferences based on training levels and experience in treating one or both disorders, as well as various workplace constraints. Client values and preferences were strongly emphasised, with all participants reporting involving the parents in many of the decisions around both assessment and treatment. The majority of the participants were drawing on the external evidence for both disorders in isolation for treatment approaches. Most were using direct approaches such as the LP for stuttering, as well as treatments for SSD that were supported by high levels of evidence, such as those identified in Chapter 2 of this thesis. All participants considered other factors from the external evidence, but mostly in relation to stuttering. For example, factors such as age of onset and time since onset of stuttering, predictors of natural recovery, the development of stuttering and the tractability of stuttering were all considerations in decision-making for these SLPs. In
contrast to this, only two participants mentioned external evidence in relation to SSD. One reported a belief that while stuttering as a disorder had the potential to worsen and become chronic, SSD would normalise with or without treatment. There was also mention of speech developmental data to support clinical decisions. These are all important considerations when making decisions around how, when and whether clinicians should intervene with these children. However, there is evidence to support that some children do not naturally recover from both disorders (Bloodstein & Ratner, 2008; Law et al., 2000; Yairi & Ambrose, 1999a). Further, that negative implications exist if both disorders are left untreated. For example, reports of estimated rates of natural recovery for stuttering vary but may be as high as around 80% (Kalinowski et al., 2005; Yairi et al., 1993). There are known factors that may predict natural recovery (Ambrose et al., 1997), although it is impossible to predict which children will recover without intervention. For those who do not naturally recover, there are reports that stuttering can worsen and become harder to treat with advancing age (Bloodstein & Ratner, 2008). Similarly, there are many studies investigating the potential negative vocational (Klein & Hood, 2004), educational (O'Brian et al., 2011) and psychosocial impacts (Blood & Blood, 2007; Iverach, O'Brian, et al., 2009; Langevin et al., 2009) on a person who stutters. Similarly, there is research to suggest that some children with SSD do not normalise without treatment (Law et al., 2000; Leitão & Fletcher, 2004; Roulstone et al., 2009). Those children can also suffer negative consequences as a result of a SSD. The relationship between SSD and difficulty in the development of literacy is well known, yet a SSD can also affect other areas of academic performance as well as vocation, and can have psychosocial ramifications (McCormack et al., 2009).

In summary, Study 1 contributed to the body of literature by exploring the way in which clinicians are working with this caseload. Previous studies have investigated
this phenomenon with a focus on service delivery (Arndt & Healey, 2001; Blood et al., 2003; Nippold, 2004b). The qualitative study in this thesis detailed both service delivery as well as specific treatment approaches used by clinicians who currently work with this caseload. Further this study has lent support to other literature highlighting a clear need for empirical research around a treatment approach. Clinicians in this study discussed confusion around selecting a service delivery approach due to this lack of evidence, and also the surrounding anecdotal evidence relating to the potential of exacerbating one or both disorders. However, this qualitative interview study has found evidence to the contrary. The participants who reported treating both disorders concurrently and directly stated that treating in this way was not detrimental to either disorder or development of the child’s communication.

**Establishing significance for single case study designs.** Methods of analyses employed for single case research can include various forms of visual analysis to detect trend, level and variability, however these are often more appropriate for single case experimental designs. Descriptive case study designs are used often in the field of speech-language pathology and are well-suited to explore and document change in an individual, particularly those from heterogeneous caseloads. Analysis of descriptive single case study designs employ the use of descriptive statistics and detailed observations to document change (Newell & Burnard, 2011). In this way, they are often criticised for lacking in statistical power (Yin, 2009). The original reliable change index was developed to assess change in an individual’s outcomes for statistical significance (Jacobson & Truax, 1991). However, one limitation of this method is that it relies heavily on the knowledge of typical and atypical distribution scores in the populations in question (Bothe & Richardson, 2011; Lambert et al., 2008; Zahra & Hedge, 2010), and as such utilises continuous data. Data used in the field of speech-language
pathology are not always continuous. Therefore, a new method of analysis was designed to take into account the nature of the primary outcome data used in this thesis, %SS and PCC, which are categorical data with binary outcomes. This method is called the reliable change index with 95% credible intervals. The development of this new method of analysis contributes to the field of speech-language pathology as the procedure focuses on inferring reliable and statistically significant change in individuals. It is suitable for use with descriptive single case designs and represents a step forward in addressing issues related to statistical robustness in single case study methodology. Further, this method of analysis may contribute to the literature from other fields as well (e.g., psychology and other allied health professions).

**Emerging evidence for how to treat young children with co-occurring stuttering and speech sound disorder.** The findings reported in Chapter 3 led to the development of a Phase I clinical trial for treating co-occurring stuttering and SSD, which was also considered a descriptive longitudinal case study. A Phase I clinical trial was considered appropriate for this study because the primary aims of this type of design are to determine initial safety and efficacy of a new treatment on a small number of cases. It also developed and described initial treatment protocol and looked at issues of dosage (Onslow et al., 2008).

Concurrent, direct intervention (employing discrete session goals) was delivered to five children aged from 3 to 6 years. The LP was used to treat the stuttering in all participants and was delivered as manualised (Packman et al., 2011). Intervention for the SSD was individualised according to each participant’s sound system analysis. Speech sound intervention commenced after clinic visit two or three, to ensure the participants’ parents were appropriately and comfortably delivering the stuttering
The two primary outcome measures (%SS and PCC) were measured at four assessment occasions: pre-treatment, entry into Stage 2 of the LP, 9-months post-commencement of treatment, and 12-months post-commencement of treatment. The primary outcome measures were taken from samples within and beyond the clinic across a variety of speaking contexts. The stuttering data were rated by both the researcher and an independent observer for reliability purposes.

The reliable change index with 95% credible intervals was employed to analyse the results of the primary outcome measures. This method was used as a way to quantify statistical and reliable change in the participants. Analysis of the data for stuttering revealed that four of the five participants demonstrated statistically significant improvements in their fluency levels from assessment occasion one (pre-treatment) to assessment occasion four (12-months post-commencement of treatment). One participant, Case 5, demonstrated worsening of fluency levels. This was the only participant who did not complete the LP. The number of children who do not complete Stage 1 of the LP in general has not been formally investigated; however there is previous research where non-completion has been documented. Koushik (2011) conducted a file audit of 165 children who had undergone treatment with the LP in North America. Of these, 27 children (13.5%) did not complete Stage 1 of the program, five of them due to parents reporting that progress was slower than expected, which was evident in the example of Case 5 in this study.

Analysis of the primary outcome for SSD revealed that all five participants demonstrated statistically significant improvement in PCC from pre-treatment to 12-months post-commencement of treatment. Case 4 differed from the other cases in that he did not follow the same trajectory of remediation. This could be due to the nature of
his SSD, which was predominantly motoric. Although this case also exhibited phonological difficulties, the majority of his time in treatment was spent on the motoric issues, using a motor-based treatment approach. It is possible that the competing demands of working on the two separate disorders with underlying speech motor involvement limited improvement in this area. Further this case also exhibited possible sensory issues which may also be a reason for resistance to therapy. It is not known whether or not the treatment for SSD prior to entry into Stage 2 had any effect due to the nature of the methodology employed, but of note was that despite the limited gains to that point, neither disorder was exacerbated by the direct concurrent treatment of the other, and the overall outcome was a significant improvement for both disorders.

