

## Research Article

# Group Lidcombe Program Treatment for Early Stuttering: A Randomized Controlled Trial

Simone Arnott,<sup>a,b</sup> Mark Onslow,<sup>a</sup> Sue O'Brian,<sup>a</sup> Ann Packman,<sup>a</sup>  
Mark Jones,<sup>c</sup> and Susan Block<sup>b</sup>

**Purpose:** This study adds to the Lidcombe Program evidence base by comparing individual and group treatment of preschoolers who stutter.

**Method:** A randomized controlled trial of 54 preschoolers was designed to establish whether group delivery outcomes were not inferior to the individual model. The group arm used a rolling group model, in which a new member entered an existing group each time a vacancy became available. Assessments were conducted prerandomization and 9 months and 18 months postrandomization.

**Results:** There was no evidence of a difference between treatment arms for measures of weeks or clinic visits required, percent syllables stuttered, or parent severity ratings. However, children in the group arm consumed around half the number

of speech-language pathologist hours compared with children treated individually. In addition, children in the group progressed more quickly after the treating speech-language pathologist became more practiced with the group model, suggesting the group results are conservative estimates.

**Conclusions:** Group delivery of the Lidcombe Program is an efficacious alternative to the individual model. Parents responded favorably to the group model, and the treating speech-language pathologists found group treatment to be more taxing but clinically gratifying.

**Key Words:** stuttering, group delivery, Lidcombe Program, children

The Lidcombe Program is an operant treatment for early stuttering involving parent verbal contingencies for stutter-free and stuttered speech. The program was designed for use with children younger than 6 years (Packman et al., 2011) but has been used with primary-school-age children (Bakhtiar & Packman, 2009; Koushik, Shenker, & Onslow, 2009; Lincoln, Onslow, Lewis, & Wilson, 1996; Miller & Guitar, 2009). During weekly clinic visits with the child, a speech-language pathologist (SLP) trains the parent to administer the treatment. Parents administer the verbal contingencies during Stage 1 and occasionally during Stage 2 of the program. Verbal contingencies for stutter-free speech may include praise, such as “great

smooth talking.” Contingencies for stuttered speech may include a request for self-correction—for example, “Can you say that word again?” Contingencies are given during structured conversations for 10–15 min daily. They also occur during unstructured conversations such as when traveling to preschool or during bath time, as long as stuttering is infrequent.

Parents record daily stuttering severity ratings (SRs), which, combined with similar clinician measures, document treatment response and inform the treatment process. The 10-point SR scale defines 1 as *no stuttering*, 2 as *extremely mild stuttering*, and 10 as *extremely severe stuttering*. During Stage 1 of the treatment, children aim to attain *no stuttering* or *almost no stuttering*. Speech criteria for progression to Stage 2 are three consecutive clinic visits where the SLP SR is 1 or 2 and three consecutive visits where daily parent SRs are 1 or 2, with at least four of these being 1. Stage 2 is the maintenance stage of the treatment, which is designed to ensure that treatment gains, as specified by those criteria, are durable. Stage 2 requires less frequent clinic visits than Stage 1, typically over a 12-month period. During Stage 2, treatment is gradually withdrawn, with the aim of maintaining no stuttering or almost no stuttering.

<sup>a</sup>University of Sydney, Sydney, New South Wales, Australia

<sup>b</sup>La Trobe University, Melbourne, Victoria, Australia

<sup>c</sup>University of Queensland, Brisbane, Australia

Correspondence to Mark Onslow: mark.onslow@sydney.edu.au

Simone Arnott is now at the School of Allied Health, Australian Catholic University, Melbourne, Victoria, Australia.

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## ***The Lidcombe Program Evidence Base***

The Lidcombe Program has an evidence base that includes three Phase I trials (Harrison, Wilson, & Onslow, 1999; Onslow, Costa, & Rue, 1990; Wilson, Onslow, & Lincoln, 2004), five Phase II trials (Jones et al., 2008; Lewis, Packman, Onslow, Simpson, & Jones, 2008; Lincoln & Onslow, 1997; Onslow, Andrews, & Lincoln, 1994; Rousseau, Packman, Onslow, Harrison, & Jones, 2007), and one Phase III randomized controlled trial (Jones et al., 2005). Phase I trials are preliminary investigations of a new treatment. Phase II trials usually have larger numbers of participants and investigate the likelihood and relative size of a treatment effect, whereas Phase III randomized controlled trials are considered to be the “best source of evidence for effects of interventions” (NHMRC, 2000, p. 9). In addition, there have been four randomized controlled reports that involved less than the entire treatment (Franken, Kielstra-Van der Schalk, & Boelens, 2005; Harris, Onslow, Packman, Harrison, & Menzies, 2002; Harrison, Onslow, & Menzies, 2004; Lattermann, Euler, & Neumann, 2008) and five data-based case studies (Femrell, Avall, & Lindström, 2012; Hayhow, Kingston, & Ledzion, 1998; Lattermann, Shenker, & Thoradottir, 2005; Miller & Guitar, 2009; Murza & Nye, 2009). A meta-analysis of randomized controlled evidence for the treatment ( $N = 134$ ; Onslow, Jones, Menzies, O’Brian, & Packman, 2012) reported an odds ratio of 7.5; that is, those who received the Lidcombe Program had 7.5 times the odds of recovering from stuttering at 9 months compared with those who received no treatment.

To complement the Lidcombe Program treatment outcome evidence base, there is an evidence base for the treatment process. Large-cohort recovery studies have shown that pretreatment stuttering severity is the most significant predictor of treatment time (Jones, Onslow, Harrison, & Packman, 2000; Kingston, Huber, Onslow, Jones, & Packman, 2003). Further studies investigating the impact of the program on psychological, linguistic, phonological, and speech timing variables have shown no negative consequences following treatment (Bonelli, Dixon, Bernstein Ratner, & Onslow, 2000; Onslow, Stocker, Packman, & McLeod, 2002; Rousseau et al., 2007; Woods, Shearsby, Onslow, & Burnham, 2002). Clinician experiences of the treatment have been explored (Harrison, Ttofari, Rousseau, & Andrews, 2003; Rousseau, Packman, Onslow, Dredge, & Harrison, 2002) along with how parents administer the treatment (Carr Swift et al., 2011) and their range of experiences in doing so (Goodhue, Onslow, Quine, O’Brian, & Hearne, 2010; Hayhow, 2009).

