

Chapter 1

Modifying Phonation Interval Stuttering Treatment Program

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Overview

Modification of phonation intervals

The Modifying Phonation Interval (MPI) Stuttering Treatment Program is a computer-aided, biofeedback programme based on reducing the occurrence of short intervals of phonation during speech production. Clients proceed through a series of performance-contingent steps, requiring the completion of several speech tasks in various situations. The goal of the programme is self-managed, stutter-free, natural-sounding and effortless speech in beyond-clinic settings. The MPI programme is intended for adults, adolescents and school-age children.

A phonation interval (PI) is a measure of the duration of vibration measured from the surface of the throat (via an accelerometer) in between breaks of 10 milliseconds (ms) or more. PIs are collected via the MPI system (Ingham et al., 2007), which runs in a Windows environment and consists of an accelerometer, a signal conditioning system, computer software and related hardware (see Davidow et al., 2009 for technical details). The software allows for the recording of all PIs and allows for PIs within a specified ms range (e.g. 30–120 ms) to be fed back (audio-visually) to the client in real time. Perceptually based measures of percent syllables stuttered (%SS), syllables per minute (SPM), speech naturalness (1–9 scale; 1 = highly natural, 9 = highly unnatural; Martin et al., 1984) and speech effort (1–9 scale; 1 = highly effortless, 9 = highly effortful) can also be gathered using the MPI software. Speech effort targets, however, are not part of the MPI treatment protocol outlined by Ingham et al. (2007).¹

¹Although not outlined in the Ingham et al. (2007) treatment manual, speech effort targets are part of the performance-contingent requirements in the currently used MPI treatment protocol. See Ingham, Ingham, and Bothe (in press) for a discussion regarding the use of speech effort ratings during treatment.

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Pre-establishment

The MPI programme includes Pre-establishment, Establishment, Transfer and Maintenance Phases. The purpose of the Pre-establishment Phase is to collect baseline %SS, SPM and speech naturalness data, and to find the PI range that the client will manipulate (called the Functional or Target PI Range). The Target PI Range is found via several steps. First, the MPI software collects all of the client's PIs across 3-minute speaking tasks repeated on at least three occasions over the 2-3 month Pre-establishment Phase. PIs during normal speaking situations (reading, monologue, conversation) typically range from 10 to 1000 ms (very few PIs are longer than 1000 ms); however, PIs below 30 ms are discarded since they have been found to be too difficult to control and may be confounded by head and neck movements. Second, the software categorises the PIs into quintiles; that is, the software identifies the ms PI range that contains the lowest 20% of PIs (e.g. 30-60 ms PIs), the lowest 40% of PIs (e.g. 30-150 ms PIs), the lowest 60% of PIs (e.g. 30-290 ms PIs), and so on. Third, the client attempts to reduce the number of PIs by 50% in the lowest quintile range, which is now the Target PI Range, and tries to exert control of Target Range PIs (produce them on demand and produce longer PIs on demand) across several speaking tasks. If the client can accomplish this, the lowest 20% is used as the Target PI Range for the remainder of the treatment programme. If control is not shown over the 20% quintile range, the Target PI Range is increased in 10% increments (lowest 30%, then lowest 40%) until the client can reduce the number of PIs by 50% and exert control of them. The creators of the programme state that no participant has needed to go beyond the 40% quintile range to exert control (Ingham et al., 2007). No speaking style or speech rate is prescribed during this process; that is, the speaker needs to discover how to control PIs.

Establishment

The remaining phases of the programme are designed as performance-contingent schedules. The Establishment Phase consists of a series of speaking tasks of different lengths of time (see Ingham, 1999 for the complete treatment schedule), progressing from reading tasks to conversational tasks. Each speaking situation requires 1-minute, 2-minute and 3-minute trials. A trial is 'passed' if there is zero self-judged stuttering, self-judged naturalness of below 3 and target PIs are reduced by 50%. If these criteria are not met, the client repeats the trial or regresses in the treatment schedule. Additionally, the clinician judges the final speaking trial for each speaking situation and the criteria just mentioned must be met for progression to the next speaking situation. Clients are encouraged to attend daily 2-3 hour sessions within the clinic, but clients completing bi-daily sessions have had success with the programme (Ingham et al., 2007).

