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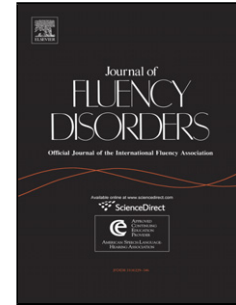
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Running Heading: Verbal contingencies during the Lidcombe Program

Parent verbal contingencies during the Lidcombe Program: Observations and
statistical modeling of the treatment process

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Abstract

Purpose: The purpose of this study was to document parent presentation of the Lidcombe Program verbal contingencies and model potential relationships between contingency provision and treatment duration.

Methods: Forty parent-child pairs undertaking the Lidcombe Program participated, 26 of whom completed Stage 1. All participants were included in the analyses. Parents completed weekly audio-recordings of treatment during practice sessions and a diary of treatment during natural conversations. The number and types of contingencies provided during practice sessions were counted for 520 recordings. Accelerated failure time modeling was used to investigate associations between contingency provision during the first 4 weeks of treatment and duration of time to complete Stage 1.

Results: During practice sessions 91% of contingencies were for stutter-free speech, 6.8% were for stuttering and 2.7% were incorrectly applied. Parents often combined several verbal contingencies into one. During natural conversations, the number of verbal contingencies reportedly provided across the day was low, an average of 8.5 ($SD = 7.82$) contingencies for stutter-free speech and 1.7 ($SD = 2.43$) for unambiguous stuttering. There was a positive, significant relationship between the number of verbal contingencies for stuttering provided during the first 4 weeks of treatment and time taken to complete Stage 1.

Conclusion: Parents mostly provided the expected types of contingencies but the number was lower than expected. An unexpected association was found between number of verbal contingencies for stuttering and treatment duration. Further research

is required to explore the relation between rates of parent verbal contingencies, treatment process duration, and treatment outcome.

Keywords

Parent-delivered treatment, the Lidcombe Program, early childhood stuttering

1 Introduction

The Lidcombe Program

The Lidcombe Program is a parent-conducted, behavioral treatment developed for children aged younger than 6 years, administered with the training of a speech-language pathologist (SLP; Packman et al., 2015). While SLPs are strongly encouraged to attend Lidcombe Program Trainers Consortium training (Australian Stuttering Research Centre, 2015) prior to using the program with clients (Packman et al., 2015), this is not a mandated requirement (O'Brian et al., 2013), and student SLPs administering the Lidcombe Program receive their training in the treatment through their university course and clinical educator. As the program is parent-conducted, parents are trained to conduct Lidcombe Program treatment during weekly clinic visits with their SLP.

Speech-language pathologists teach parents to apply verbal contingencies to stuttering and stutter-free speech and to measure the child's stuttering daily in everyday situations (Packman et al., 2015). Verbal contingencies are comments made by the parents after moments of the child's stutter-free speech or unambiguous stuttering, the aim of both being to reduce the frequency of stuttering. These may be supplemented by non-verbal contingencies such as high-fives but non-verbal contingencies are not expected to replace the verbal contingencies. The Lidcombe Program no longer has a prescribed ratio for contingencies for stutter-free speech to those for stuttering (Packman et al., 2015). The expectation is that contingencies will be given for both stutter-free speech and unambiguous stuttering but more contingencies will be for stutter-free speech than for stuttering. Verbal contingencies are recommended to be provided only by SLP-trained parents in order to ensure that

they are accurate, with the assumption that their inaccurate provision will cause slowed treatment and poorer outcomes.

Initially verbal contingencies are provided during practice sessions of 10–15 minutes duration, which are organized so that the child’s level of stuttering is extremely low (Packman et al., 2015). As the treatment progresses the parent moves to providing verbal contingencies during natural conversations, which are everyday conversations with the child.¹ The Lidcombe Program is divided into two stages. The aim of Stage 1 is to reduce the child’s stuttering to extremely low levels (a severity rating of 1 or 2 on a 10-point scale; 1 = no stuttering, 2 = extremely mild stuttering, 10 = extremely severe stuttering).² The aim of Stage 2 is to maintain these low levels over the course of at least a year. Pre-treatment severity has been consistently shown to be a predictor of the time required for preschool children to complete Stage 1 (Jones, Onslow, Harrison, & Packman, 2000; Kingston, Huber, Onslow, Jones, & Packman, 2003; Koushik, Hewat, Shenker, Jones, & Onslow, 2011). A meta-analysis of three clinical audit studies found that children with a pre-treatment severity of <5 percentage syllables stuttered (%SS) had double the odds of a shorter Stage 1 duration than children who had a pre-treatment severity of between 5-9.9 %SS, and more than five times greater odds of a shorter Stage 1 than children with a pre-treatment severity

¹ The terms “practice sessions” and “natural conversations” are used in the current Lidcombe Program treatment guide (Packman et al., 2015), although the corresponding terms in previous versions of the treatment guide were “structured conversations” and “unstructured conversations.” Although the former terms were used during the period during which this study was conducted, the latter terms are presented here.

² The current Lidcombe Program treatment guide (Packman et al., 2015) specifies a slightly different severity rating scale: 0 = no stuttering, 1 = extremely mild stuttering, 9 = extremely severe stuttering.

of ≥ 10 %SS (Koushik et al., 2011). Age, gender and onset-to-treatment interval did not predict treatment duration.

The putative treatment agent in the Lidcombe Program is the verbal contingencies. The Lidcombe Program Treatment Guide (Packman et al., 2015) outlines five parent verbal contingencies. There are three parent verbal contingencies for stutter-free speech: *praise*, *acknowledge* and *request self-evaluation*, and two verbal contingencies for unambiguous stuttering moments: *acknowledge* and *request self-correction*. Parents can also respond positively to two non-essential responses by the child: *spontaneous self-acknowledgement of stutter-free speech* and *spontaneous self-correction of stuttering*. The treatment guide specifies that parents provide verbal contingencies during practice sessions, which are conducted once or twice each day, as follows:

The parent typically sits with the child at a table or on the floor in a quiet place, with suitable activities such as books and games. Such activities are not essential, however, and treatment ... can be done in many situations, such as meal preparation, bath time, and shopping. (Packman et al., 2015, p. 8)

The treatment guide specifies that parents also provide verbal contingencies during natural conversations each day, as follows:

... conversations of everyday life are never modified to optimize the occurrence of stutter-free speech. Instead, parents take advantage of naturally occurring periods of reduced stuttering severity during each day to present verbal contingencies. (Packman et al., 2015, pp. 8-9)

There are several randomized controlled trials in support of the Lidcombe Program (Arnott et al., 2014; de Sonnevile-Koedoot, Stolk, Rietveld, & Franken, 2015; Jones et al. 2005; Lewis, Packman, Onslow, Simpson, & Jones, 2008) and evidence that it translates from research environments into generalist speech clinics (O'Brian et al., 2013). It is used internationally and is supported by an International Lidcombe Program Trainers Consortium in nine countries (Australian Stuttering Research Centre, 2015). However, like many childhood interventions for communication disorders conducted by parents (e.g., The Hanen Program, Girolametto & Weitzman, 2006; Palin Parent Interaction Therapy, Botterill & Kelman, 2010), there has been little research into how parents conduct the treatment when instructed by SLPs.

Parent Delivery of the Lidcombe Program

To date, there has been some cursory checking of parent delivery of the Lidcombe Program for the purposes of assessing treatment fidelity but there has not been an in-depth analysis. Jones et al. (2005) had parents audio record themselves doing the treatment and reported they were presenting the treatment in a manner consistent with the SLP instruction materials. However, they did not present any details about what the parents were in fact doing. Lewis et al. (2008) reported that parents delivered all five verbal contingencies in a manner consistent with the instruction materials. However, that clinical trial was for telepractice and parents did not attend the clinic for instruction. Also, Lewis et al. only reported on use of verbal contingencies during practice sessions.

Carr Swift et al. (2011) developed a protocol to conduct more detailed studies of parent administration of verbal contingencies and trialed it with three mothers. Mothers in their study completed a daily diary detailing their use of verbal

contingencies during natural conversations, and audio-recorded two randomly allocated practice sessions each week. Carr Swift et al. listened to each of the practice sessions and classified each verbal contingency into one of three categories: 1) correctly given for stutter-free speech, 2) correctly given for stuttering or 3) given incorrectly. They reported that during practice sessions, over 97% of the verbal contingencies given were provided correctly, with the percentage of incorrectly applied contingencies ranging from 0.8–2.3% across the three mothers. All three mothers gave more contingencies for stutter-free speech than unambiguous stuttering, with the ratios higher than expected ranging from 18:1 to 38:1. Verbal contingency delivery during natural conversations was reportedly low with an average of 0–2.8 contingencies provided for stuttering and 0–10.8 provided for stutter-free speech. One mother reported providing a ratio of 1.8 contingencies for stutter-free speech for every contingency for stuttering, and she started providing contingencies during natural conversations from the first week of treatment, both of which are contrary to expectations. Thus, while parent verbal contingency delivery was broadly consistent with the treatment guide, some departures were observed. However, those findings for small participant numbers could have been unique to the mothers involved.

Additionally, valuable information could have been missed through the broad classification of verbal contingencies into only three categories. An expanded version of the Carr Swift et al. study with more participants and more finely differentiated verbal contingency classifications would provide more detailed information about how parents are providing verbal contingencies to their children as part of the Lidcombe Program.

The Present Study

The purpose of the present study was to use an expanded version of the Carr Swift et al. (2011) protocol to document parent use of contingencies and model their contribution to the treatment progress.

The research questions were: (1) how many and what types of verbal contingencies do parents provide during practice sessions, (2) how many and what types of verbal contingencies do parents report that they provide during natural conversations, and (3) is there any relationship between parent provision of verbal contingencies and time taken to complete Stage 1 of the Lidcombe Program?

Material and methods

Participants

Participants were 40 children receiving the Lidcombe Program and the treating parent/guardian. Thirty-eight of the parents were mothers, one was the father, and one was a grandmother who had custody of the child. Twenty of the participant pairs were from Adelaide, Australia, and 20 were from Sydney, Australia. Participants were recruited after contacting either the Sydney or Adelaide clinic seeking treatment for preschool stuttering. Fourteen participants (six from Adelaide, and eight from Sydney) withdrew from the research prior to completing Stage 1 of the Lidcombe Program. In keeping with intent-to-treat principles, data collected from those participants were included in all analyses.

Institutional ethics approval was obtained for both research sites: the Australian Stuttering Research Centre in Sydney and the Flinders University Fluency Clinic in Adelaide.

Inclusion criteria were (1) child aged between 2 years 0 months and 5 years 11 months, (2) child stuttering for longer than 6 months (3) parent and child able to speak English for assessment and treatment and (4) diagnosis of stuttering by consensus between parent and SLP for a clinic speech sample. Exclusion criteria were (1) child received treatment for stuttering during the previous 3 months, (2) attention deficit hyperactivity disorder, autism spectrum disorder, intellectual disability, stuttering caused by neurological insult, cerebral palsy or a degenerative neuromuscular disease.

Treatment

Data collection occurred over a 32-month period. Five Lidcombe Program Trainers Consortium-trained SLPs (four in Sydney, one in Adelaide) presented the Lidcombe Program to the 40 parent-child pairs. Those SLPs had been practicing speech and language therapy from 2–5 years and had previous Lidcombe Program experience. The SLPs used a previous iteration of the Lidcombe Program guide (Packman, Webber, Harrison, & Onslow, 2008) to present the treatment to the 40 participants. Apart from the previously outlined changes to terminology and the severity rating scale, the major difference between the 2008 and 2015 versions of the Lidcombe Program guide is the level of detail and problem-solving suggestions for each section of the program. The 2008 guide (Packman et al., 2008) outlined the required components of the Lidcombe Program but SLPs were expected to use their Consortium training and published literature about the Lidcombe Program to guide clinical decision making and problem-solving, while the 2015 version (Packman et al., 2015) incorporates this information into the guide itself. The Lidcombe Program itself has not changed.

At the Adelaide site, 19 students in entry-to-practice Bachelor and Master of Speech Pathology courses presented the majority of the treatment under the supervision of one of the Consortium-trained SLPs. Two or four students were assigned to the Adelaide clinic per practicum, with each practicum running for 11–14 weeks. The SLP supervised the students by video monitor, entering the clinic room during clinic visits as needed to ensure that their treatments conformed satisfactorily to the Lidcombe Program guide (Packman et al., 2008). The SLP presented Lidcombe Program treatment during weeks in which no students were assigned to the clinic, which comprised 117 of 433 (27%) Adelaide clinic visits. No students were involved in the treatment of participants in Sydney.