## ***The Lidcombe Program’s Resource Intensiveness***

The Lidcombe Program is resource intensive, with a median of 15.4 clinical hr to complete Stage 1 according to its evidence base. Subsequently, eight to 12 clinic visits are required to complete Stage 2 (Packman et al., 2011). There is good reason to think that such resource intensity is a drain

on health care resources. Survey evidence of 277 Australian community clinicians (Rousseau et al., 2002) suggested that around half of them do not conform to the treatment guide and that public health care providers for whom they work rationalize treatment services by not allowing a full treatment to be given to every child. The most recent study to investigate SLP delivery of the Lidcombe Program showed that Australian community clinicians are often reducing the frequency and duration of clinic visits in order to comply with service delivery restrictions, treatment cost to the client, or both (O’Brian et al., 2013). As yet, it is unknown what impact these restrictions will have on outcomes.

This information is consistent with a health care system struggling to provide adequate health care services to treat all preschool children who stutter. Indeed, it seems obvious that the speech-language pathology discipline does not have sufficient resources to properly manage the public health problem of early stuttering. For example, the Australian population currently is 22.6 million with 3.3% younger than 4 years (Australian Bureau of Statistics, 2012), meaning that hundreds of thousands of Australian preschool children will require stuttering treatment at any one time. The cumulative incidence of early childhood stuttering is certainly above 5% (Yairi & Ambrose, 2013). In Australia, a prospective community cohort study involving expert diagnosis (Reilly et al., 2009) reported cumulative incidence of 8.5% at 3 years of age, with cumulative incidence of the same cohort at 12.2% by 4 years (Reilly et al., 2013). At 4 years of age in the latter study, the cumulative incidence graph was still showing an increasing trend, suggesting higher figures subsequently. There are around a thousand clinicians listed by Speech Pathology Australia<sup>1</sup> who indicate they are prepared to treat stuttering. With a median of around 25 treatment hours required for every preschooler who stutters, it is obvious that the discipline is underresourced for the clinical needs of the affected population.

To date, the Lidcombe Program has been researched using only an individual model of service delivery, with weekly individual visits by parent and child to the SLP, or by telehealth delivery. One response to the resource problem with early stuttering intervention is to administer the Lidcombe Program to parents and children in a group rather than individually.

## ***Group Speech-Language Pathology Treatment Models***

Group intervention has been shown to be efficacious for disorders from a range of health-related disciplines, including speech pathology. Although research outcomes vary depending on variables such as type of disorder, client age, and severity, group health intervention for speech and language disorders has consistently been found to have superior outcomes to no treatment and, in most cases,

<sup>1</sup>[www.speechpathologyaustralia.org.au](http://www.speechpathologyaustralia.org.au)

similar or superior outcomes to individual treatment (Brumfitt & Sheeran, 1997; Hearne, Packman, Onslow, & Quine, 2008; McCauley & Fey, 2006; Munro & Atkinson, 2003).

Cost savings are a frequently reported positive outcome from group intervention (Boyle, McCartney, Forbes, & O'Hare, 2007; Chen et al., 2003; Hung & Pang, 2010), as is client satisfaction with the group modality (Hunter, 2009; Pevsner, 1982; Ramig & Bennett, 1997). Hence, when the treatment is efficacious, groups can provide a means of successfully treating more clients with fewer clinician hours.

It is not surprising, then, that group-based stuttering treatment for children has historically been popular. Onslow and Ingham (1989) reported that 86 surveyed SLPs referred 36% of stuttering clients they assessed for specialized, group-based therapy. More recently, Liddle, James, and Hardman (2011) reported that, of 95 respondents who indicated they were "dysfluency specialists" (p. 275), 70% reported that they had provided group therapy during the previous year for school-age children who stutter. There was, however, a lack of consensus among the speech therapists regarding the main aims of the group sessions.

There have been some data-based reports of group treatment for preschool children (younger than 6 years). The Preschool Fluency Development Program (Culp, 1984) reported a direct speech restructuring technique and the indirect technique of modifying parent behaviors such as "being good and patient listeners," "identifying and modifying any circumstances that appear to increase the amount of disfluency," "encouraging the child to talk during more fluent periods or in situations that are more conducive to fluency," and "encouraging short utterances by asking yes-no or short-answer questions" (p. 58).

Culp (1984) presented outcome data for 14 children ages 2–5 years, based on clinic recordings. The group mean "percent disfluency" pretreatment was 11.4, with scores of 2.6 and 2.9 at 3 months posttreatment and 2 years posttreatment, respectively. Wakaba (1983) reported the results of group play therapy with three children, ages 4–5 years. The treatment was designed for features of early stuttering judged by the author to be clinically pertinent: "emotionally immature and meager expression, an introverted type of character, severe anxiety, and delayed interpersonal relations" (p. 93). Two of the three children appeared to show clinically significant stuttering reductions in the clinic immediately posttreatment. Hasbrouck et al. (1987) reported data for three children age 5 years who received an intensive airflow technique. At 5–7 months posttreatment in the clinic, the children had near-zero stuttering scores. Four children in the Conture, Louko, and Edwards (1993) group report were 4–5 years old. Treatment involved variants of direct speech restructuring techniques and indirect environment manipulation; however, no speech data were reported.

### ***The Current Trial: Group Delivery of the Lidcombe Program***

Despite the comprehensive evidence base for the Lidcombe Program, it has not been studied in group

delivery format. Yet the treatment is suited for such a format because there are core treatment components that apply to all families. These include methods to collect and discuss daily parent SRs, basic training for use of verbal contingencies with children, and basic problem solving about treatment implementation. In addition, qualitative research has provided information from parent perspectives about treatment benefits, challenges, and emotional reactions (Goodhue et al., 2010; Hayhow, 2009). Such information is invaluable to present and discuss with all parents. One of those reports (Goodhue et al., 2010) suggested the value of a venue for parents to air and discuss issues and support each other during treatment. A group treatment environment provides a potentially ideal venue for such activities. Therefore, this study aimed to investigate the efficacy and efficiency of standard Lidcombe Program treatment compared with group delivery of the same program.