Therefore this research has demonstrated that for children who stutter with a co-occurring SSD (where the underlying basis of the SSD is primarily phonological), the two disorders may be treated concurrently in some instances. That is, the two disorders may be treated at the same time within the same sessions yet discretely, using treatment approaches that are direct in nature. Further, greater gains may be seen if the treatment approach for SSD is linguistically based (e.g., minimal pairs) where the aim of therapy is to highlight homonymy and teach the child the function of sounds (Barlow & Gierut, 2002). Though there are several recommendations in the surrounding literature for which to treat co-occurring stuttering and SSD, many of them recommend the use of indirect treatment approaches to address both the stuttering and/or the SSD (Byrd et al., 2007; Ratner, 1995; Wall & Myers, 1995; Wolk, 1998). Other literature proposes that there is no need to avoid direct treatment for this caseload (Guitar, 2006; Nippold, 2004a) particularly as there is insufficient empirical evidence to support an interaction between the two disorders. This research contributes to the recommendations of the
latter authors who propose that both disorders may be treated concurrently using direct treatment approaches.

Another consideration for the Phase I clinical trial was to assess whether concurrent service delivery has the potential to be more time and cost efficient. Treatment data for the stuttering revealed that the four cases who successfully completed Stage 1 of the LP did so in 14, 15, 17 and 22 weeks consecutively. This is in line with established worldwide benchmarking data. Research surrounding delivery of the LP (in isolation) has indicated that the median time taken to reach Stage 2 of the program is around 16 clinic visits (Rousseau et al., 2007), and established worldwide benchmarking data has shown that the majority of children complete Stage 1 in between 11 to 22 clinic visits (Packman et al., 2014). Once in Stage 2, the manualised increments for clinic visits take a further 11 months to reach completion (Packman et al., 2014). Case 4 completed Stage 1 of the program, however did so in 22 clinic visits. Although this aligns with benchmarked median data, albeit at the higher-end, he took longer than the others to complete. This participant demonstrated more severe levels of stuttering at pre-treatment than the other participants. Previous research has established the correlation between higher severity levels of stuttering and longer time taken in treatment (Jones, Onslow, Harrison, & Packman, 2000). It is not known whether the severity of this participant’s stuttering or the nature of his speech errors was a factor that may have predicted longer time in treatment, however this is a consideration warranting further investigation.

These same four participants in the Phase I clinical trial were treated in an average of 22.25 clinic visits for their SSD, after which they were all in alignment with age-expected estimates of PCC, approximately 88.5% for children aged 4 to 5 years,
and around 93.4% for children aged 5 to 6 years (McLeod & Bleile, 2003). One of these
participants had also met criterion for discharge for his SSD after 20 clinic visits. The
duration of intervention for SSD in isolation has yielded mixed findings depending on
the intervention approach under study, with traditional articulation therapy reported to
take upwards of 40 months until discharge criteria are reached (Baker & McLeod,
2011). Interventions that are phonological in nature (e.g., minimal pairs) may require a
minimum of 30 sessions to be effective (Williams, 2012).

One participant in the Phase I clinical trial reported in this thesis relapsed for a
short time upon entering into Stage 2 of the LP. However, after returning to Stage 1 he
again maintained Stage 2 criteria after six more clinic visits. This participant has since
successfully completed all but one Stage 2 appointments as manualised without further
relapse or complication. It is well known that stuttering is prone to relapse following
treatment. However, the evidence to date regarding relapse exists largely for adults who
have undergone different treatment approaches than the one implemented in Study 2.
The estimated report of relapse following treatment in adults varies from approximately
30 to 73% (Boberg & Kully, 1994; Howie, Tanner, & Andrews, 1981; Martin, 1981;
Perkins, 1981). In school-aged children, it has been reported that up to 1 year post-
treatment, a third of children were stuttering following previous treatment (Hancock &
Craig, 1998). Specifically relating to the LP, a file audit of 25 children conducted by the
Program’s authors found that 16% had returned to Stage 1 weekly visits after prior
progression into Stage 2 of the Program (Onslow et al., 2003). Similarly, in a long-term
(mean 5-years) follow-up of children who had previously completed the LP, Jones et al.
(2008) found that four of the 19 children who underwent follow-up assessment had
relapsed.
The treatment protocol in the Phase I clinical trial involved the use of parental surveys to obtain qualitative information exploring caregiver perceptions of the treatment process and the participants’ overall communication before and after treatment. All parents completed surveys and all felt that their children’s’ stuttering and speech sound production had improved as a result of speech treatment. All parents also felt that they themselves as well as other people could understand their children more since commencing intervention. All found that both the LP and treatment for SSD was easy for them to understand and reported their children were not confused by having two therapeutic targets to work on. The only variable that two parents were unsure of (reporting that they did not agree nor disagree) was that they found the home practice component for both disorders manageable. The LP involves the parents delivering daily treatment in the child’s natural environment, as well as taking daily measures of their child’s fluency levels. Early in the LP, parents are instructed to deliver treatment during structured conversations that typically occur for 10 to 15 minutes daily. As treatment progresses, parents are also asked to deliver treatment in unstructured conversations that may occur naturally throughout the day. For a period of time, treatment may occur in both structured and unstructured conversations daily until eventually all treatment is being delivered in natural and unstructured conversations (Packman et al., 2014). For SSDs, the addition of home practice incorporated into treatment programs can significantly improve therapeutic outcomes (Gunther & Hautvast, 2010). Therefore, in order to ensure the success of treatment for this caseload, parent-conducted home treatment was considered necessary. This would need to be a consideration that is discussed and negotiated between clinicians and caregivers when making decisions around treating the two disorders concurrently, particularly as delivering treatment in this way may not suit the lifestyles of some families.
Clinical Implications

The paucity of external evidence for the treatment of co-occurring stuttering and SSD is a subject that has arisen time and time again in the scholarly literature (Conture et al., 1993; Nippold, 2002, 2004b; Unicomb et al., 2013). As previously discussed, only one of the available options concerning the nature of treatment approach and service delivery has been investigated empirically (Conture et al., 1993).

The findings of both studies detailed in this thesis give rise to some clinical implications that may further inform the field when engaging in clinical reasoning for this caseload, and also add to the surrounding research base. The purpose of the Phase I clinical trial described in Chapter 5 was to describe each single case in full detail because of the heterogeneous nature of both stuttering and SSD in individuals. However, some overall similarities and differences can be noted when observing these participants.

The five participants who were involved in the current research underwent treatment approaches in line with best practice for both disorders in isolation. In this way, the treatment for both stuttering and SSD were direct. Treatment was delivered concurrently, although treatment (session) goals were discrete. Four of the five cases had either mild or mild-moderate levels of stuttering at pre-treatment. All of the cases had mild or mild-moderate severity of involvement for SSD at pre-treatment. The results of this study have indicated that intervention saw the most successful results when the nature of a child’s underlying SSD was predominantly phonological. There was no evidence that treating both disorders at the same time using direct treatment approaches was detrimental to either disorder. Time taken in treatment was in line with available worldwide benchmarking data for stuttering. Further, time taken in treatment
for SSD also aligned with data in the available research. Therefore, these children may be successfully treated concurrently using approaches that are considered best-practice and are being currently used by clinicians working in the field. Overall time taken in therapy may be more efficient than treating the disorders serially.

If the underlying nature of a child’s disorder is predominantly articulatory in nature, treating concurrently was not detrimental to either disorder; however time taken in both stuttering and SSD treatment appeared to take longer. Indeed, minimal gains for SSD may be observed while the child is in Stage 1 of the LP, particularly if the primary SSD target is articulatory in nature. In these cases, it may be more effective to explore alternative methods of service delivery. For example, if the stuttering was prioritised, treatment may be delivered serially. The LP could be implemented initially in isolation until the child reaches Stage 2 of the program. At that time, treatment for the SSD may commence.

Another clinical consideration when treating children concurrently was average session duration. The average overall session duration for the participants in this study during Stage 1 was approximately 80 minutes (i.e., when treating both disorders within the same session on a weekly basis). When weighed up against overall time taken in treatment if using a serial method of service delivery, concurrent delivery may be a more viable and efficient option to avoid financial burden on service providers and families, as well as minimising the risk of therapy burnout. However, some service providers may have difficulty providing such lengthy sessions, therefore more data is required in order to provide further support for this recommendation. The average session time of 80 minutes was found to be in contrast to what participants reported in
Study 1. The participants in that study who treated concurrently reported that they did so in either 30 or 45 minutes per session.