Transfer

The Transfer Phase, initiated at the completion of the Establishment Phase, includes several 3-minute beyond-clinic speaking tasks selected to reflect

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situations in the client's natural environment that are important to the client. Six different situations are required with three 3-minute trials passed for each situation. This results in eighteen 3-minute trials that must be passed. The progression includes telephone conversation, general conversation and self-selected tasks. A trial is 'passed' if it is judged stutter free and natural sounding (below 3 on the 1-9 scale) by the client, with the last trial for each task judged by the clinician. If these criteria are not met, the client repeats the trial or regresses in the treatment schedule.

Maintenance

The final phase, the Maintenance Phase, involves increased time between clinical visits as the reward for meeting 'pass' criteria. Three 3-minute speaking tasks are completed, and two of the tasks are scored and must be judged as stutter free and natural sounding by the client, while one is scored and must be judged as stutter free and natural sounding by the clinician. The duration of the Maintenance Phase in the current MPI manual (Ingham et al., 2007) is 22 weeks if no step is 'failed'. If any step is 'failed', the client returns to the beginning of the Maintenance Phase.

Theoretical basis

Research into PIs began as an empirically grounded search to operationalise the characteristics of prolonged speech (Ingham et al., 1983); see Preface for a definition of this term. Previous literature had shown that stutter-free speech was accompanied by increases in phonation time during delayed auditory feedback/prolonged speech (Goldiamond, 1965, 1967), in addition to other so-called fluency-inducing conditions (FICs), such as singing (Colcord and Adams, 1979) and chorus reading (Adams and Ramig, 1980), as researchers examined Wingate's 'Modified Vocalization Hypothesis' (Wingate, 1969, 1970). However, the effect on stuttering of directly manipulating any specific element of phonation time had not been studied.

Along with the idea that increased phonation time can decrease stuttering, two studies provided the initial motivation for focusing on reducing the occurrence of short PIs, rather than directly extending phonation. The first was a study by Adams and Hayden (1976) showing that adults who stutter had slower laryngeal reaction times than normally fluent controls. Although there were some findings to the contrary, the majority of subsequent studies confirmed this initial finding (see Bloodstein and Ratner, 2008, Chapter 5 for a review). The other study by Manning and Coufal (1976) provided 'additional evidence that stuttering is increased during speech that requires the rapid alternation of phonated and non-phonated sounds' (Ingham et al., 2001, p. 1229). These findings taken together compelled Gow and Ingham (1992) to conclude, '... it should follow that training to control the frequency of short intervals of phonation (presumably they require faster and more frequent initiation/termination of phonation) should control the frequency of stuttering...' (p. 495).

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The early PI studies were single-subject investigations (Gow and Ingham, 1992; Ingham and Devan, 1987; Ingham et al., 1983) validating the use of reducing the frequency of short PIs as a stuttering reduction agent. When participants reduced the frequency of short PIs (30–200 ms) in their speech by 50%, stuttering was reduced to zero or near-zero levels. In addition, when people who stutter (PWS) increased the number of short PIs in their speech back to baseline or above baseline levels, stuttering returned, although this was not a consistent finding (Gow and Ingham, 1992). In general, however, these studies showed that manipulating short PIs could control stuttering frequency. Speakers were also able to reduce the number of short PIs (accompanied by stuttering reductions) while receiving naturalness ratings between 3 and 6 on the 1–9 naturalness scale (Martin et al., 1984) using normal speaking rates. These latter findings revealed that attaining another goal of the MPI research line was possible, which was overcoming the problem of unnatural-sounding speech following speech-pattern style treatments such as prolonged speech that involved directly increasing phonation time.