## **Method**

### ***Design***

The design was a noninferiority randomized controlled trial. Noninferiority designs are becoming increasingly common in the fields of medicine and health (Greene, Morland, Durkalsi, & Frueh, 2008) as they demonstrate whether a novel treatment or intervention modification, in this case group delivery, can offer benefits while maintaining similar outcomes to the evidence-based standard treatment. Noninferiority trials have recently been used in the area of stuttering to demonstrate efficacy of telehealth modifications to the Camperdown Program (Carey et al., 2010) and the Lidcombe Program (Bridgman, Onslow, O'Brian, & Block, 2012).

Participants in this trial were randomized for Stage 1 of their treatment to one of two arms: group or individually delivered Lidcombe Program. Given the nature of the treatment, it was impossible for participants to be unaware of the treatment arm to which they had been assigned. To minimize bias, outcome assessments were conducted prerandomization and at 9 months and 18 months postrandomization by observers who were unaware of the identity, assessment point, or trial arm of each assessment sample.

The experimental hypothesis was that the group treatment was not inferior to the standard treatment. The control arm was the standard Lidcombe Program with parents and children seen individually on a weekly basis. The experimental arm was Lidcombe Program delivered in groups of up to four children with their parents also seen on a weekly basis. For all participants, Stage 2 was conducted with individual clinic visits as described in the treatment guide (Packman et al., 2011). The primary treating SLP (see below) was experienced with the individual Lidcombe Program model. Prior to the trial, a feasibility study was conducted with a group of three parent-child pairs. This study established that it was viable to use a group Lidcombe Program format and allowed for refining of the group treatment protocol.

## Participants

We recruited the children with stuttering and their families from the waiting list of a speech clinic at La Trobe University, Melbourne. Consent for the trial included information that parents randomized to the group arm would be sharing details of their children's treatment with other parents. Trial inclusion criteria were as follows: (a) age 3 years 0 months to 5 years 11 months at assessment, (b) consensus diagnosis of stuttering by a parent and SLP, (c) stuttering observed by the SLP in the clinic, (d) stuttering for longer than 6 months, and (e) at least 2% syllables stuttered (%SS), according to the SLP, on at least one of two recordings of the child speaking during naturally occurring conversations with a family member at home and with a non-family member outside of the family home. Exclusion criteria were (a) treatment for stuttering during the previous 6 months, (b) parent or child unable to use functional English for assessment and treatment, and (c) attention-deficit/hyperactivity disorder, intellectual disability, developmental delay, or autism spectrum disorder.

## Randomization

An Australian Stuttering Research Centre researcher, who was independent of the trial, randomized 54 children and families after assessment, using a permuted-block design of six. That is, for each six children randomized, three were allocated to group treatment and three were allocated to individual treatment. This restricted form of randomization is commonly used in smaller-scale clinical trials because it allocates participants to each arm with reasonably balanced numbers (Lachin, Matts, & Wei, 1988). Once each group had three parent-child pairs allocated, randomization occurred on a pair-wise basis when a vacancy became available in one of the groups. Table 1 shows the characteristics of the children in each arm at randomization.

## Treatments

All children were treated at La Trobe University using the primary treating SLP exclusively for the first 3 years

**Table 1.** Characteristics of children in each arm of the study: group or individual.

Characteristic	Group n (%)	Individual n (%)	Total n (%)
Gender			
Boy	20 (37)	22 (40.7)	42 (77.8)
Girl	7 (13)	5 (9.3)	12 (22.2)
Age (years;months)			
3;0–3;11	13 (24.1)	10 (18.5)	23 (42.6)
4;0–4;11	12 (22.2)	10 (18.5)	22 (40.7)
5;0–5;11	2 (3.7)	7 (13)	9 (16.7)
Mean age (months)	48.1	51.2	
Family history of stuttering	16 (29.6)	18 (33.3)	
Mean %SS pretreatment (SD)	3.9 (2)	4.4 (4)	4.2

Note. %SS = percent syllables stuttered.

of the trial. Subsequently, a second SLP treated all the children. Both SLPs were very experienced in the delivery of individual Lidcombe Program treatment, and both had been working as SLPs for a number of years. The second SLP was trained in the conduct of the trial and group treatment by the primary SLP. One-way observation mirrors in the clinic facilities at La Trobe University enabled both SLPs to observe each other's treatment provision. This facilitated treatment consistency without increasing the number of SLPs in the clinic room during clinic visits. Children in the control arm were treated as outlined in the treatment guide (Packman et al., 2011). Children in the group arm were treated with an adaptation of that guide, as described below.

## Preliminary Training Session

Prior to attending their first group clinic visit, children and parents randomized to the experimental arm attended one 60-min individual training session. During that session the SLP recorded the child's SR and a %SS score. Parents received preliminary training for assigning and documenting SRs, for conducting treatment conversations, and for presentation of verbal contingencies. They were instructed to conduct those procedures, albeit in a novice manner, during the intervening week until the first group visit. Procedures were further refined or modified during subsequent group clinic visits, based on progress and parent reported SRs.

## Group Composition

Each group was initially established with three parent-child pairs. Throughout the trial, up to three different groups were offered each week. Although this was not encouraged, parents were allowed movement between groups as needed in the interests of regular attendance of one group visit per week. Every effort was made to maintain three parent-child pairs per group visit, but on some occasions there were one, two, or four parent-child pairs per visit. Of the total number of group clinic visits delivered during the course of the randomized controlled trial (RCT), 10.9% were attended by one parent-child pair, 29.4% were attended by two parent-child pairs, 55.9% were attended by three parent-child pairs, and 3.8% were attended by four parent-child pairs. Variations occurred due to clinic visit cancellations, parent-child pairs switching to a different group, or parent-child pairs completing Stage 1 and leaving the group. When a group involved only two pairs for successive weeks, a new pair joined the group. The target was to maintain three parent-child pairs per group. Groups therefore constantly changed their composition and comprised parents with varying experience with delivery of the Lidcombe Program. The term *rolling group* is used to describe this style of group format. Although it is possible that the rolling design and group swapping may have altered group dynamics, the treatment does not rely on peer support or friendship but rather a common goal.