Since early intervention is considered crucial for both disorders in isolation, SLPs need to consider the external evidence for both disorders when making management decisions. As some participants interviewed in Study 1 revealed, parents of children with co-occurring stuttering and SSD are concerned more about their child’s stuttering, and were sometimes not aware that their child had a SSD. This highlights a potential need for a focus on stakeholder training in this area (e.g., early childhood educators and caregivers). Parental education focusing on both disorders and their potential impacts is required so that any decisions made are fully informed and in the best interests of the children and their families.

The participants in Study 1 were engaging with all facets of the surrounding evidence (external, internal, client preferences) when undertaking clinical reasoning for this caseload. Yet they mention a clear need for more up-to-date guidelines and evidence in the area. This is particularly the case as they are using treatment approaches that are best-practice and supported by high levels of evidence, and are direct in nature. The flow-chart shown in Figure 6.1 based on the results of this thesis may assist when making decisions using an E³BP framework for this caseload.
Figure 6.1. Proposed framework for the clinical management of co-occurring stuttering and SSD.

Serial Treatment
Level of evidence: Expert opinion
- Treat stuttering first
- Maintain low-levels of stuttering
- Commence therapy for SSD
  Or:
- Treat SSD first if severe (poor intelligibility)
  Consider:
- Child’s age and level of schooling in conjunction with required dosage

Concurrent Treatment (Discrete Goals)
Level of evidence: Level IV (case studies)
- Discrete goals
- Longer sessions in Stage 1
- Treat if mild or mild-moderate stuttering with mild or mild-moderate SSD
- Nature of SSD mostly phonological
- Most-knowledge approach to target selection
- First 2-3 clinic visits focus on stuttering therapy only
- If child has not reached Stage 2 by 22 clinic visits or is showing little to no progression, discontinue treatment for one disorder
- Maintain Stage 2 LP schedule if appropriate and continue SSD weekly (or as required)
Limitations

A limitation of Study 1 was that only a small number \((n=13)\) of SLPs in Australia were interviewed, the majority of whom worked in private practice. Three participants noted they were specialist SLPs in the area of stuttering. Therefore these findings cannot be generalised across all Australian SLPs working with this caseload. The research did not take into account the practices of clinicians in other countries. The use of the interview guide in the semi-structured interviews did not take into consideration post-graduate training in the area of SSD, only stuttering, and this was an oversight that would have provided valuable information, because although it did come up for a small number of participants, it was not discussed with the majority. Further, the data gained from the participants in this study were based on their clinical experiences and observations of their own clients. They were not asked to specifically draw from client file data, and their impressions may have therefore been somewhat general in nature.

The research design employed for Study 2 was a Phase I clinical trial according to the criteria of Onslow et al. (2008). This design was considered appropriate for preliminary research where the safety of participants was paramount. This was due to the limited amount of surrounding evidence available to guide treatment for these children, and alongside the anecdotal reports around the potential to exacerbate one or both disorders if treating directly and concurrently, this was an important ethical consideration. This study was also considered a descriptive, longitudinal case study design that allowed the researcher to report thoroughly on the observations and measures for each participant individually, and involved no control or manipulation to the variables under study. Such research designs can highlight any observable
therapeutic change that may go on to require further empirical inquiry (Rose, 2010). A limitation to this study, therefore, was that by design, the researcher cannot infer cause and effect of the treatment, as it was not truly experimental in nature (for example, there was no systematic manipulation of aspects of treatment). Employing a more experimental design would allow for cautious and rigorous control of the dependent and independent variables, ensuring that any observable changes in outcome measures were due to the treatment itself, not to any other confounding variables.

Case descriptions by their nature involve small numbers of individuals and therefore one must be cautious in attempting to generalise the results beyond the sample used. Also, due to the heterogeneous nature of both the stuttering and the SSD in each individual, the results may not be easily replicable. However, the detailed description of treatment and statistical analysis of the data provided in Study 2 assist with the process of replicability and preliminarily indicate that concurrent treatment of stuttering and SSD may be feasible and effective.

The perceptual data were based on an informal survey given to parents and familiar listeners at the 9-month assessment occasion. In doing so, may not have accurately reflected the views of some parents. This may have been the case for Aiden, whose stuttering worsened from pre-treatment to 12-months post commencement of treatment, this change being most visibly evident between the 9-month to 12-month assessment occasions.

Finally, the study did not allow for long-term follow up, therefore the issue of potential relapse of stuttering could not be determined, as well as the continued resolution of age appropriate speech sound errors. Ideally, further assessment once each participant had completed Stage 2 of the LP would provide more information about the
stability of both disorders in each child following successful treatment, particularly
given that stuttering is a relapse-prone disorder.

**Future Directions**

This Phase I trial was non-experimental in nature, however as this initial trial showed positive results (as indicated by the confidence in the degree of change determined by the reliable change index with 95% credible intervals), future research could employ single-subject experimental designs such as multiple baselines to observe whether the treatment was what caused a change in dependent variables. Future research could also employ a Phase II clinical trial design on larger groups of participants. Phase II trials would be an important next step in order to see whether the methodology described in this thesis could be replicated on larger numbers in order to further determine efficacy and to estimate treatment effect size. Implementing a Phase II trial could also allow for refinement of the target population in question (e.g., co-occurring stuttering with SSD (primarily phonological). Similarly, refinement of dosage and treatment protocol could occur during this phase (Onslow et al., 2008; Robey, 2004). Future replication studies could also incorporate longer-term follow up measures to assess the stability of both disorders, as previously discussed. Follow up some time after successful completion of Stage 2 of the LP would be optimal to assess whether stuttering had relapsed. This would be an important variable to investigate in this caseload particularly as age-inappropriate speech sound errors may predict persistent stuttering (Paden et al., 2002; Paden & Yairi, 1996; Paden et al., 1999). Long-term follow up of stability for SSD would ascertain whether participants were in-line with age appropriate expectations on the literacy continuum. Therefore, assessment of
phonological awareness abilities could also be conducted at follow-up once the child
had completed Stage 2 of the LP and entered into their first formal year of schooling.

It would also be interesting to see the effect of treating in a serial and direct
manner on either disorder. Employment of an alternating treatments design may allow
researchers to investigate whether that form of service delivery does exacerbate the
other disorder, or if (as some participants mentioned anecdotally) it has a positive effect
on the other disorder (Unicomb et al., 2013). A retrospective file-audit may also lend
information to this line of research. In a similar manner, a study investigating stuttering
treatment only versus concurrent treatment or SSD treatment only versus concurrent
treatment may allow researchers to assess whether there was any carryover of treatment
effect to the other disorder(s).

The participants in this study had varying degrees of stuttering severity, and all
had mild-moderate SSD severity at pre-treatment. Future research could look at more
severely impaired children (across both disorders) and also investigate stuttering when it
co-occurs with motor-speech based disorders such as childhood apraxia of speech, as
this has not been specifically investigated in the surrounding literature. As previously
mentioned, another variable worthwhile exploring would be to examine time taken in
treatment for children with varying underlying aetiologies of SSD.

Another line of future research is related specifically to speech sound errors and
target selection criteria. This study employed a most knowledge approach to target
selection, and while still supported by evidence, this approach is considered more
traditional and conservative in nature. Current evidence supports a least knowledge
approach to target selection, looking at more advanced sounds and structures. Given the
results of this study, and the limited research supporting a positive interaction between
stuttering and phonology, future research may consider choosing a least knowledge approach to target selection when treating concurrently using direct approaches. This would be particularly relevant, as earlier research has indicated that age-inappropriate cluster reduction in young children may predict stuttering persistence (Paden et al., 1999).