Research into PIs was also motivated by a need to find a replicable procedure for manipulating phonation time (Ingham et al., 1983). The use of a computer and accompanying hardware to measure PIs was important for this purpose. Most prolonged speech programmes require perceptual judgment of task compliance by clinicians, a task that clinicians do with questionable reliability (Onslow and O'Brian, 1998). An objective measurement of the treatment target could aid in this difficult task and provide a more controlled way to modify stuttering. The early PI studies showed that participants could replicate the speech pattern and maintain stuttering reductions (Gow and Ingham, 1992; Ingham et al., 1983). In summary, the results of these early studies provided evidence for a desirable treatment outcome: a replicable speech pattern that produces stutter-free and natural-sounding speech, within normal speaking rates.

Demonstrated value

Besides the early PI studies that showed manipulating the number of short PIs resulted in changes in stuttering frequency (Gow and Ingham, 1992; Ingham and Devan, 1987; Ingham et al., 1983), several other pieces of literature provide support for the MPI treatment programme. First, and the most complete assessment of the MPI programme, was a long-term study by Ingham et al. (2001). In that study, five men who stutter ranging in age from 18 to 28 years demonstrated zero or near-zero stuttering during within- and beyond-clinic speaking contexts, 1 year into the Maintenance Phase. Their speech was also natural sounding and speaking rates increased. Figure 1.1 shows part of the results for this study from assessments when participants were speaking in the clinic and beyond the clinic on the telephone. These assessments were conducted without feedback from the MPI programme.

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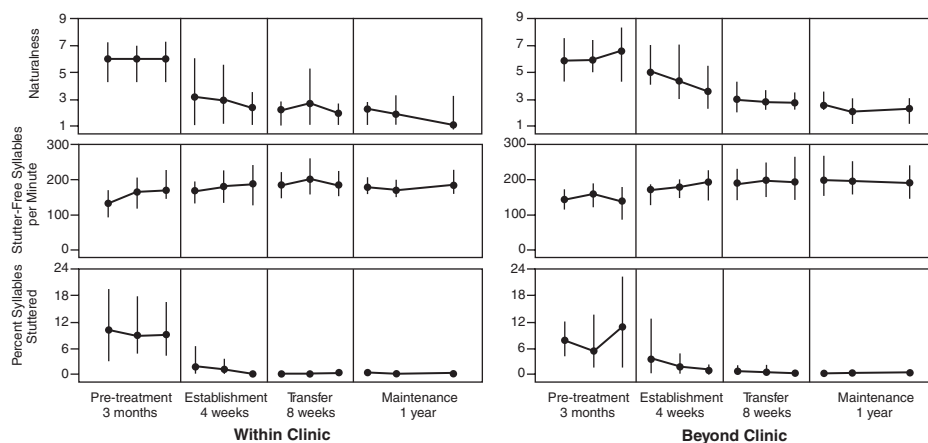


Figure 1.1 Means of assessments during within and beyond the clinic speaking situations for the five participants in the Ingham et al. (2001) report. The left panel shows results for telephone conversations and the right panel for self-selected speaking tasks. Speech naturalness scores, speech rate scores in stutter-free syllables per minute and stuttering rate in percent syllables stuttered are presented. The vertical bars represent the ranges for the five participants. Adapted by permission of the American Speech-Language-Hearing Association.

Second, in a positron emission tomography study, Ingham et al. (2003) found that a group of 17 participants who completed approximately half of the Establishment Phase exhibited normalised cerebral blood flow in brain regions that appear critical for fluency during a monologue task. Third, Davidow et al. (2009) found a reduction in the occurrence of short PIs (30-150 ms) during singing, chorus reading, prolonged speech and syllable-based metronomic speech. Packman et al. (1994) previously found a reduction in the 50-150-ms range during prolonged speech. Findings from these latter two studies suggest that a reduction in the number of short PIs may be influential in our understanding of the fluency-inducing mechanisms underlying the most powerful fluency-enhancing conditions (FICs), and they provide further support for the association between reducing the number of short PIs and stuttering reductions.