## Group Procedures

Group visits reflected, as much as possible, the sequence of a clinic visit using the standard treatment format

(Packman et al., 2011). The basic structure of each group clinic visit was as follows.

*Free play (approximately 10 min).* The clinic room was set up with generic play tasks and toys such as coloring, craft, train set, or car tracks. The children were encouraged to play together while the parents and the SLP engaged in discussion. Children sometimes sat with their parents during this time as all discussions were conducted in the one room.

*Parent report and discussion of SRs (approximately 10–20 min, concurrent with free play).* At the beginning of each visit, while the children were playing, each parent reported the stuttering SRs for each day of the previous week, and the SLP recorded them in the child's file. The group discussed any issues with the collection or assigning of SRs. All conversations were overt and conducted within earshot of the children, as per standard Lidcombe Program procedures. Subsequently, SRs were used as a focus of each child's treatment responsiveness. If the children were talkative during the free play, the parents and SLP would listen to the conversation and discuss the children's SRs, types of stuttering, and clinical progress.

*Practicing treatment during structured and unstructured conversations (approximately 30 min).* Parent-child pairs participated in either an individual or group talking activity (structured conversation).<sup>2</sup> During individual talking activities, each parent-child pair was assigned table or floor space and conducted treatment during a structured conversation. The SLP moved around the room and provided direction individually to parents for giving verbal contingencies, and modeling any changes the parent needed to make. At such times, the SLP discussed each child's progress with the parent so that parents were equipped to appropriately deliver the treatment each day, outside of the clinic, to their own child.

During group talking activities, the SLP sat among the children and their parents and provided feedback that the group could hear, enabling the SLP to highlight when verbal contingencies were provided correctly and to encourage parents to learn from each other's efforts.

*Recommendations for the coming week (approximately 5 min).* In a group format, the SLP provided recommendations for the coming week to each parent. The SLP

encouraged parents to assist each other to problem solve any issues they were encountering with the treatment, to share experiences, and to support each other's efforts.

*SLP in-clinic SR (completed throughout the visit, no time specifically allocated).* The SLP assigned an SR for each child's speech based on conversations during the visit. That SR and the parent SRs for the preceding week were used as criteria for progression to Stage 2.

### **Primary Outcome and Analysis Method**

*SLP hours per child to Stage 2.* For both trial arms, each clinic visit was 45–60 min, as specified in the treatment guide (Packman et al., 2011). We timed in minutes each visit until admission to Stage 2 and then divided by the number of children who attended that visit. We then divided the resulting sum by 60 to obtain the number of SLP hours per child to Stage 2.

To analyze SLP hours per child, we used time-to-event (survival) analysis, with an accelerated failure time model (Wei, 1992) for the number of SLP hours until each child reached Stage 2.

One child who did not complete Stage 1 (see below) was censored at the date of the last clinic visit; thus, her incomplete information was included in the analysis. Censoring ensures a valid estimate of treatment effect and is routinely used in time-to-event analysis. In addition to means, we present the median and interquartile range for each measure, because the time-to-event analysis results were not normally distributed and contained measures for the child who did not complete Stage 1.

### **Secondary Outcomes and Analysis Methods**

*Number of clinic visits and weeks to Stage 2.* We determined the number of clinic visits to Stage 2 for each child by counting all clinic visits from their first treatment visit (for individual children) or the preliminary training session (for group children) to their final Stage 1 visit. Number of weeks was calculated by counting the number of weeks from the first treatment visit or preliminary training session to the final Stage 1 visit, regardless of clinic nonattendances.

To analyze these data, we again used time to event analysis with an accelerated failure time model. We provided the median and interquartile range for each measure rather than means, because the time to event analysis results were not normally distributed.

*Percent syllables stuttered.* At each assessment, parents were asked to make two 10-min audio recordings of their children's conversational speech. One of these was with a family member who lived with the child and one with a non-family member outside the family home. A total of 262 audio recordings—86.2% of scheduled assessments—were available for %SS measurement. We presented the de-identified recordings to two blinded, independent SLP observers who each measured %SS for half the recordings

<sup>2</sup>Structured conversations are 10- to 15-min treatment conversations that are structured to elicit stutter-free or almost stutter-free speech for the duration of the conversation. Parents may use a joint activity such as a book or card game to facilitate this goal. The complexity of the structured conversation is adapted each day in a nonprogrammed manner, dependent on the child's SR prior to the treatment conversation taking place. Verbal contingencies are provided during the conversation. The structured conversation is individualized to suit the stuttering severity, interests, and conversational style of the child and parent. Unstructured conversations occur when SRs decrease to low levels. The parent will join in a naturally occurring activity or conversation, for example, while walking to preschool or packing away toys, and provide verbal contingencies without needing to structure the conversation. Unstructured conversations do not have a defined duration and may occur several times throughout the day.

using a two-button counter. Each observer scored recordings distributed equally across the three assessments.

We used two blinded observers because of the bulk of the recordings. To determine their interobserver reliability, we initially presented both observers with the same 36 recordings for them to make %SS measures. These recordings were selected randomly from the prerandomization, 9 months postrandomization, and 18 months postrandomization assessments. Pearson's  $r$  was .94 for the two sets of %SS scores. The minimum difference between pairs of measures was 0%SS, the maximum difference was 2.6%SS, and the mean difference was 0.84%SS.

To establish intraobserver agreement, we randomly selected 24 samples and re-presented them to each observer. Pearson's  $r$  for Observer 1 was .99, with a maximum difference of 1.2%SS and a mean difference of 0.23%SS. Pearson's  $r$  for Observer 2 was also .99, with a maximum difference of 0.5%SS and a mean difference of 0.15%SS.