Previous studies have sought to investigate the psychosocial impact of both stuttering and SSD (as they occur in isolation) on young children. Future research could investigate children who have the two disorders co-occurring, to consider whether there is a greater psychosocial impact on this caseload, given that both disorders are known to have a negative impact on the lives of some individuals (Blood & Blood, 2007; McCormack et al., 2009). This information could potentially provide a rationale for a more efficient treatment approach for this caseload, as early intervention for both disorders as they occur in isolation is already considered crucial.

Finally, there are other models of intervention and service delivery available to clinicians when treating this caseload that include: (i) treating both disorders in a serial manner using indirect intervention approaches, (ii) treating in a serial manner using direct intervention approaches, and (iii) treating concurrently using indirect intervention approaches. Further, where concurrent approaches are considered, treatment goals may be either blended or discrete. However, to date, only one has been published (Conture et al., 1993) and one was investigated in this thesis. This thesis investigated concurrent service delivery using direct treatment methods with discrete goals. Serial service delivery, using any form of intervention approach (direct or indirect), has not been empirically investigated, although there are published guidelines recommending this form of treatment, and clinicians in the field are following them (Unicomb et al., 2013).
Concluding Remarks

Overall, this thesis contributes to the field of speech-language pathology in several ways. Firstly, the way in which SLPs are currently managing co-occurring stuttering and SSD in young children has been explored and detailed. This has been done in light of the most up-to-date treatment evidence for the disorders as they occur in isolation. Secondly, a new method of statistical analysis has been developed for single case study research designs. This method of analysis, the reliable change index with 95% credible intervals is particularly well suited for both clinical and research studies that utilise categorical data with binary outcomes. Finally, the research has added to the body of evidence for how to treat co-occurring stuttering and SSD.

The findings established from the research contained in this thesis suggest that when it comes to the management of children with co-occurring stuttering and SSD, SLPs draw from many factors under the E³BP framework (Dollaghan, 2007), often from external research that relates to either disorder as it occurs in isolation. A certain amount of uncertainty is reported in the literature concerning decision-making on how best to treat these children, most likely due to the paucity of available external evidence. When a service delivery approach for this caseload is contemplated, several options are available, centred on whether or not to treat in a concurrent or a serial manner. The evidence surrounding intervention approaches for either disorder has evolved over the years, with high levels of evidence supporting direct intervention over indirect methods. There is currently no scientific research surrounding the treatment of this caseload using direct intervention approaches that are supported by high levels of scientific evidence. Study 1 found that when using these treatment approaches, SLPs are predominantly treating in a serial manner. However, this has the potential to jeopardise early
intervention opportunities for both stuttering and SSD. Clinicians have reported a need for more up-to-date guidelines on the management of this caseload.

The children who participated in this research received concurrent, direct treatment for both disorders, and in the majority of cases showed statistically significant improvements in both stuttering and SSD from pre- to 12 months post-commencement of treatment. Therefore treating co-occurring stuttering and SSD directly and concurrently in some children may be a more cost and time-efficient way of working. In turn, this may minimise the potential for negative long-term ramifications observed in some individuals.

Data gathered from descriptive case studies such as those detailed in this thesis are considered an essential first step in the translational research process. Such data may lead to the translation of preliminary research to efficacy and effectiveness studies. In turn, this may result in a change in policy and practice in the way in which this caseload is managed (Davidson, 2011).

More research is required in order to build the evidence base for this caseload, particularly as the evidence-base for the disorders in isolation has evolved. As one participant SLP stated in Study 1 of this thesis,

“...every time they present you've got to evaluate if that's still the right thing to do. I'd love some guidelines that helped me structure it better” (Natalie)

With those words, it seems timely to again return to the call for research put forward over a decade ago by Nippold (2002). Hopefully, the research detailed in this thesis will lead to further studies in the area of treatment for co-occurring stuttering and SSD.
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APPENDICES
Appendix A – Sample Participant Memos Exported from NVivo Software

23/12/2011 3:32 PM

Transcribed today in full. Took around two and a half hours. Still learning to use features of software, but much easier to transcribe using Dictaphone feature within this program. Need to update attribute values to include years of experience, workplace etc.

Pseudonym is Alison. Works in a xxxxxxxx part time, but primarily in private practice for herself - metro. Based in VIC. Years of experience 30 years and identifies expertise in the area of stuttering. Also does a xxxx xxxx role within xxxxx xxxxxx (perhaps need to do another code combining these 2 as there is at least one other participant who is the same…although these roles together are potentially identifiable, so discuss with supervisors re ethical considerations) Draws mostly on her experience in private practice Wants to be involved in member-checking and editing transcript. Stay in touch via email once transcript has been done.

Service delivery:
Treats serially depending on intelligibility relating to speech. If unintelligible, sounds first. If milder artic issues would consider concurrent, though states to date treating serially.

Conventions used:
: extended vowel
(deliberately omitted/explanations)
. . . ellipses
. . truncated ellipses
[ ] overlapping conversation
[laughs] non speech sounds

Have added the additional conventions and finalised word document also accordingly.

29/12/2011 11:14 AM

Transcribed today, took approximately two and a half hours.

This SLP is Victorian based
Pseudonym is Danielle
Works in private as well as a xxxxxx role (specific to stuttering)
Unsure of general experience as it didn’t emerge from interview
2 years working with CWS
Preschool aged up to adolescents
Has been trained Lidcombe Program and Westmead Program
Refers to both roles quite regularly, but as she is only xxxxxxxxxx therefore I won't assign an attribute value specific to this as she mostly draws on her role in private practice.

This is one of several who mention a speciality area in stuttering. Others are general clinicians who would treat both, specialising in neither $ or SSD
Perhaps need to consider the views of specialists in the field of SSD also to balance things out (theoretical sampling)…..Yahoo Phonological Therapy group??? Discuss with Sally to put in amendment to ethics to recruit from here also (contact administrator of group for permission) to gain insight into that perspective also.

Service delivery:
Never treats concurrently. Always serially. Prioritises stuttering almost always. Believes artic can be fixed at any age.
Commenced in vivo/process/open coding today on P001

Some confusion around term SSD (“assume don't mean minor artic”), may need to clarify this in future interviews
Refers on for SSD, has been treating stuttering almost 30 years
Sees self, and notes that others see her as a specialist in the field of $ in vivo code: “value”
As in more value for family’s therapeutic dollar
Reason for initial referral - by parent (code “referral”?)
If unintelligible, address SSD first (code “order of service delivery”?)
Concurrent therapy, but mainly only with language (code “concurrent language”?)
Language Rx Facilitating Fluency (code – “facilitators”?)

Deleted all previous coding, because the names weren't representative and I wasn't really coding by asking pertinent questions, such as "why is this interesting", "what is this about" etc.
I had also created some codes before I started coding based on the semi structured interview questions, but thought I would start with a fresh slate and let the data tell me a story and not the other way around, as is with grounded theory inductivist approach.

So now, starting all over again with P001.

P001 states she has been working with mostly older children and adults - so wonder how much this phenomenon occurs for her, and level of experience around the same? Discusses an assumption of normal maturation, but really there is no way to measure that. Need to generate a code around natural recovery or similar.

P002 starting to code today as well (iterative process). This one prioritises $ therapy first (but relates this back to her caseload and that most children she classes as mild to mod SSD), so need a code around severity of involvement or similar.

P001 prioritises SSD first particularly if they are not intelligible Seems to be a relationship between prioritising and intelligibility

Transcribing P003 and P004 as well as coding first two at the same time
I didn't ask why the parents generally first present/refer. Need to make sure I mention this in future interviews.
27/02/2012 10:54 AM

Looking at P007 now.
Mentions she will do a $ and SSD assessment at one time, if she notices something going on with the speech sounds. This could be a code around assessment/clinical decision making
I need to go back and compare that with other transcripts.....as I have now created a new code around Ax timing and I know others have referred to it, so want to go back and code these if relevant. Some Ax’s based on parental concern. Some won’t do both Ax’s at the same time. Go back and check other participants. Really need a code relating to reason for Ax or similar.