In addition to the value of the specific treatment technique (reducing the frequency of short PIs), many elements of the MPI treatment framework have substantial support in the literature. In the most recent comprehensive review of the stuttering treatment literature, Bothe et al. (2006) found that the most successful (largest reductions in stuttering and social, emotional and cognitive symptoms) treatments for adults who stutter are 'prolonged speech-type' treatments that include 'self-evaluation of speech and/or self-management of program steps, a focus on speech naturalness and feedback of naturalness measurements, and an active contingent maintenance program that continues to address not only stuttering but also speech naturalness and self-evaluation skills' (p. 335). The MPI programme includes all of these elements. The most

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successful treatments for school-age children and adolescents in the Bothe et al. review also included many of these treatment elements.

Advantages and disadvantages

Advantages

One of the unique advantages of the MPI programme is that the MPI system allows for an objective evaluation of the target speech pattern. This ensures maintenance of a speech pattern that has been found to induce fluency and eliminates the need for a subjective evaluation by a clinician. Although the necessity of accurate feedback of prolonged speech targets during treatment has not been established, more objective and reliable feedback of the target speech pattern may increase programme effectiveness (Onslow and O'Brian, 1998), particularly if the specific speech pattern manipulation has been shown to be important for reducing stuttering. Clients can also connect the MPI system to their home computer, which allows them to assess the targeted speech pattern at their convenience. Another advantage of the MPI programme, and one mentioned by MPI clients, is that emphasis on self-management provides the client with control during the treatment process (Ingham et al., 2001). Clients choose the time and duration of practice sessions, type of transfer tasks and evaluation situations during the Maintenance Phase. Other advantages include natural-sounding speech early in the treatment process, experimentally supported treatment procedures (see Section Demonstrated value), including evidence for increased probability of maintaining stuttering reductions using a self-managed, performance-contingent maintenance schedule (Ingham, 1980, 1982), and a step-by-step account of the treatment protocol (Ingham, 1999; Ingham et al., 2007), which eliminates guesswork by the clinician and the need for development of a highly individualised programme for each client.

Disadvantages

There are several issues with the MPI programme that require further inquiry. First, there is a lack of published, long-term follow-up data. To date, there is evidence from only five participants 1 year into the Maintenance Phase. Ingham et al. (2001) do state that 'all participants were also assessed in all beyond-clinic speaking conditions 12 months after the completion of the Maintenance Phase and showed levels of performance that were essentially identical to the levels reported at the completion of that phase' (p. 1241), but no data are provided. Second, the exact percentage of PIs to reduce within the Target PI Range, and the Target PI Range itself, require further study. The 50% reduction in the number of short PIs used to reduce stuttering was chosen initially for a series of unspecified reasons. Interestingly, however, the Davidow et al. (2009) study found percentage reductions in short PIs close

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to this value during several FICs. Similarly, although the lowest quintile range has been successful in reducing stuttering, a different range may be more advantageous. For example, the Davidow et al. study also found that PIs in the 51-150 ms range had the largest reduction. The lowest quintile range often extends past 150 ms. It may be more beneficial to just focus on the 51-150-ms range. Lastly, as mentioned by Ingham et al. (2001), determining the efficacy of the treatment package is important. In the Ingham et al. study, participants had unlimited access to the MPI system; that is, participants were allowed to practice with the MPI system outside of the treatment schedule throughout all of the treatment phases. Therefore, it is difficult to determine the necessity of this extra practice on the final treatment outcome and the efficacy of the complete treatment schedule or certain treatment phases as outlined in the MPI manual.

Conclusions and future directions

There are several conclusions that can be drawn from the MPI research line. First, reducing the number of short PIs can be a powerful fluency inducer for PWS. Second, in combination with a self-managed, performance-contingent treatment schedule, reducing the number of short PIs can result in long-term stutter-free, natural-sounding speech within normal speaking rates (Ingham et al., 2001). Lastly, further investigation into the role of PIs in reducing stuttering should continue, especially the collection and publication of long-term follow-up data after the completion of the Maintenance Phase. The results of the initial treatment study (Ingham et al., 2001) were promising and strongly suggest the value of a clinical trial with a larger, more varied group of participants.