We used analysis of covariance for %SS at 9 months and 18 months postrandomization. We used sensitivity analysis to assess the impact of missing data—we substituted the last available %SS score when no %SS measures were available for that particular assessment point. Analysis of postrandomization %SS was adjusted for prerandomization %SS to account for any imbalance between the treatment arms. We also assessed the relationship between age and %SS at 9 months and 18 months postrandomization in the analysis of covariance models.

*Parent-reported stuttering severity.* To complement %SS measures, parents reported daily SRs for the week prior to assessments. For these data, we used the analysis of covariance method described above for %SS.

*Exit questionnaire.* At the completion of Stage 1, parents completed a questionnaire about their experience of the treatment and satisfaction with the service delivery model. They scored items on a 9-point scale where 1 = *strongly disagree* and 9 = *strongly agree*. We then categorized each response into “strongly agree” (9), “positive range” (6–8), “neutral” (5), “negative range” (2–4), and “strongly disagree” (1). The response form contained a space for optional written comments.

## Results

### Clinical Progress

Forty-four (81.5%) of the 54 randomized participants completed Stage 1. Of the 10 participants who withdrew before completing Stage 1, two (7.4%) were from the group arm and seven (25.9%) were from the individual arm. The final participant, from the individual arm, had not met criteria for completion of Stage 1 by the 18-month postrandomization assessment. Although more children withdrew from the individual arm, a Fisher's exact test was used to test for significance of the increased withdrawal rate. The results were nonsignificant ( $p = .14$ ), suggesting the rate was probably due to chance. The reasons for withdrawal are noted in the Consolidated Standards of

Reporting Clinical Trials (CONSORT) diagram (Schultz, Altman & Moher, 2010) (Figure 1). The CONSORT diagram offers a transparent way of reporting the progress of participants through a trial.

Analysis of covariance was used to assess the relationship between age and stuttering frequency. There was no evidence of an association at 9 months ( $p = .94$ ) or 18 months ( $p = .75$ ) postrandomization.

### Data Analyses

We used SAS Version 9.2 for Windows (SAS, 2008) and Stata/IC Version 10.1 for Windows (StataCorp, 2007) to conduct the following analyses.

*Primary outcome: SLP hours per child to Stage 2.* The mean number of SLP hours for children to reach Stage 2 was lower for those who received group treatment (log-rank  $p < .0001$ ). Means were 9.2 hr for the group arm (median 5.7, interquartile range 10.4) and 14.3 hr for the individual arm (median 11.3, interquartile range 20.7). The Kaplan-Meier plot in Figure 2 shows the distribution by allocated treatment arm.

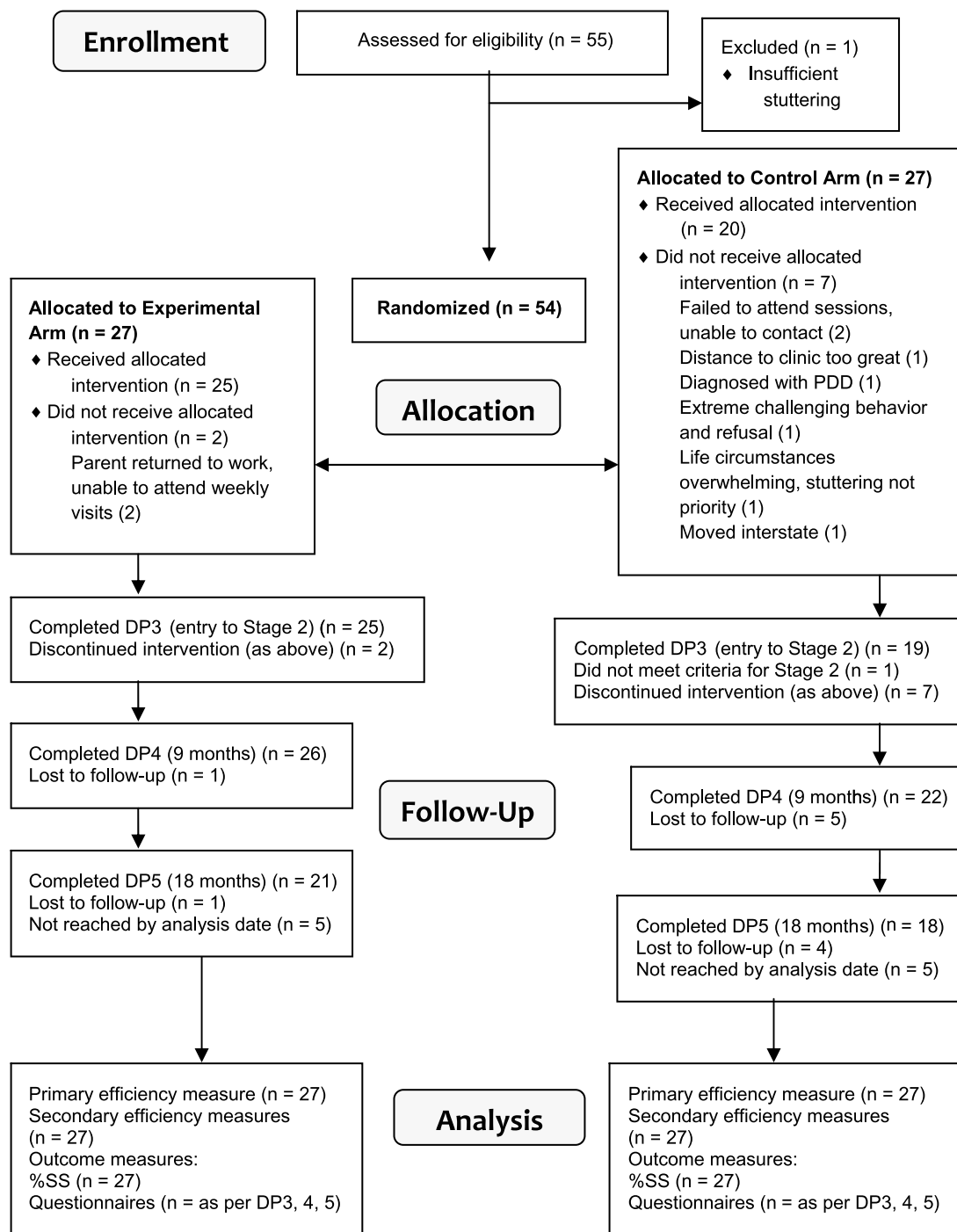
For percentage reduction of SLP hours for the group arm, the treatment effect was 0.54 (confidence interval [CI] 95%, range 0.43–0.68), meaning that children treated with a group consumed 46% fewer SLP hours to reach Stage 2 than the children treated individually.