All treating SLPs and students were aware of their involvement in the study but had no access to any of the study data nor any influence over the collection procedures described below.

Pre-Treatment Assessments

At a pre-treatment assessment, the SLP elicited a 10-minute clinic conversation with the child. From this, a %SS measure was calculated and a severity rating on a 10-point scale (1 = no stuttering, 10 = extremely severe stuttering) was assigned by the assessing SLP. Parents were also required to document their child's typical stuttering severity during the previous week using the same 10-point scale. They were instructed to make two beyond-clinic audio recordings of their child's speech, one conversing with a parent at home and one with an adult outside the home, that adult not being a family member. These recordings were assigned %SS and a severity rating by a blinded independent SLP. The average beyond-clinic %SS from the two parent recordings is presented in table 1. The average severity rating from the three

recordings and the parent assigned typical rating was used during the accelerated failure time modeling and is presented in table 1.

Reliability

The two pre-treatment beyond-clinic audio recordings provided by the parent were analyzed by an independent observer blinded to the purpose of the study. Inter-judge and intra-judge agreement of the independent observer severity rating and %SS score was calculated for eight (10%) randomly selected audio recordings. To calculate inter-judge agreement, the eight recordings were given to another independent observer who also calculated severity rating and %SS. Inter-judge agreement was Pearson $r=.92$ for %SS. Pairwise differences in severity rating ranged from 0–4 (mean difference 1.3) and 0.7–3.7%SS (mean difference 1.9%SS). To assess intra-judge agreement the eight recordings were provided again to the original independent observer resulting in Pearson $r=.98$ for %SS. Pairwise differences in severity rating ranged from 0–1 (mean difference 0.3) and 0–1.2%SS (mean difference 0.6%SS).

INSERT TABLE ONE ABOUT HERE

Data Collection

2.5.1 Treatment during practice sessions

Parents were given an audio recording device at the first treatment session. On two randomly allocated days per week, they were asked to audio record their child's treatment during practice sessions. Given the large volume of data, the first recording received each week was analyzed by one of two researchers, with 520 recordings analyzed in total. Each researcher listened to the recordings and, using an expanded version of the protocol developed during the Carr Swift et al. (2011) study, (1) counted the number and type of verbal contingencies given by parents using the finely

differentiated categorization of verbal contingencies outlined in table 2, (2) counted the number of non-essential child responses, (3) measured child speaking time and, (4) recorded any supplementary observations. The breakdown of the different types of verbal contingencies counted can be seen in table 2. Verbal contingencies were classified as being incorrect if they worked against operant conditioning principles.

Inter-judge agreement for experimenter contingency counts was calculated for 63 recordings (12%) from both treatment sites selected from early, midway and late in treatment. A correlation was calculated for total values of the experimenter and an independent SLP for each of the types of verbal contingency and child speaking time. A high level of inter-judge reliability was obtained, with a Pearson r coefficient of 1.0. Mean difference scores for each type of contingency for the two judges ranged from 0.01–1.2.

Intra-judge agreement was calculated by having the experimenter repeat analyses of 65 recordings (12.5%) that were randomly selected by an independent research assistant. Intra-judge reliability was Pearson $r= 1.0$. Mean difference scores for each type of contingency at the two time points ranged from 0–1.4.

Treatment During Natural Conversations

On the same two days as outlined above parents were also asked to diarize the following information using a provided template: (1) the number of practice sessions conducted with their child that day, (2) the estimated number of times they provided verbal contingencies for stutter-free speech during natural conversations, (3) the estimated number of times they provided verbal contingencies for stuttering during natural conversations, (4) whether any verbal contingencies during natural conversations were provided by someone other than themselves, (5) whether they

recorded a severity rating for the day and if so what it was, and (6) whether they attended the speech clinic on that day. Diary data were collected from parents on each assigned day via text message, email or telephone call. Additionally hard copies of the diaries were collected at the end of the data collection period.

Analysis of Verbal Contingency Provision and Stage 1 Duration

Survival analysis was used in this calculation in order to include participants not completing Stage 1 (Kleinbaum & Klein, 2012). Data from all participants were included until the time they dropped out of treatment or they completed Stage 1. Survival analysis provides an analysis of time-to-event data. It plots the variable in question, in this case cumulative proportion of participants completing Stage 1 against number of treatment sessions. As the participants who withdrew had not yet completed Stage 1, they are said to be censored at the point of withdrawal. Survival analysis enables the number of sessions these participants attended prior to withdrawing to be included. Survival distribution was plotted using the Kaplan-Meier product limit method.

To reach the end of Stage 1 a severity rating of 1 or 2 was required to be achieved for three consecutive clinic visits, and beyond clinic, daily severity ratings of only 1 and 2, and more 1s than 2s per week were required to be recorded for three weeks. Time to complete Stage 1 has been used as an outcome measure or a target for regression modeling in many research studies into the Lidcombe Program (e.g., Kingston et al., 2003; Koushik et al., 2011; Lewis et al., 2008) due to its documentation of the time commitment required from the SLP, parent and child to obtain extremely low stuttering levels.

Survival distribution data were included in log-normal accelerated failure time models to investigate the association between potential predictor variables and number of sessions to complete Stage 1. Accelerated failure time models are a variant of survival or time-to-event analysis that allow covariates to be included in the model (Kleinbaum & Klein, 2012). Estimates of the effect of covariates can be interpreted as proportional increases or decreases in survival time. The log-normal distribution was chosen based on previous studies (e.g., Jones et al., 2000) and testing for goodness of fit, which showed that the number of clinic visits to complete Stage 1 in the current study was distributed in a fashion approximating a log-normal curve. This method was used to investigate relationships between the number of verbal contingencies during practice sessions for the first 4 weeks of treatment and Stage 1 duration. The first 4 weeks of treatment was used because all participants were treated for at least 4 weeks and this was sufficient time to obtain a representative sample of parents' treatment parameters.