Future PI research may include clarifying the issues in the immediately preceding section: percentage of short PIs to reduce, Target PI Range and efficacy of particular parts of the treatment package. More long-term outcome data should be obtained due to the recent opening of an MPI clinic at The University of California at Santa Barbara (UCSB, 2010). We are also currently exploring the necessity of PI alterations during FICs. Previous PI investigations have found reductions in the occurrence of short PIs during such conditions (Davidow et al., 2009; Packman et al., 1994); however, the necessity of these adjustments for fluency during the FICs has not been established. In order to determine this necessity, we are having speakers perform chorus reading and metronomic speech while attempting to not make the adjustment. Studies exploring the relationship of PI control to neural regions that might be functionally related to stuttering may also be conducted.

Acknowledgement

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Discussion

Joseph Attanasio

You are rightly concerned about the reliability of perceptual or subjective clinician-provided feedback in prolonged speech programmes. Could you make a more compelling case, than you do in your presentation, in favour of the MPI Stuttering Treatment Program as an alternative to prolonged speech programmes; is your approach more effective in providing feedback than what is done in those other programmes? Is your programme more efficient than programmes that do not require the use of a computer?

Jason Davidow

Could you please clarify what you mean by 'more effective in providing feedback'? Do you mean accuracy, ability of the client to take the feedback and adjust the speech pattern, etc.?

Joseph Attanasio

Yes, exactly. You state that most prolonged speech programmes require clinicians to make perceptual judgments of task compliance but that they do so with questionable reliability. You also state that the necessity of accurate feedback of prolonged speech targets during treatment has not been established but, nevertheless, more objective and reliable feedback of the target speech pattern may increase programme effectiveness.

Jason Davidow

The effectiveness and efficiency of the computer-aided parts of the MPI programme over similar parts of prolonged speech treatments that are not computer-aided is an issue for future research. Direct comparisons of the MPI treatment study to other treatment literature are difficult, due to various methodological differences between the studies. For this reason, there are no direct comparisons in our presentation. The main advantage of a computer-aided programme over one relying on clinician feedback is likely to be that a clinician is not needed to reinforce correct production of the target speech pattern. This may allow for fewer clinician contact hours, possibly reducing the cost of therapy, particularly during the learning of the speech pattern. A client may also be more confident with performing the targeted speech pattern properly during beyond-clinic or maintenance exercises when using systems, like the MPI system, that can be connected to a home computer. This could reduce the need for 'refresher sessions' with a clinician during the Maintenance Phase of treatment.

Joseph Attanasio

My next question is somewhat related to what you state in your response. From your description of the programme, I take it that clients in the Transfer and Maintenance Phases do not necessarily use the computer. If I am correct, then in the absence of computer-assisted feedback, what do you think is operating to enable the client to produce stutter-free, natural-sounding speech? That is, can you be certain that there is a relationship between successful target PI

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reduction during the Establishment Phase of the programme and performance during the Transfer and Maintenance Phases?

Jason Davidow

Your question seems applicable to all treatments, not just computer-assisted treatments. Activities may be performed outside of the treatment protocol during transfer and maintenance that assist the client in retaining treatment benefits. The impact of those activities, or an influence such as maturation, on treatment outcome and their interaction with the treatment target would certainly provide valuable information for all stuttering treatments. That being said, the Ingham et al. (2001) report states that the participants performed 'periodic practice with the MPI system' (p. 1241) throughout the Transfer and Maintenance Phases, and an assessment during the Maintenance Phase showed that the participants maintained reductions in the number of short PIs from pre-treatment assessments, accompanied by zero or near-zero stuttering. If we assume, however, that an MPI client does not use the computer-assisted feedback during the Transfer and Maintenance Phases, there are several other components that could contribute to the maintenance of stutter-free and natural-sounding speech, including retaining the alteration in speech pattern that occurred during the Establishment Phase, the performance-contingent maintenance schedule, the focus on self-management, and the emphasis on beyond-clinic speaking tasks.