Now I am reaching a little theoretical saturation, new codes are emerging, but these are getting fewer and fewer. I am understanding now what 'constant comparison' is all about. I forgot to ask what actual measures for $ assessment this participant uses. Need to make sure I ask that in future.

There seems to be a common theme around rural and remote regarding dosage and also service delivery (i.e. concurrent because they have to), so need to code for this, as is recurring for a couple of participants.

This information seems a little contradictory. Participant first states rationale that younger children need to focus more on SSD because fluency is part of developmental process. Then states rationale for concurrent therapy being an older child and if stuttering is more severe. The case she then presents the child is 5 years old, the stutter was only mild but she worked on them concurrently anyway. Must be more about SSD and age, consider this in coding.

Seems to be a common pattern for those that treat sequentially, to wait until end stage 1, or in some cases when they are at late stage 2 or end stage 2. Have created some codes for this and gone back to check other transcripts for same. As this is common – start to consider axial coding?

Some clinicians use not just Lidcombe program for the young children, they may use other approaches.

Some clinicians also report using LP combined with other approaches. Need to go back and check this against other transcripts.

28/02/2012 12:56 PM

Coding P010 today onwards
Need to compare this with others: variations on LP mentioned (code for LP variants)

29/02/2012 9:38 PM

Coding P011 today.
Another code has arisen that being "parental concern considered for Ax", seems that parents are considered all the way along in this process (referral, Ax, Rx, decision making etc)
Need to go back and compare this with all other transcripts, because I am sure this is considered by at least a couple of others. I think I have just coded such concerns previously as “parental concerns” generally.

1/03/2012 10:19 PM

More coding tonight. Two more to go. I have a commonality here across other participants but will have to go and search for it – they are hoping to improve stuttering by treating sounds first. Code – rationale? Do this on Monday.

I don’t think this is a common theme but will check but this participant mentions not being able to see whole programs through due to service provision limitations. Public health only sees till 4 yrs of age and then school picks them up.

3/03/2012 11:25 AM

Last transcript coding today. Parental concern around initial referral seems to be something that is similar across some transcripts. Go back and check that any reference to this has been coded (parental concerns), and we can think of another more appropriate term later. Also ax considerations might be worthwhile creating and putting in there too? Actually I have a code Parental Concern considered for Ax…..compare against others for ref’s to this. This therapist stated doesn’t work on concurrently because not sure of what outcome will be - and that rings a bell. I think I have another code that may be similar, but I have put it as “Unsure of Outcome” for now. On Monday, print out full list of codes again, search for similar code and if can’t find, may need to go and compare this with other transcripts. This one mentions iPad, as does another - go back and find and code under keeping child engaged, and also technology

What seems to stand out to me is that almost everyone I have interviewed has a different approach to treatment, and a different rationale behind why they do it the way they do. Even with assessment, it seems to be done differently for most. Also that none of them mention related evidence for either disorder when discussing rationales…. Could a core category perhaps be difference rather than patterns?

12/03/2012 8:55 PM

Looking at merging some codes together tonight. So going through each code/category at a time and merging similar items. At least five sources mention involving the parents during the assessment process, letting this guide assessment decision making
Appendix C: Interview Guide – Qualitative Study

*Interview Guide for Project: Children with stuttering and speech sound disorders: Clinical decision making*

Time of interview: ______________________

Date: ______________________

Interviewer: ______________________

Interviewee: ______________________

Interviewee research code: ______________________

*Introductory statement (read by interviewer)*:

Hi, my name is (insert interviewer name in full) and I am part of the research team for the project titled “Children with stuttering and speech sound disorders: clinical decision making” that forms part of a PhD project undertaken by Rachael Unicomb at the University of Newcastle. Can I firstly confirm that you received our email on _____ confirming the date and time of this interview? I refer now to the research information statement that was provided to you. Can I confirm that you have read this information statement and have had the time to consider whether you are willing to participate? Do you have any questions based on the information statement before we commence the interview? I also wish to advise you before we begin that this interview is being audio-taped, and if possible, ask you not to identify yourself or any third party by name during the interview duration. Every ten minutes, I will break the interview to ask if you are still willing and able to continue. Are you ready to begin?

### Guiding Questions*

<table>
<thead>
<tr>
<th>Guiding Questions*</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Can you tell me about your experience of working with children who stutter?</td>
<td></td>
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<tr>
<td><strong>Probe questions (if required):</strong></td>
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<tr>
<td>• How many years have you been working?</td>
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<td>• What percentage of children do you have on your caseload of children who stutter?</td>
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<td>• What setting do you currently work in?</td>
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<td>• What age groups are the children you are treating?</td>
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<tr>
<td>2. When working with children who stutter and also present with co-occurring speech sound disorder, what assessment approaches do you use?</td>
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<td><strong>Probe questions (if required):</strong></td>
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<tr>
<td>• What measures do you typically use to assess stuttering?</td>
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<tr>
<td>• What measures do you typically use to assess the speech sound disorder?</td>
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<td>• Formal/informal?</td>
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<td>• Do you assess anything else, such as phonological awareness, literacy etc.?</td>
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<tr>
<td>• How would you describe the nature of the speech sound</td>
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</tbody>
</table>
disorder in children who present to you with both disorders? Phonological/articulatory/apraxia?
- How would you describe the typical severity of the speech sound disorder in these children?

3. When working with children who stutter and also present with co-occurring speech sound disorder, what treatment programs/approaches do you use?

**Probe questions (if required):**
- For the stuttering?
- For the speech sound disorder?
- Do you use a different treatment program for either disorder if these disorders are solitary in a child?
- Have you ever seen changes in the speech sound disorder if you treat stuttering first? If so, what kinds of changes did you note?
- Have you ever seen changes in the stuttering if you treat the speech sound disorder first? If so, what kinds of changes did you note?

4. When working with children who stutter and also present with co-occurring speech sound disorder, what types of service delivery models would you tend to use?

**Probe questions (if required):**
- Would you treat one disorder before the other (sequential)
- At what point would you decide to intervene for the other disorder?
- Would you treat both disorders at the same time but alternate treatment (i.e. one week stuttering, one week speech sounds)?
- Would you treat both disorders in the same session?
- Would you refer treatment for one of the disorders to another service provider?

5. For this caseload (stuttering and speech sound disorders) what would your treatment goals and outcomes be?

**Probe questions (if required):**
- Treatment goals for the stuttering
- Outcomes for the stuttering
- Treatment goals for the speech sound disorder
- Outcomes for the speech sound disorder

6. Can you talk me through some of your cases where you saw a child who both stuttered and had a co-occurring speech sound disorder, and guide me through your clinical decision making processes from start to finish?

Interviewer: Thank you for all of that valuable information. As all of the interview topics have been covered, and we can finish the interview up now.
*Note that all questions above are listed as a guide for the researchers only. They are intended to ensure that all areas of interest to this research project are covered during the interview. As such, they may not be asked exactly as they are listed above, or in the same order.