Following Spearman correlation checks for data collinearity, a mean pre-treatment severity rating (see section 2.3) was forced into the accelerated failure time models because of the documented relation of pre-treatment severity to time to complete Stage 1. Mean pre-treatment %SS was not included because of its collinearity with the mean pre-treatment severity rating score. Several studies have shown that age and gender have no impact on time taken to complete Stage 1 (Jones et al., 2000; Kingston et al., 2003; Koushik et al., 2011). Therefore those variables were not included in statistical modeling. Variables included in the statistical modeling were (1) verbal contingencies for stutter-free speech during practice sessions, (2) verbal contingencies for stutter-free speech during natural conversations, (3) verbal contingencies for unambiguous stuttering during practice sessions, (4)

verbal contingencies for unambiguous stuttering during natural conversations, (5) incorrect verbal contingencies and (6) treatment site. These variables were tested in separate models in combination with mean pre-treatment severity rating score. Hence all estimates obtained were adjusted for mean pre-treatment severity rating score.

Missing Data

Two participant pairs had no data from the recordings of treatment during practice sessions for the first 4 weeks of treatment. For these participant pairs, data from treatment during natural conversations was imputed for variables that showed a correlation with the missing variables (i.e. verbal contingencies for stuttering from the diary; both had values of zero) but not for variables that did not show a correlation (i.e. verbal contingencies for stutter-free speech from the diary).

Results

Attrition and Clinical Progress

Fourteen participants (six Adelaide, eight Sydney) withdrew from the research prior to completing Stage 1 of the Lidcombe Program (35% withdrawal rate). This percentage was higher than for other prospective research studies into the Lidcombe Program (e.g., 15% withdrawal rate, Rousseau, Packman, Onslow, Harrison, & Jones, 2007), but not other preschool-stuttering treatments (e.g., The Westmead Program, 52% withdrawal rate, Trajkovski et al., 2011). The demographic characteristics of the withdrawn children are detailed in table 1. Reasons for withdrawal from the research included family relocation ($N=2$), family issues, such as birth of a sibling ($N=4$), changes in parent work pattern ($N=1$), treatment obtained closer to home ($N=1$), parent happy with level of treatment gains ($N=1$), perceived insufficient treatment progress ($N=2$) and issues with the research process ($N=3$). The research requirements

in this study were more than other prospective studies into the Lidcombe Program. They included the requirement to attend in person on specified days of week, not take breaks from therapy, and to provide weekly research data. Inability to meet these additional research requirements accounted for 11 of the withdrawals. Due to the clinic funding arrangements, withdrawing from the research also meant withdrawing from therapy. However, only three participants (7.5%) actually withdrew due to a stated wish to discontinue therapy. That said, children who withdrew had on average a higher pre-treatment %SS than those who completed Stage 1. It is known that children with higher pre-treatment stuttering severity take longer to complete Stage 1, and so it may be that parent perception of slow progress contributed to the decision to withdraw. In keeping with intent-to-treat principles, participants who withdrew were included in all analyses.

The median number of clinic visits attended was 18 for those completing Stage 1 and nine for those withdrawing from the research. There was no difference between sites for the number of Stage 1 clinic visits attended by children who completed Stage 1 (Adelaide = 18, Sydney = 18.5, $p = 1.000$) but there was a clinically and statistically significant difference between sites for the number of clinic visits attended prior to children withdrawing from the research (Adelaide = 15.5, Sydney = 8.5, $p = 0.026$). It is speculated that this difference was due to differing levels of access to other services for preschool stuttering in the two locations. Children in Adelaide do not have access to any publicly funded services for stuttering after the age of four, whereas in Sydney these services continue until six years of age. Therefore, Adelaide participants may have remained in the research for a longer period due to fewer alternative treatment options being available. Another possible explanation for this difference is that parent expectations might have been higher for

services provided by an SLP rather than student SLPs. So parents of children who were making slow progress might not have perceived this as problematic until a later stage of treatment when students were involved.

Duration of Treatment during Practice Sessions

Mean duration of treatment during practice sessions was 12.7 minutes ($SD = 5.5$ minutes, 2.1–31.3 minutes) and the average child speaking time was 3.8 minutes ($SD = 1.8$ minutes, 0.1–11.2 minutes). This gave a ratio of 3.4:1 minutes of conversation to minutes of child speech.

Number of Daily Practice Sessions

Parents reported that they conducted treatment during practice sessions a median of once per day with a mean of 0.8 per day ($SD = 0.66$, 0–4). As expected, the 21 parents who supplied recordings from both the first and last 4 weeks of treatment conducted more treatment during practice sessions during the first 4 weeks of treatment (an average of once per day; mean = 1.0) than during the last 4 weeks of treatment (an average of once every two days; mean = 0.6).

Parent Verbal Contingencies during Practice Sessions

During each practice session there was an overall mean of 18.8 ($SD = 13.18$, 0–90) verbal contingencies provided for stutter-free speech and an overall mean of 1.4 ($SD = 1.98$, 0–9) verbal contingencies provided for stuttering. Of all verbal contingencies provided during practice sessions, 90.4% were given for stutter-free speech. Adelaide parents gave fewer verbal contingencies for stuttering (mean = 0.7, $SD = 1.22$, 0–9) than Sydney parents (mean = 2.4, $SD = 2.39$, 0–9), $p = 0.000$, 95% CI [-2.032, -1.337]. Details are presented in table 3.

INSERT TABLE TWO ABOUT HERE

Table 2 shows the different types of verbal contingencies that were used by the parents. It can be seen that the majority of verbal contingencies provided during practice sessions were those described in the treatment guide: praise, acknowledgement of stutter-free speech, request self-evaluation of stutter-free speech, acknowledgement of stuttering, and request self-correction of stuttering; however on many occasions several of these verbal contingency types were presented concurrently. For example, 15.0% of verbal contingencies were praise and acknowledging stutter-free speech combined, and 1.5% were acknowledging stuttering and requesting self-correction combined.

Table 2 shows that 2.7% of verbal contingencies were incorrect; either a verbal contingency for stutter-free speech when in fact an unambiguous stutter occurred, a contingency for stuttering when in fact none occurred, or a combined verbal contingency for stutter-free speech and unambiguous stuttering. Most errors, 89% of them, were in the first category. Parents provided a mean of 0.6 ($SD = 1.01$) incorrect verbal contingencies during practice sessions.