Joseph Attanasio

Thank you for that thoughtful and detailed response. Have you found that zero self-judged stuttering and self-judged naturalness below 3 can occur when the target PIs are not reduced by 50%?

Jason Davidow

The Ingham et al. (2001) study includes assessments during the Establishment and Maintenance Phases showing that some participants, although they were very close to it, did not quite reach the 50% reduction mark on certain occasions and still had zero stuttering (counted by raters). Unfortunately, I do not have access to the data needed to appropriately answer your question in regards to self-judged naturalness.

Ann Packman

We were wondering how the PI information is fed back audio-visually. Could you please explain?

Jason Davidow

The PIs are recorded and fed back to the speaker via a computer screen and brief tone. The software allows the user to specify a Target Range (e.g. 30-150 ms) and a dot is placed in the 'Target Range' box on the computer screen each time a PI in the Target Range is produced. There is also a brief tone as each dot appears.

Ann Packman

It seems that the Ingham et al. (2007) publication is the treatment manual. Is this available?

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Jason Davidow

The current treatment manual is not available online. However, it is similar to the procedures outlined in the Ingham (1999) chapter. That chapter includes explanations of the Pre-establishment, Establishment, Transfer and Maintenance Phases, and a step-by-step description of the speaking tasks in each phase.

Ann Packman

The first report of the programme was in 2001 but the software is still not available for others to use. Can you estimate when it will be made available?

Jason Davidow

It will be available after the current long-term study is completed and the data for that study will continue to come in until next year. Some of those data were presented at a recent ASHA conference.

Ann Packman

Do you have some idea of which clients respond better to the programme? For example, do people with mild stuttering do better, or progress quicker?

Jason Davidow

I will answer that question using the data presented in the Ingham et al. (2001) study, since I do not have access to the relevant data from other clients using the MPI programme. As can be seen in the Ingham et al. study, the MPI treatment programme has been shown to be effective for clients with varying levels of stuttering. Stuttering frequency ranged from 4%SS to approximately 20%SS before treatment in that investigation. The information presented in the Ingham et al. study does not allow for determining the association between pre-treatment stuttering levels and time to progress through the programme. However, Figure 4 in that publication reveals the average time to complete each phase of the programme. That figure shows an average of 4 weeks to complete the Establishment Phase, 8 weeks for the Transfer Phase and 1 year for the Maintenance Phase.

Ann Packman

Is it possible to estimate how many clinician hours are required to conduct the programme?

Jason Davidow

The MPI programme has mainly been run in a research mode, so it is difficult to determine how many hours it will take to conduct the programme outside of a research context or the average number of face-to-face clinician hours needed to run the programme. Additional hours were needed to complete the components of the experimental protocols used during the MPI studies that would not be necessary in a clinical environment. However, the MPI clinic at UCSB was opened this past summer and the programme has been conducted in a non-research context with three clients in that clinic, allowing us a preliminary look at the number of face-to-face hours needed. The following is the current breakdown for clinician face-to-face time for these three clients for

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the routine MPI programme: 2.5 hours for pre-treatment assessment, 20-25 hours for the Establishment Phase, 3 hours for the Transfer Phase and 3 hours for the Maintenance Phase.

Sheena Reilly

My question concerns the applicability of the MPI programme for adults, adolescents and school-age children. What evidence is there to support using MPI for each of the age groups? I think the data referred to in the paper mainly concerns adults older than 18 years. Could you clarify and also explain why it would not be applicable for preschool-age children and is the programme delivered in exactly the same way for adults as for school-age children?