**Conclusion statement (read by interviewer):**

Thank you very much for your time on behalf of the research team for this project and also on behalf of the University of Newcastle. I remind you that your privacy and confidentiality will be protected by the use of coding to replace your name, and also the use of general descriptor headings for participant places of work. The use of pseudonyms may be used when writing up any results from these findings. You will also be given the opportunity to review the interview transcript to check for accuracy and edit as you see fit. Once data analysis has taken place, you will also be given the opportunity to participate in member-checking for validity purposes, where the researcher(s) may go through the final report with you, or provide descriptions of the themes that have emerged from the data. **Do you wish to have the opportunity to review your transcript and participate in member-checking?** Again, thank you very much for your time.
# Appendix D: Node Structure Report - Qualitative Study

## Node Structure

**PhD Interview Project**

20/02/2014 4:26 PM

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21/02/2014 12:54 PM

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Appendix E: Peer Review Process Stage 1

Coding Check - Portion of Transcript

I: Great okay. So just thinking about just those guys now that have stuttering and speech sound disorder . . . can you guide me through your assessment approaches that you use in terms of both disorders when they first present to you, if you wouldn't mind?

R: Sure. So when we do our initial assessments we pretty much look at everything so we do the language assessment, the speech assessment and the stuttering assessment if they start stuttering and we become aware of that. So I tend to do a bit of a rating throughout some of the language assessment. Actually I had one today, I was just thinking I had one today and um for him I did a conversation, I did a conversation just to start off with so it was a conversation with an unfamiliar adult, like with me for probably syllables and did a rating based off that 300 syllable, roughly sort of 3 minute conversation with one who was a preschooler and then got into some of the language but because it was just me for that assessment, I only rated in that conversation and then when I have the language and the speech assessment I just do the language and the speech and focused on it that way. Other times for another school aged one I had another person in the room with me so I got her to do the rating while I did the language and speech and when we have that opportunity we tend to do it throughout so see how they go at single word level in the speech assessment, see how they go at more longer um levels depending on the type of language assessment that they have, um and then just informally during games how are they going so sometimes we break it up over three and do a bit of an average or just have those there written down so we can compare okay how are they in spontaneous conversation, how are they going in single words, how are they going when the language demands are high so we can see a bit of variation between those, but that varies depending on who I have in the room with me, if it's just have someone else like another therapist in there with me so . . .

I: Great that sounds great. So that's for the stuttering and you did mention that you would do a typically a battery of assessments when they first come to you. Just thinking about the speech sound disorder, how do you assess the speech sound disorder? What types of measures do you use?

R: Um so we have our own speech sound test. So it's not one of the standard ones like Daz Roberts of the Articulation Survey. It's actually one that the manager developed which goes through . . . it's got some multisyllabic words in there, it's got . . . it looks at the sound in initial medial and final position um it also has some wh questions in there so like who what when so we get a bit of an extended sample and we tend to just note that. When we're analysing it, we haven't really been doing percentage consonants correct but more been looking okay for what are their phonological processes, what's their artic repertoire of speech sounds, um and sort of judged that it based off that depending on the types of errors they're having how intelligible they are, how they're going in connected speech versus single word labelling tasks and tend to do it more . . . I guess a little bit more qualitative rather than quantitative.

I: Sure. When these families first come to you, what do you think that the parents are coming to you for? What seems to be the parents' initial concerns?

R: Um so we have our own speech sound test. So it's not one of the standard ones like Daz Roberts of the Articulation Survey. It's actually one that the manager developed which goes through . . . it's got some multisyllabic words in there, it's got . . . it looks at the sound in initial medial and final position um it also has some wh questions in there so like who what when so we get a bit of an extended sample and we tend to just note that. When we're analysing it, we haven't really been doing percentage consonants correct but more been looking okay for what are their phonological processes, what's their artic repertoire of speech sounds, um and sort of judged that it based off that depending on the types of errors they're having how intelligible they are, how they're going in connected speech versus single word labelling tasks and tend to do it more . . . I guess a little bit more qualitative rather than quantitative.

I: Sure. When these families first come to you, what do you think that the parents are coming to you for? What seems to be the parents' initial concerns?

R: Thinking of the one that we saw today although he was pretty straight cut stuttering, it was stuttering. The other one, the other little preschooler I was telling you about who had the speech sounds and stuttering, um he, they came in talking about stuttering being the main concern and then sort of talked about the other ones that they sort of came in afterwards. So stuttering seemed to be the big one ("because") people know about stuttering I think is part of it. So yeah they would come in and...
R: Yeah because we've done a battery of assessments we fill them in on everything and we tend to we go a little bit as well. So we might talk about in the case history if they've presented with stuttering and what types of stuttering are you seeing, these are some types of stutters that are out there, what are examples of what this particular child does? Is there a family history of stuttering, when did the stuttering first start? then we sort of talk about, okay these are some of the things that we've been hearing, do you find that they do that at home, is this fairly typical? And they tend to say after watching the articulation test, go oh yes that. And sort of become more I guess...aware of it, I think for the one that was speech sounds plus um stuttering...they were a bit oh which way do we go, like I think there was a bit of a...uncertainty. I think I do have another one as well that discontinued, and I think that by the time the end of it and she was a little bit of speech sounds a little bit of stuttering. I think it was the issue where we were tossing up which way to go and so I kind of left it fairly open to them, point like they'd seen, they'd sat through the assessments so they, we talked about each one, in our options and I think both of them decided, yeah stuttering is the way we want to...um look first.

I: Great and that kind of feeds into the next question, which in terms of service delivery. So it seems like you're treating in a very sequential fashion. So you would treat the stuttering to the end of stage one then what would happen when stage one was finished with these kids?

R: We probably start doing the speech sounds pretty much as soon as stage one is finished. But as to the parents, making sure we're seeing the ratings every time they come in. As far as service delivery in terms of times, we tend to see the kids on a weekly basis for half an hour. So we do Lidcombe once a week. And continue in that way um...some kids have come in twice a week, but by that point in time...we tend to keep it weekly um but we're more looking at the severity ratings each week. Maybe doing a little bit of a baseline assessment ever so often to sort of see where they're up to, doing a severity rating for the whole session, seeing where they are at. And continuing to talk to the parents about how they are going at home, how have you been doing back the feedback, how are they doing at home. So it tends to be more...as far as actual giving therapy, we tend to be more specific focused in that stage two point but still doing a lot of interaction with the parents in terms of how stuttering is going.

I: Sure. And so when you sort of move into stage two and you are kind of doing weekly speech sounds therapy, how do you find that the parents and the children are kind of...do they make that transition from one type of therapy to another, how do they find that from a parents and a child's perspective?

R: To be honest, I haven't gotten that far...laughs. I've only gotten that far with one child. So yeah cos..."because") a lot of them have actually, the ones that I have on my caseload at the moment have started in the last few months or so, so I haven't had them for that long. The one that has been going all year was a handover to me, and we've just started, like our first session was last week. And because it was a lisp and it's an interdental lisp, it was a bit of a crash and burn type session. Yeah so I think...
I: I didn't ask you, how many clinicians are there working with you?

R: We have three and our manager also comes in once a week to do training with us and also to do some assessments. She doesn't have any therapy clients so there's probably three in our practice.

I: So when you were saying that you tend to treat Lidcombe Program to stage one and then you might introduce speech sound disorder, is that something that you do within your practice, is that generally the norm there?

R: Yeah.

I: Do you know what guides you guys to make that decision in terms of . . what is some of your clinical decision making processes on why you would treat stuttering first?