*Secondary outcomes: Number of clinic visits and weeks to Stage 2.* The median number of clinic visits to Stage 2 for both arms of the trial was 18 visits. Statistically there was no difference ( $\chi^2 = 0.11$ ,  $df = 1$ ,  $p = .74$ ) between the two arms of the trial for number of clinic visits to Stage 2. The interquartile range values showed that 75% of all children reached Stage 2 with exactly the same number of visits.

The median number of weeks to Stage 2 for the individual arm was 25 compared with 29 weeks for the group arm. Although these values suggest a difference in the median weeks to Stage 2, the  $p$  value of .97 ( $\chi^2 = 0.0014$ ,  $df = 1$ ) showed no evidence of a difference over the entire distribution. Interquartile range values showed that the variation around the median for each arm was smaller for the group arm than the individual arm (group 19, 33; individual 19, 41).

When interpreting the group values, we explored whether children in the group arm progressed to Stage 2 more quickly as the SLP became more practiced at delivering the Lidcombe Program in groups. A linear regression model was applied to all participant “days to Stage 2” calculations obtained during the first 2 years of the trial. The individual model showed a nonsignificant trend ( $p = .9$ ) (see Figure 3). The SLP had been delivering the individual model for many years, so this finding was not surprising. Figure 4 illustrates the group data, which showed a statistically significant downward trend ( $p = .001$ ), suggesting the children in the group progressed to Stage 2 more quickly over the duration of the trial. Hence, it appears that group participants were entering Stage 2 in fewer weeks as the primary SLP gained experience with delivering Lidcombe Program group treatment.

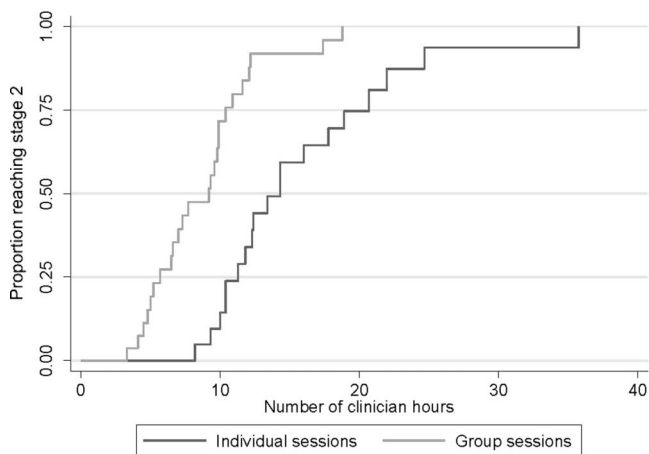
**Figure 1.** Consolidated Standards of Reporting Clinical Trials (CONSORT) diagram of participant flow through the randomized controlled trial. PDD = pervasive developmental disorder; DP = data point.



*Percent syllables stuttered.* Percent syllables stuttered (%SS) at each assessment, without last known value carried forward (that is, when missing data were not supplemented by previously available %SS), are shown in Table 2 and Figure 5. Analysis of covariance was calculated on these data. This analysis showed no evidence of a difference

between the two treatment arms at 9 months (Estimate 0.07%SS, 95% CI: -0.64 to 0.50%SS,  $p = .80$ ) or 18 months (Estimate 0.24%SS, 95% CI: -0.19 to 0.67%SS,  $p = .30$ ) postrandomization. These confidence intervals imply that, compared with individual treatment, group treatment could be associated with an increase in %SS by as much

**Figure 2.** Kaplan-Meier plot of number of SLP hours to Stage 2 by treatment arm.



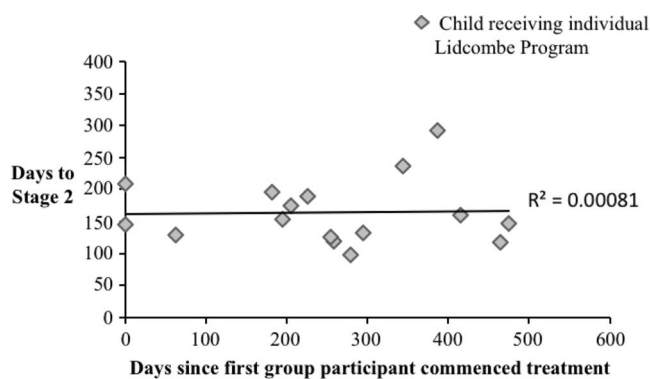
Note. SLP = speech-language pathologist.

as 0.67%SS on average. However, the large  $p$  values show no evidence that there is a true difference in %SS at 9 or 18 months postrandomization and hence that the group model of delivery results in noninferior %SS outcomes. There was also no evidence of an association of age with %SS at 9 months ( $p = .91$ ) or 18 months ( $p = .26$ ).