The non-essential child responses listed in the Lidcombe Program Treatment Guide (Packman et al., 2015), spontaneous self-evaluation of stutter-free speech and spontaneous self-correction of stuttering, occurred rarely (42 occasions out of 520 recordings) during the recordings of practice sessions. On 27 occasions (64%) the child received a positive response from the parent. On one occasion the child received a negative response from the parent ('I'll tell you when it is smooth') and on 14 occasions (33%) the parent did not respond to the child's non-essential response.

INSERT TABLE THREE ABOUT HERE

Parent Verbal Contingencies during Natural Conversations

Parents reported providing a mean of 8.5 ($SD = 7.82$) verbal contingencies for stutter-free speech during natural conversations each day and a mean of 1.7 ($SD = 2.43$) contingencies for stuttering. Adelaide parents reported presenting significantly fewer verbal contingencies for stuttering (mean = 0.8, $SD = 1.35$) than Sydney parents (mean = 2.7, $SD = 2.98$), $p = 0.000$, 95% CI [-2.049, -1.639]. Adelaide parents also reported presenting fewer contingencies for stutter-free speech (Adelaide mean = 8.0, $SD = 6.13$; Sydney mean = 9.0, $SD = 9.43$; $p = 0.012$, 95% CI [-1.599, -0.196]).

Percentages of children receiving verbal contingencies during natural conversations from someone other than the trained parent was consistent across the two sites (75% for Adelaide, 70% for Sydney). However, Adelaide children received verbal contingencies from someone else more frequently (on 21% of days) than Sydney children (on 7% of days), $t = 9.362$, $p = 0.000$, 95% CI [.109, .166].

Analysis of Verbal Contingency Delivery and Stage 1 Duration

Univariable analysis indicated a strong association between pre-treatment parent severity rating and number of clinic visits to complete Stage 1 (estimate 0.24, 95% CI: 0.13 – 0.35, $p < 0.0001$). There were no associations between contingencies for stutter-free speech during practice sessions (estimate 0.074, 95% CI: -0.006 – 0.021, $p = 0.29$) or natural conversations (estimate -0.025, 95% CI: -0.064 – 0.013, $p = 0.20$), verbal contingencies for stuttering during natural conversations (estimate -0.12, 95% CI: -0.34 – 0.09, $p = 0.27$), incorrect contingencies (estimate -0.09, 95% CI: -0.32 – 0.14, $p = 0.45$) or treatment site (estimate -0.14, 95% CI: -0.51 – 0.23, $p = 0.47$) and number of clinic visits to complete Stage 1.

The best multivariable model included the mean pre-treatment severity rating (estimate 0.29, 95% CI: 0.18 – 0.40, $p < 0.0001$) and the number of verbal

contingencies for stuttering given during practice sessions (estimate 0.15, 95% CI: 0.02 – 0.29, $p = 0.024$). This indicates that: (1) higher mean pre-treatment severity and (2) higher mean number of contingencies for stuttering during practice sessions during the first 4 weeks of treatment were associated with more clinic visits to complete Stage 1. These estimates can show the proportional increase of clinic visits required to complete Stage 1 for a one unit increase in the predictor variables. With accelerated failure time models the estimates can be transformed into percentage changes in survival time via the exponential function. In this case, $\exp(0.29) = 1.34$ which can be interpreted as 34% increase in survival time. Thus, for mean pre-treatment severity, an increase of severity rating by one scale value was associated with a 34% increase of clinic visits to complete Stage 1. Similarly every additional verbal contingency for stuttering was associated with a 16% increase of number of clinic visits taken to complete Stage 1 [$\exp(0.15) = 1.16$].

The previous analysis assumes that the number of verbal contingencies for stuttering given during practice sessions is linearly related to the log of the number of clinic visits to complete Stage 1. An alternative method of analyzing the association between these variables is to categorize the number of verbal contingencies for stuttering provided during practice sessions into zero (no contingencies), low (between 0 and 2 contingencies per practice session), or high (more than 2 contingencies given per practice session), with approximately equal numbers of participant pairs in each group. The reference group in statistical modeling of categorical exposure variables is often chosen to be the standard or typical group. In this case, typically the treatment involves low levels of parent verbal contingencies. Hence the comparisons show the effects of high compared to low levels of parent verbal contingencies as well as no parent verbal contingencies compared to low levels

of parent verbal contingencies. The results of this analysis are given in Table 4. This analysis showed no difference between giving no or low levels of contingencies for stuttering during practice sessions ($p = 0.81$) but giving a high level of contingencies for stuttering was associated with 90% more clinic visits to complete Stage 1 compared to giving low levels of contingencies for stuttering ($p = 0.0024$).

INSERT TABLE FOUR ABOUT HERE

Discussion

The Lidcombe Program is an evidence-based early stuttering intervention that uses parent-delivered verbal response contingent stimulation for stutter-free speech and for unambiguous stuttering moments. Parents deliver the treatment in the child's everyday environment with the direction of a SLP. This study investigated parent presentation of verbal contingences and modeled the treatment process duration using those verbal contingencies.

Treatment during Practice Sessions

The vast majority of verbal contingencies provided during practice sessions were for stutter-free speech. There were 21 different types of verbal contingencies used by parents, most of which were the five in the Lidcombe Program guide or various combinations of the five. It is recognized that verbal contingencies may be provided in combination with each other, but it is not clear whether using combinations inhibits or increases variety of contingency delivery with resulting impact on the level of satiation in the child. Satiation occurs when a verbal contingency for stutter-free speech is applied so often that it loses its reinforcing value (Chance, 2006). A contingency is only reinforcing if it results in an increase in the target behavior. Thus,

the variety of verbal contingency wording could be an area to address in cases where stuttering is not decreasing as expected.

Numbers of verbal contingencies for unambiguous stuttering provided during practice sessions were very low, especially relative to the much higher number of verbal contingencies for stutter-free speech during practice sessions. The Lidcombe Program is based on control of stuttering with verbal contingencies, hence a positive association between the number of them and treatment progress would be expected, making these low numbers problematic. However, associations found in the statistical model suggest this may not actually be the case – the analysis instead found that more verbal contingencies for stuttering was associated with a longer time to complete stage 1 of the treatment. The results from the present study suggest that verbal contingencies for stuttering might not be contributing to the treatment in the way in which it is assumed. This fits with recent findings by Donaghy et al. (2015) who conducted a randomized controlled clinical experiment comparing Lidcombe Program treatment with and without the request for self-correction contingency for unambiguous stuttering. While inclusion of this contingency was predicted to be necessary for treatment progression, there was in fact no difference between the number of clinic visits or time required for the children to achieve a 50% reduction in stuttering severity. Thus the role of contingencies for unambiguous stuttering in the Lidcombe Program requires further investigation.