R: I guess there's a few things. Parent concern is one of them. Um . . . I guess . . . as far as sort of was to go really superficial, I would say my manager told me so but I can sort of see where she from in terms of, it can take a while for the parents and the children to get used to the Lidcombe particularly in those first few weeks. Like it just seems to take time get heads around it, to do training, to do the work with the child, to set it up, to set up the situation for us to do it and then parents to do it. By the time we've done our baseline, by the time we've set up our situation, by we've modelled therapy, by the time we've seen the parents to therapy and by the time we've got feedback to the parent on doing the therapy, the session is over . . um is part of it. At the same time . . I guess if there's slow progress in Lidcombe, I don't want the question raised, is it because we're doing both of those things and am I doing the wrong thing as a therapist, like I don't want the parent to sort going oh well we're not really progressing, um, like I guess, and also for myself, like is it going effective, like the sort of fear of is it going to be less effective because I'm working on something else at the same time, am I just confusing them by doing too much all at once? So I guess there's a little bit of that. Part of it's also we . . um tend to consult with Bankstown and I don't know if perhaps it's because they've said something along those lines at some point in time, I don't know that because I have had . . the communication I've had with ((xxxx)) has been more with children with stuttering and language rather than stuttering and speech. So I haven't really had a lot of communication with them but I know that's one of the places that we go to to make some of those decisions. So yeah, as far as understanding of the rationale, those are probably the things that stand out in terms of um . . . just it simple. So it's not too overwhelming because it seems to take time for parents to get the hang of that as it is, it's so much work for them to do the severity ratings, to give the feedback, to be given the feedback, to set up the situation. It seems to take a while to get their heads around as it is without adding speech sound and phonological feedback and all those sorts of things into the process as well.

I: Absolutely. Okay so when you're treating the stuttering and it's a child who's got both that an sound disorder, have you ever noticed any changes in the actual speech sound disorder whilst you've been treating the child in stage one?

R: With the two clients that I have with both of those things? No. I haven't really had any changes.

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## Appendix F: Peer Review Process Stage 2

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"I guess there's a few things. Parent concern is one of them..."

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| SP involving other clinicians | Number of codes: 34 | Agreement of codes: 94% |

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Appendix G
Child Consent Visual – Stuttering and Speech Sound Disorders Project


Hi, my name is Rachael and I am a speech pathologist.
I was wondering if you wanted to do some work with me and your (mum/dad) to help us learn about the way you and other children use their words to speak?

If you want to, the first thing we will do is to go into my office, and we need to look at a few books together, and I am going to ask you some questions about what you see.

Then, if you still want to, you can come back and see me here for a little while every week.
We will do some fun things here, like reading some books together.....

We will be doing some talking about the way people speak, and how sometimes speaking might sound a little bit “bumpy”....

We will be playing games like basketball or ten pin bowling or doll’s houses....

Or even games like this one, it’s called Pop Up Pirate. We have lots of fun games like this here.

Every night, I will be asking (mum/dad) to do a little talking practice at home with you too where you will be doing some speaking and playing games, just like you would be doing here.
Sometimes you might have to do a little bit of talking, but sometimes all you will have to do is some careful listening, and playing.

Do you think that you would like to come here each week and help me find out a bit more about the way people talk?

Child’s name: __________________________
Participant number: ______________________
Child’s verbal response: __________________________

Child’s non-verbal behaviours: __________________________

Assent gained:  [ ] Yes  [ ] No
Date: __________________________
Appendix H – General Session Structure for a Typical Stage 1 Session

- Welcome child/parent in to the clinic room
- Show child visual schedule and finished posting-box

- Commence conversation with child (involve parent and play if required), aiming for approximately 10 minutes of conversation or a minimum of 300 syllables
- Record %SS and SR based on above conversation
- Ask parent what SR they assign to the above conversation and discuss/calibrate as necessary
- Ask child to remove “conversation” visual from schedule and post to finished box, and instructed to play for ten minutes in the play-corner (where appropriate toys/activities are arranged)

- Parent to provide daily SRs for previous week beyond clinic on their chart (note, if parent forgets this chart, clinician seeks permission to phone parent when they get home for this information)
- Discussion with parent regarding previous week’s SRs, and how therapy went in general
- Child instructed that play-time is finished and they remove this visual from the schedule and post to finished box

- Parent to demonstrate previous week’s therapy procedures (delivery of parental verbal contingencies). Clinician taking careful data in this activity on this delivery and the child’s reaction to the same.
- Discussion between parent and clinician based on delivery of the verbal contingencies, demonstration by clinician with the child if necessary
- Clinician and parent discuss changes to therapy for the coming week and home expectations for the LP
- Child asked to remove the structured therapy visual from the schedule and post to finished box

- Both child and parent are re-directed by clinician to a change in goal-sets to SSD therapy
- Clinician asks parent how homework for the SSD went during the week, and asks whether they are noticing any generalisation on speech sound skills in the home environment
- Individualised therapy for SSD takes place between clinician and child, with parent present and observing these procedures
- Clinician provides stimuli for SSD home practice during the week and discusses these homework expectations
- Child asked to remove the sound cards visual from schedule and place to finished box

- Child is then asked to choose their motivating game or app on clinician’s iPad for completion of the session
- Clinician re-iterates home plan for both LP and SSD. Clinician advises that the two must be separated out. Ideally LP therapy (structured) to take place early in the day,
and SSD Rx later in the day (however this is highly tailored to suit the demands of each family). Clinician reiterates that whilst LP therapy is taking place at home, parent not to comment on sound production and vice versa

- Child asked to remove iPad visual from schedule and post to finished box

- Next appointment is scheduled
- Session concludes
Appendix I
Stuttering and Speech Sound Disorders Phase I Clinical Trial: Surveys

What were your initial concerns for your child upon entering this study?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What was it that concerned you the most upon entering this study?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

This research study used a combination of therapy interventions. They included the Lidcombe Program for stuttering, as well as individualised intervention approaches to treat the speech sound disorder.

On a scale of 1 to 5, please rate the following questions:

1. I believe my child’s fluency has improved since he/she has received speech therapy
   - Strongly agree
   - Agree
   - Neither agree or disagree
   - Disagree
   - Strongly disagree

2. I believe my child’s speech sounds have improved since he/she has received speech therapy
   - Strongly agree
   - Agree
   - Neither agree or disagree
   - Disagree
   - Strongly disagree
3. I find it easier to understand my child since he/she has received speech therapy

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

4. Other people have commented that they can understand my child better now that he/she has received speech therapy

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

5. I found that the length of the therapy session was appropriate (e.g. approximately 1 hour in length)

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

6. I found the Lidcombe Program component of the therapy session easy to understand

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

7. I found the speech sound therapy component of the therapy session easy to understand

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

8. I found it manageable, conducting the required home practice with my child

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

9. I found that the length of time required for home practice was appropriate

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree
10. I found that I sometimes got my speech sound disorder/stuttering targets confused

☐ Strongly agree  ☐ Agree  ☐ Neither agree or disagree  ☐ Disagree  ☐ Strongly disagree

11. I found that my child sometimes got my speech sound disorder/stuttering targets confused

☐ Strongly agree  ☐ Agree  ☐ Neither agree or disagree  ☐ Disagree  ☐ Strongly disagree

12. Knowing what I now know about this treatment program, I would have preferred to focus on treating one disorder at a time

☐ Strongly agree  ☐ Agree  ☐ Neither agree or disagree  ☐ Disagree  ☐ Strongly disagree

13. Knowing what I now know about this treatment program, I would have preferred to first treat the fluency and then move on to treatment for the speech sound disorder

☐ Strongly agree  ☐ Agree  ☐ Neither agree or disagree  ☐ Disagree  ☐ Strongly disagree

14. Knowing what I now know about this treatment program, I would have preferred to first treat the speech sound disorder, and then move on to treatment for the fluency

☐ Strongly agree  ☐ Agree  ☐ Neither agree or disagree  ☐ Disagree  ☐ Strongly disagree

Overall, the things that I most liked about this program were:

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

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Overall, the things that I most disliked about this program were:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Familiar Listener Questionnaire:

Stuttering and speech sound disorders: A phase I clinical trial

Version 1, dated 4.2.2013

Researchers
Dr. Sally Hewat
Mrs. Rachael Unicomb
Dr. Elizabeth Spencer
Dr. Elisabeth Harrison

Having read the ‘Familiar Listener Information Statement’, and if you consent to participate, please complete this questionnaire listed below. Also please signed the consent form attached at the back of this questionnaire and return to the research team using the reply-paid envelope provided.