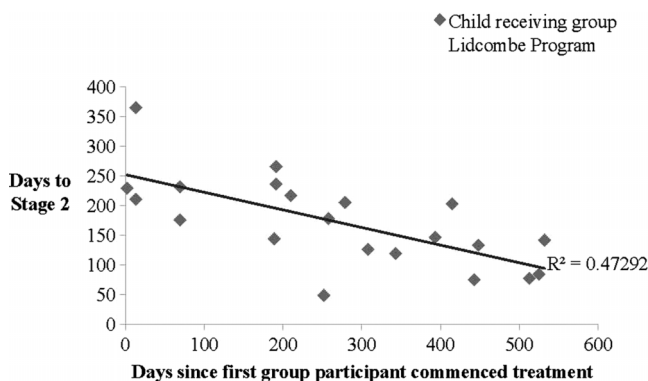
Analysis of covariance was also calculated with the last known value carried forward, that is, with any missing data replaced with previously available %SS scores. This analysis again showed no difference between treatment arms at 9 months (Estimate  $-0.12\%$ SS, 95% CI:  $-0.85$  to  $0.62\%$ SS,  $p = .74$ ) or 18 months (Estimate  $-0.24\%$ SS, 95% CI:  $-0.82$  to  $0.33\%$ SS,  $p = .40$ ) postrandomization. Overall, results show that the group model of delivery results in noninferior %SS outcomes.

*Parent-reported stuttering severity.* Analysis of covariance, without last known value carried forward, showed no difference between treatment arms at 9 months (Estimate  $-0.14$ , 95% CI:  $-0.68$  to  $0.40$ ,  $p = .59$ ) or 18 months (Estimate  $0.04$ , 95% CI:  $-0.50$  to  $0.59$ ,  $p = .87$ ) postrandomization.

**Figure 3.** Days to Stage 2 for individual participants.



**Figure 4.** Days to Stage 2 for group participants.



Results are presented in Figure 6. Again, these results show that the group model of delivery results in noninferior outcomes.

*Exit questionnaire.* Table 3 shows the percentage of responses in each of the five classifications. Overall, responses from the group parents were weighted much more positive than negative or neutral, but the responses were less positive than those of the individual participants to the same items. Fewer parents in the group arm reported satisfaction at the extreme positive end of the scale, particularly with receiving enough training in the Lidcombe Program techniques and feeling comfortable interacting during the clinic visit. Parents were most divided on whether group treatment reduced pressure on them. Parents were also divided about how much their children enjoyed interacting with the other children in the group.

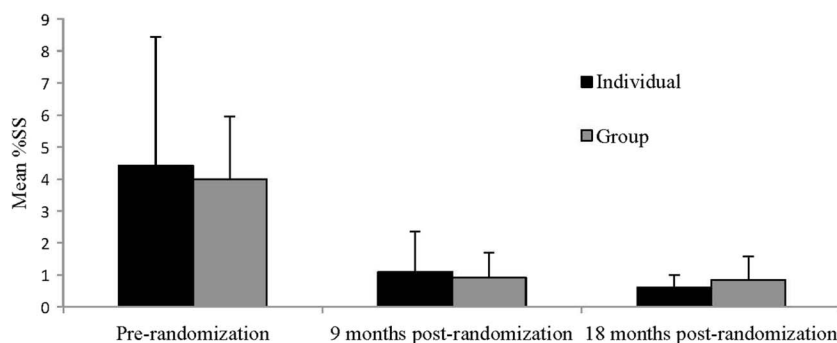
For items that were exclusive to the group delivery model, the majority of group participants reported positive ratings. These included gaining confidence in delivering the Lidcombe Program from watching and talking with other parents in the group, and enjoyment when interacting with other group members for both the parents and the children. Written parent comments included reflections on sharing the burden of treatment with other parents and establishing new friendships. Comments included “It was good to hear what other parents were doing and how they were feeling” and “knowing that other people were undergoing similar scenarios made me very comfortable.” Some parents commented that the group was beneficial for children who were lacking in confidence. Responses included

**Table 2.** Percent syllables stuttered at prerandomization and 9 and 18 months postrandomization for both treatment arms.

Arm	Assessment	N	M	SD	Min	Max
Individual	Prerandomization	27	4.4	4.0	0.9	21.5
	9 months postrandomization	22	1.1	1.3	0	4.6
	18 months postrandomization	17	0.6	0.4	0.2	1.2
Group	Prerandomization	27	4.0	2.0	0.9	8.5
	9 months postrandomization	24	0.9	0.8	0	2.7
	18 months postrandomization	19	0.9	0.7	0	2.7



**Figure 5.** Mean percent syllables stuttered at prerandomization and 9 and 18 months postrandomization for both treatment arms. Error bars represent standard deviation.



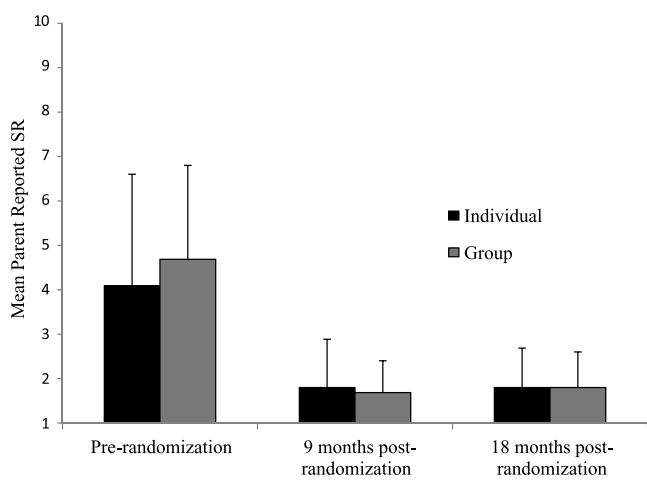
“having other children with him helped him to boost his self-esteem” and “it gave my child confidence that he knew he wasn’t the only one with bumps in his speech.”

## Discussion

There are good reasons to consider speech-language pathology treatments in a group format, one of those being cost efficiency. The speech-language pathology discipline is underresourced for the public health problem of early stuttering. Hence, the present randomized controlled trial added to the Lidcombe Program evidence base by comparing individual treatment of preschoolers who stutter with treatment in groups of up to four parent-child pairs.