Treatment during Natural Conversations

Parent verbal contingencies

The number of practice sessions relative to natural conversations decreased as would be expected across the course of treatment (Packman et al., 2015). During natural

conversations the reported ratio of contingencies for stutter-free speech to contingencies for stuttering was close to expectations, but the numbers of each were very low. While it is important that verbal contingencies for stutter-free speech are not given so frequently as to lose their reinforcing power (Packman et al., 2015), the dose given needs to be sufficient so that the child actually pairs the contingency with the stutter-free speech (Chance, 2006). If the number of contingencies is too low, they are likely to have minimal effect on the child's speech, reducing generalization. Treatment during natural conversations is more difficult to replicate in the clinic environment than practice sessions, so in the case of lack of generalization it may help SLPs to have clients complete a diary to document their provision of verbal contingencies during natural conversations. The necessity of this will of course be informed by future research investigating whether or not verbal contingencies are in fact a necessary part of the Lidcombe Program treatment.

The extremely low numbers of contingencies for stuttering given as part of treatment during natural conversations suggests that verbal contingencies for stuttering may not be a necessary part of treatment, as children still achieved expected treatment gains despite these low numbers. These findings, combined with those from treatment during practice sessions, suggest that verbal contingencies for stuttering might not be as potent a part of the treatment process as was previously assumed.

Non-trained parent contingency delivery

A high proportion of children reportedly had someone other than the trained adult provide verbal contingencies. When untrained people provide contingencies the potential for adverse reactions from the child or for treatment that actively works against Lidcombe Program principles is increased. It is therefore important for treating SLPs to regularly check if anyone else is giving contingencies to the child

and to reiterate that all people providing treatment need to be trained. It is also important for the SLP to find out why someone else was providing contingencies. The SLP can then help the parent find effective solutions to potential issues such as difficulty finding time or difficulty with treatment generalization (Packman et al., 2015).

Stage 1 Treatment Duration

Consistent with previous findings, pre-treatment stuttering severity was positively related to time for Stage 1 completion. The median number of clinic visits to complete Stage 1 was 18, regardless of whether treatment was delivered by SLPs or students. That value is within the ranges reported in clinical trials (Packman et al., 2015). This suggests that student involvement in the training of parents did not impact negatively on the duration of treatment.

Modeling of Parent Verbal Contingencies and Treatment Duration

The association between increased numbers of verbal contingencies for stuttering and increased time to complete Stage 1 was unexpected. It has always been assumed that verbal contingencies are the active treatment agent of the Lidcombe Program and hence a negative correlation between number of contingencies and treatment duration was expected. The positive association found was not due to child participants with increased severity receiving more contingencies for stuttering, as the data indicated that there was no difference in average number of contingencies for stuttering given between the more and less severe groups of child participants. Moreover, initial severity, as a known predictor (Jones et al., 2000; Kingston et al., 2003; Koushik et al., 2011), was included in the statistical model. However the model only included the first four weeks of treatment, and different results might be found if all of Stage 1 was included. The study was also not designed to investigate a causal relationship.

There are a number of possible explanations for these findings, which need to be investigated through controlled studies designed to determine causal relationships. Firstly, it is possible that the mechanism for stuttering control in the Lidcombe Program is more complex than previously thought. Donaghy et al. (2015) also found that the request for self-correction contingency for stuttering did not have the expected impact on treatment progression, which supports this interpretation.

Secondly, the motor learning literature suggests that different feedback schedules support acquisition and maintenance of skills, such that feedback provision which results in a skill taking longer to learn might result in increased maintenance (Salmoni, Schmidt, & Walter, 1984). While the Lidcombe Program does not directly teach the child a skill, motor learning is still occurring during the practice sessions, which provide the child with opportunities to practice speaking with zero to extremely low levels of stuttering. It is possible that the inclusion of verbal contingencies for stuttering might slow initial treatment but increase maintenance of gains. The findings from one previous study into the role of verbal contingencies for stuttering (Harrison, Onslow, & Menzies, 2004) were inconclusive but showed a trend towards better maintenance of treatment gains for participants who received contingencies for stuttering compared to contingencies for stutter-free speech only.

Thirdly, the increased number of verbal contingencies for stuttering might not cause slowed treatment progression but rather be *caused by* the slowed treatment progression. Previous research into parental experiences of delivering the Lidcombe Program has found that parents can find it difficult to problem-solve treatment when it does not progress in the anticipated fashion (Goodhue, Onslow, Quine, O'Brian, & Hearne, 2010; Hayhow, 2009). It is possible that when confronted with slowed or stalled treatment progress parents increased the numbers of contingencies provided

for stuttering rather than problem-solving other aspects of treatment delivery such as the level of structure or using a variety of activities during treatment to increase generalization (Packman et al., 2015).

Finally, the design of this study did not allow for identification of natural recovery. It is possible that some of the children who completed Stage 1 did so naturally. For these children, parent provision or non-provision of verbal contingencies may not have had any bearing on completion of Stage 1. Thus, the inclusion of these participants in the model may have influenced which verbal contingencies were or were not associated with the time required to complete Stage 1 and over-ridden the effects of type and frequency of verbal contingencies given to those children who did not naturally recover.

If verbal contingencies for unambiguous stuttering do in fact cause increased treatment duration, then this would be a reason for SLPs to not include them in treatment. At this point, however, we caution against the wholesale removal of these components from the Lidcombe Program. The causal relationship is unclear and as previously outlined, there are a number of possible reasons for these results. It is possible that when more conclusive evidence has been collected there will be changes to the recommendations regarding verbal contingency delivery in the Lidcombe Program. For this reason, SLPs are strongly encouraged to keep up-to-date with the research and regularly check for updates to the Lidcombe Program treatment guide on the Australian Stuttering Research Centre website (<http://sydney.edu.au/health-sciences/asrc/>).