Familiar Listener Questionnaire

Name of child: ____________________________________________________________

Relationship to child: ______________________________________________________
Were you aware that this child was undergoing speech therapy (please tick)?

☐ Yes  ☐ No

How would you describe this child’s communication before he/she started speech therapy?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

How would you describe this child’s communication now?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Can you describe any specific changes to this child’s communication skills that you have noticed?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Can you describe any other changes that you may have noticed in this child (e.g. social skills, interaction, play skills, confidence, frustration levels etc.)? If so, could you provide details of examples of these?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
<table>
<thead>
<tr>
<th>How would you rate your ability to understand this child before treatment?</th>
<th>Very difficult</th>
<th>Somewhat difficult</th>
<th>Neutral</th>
<th>Somewhat easy</th>
<th>Very easy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How would your ability to understand this child now?</th>
<th>Very ineffective</th>
<th>Somewhat ineffective</th>
<th>Neutral</th>
<th>Somewhat effective</th>
<th>Very effective</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How effective is this child’s communication now?</th>
<th>Very ineffective</th>
<th>Somewhat ineffective</th>
<th>Neutral</th>
<th>Somewhat effective</th>
<th>Very effective</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Do you have any additional information you wish to provide us about this child?

____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________

*The research team thank you for your time and valuable information you have provided on completing this questionnaire. Please return to us via the reply paid envelope provided. Do not hesitate to contact the research team (above) if you have any questions related to this protocol.*
Appendix J – Brad’s severity-rating home recording chart
Appendix K – Daniel’s severity-rating home recording chart
Appendix L – Frank’s severity-rating home recording chart
1 = no stuttering
2 = extremely mild stuttering
10 = extremely severe stuttering

NAME: Pol Frank p.2

Diagram with dates and notes:
- 22/4/13
- 23/4/13
- 2/5/13
- 26/4/13
- 27/4/13
- 2/5/13
- 2/1
- 3/1
Appendix M – Elijah’s severity-rating home recording chart

1 = no stuttering
2 = spontaneously mild stuttering
10 = extremely severe stuttering
Appendix N – Aiden’s severity-rating home recording chart
1 = no stuttering
2 = extremely mild stuttering
10 = extremely severe stuttering

NAME: Aiden P. 2

Graph showing stuttering intensity with dates and notes:
- 5/2/13
- 22/2/13
- 11/2/13
- 5/3/13
- 15/3/13
- 22/3/13

Graph showing stuttering intensity with dates and notes:
- 29/3/13
- 5/4/13
- 12/4/13
- 19/4/13
- 26/4/13
- 3/5/13

Graph showing stuttering intensity with dates and notes:
- 18/5/13
- 17/5/13
- 24/5/13
- 31/5/13
- 16/6/13
- 17/6/13

Notes:
- SP available
- SP away
- Attend
- No SP
- Attended
1 = no stuttering
2 = extremely mild stuttering
13 = extremely severe stuttering

NAME

Aiden p.3

Date

34/6/15 6/7/13 9/7/13
### Informal survey completed by Brad’s mother

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe my child’s fluency has improved since he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I believe my child’s speech sounds have improved since he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I find it easier to understand my child since he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Other people have commented that they can understand my child better now that he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found the length of the therapy sessions appropriate</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found the Lidcombe Program component of the therapy session easy to understand</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the speech sound therapy component of the therapy session easy to understand</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found conducting the home practice with my child manageable</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found the length of time required for home practice with my child appropriate</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found that I sometimes got my speech sound disorder and stuttering targets confused</td>
<td>Disagree</td>
</tr>
<tr>
<td>Knowing what I know now about this treatment program, I would have preferred to focus on treating one disorder at a time</td>
<td>Strongly disagree</td>
</tr>
</tbody>
</table>

### Informal survey completed by Daniel’s mother

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe my child’s fluency has improved since he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I believe my child’s speech sounds have improved since he/she has received speech therapy</td>
<td>Agree</td>
</tr>
<tr>
<td>I find it easier to understand my child since he/she has received speech therapy</td>
<td>Agree</td>
</tr>
<tr>
<td>Other people have commented that they can understand my child better now that he/she has received speech therapy</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the length of the therapy sessions appropriate</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the Lidcombe Program component of the therapy session easy to understand</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the speech sound therapy component of the therapy session easy to understand</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found conducting the home practice with my child manageable</td>
<td>Neither agree or disagree</td>
</tr>
<tr>
<td>I found the length of time required for home practice with my child appropriate</td>
<td>Agree</td>
</tr>
<tr>
<td>I found that I sometimes got my speech sound disorder and stuttering targets confused</td>
<td>Disagree</td>
</tr>
</tbody>
</table>
Informal survey completed by Frank’s mother

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe my child’s fluency has improved since he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I believe my child’s speech sounds have improved since he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I find it easier to understand my child since he/she has received speech therapy</td>
<td>Strongly agree</td>
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<tr>
<td>Other people have commented that they can understand my child better now that he/she has received speech therapy</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found the length of the therapy sessions appropriate</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the Lidcombe Program component of the therapy session easy to understand</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the speech sound therapy component of the therapy session easy to understand</td>
<td>Agree</td>
</tr>
<tr>
<td>I found conducting the home practice with my child manageable</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the length of time required for home practice with my child appropriate</td>
<td>Agree</td>
</tr>
<tr>
<td>I found that I sometimes got my speech sound disorder and stuttering targets confused</td>
<td>Disagree</td>
</tr>
<tr>
<td>I found that my child sometimes got the speech sound disorder and stuttering targets confused</td>
<td>Disagree</td>
</tr>
<tr>
<td>Knowing what I know now about this treatment program, I would have preferred to focus on treating one disorder at a time</td>
<td>Strongly disagree</td>
</tr>
</tbody>
</table>

Informal survey completed by Elijah’s mother

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe my child’s fluency has improved since he/she has received speech therapy</td>
<td>Agree</td>
</tr>
<tr>
<td>I believe my child’s speech sounds have improved since he/she has received speech therapy</td>
<td>Agree</td>
</tr>
<tr>
<td>I find it easier to understand my child since he/she has received speech therapy</td>
<td>Agree</td>
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<tr>
<td>Other people have commented that they can understand my child better now that he/she has received speech therapy</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the length of the therapy sessions appropriate</td>
<td>Agree</td>
</tr>
<tr>
<td>I found the Lidcombe Program component of the therapy session easy to understand</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found the speech sound therapy component of the therapy</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>
I found conducting the home practice with my child manageable & Agree
I found the length of time required for home practice with my child appropriate & Agree
I found that I sometimes got my speech sound disorder and stuttering targets confused & Disagree
I found that my child sometimes got the speech sound disorder and stuttering targets confused & Disagree
Knowing what I know now about this treatment program, I would have preferred to focus on treating one disorder at a time & Disagree

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe my child’s fluency has improved since he/she has received speech therapy</td>
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<tr>
<td>I believe my child’s speech sounds have improved since he/she has received speech therapy</td>
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<tr>
<td>I found the length of the therapy sessions appropriate</td>
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<tr>
<td>I found the Lidcombe Program component of the therapy session easy to understand</td>
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<tr>
<td>I found the speech sound therapy component of the therapy session easy to understand</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>I found conducting the home practice with my child manageable</td>
<td>Neither agree nor disagree</td>
</tr>
<tr>
<td>I found the length of time required for home practice with my child appropriate</td>
<td>Agree</td>
</tr>
<tr>
<td>I found that I sometimes got my speech sound disorder and stuttering targets confused</td>
<td>Disagree</td>
</tr>
<tr>
<td>I found that my child sometimes got the speech sound disorder and stuttering targets confused</td>
<td>Disagree</td>
</tr>
<tr>
<td>Knowing what I know now about this treatment program, I would have preferred to focus on treating one disorder at a time</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>