Results showed that children treated in a group required around half the SLP hours to complete Stage 1 than those treated individually. These cost-efficiency benefits were not obtained at the expense of satisfactory outcomes, with evidence of noninferior outcomes for the group

**Figure 6.** Mean parent-reported severity ratings (SRs) at prerandomization and 9 and 18 months postrandomization for both treatment arms. Error bars represent standard deviation.



delivery in terms of %SS, parent SRs, clinic visits, and weeks required to complete Stage 1. These results are conservative estimates of the benefits of group treatment, because the novel group treatment format was associated with clinical SLP learning.

There was some evidence that a group model provided benefits unavailable with an individual model, as predicted by Goodhue et al. (2010), such as parent and child confidence from a group environment. Unsurprisingly, there was evidence that in some respects parents are more favorable toward an individual treatment model than a group one. This occurred even though group parents were generally in favor of the group model and it was not associated with inferior treatment outcome. Fewer parents in the group arm reported satisfaction at the extreme positive end of the scale, particularly in the areas of receiving enough training in the Lidcombe Program techniques and feeling comfortable interacting during the clinic visit. However, considering the noninferiority of clinical outcomes we reported, such findings might be interpreted as suggesting that the individual model involves clinical overservicing.

The rolling group model used during this trial is, to our knowledge, a previously undocumented treatment process design in the field of speech-language pathology. This is probably because speech-language pathology group programs are generally administered for a specified number of weeks or visits and hence attendance remains stable for the entire treatment. This is true of pediatric speech and language groups (Boyle, McCartney, O’Hare, & Forbes, 2009; McCauley & Fey, 2006; Munro & Atkinson, 2003) and groups of adolescents and adults who stutter (Block, Onslow, Packman, Gray, & Dacakis, 2005; Guitar, 1998; Ramig & Bennett, 1997). Conversely, children being treated with the Lidcombe Program attend weekly clinic visits until their individual speech measures meet the criteria for Stage 2, which is the maintenance treatment stage. The rolling group structure meant that parent-child pairs continually entered the group at different points of the treatment process from other pairs. The introduction of parents who were novice with the treatment process added diversity and dynamics to the group.

**Table 3.** Responses to exit questionnaire.

Item	Group questionnaire responses (%)					Individual questionnaire responses (%)				
	Strongly agree	Positive range	Strongly disagree	Negative range	Neutral	Strongly agree	Positive range	Strongly disagree	Negative range	Neutral
The speech pathologist and I established a strong relationship	71	29				91.7	8.3			
I had enough training to make quality recordings	43	57				66.7	33.3			
I had enough training to feel confident using the SR scale	66.7	28.5		4.8		75	25			
I had enough training in responding to my child's stutter-free speech	57.1	38.1		4.8		75	25			
I had enough training in responding to my child's stuttering	57.1	38.1		4.8		83.3	16.7			
There was enough time to discuss my child's treatment with the speech pathologist	81	19				91.7	8.3			
I enjoyed interacting with other parents in the group	57.1	38.1			4.8	n/a	n/a	n/a	n/a	n/a
I felt comfortable asking questions in front of other parents in the group (Group) / I felt comfortable asking the speech pathologist questions (Individual)	81	19				91.7	8.3			
I felt comfortable discussing my child's speech measures in front of the other parents (Group) / I felt comfortable talking about my child's speech measures with my speech pathologist (Individual)	81	19				91.7	8.3			
Watching other parents do the treatment increased my confidence in my own ability to do the treatment with my child	66.7	19		14.3		n/a	n/a	n/a	n/a	n/a
Being in a group reduced pressure on me	19	52.4		14.3	14.3	n/a	n/a	n/a	n/a	n/a
Listening to and talking with the other parents increased my confidence in making decisions about how to do the treatment at home	43	42.7		4.8	9.5	n/a	n/a	n/a	n/a	n/a
Being in a group was a positive experience for my child (Group) / Attending therapy sessions was a positive experience for my child (Individual)	76.2	23.8				91.7	8.3			
My child didn't enjoy interacting with the other children		9.5	57.1 <sup>a</sup>	28.6 <sup>a</sup>	4.8	n/a	n/a	n/a	n/a	n/a
My child developed skills in how to behave with other children	19	43		19	19	n/a	n/a	n/a	n/a	n/a
My child's understanding of the treatment was helped by watching other children receiving treatment	23.8	52.4		14.3	9.5	n/a	n/a	n/a	n/a	n/a

<sup>a</sup>Percentages were in response to a negatively phrased statement. Hence, these scores did not reflect a negative attitude, per se.

Two SLPs with considerable Lidcombe Program experience provided the treatment during this trial; however, they found some aspects of the group format challenging. These included scheduling mutually agreeable appointment times for clients, encouraging parents to share equally during clinic visits, and ensuring that children were occupied in activities that met the needs of their differing genders, ages, personalities, and stuttering severities.

Although not formally measured and not directly related to the outcomes of the trial, it is interesting to note the perceptions of the SLPs who conducted the group treatment. The SLPs found the group model more complex to implement than the individual model. Predictably, they found it to be more physically, emotionally, and mentally demanding than individual treatment. It required more effort to ensure that clinic visits met the differing needs of each parent-child pair, to foster positive group dynamics, and to cope with the logistical challenges of the numbers of parents and children in the one clinic room. Those logistical challenges increased with the inevitable attendance of siblings during groups.

However, the SLPs found much about the group treatment environment to be clinically gratifying. Children established friendships, praised one another's stutter-free speech, and appeared to benefit from discovering other children who stuttered. Rather than resting solely with the SLP, the roles of problem solver, motivator, and teacher were shared among the parent group members. This provided a broader range of experiences to draw on when finding solutions to common problems with the treatment process.

## Conclusions

This trial demonstrated that group delivery of the Lidcombe Program offers an efficacious alternative to the standard individual model. Although RCTs are considered the gold standard of clinical research, this trial was not without limitations. They include (a) drawing participants from a single site, which may have resulted in population-specific findings; (b) the stringent selection criteria, making the translation of the findings to more complex caseloads unpredictable; and (c) therapist-specific factors, suggesting that the trial outcomes may have been dependent on the experience of the two treating SLPs. Future pragmatic trials will be required to determine the impact of expertise and familiarity with the Lidcombe Program on outcomes.

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