The role of verbal contingencies during the Lidcombe Program

Taken as a whole, the results raise some interesting questions about the role of verbal contingencies in the Lidcombe Program. Parents provided low numbers of verbal contingencies of all types and yet the children still made progress and 26 met clinical guidelines for treatment completion. Differing numbers of contingencies for stutter-free speech and stuttering were provided by parents at the two sites during natural conversations and yet this did not make any difference to the overall treatment duration, nor treatment completion. In fact, only the provision of verbal contingencies for unambiguous stuttering during practice sessions was associated with treatment duration and this was in the opposite direction to expectations. While these results might be due to natural recovery washing out some of the associations, there is a clear need for further research to identify whether or not verbal contingencies are in fact the effective treatment components of the Lidcombe Program.

As has been previously noted, the Lidcombe Program contains factors in addition to the verbal contingencies that may have a therapeutic effect (de Sonnevile-Koedoot et al., 2015; Onslow & Millard, 2012; Packman et al., 2015). These include the daily opportunity to practice speaking using zero to low levels of stuttering, a therapeutic alliance developed between parent and SLP, and engagement of the parent and child in a regular enjoyable activity, which they complete together. Should verbal contingencies be found to not be a necessary component of the Lidcombe Program, further research investigating the importance of these factors would be indicated.

Limitations and future research

One limitation of the current study is the potential for the parents to have conducted treatment differently when recording themselves compared to other sessions. This phenomenon, which has been reported in the field of nutrition and dietetics, is thought to be due to consciously thinking about the behavior; the moral associations linked to

the activity, such as being a “good parent”; or the desire to please the SLP by doing what the client expects the SLP wants (Blundell, 2000; Carr Swift et al., 2011).

A second limitation was the variation in numbers of recordings received from different families. It is possible that families who were more diligent in research data collection also provided treatment differently to other families biasing the results. Additionally, it was not possible to document how many and what type of contingencies people other than the parent provided the child which may have influenced the results obtained.

Of particular importance is further research into the role of verbal contingencies in the Lidcombe Program. Parents in this study used fewer than expected verbal contingencies yet their children still made clinical progress and this raises questions about whether or not verbal contingencies are a necessary component of the Lidcombe Program treatment. To further understand this unexpected finding, a randomized controlled trial comparing the Lidcombe Program with and without the inclusion of any verbal contingencies is planned. This will enable conclusions to be drawn about the importance of these treatment components to clinical outcomes.

Should verbal contingencies be found to have a therapeutic effect, then the role of verbal contingencies for stuttering in the maintenance of treatment gains needs to be further explored. The current study has shown that verbal contingencies for stuttering are associated with slowed treatment progression but it is not known what role they have, if any, in the prevention of relapse. It is also important to replicate the finding that verbal contingencies for stuttering slow treatment time and to see whether this is in fact a causal relationship. To explore this further, a randomized controlled

trial to further investigate the role of verbal contingencies for stuttering in duration of treatment is recommended.

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Table 1

Child participant details

	<i>n</i>	Gender (<i>n</i> male)	Average age at Ax (yr;month)	Minimum age at Ax (yr;month)	Maximum age at Ax (yr;month)	Average age since onset (months)	Average %SS at Ax	Average SEV at Ax	Family history (<i>n</i> yes)
Overall	40	26	4;1	2;11	5;2	13.8	5.2	4.3	19
Adelaide	20	13	4;4	2;11	5;2	14.3	5.9	4.6	7
Sydney	20	13	3;10	3;0	5;2	13.4	4.5	4.0	12
Completed Stage 1	26	19	4;2	2;11	5;2	14.4	4.9	3.9	12
Withdrawn	14	7	4;0	3;0	5;2	12.6	5.9	5.0	7

Note. Ax = Assessment, SEV = severity rating.

Table 2

Use of individual contingency types given by parents during a practice session

	Example	Total	Mean (SD)	Min	Max	%
<i>Stutter-free speech</i>						90.5
Praise	Good talking	5886	11.32 (11.27)	0	87	54.6
Praise and acknowledgement	Great talking. That was very smooth.	1618	3.11 (5.24)	0	38	15
Acknowledgement	Smooth words.	1362	2.62 (3.98)	0	30	12.6
Generic praise ^a	Great!	250	0.48 (1.21)	0	8	2.3
Request self-evaluation, praise and acknowledgement	Was that smooth? Yes it was. Great job.	154	0.30 (0.79)	0	6	1.4
Nonverbal ^b and verbal	<i>High five</i> + Good job.	153	0.29 (0.96)	0	8	1.4
Request self-evaluation and acknowledgement	Was that smooth? It was.	144	0.28 (0.79)	0	10	1.3
Request self-evaluation	Did you say that smoothly?	105	0.20 (0.70)	0	6	1
Request self-evaluation and praise	Fantastic talking? Was it smooth?	60	0.12 (0.41)	0	4	0.6
Nonverbal ^b	<i>High five.</i>	34	0.07	0	5	0.3

			(0.39)			
<i>Stuttering</i>						
Acknowledgement	Some bumps there.	275	0.53	0	8	2.5
			(1.09)			
Request self-correction	Can you say that again?	180	0.35	0	7	1.7
			(0.86)			
Acknowledgement and request self-correction	That was a bit bumpy. Can you say that again?	158	0.30	0	7	1.5
			(0.89)			
Generic prompt ^c	Take a breath.	59	0.11	0	4	0.5
			(0.47)			
Request self-evaluation	Was that bumpy?	30	0.06	0	3	0.3
			(0.27)			
Acknowledgement and request self-evaluation	That was a bit bumpy. Do you think so?	14	0.03	0	2	0.1
			(0.18)			
Request self-correction and request self-evaluation	Do you think that was bumpy? Can you say it again?	8	0.02	0	2	0.1
			(0.14)			
Acknowledgement, request self- correction and request self- evaluation	That was a bit bumpy. Do you think so? Can you say it again?	7	0.01	0	4	0.1
			(0.20)			
<i>Incorrect</i>						
Contingency for stutter-free	That was smooth.	257	0.49	0	9	2.4

speech ^d			(0.95)			
Contingency for stuttering ^e	A little bump there.	23	0.04	0	2	0.2
			(0.25)			
Mixed contingencies ^f	That was beautiful talking. There were a few bumps in there but mostly it was very smooth.	16	0.03	0	3	0.1
			(0.22)			

^a Generic praise = praise not specifically designated as being for talking or smooth speech but within the context appearing to be so

^b Audible nonverbal responses (e.g., high fives)

^c Generic prompt = a response contingent on the stutter but which was not a recognised parent verbal contingency in the Lidcombe Program, such as “slow down”, “take a big breath”

^d Incorrect contingency for stutter-free speech = given when speech was in fact stuttered

^e Incorrect for stuttered speech = given when the child was not stuttering

^f Mixed contingencies = combined feedback for both stutter-free speech and stuttering in the same utterance. Although these comments might have been correct for the speech heard, from an operant viewpoint it was impossible to tell how they would be interpreted by the child and what part of the speech would be reinforced. Therefore they were recorded separately from the other parental verbal contingencies.

Table 3

Number of parent verbal contingencies administered during practice sessions

Group	<i>n</i> participants	<i>n</i> recordings	Stutter-free speech					Stuttering					Incorrect				
			Total	Median	Mean (<i>SD</i>)	Min	Max	Total	Median	Mean (<i>SD</i>)	Min	Max	Total	Median	Mean (<i>SD</i>)	Min	Max
All	39 _a	520	9766	16	18.78 (13.18)	0	90	731	1	1.41 (1.98)	0	9	296	0	0.57 (1.01)	0	9
Adelaide	20	303	5548	15	18.31 (14.15)	0	90	213	0	0.70 _b (1.22)	0	9	175	0	0.58 (1.06)	0	9
Sydney	19 _a	217	4218	17	19.44 (11.68)	0	60	518	2	2.39 _a (2.39)	0	9	121	0	0.56 (0.93)	0	5

Table 4

Comparison of the association between giving a zero, low or high number of contingencies for stuttering during practice sessions and number of sessions to complete Stage 1

Variable	Estimate	95% confidence interval	<i>p</i> -value
Mean baseline SEV	0.28	0.18 to 0.39	<0.0001
*No PVC-stuttering	-0.04	-0.41 to 0.29	0.81
*High PVC-stuttering	0.64	0.23 to 1.05	0.0024

Note. SEV = severity rating. PVC-stuttering = parent verbal contingencies for unambiguous stuttering. * Reference (comparison) group is low number of PVC-stuttering.

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Ross Menzies is a clinical psychologist with an interest in the origins and management of anxiety. He has developed cognitive behaviour therapy packages for the treatment of

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Continuing Education Questions

1. Which of the following was the most commonly used parent verbal contingency for stutter-free speech during practice sessions?
 - a. Praise for stutter-free speech**
 - b. Acknowledgement of stutter-free speech
 - c. Request for self-evaluation
 - d. A combined contingency of Praise and Acknowledgement
 - e. Generic Praise

2. Why was a “mixed verbal contingency” containing comments on both stutter-free speech and stuttering considered to be a form of incorrect contingency delivery?
 - a. Once an utterance contains unambiguous stuttering, there is no longer stutter-free speech to reinforce.
 - b. It is not clear how a child would interpret this information and thus which part of their speech would be reinforced.**
 - c. It would have artificially increased the number of contingencies provided if one mixed contingency was individually added to both the list of contingencies for stutter-free speech and unambiguous stuttering.
 - d. A mixed verbal contingency indicates that the parent was not listening closely to the child’s speech.

- e. It reduces the variety in the contingencies provided by using them all at once which could result in satiation.
3. Which of the following best describes the numbers of verbal contingencies reportedly provided by parents during natural conversations?
- a. The number of contingencies for stutter-free speech was higher than expected while the number of contingencies for unambiguous stuttering was lower.
 - b. The number of contingencies for stutter-free speech was lower than expected while the number of contingencies for unambiguous stuttering was higher.
 - c. Both the number of contingencies for stutter-free speech and the number for unambiguous stuttering were higher than expected but the ratio was as expected.
 - d. Both the number of contingencies for stutter-free speech and the number for unambiguous stuttering were lower than expected but the ratio was as expected.**
 - e. Both the number of contingencies for stutter-free speech and the number for unambiguous stuttering were lower than expected with the ratio higher than expected.
4. Which of the following best describes having an untrained person provide verbal contingencies to children as part of the Lidcombe Program?
- a. It is recommended because it helps to increase generalisation.

- b. It is recommended because the child can get a high dose of contingencies even if the trained parent is unable to provide them.
 - c. It is not recommended because it increases the risk of contingencies being provided incorrectly or in a way that is unacceptable to the child.**
 - d. It is not recommended because only the trained parent will be able to correctly identify stutter-free speech and unambiguous stuttering.
 - e. It is only recommended if the trained parent has thoroughly trained the other person.
5. How should SLPs respond to the positive correlation between the provision of verbal contingencies for stuttering during the first four weeks of treatment and treatment duration?
- a. Immediately stop training parents to use verbal contingencies for unambiguous stuttering.
 - b. Immediately stop training parents to use any verbal contingencies as part of the Lidcombe Program.
 - c. Keep training parents to use verbal contingencies for unambiguous stuttering because they are known to improve maintenance of outcomes.
 - d. Keep training parents to use verbal contingencies for unambiguous stuttering until a causal relationship is confirmed through further research.**

- e. Keep training parents to use verbal contingencies for unambiguous stuttering because it is not possible to complete Stage 1 of the Lidcombe Program without them.

Continuing Education

Answers

1 a

2 b

3 d

4 c

5 d

Educational objectives

- (a) Readers can describe how parents are providing verbal contingencies to their children during practice sessions and natural conversations as part of Lidcombe Program treatment;
- (b) Readers can compare the provision of verbal contingencies by parents to the expectations in the Lidcombe Program Treatment Guide;
- (c) Readers can discuss the potential clinical and theoretical implications of the relationship between provision of verbal contingencies for stuttering and treatment duration.

Highlights (to be moved to a separate document)

Verbal contingency (PVC) provision may influence treatment duration and outcomes.

We provide a detailed description of PVC provision away from the clinic.

We found a positive relationship between PVCs for stuttering and treatment duration.

PVCs may have a different role in the Lidcombe Program than previously thought.