Jason Davidow

Yes, the data in the Ingham et al. (2001) study are from PWS, aged 18-28 years. As far as I know, there are no published treatment data for PWS under 18 years old. However, Ingham (1999) states that the programme has been conducted with adults and adolescents, and there are data for PWS under 18 years old in the experimental studies conducted during the development of the programme (Ingham and Devan, 1987; Ingham et al., 1983). The participants under 18 years old in those studies were able to reduce the frequency of short PIs in their speech with accompanying reductions in stuttering. I am unsure if the programme has been administered to school-age children. Perhaps the publication of the current long-term MPI study will include PWS under 18 years old.

Sheena Reilly

And preschool-age children?

Jason Davidow

As far as I know, the programme has not been conducted with preschool-age children. Although I can't speak to why the developers of the programme may not have run the programme with this age group, I can provide some of the reasons why I think the programme may not be applicable or a most appropriate option at this point in time as it is currently constructed. First, there are other programmes, such as the Lidcombe Program (LP), that seem more applicable. The LP has a solid research base with preschoolers and doesn't involve the issue of shaping the learned speech pattern into a natural-sounding pattern. Second, the MPI treatment schedule is somewhat intensive and often requires concentration over an extended period of time. It would probably be very difficult for a preschooler to focus on the necessary tasks for a long time. Third, the developers of the programme have structured the MPI programme so that it can be self-managed. It would likely be very difficult for a preschooler to manage several of these elements. A parent could possibly manage some of them, but others, including the reduction in the number of short phonated intervals that has to be understood by the client, would probably be too involved for a preschooler.

Sheena Reilly

This question concerns the dose and duration of the MPI programme. In the Establishment Phase the client is encouraged to attend 2-3 hour daily sessions.

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Could you clarify how long these daily sessions are required and how long each of the three phases takes to complete. It would be good to know what the average time is and the range as well. Perhaps you could also comment on how feasible it is to transfer this to the 'real world'?

Jason Davidow

Using the text from the Ingham et al. (2001) treatment study, we can get a general idea of how many hours the Establishment Phase took for participants in that study. The authors state that this phase took about 2-3 weeks, using daily or bi-daily sessions of 2-3 hours. So, we can get an idea of the length of this phase by using the average of those values and calculating the number of hours for someone who performed the treatment daily, and someone who only performed the treatment schedule bi-daily (once every 2 days). If someone took 2.5 weeks (17.5 days) to complete this phase and came in once per day for 2.5 hours, the Establishment Phase would have been around 44 hours (17.5 days × 2.5 hours). If someone took 2.5 weeks (17.5 days) to complete this phase and came in every 2 days for 2.5 hours, the Establishment Phase would have been around 22 hours (8.75 days × 2.5 hours). It would seem that the average number of hours was probably somewhere between the two values of 22 and 44 hours. It should be noted that these are the hour values assuming that participants came in on the weekends, which may not have been the case. If the participants only came in during the week, the averages would be around 31 hours (daily) and 16 hours (bi-daily).

Ingham et al. (2001) state that the Transfer Phase took an average of 8 weeks to complete. The Transfer Phase would require 54 minutes of speaking if the client passed each of the speaking tasks on the first attempt. If every task was not passed on the first attempt, the amount of speaking time would vary depending on how many times the client did not meet the required criteria (stutter-free and natural-sounding speech). Ingham et al. also state that participants in that study were allowed to practice with the MPI programme during the Transfer Phase, and that an average of approximately 25 minutes of practice was completed per week. The Maintenance Phase would require 63 minutes of speaking if the client passed each of the speaking tasks on the first attempt. As with the Transfer Phase, if all tasks were not passed on the first attempt, the amount of speaking time in the Maintenance Phase would vary depending on how many times the criteria were not met.

Sheena Reilly

Could you comment on how use of this device in clinical trials would translate to clinical communities, the so-called real world.

Jason Davidow

An MPI clinic has been opened at UCSB in order to examine the effectiveness of the programme in a clinical context. It is still fairly early in the development of the MPI treatment, so it is not surprising that there are no published data, to the best of my knowledge, from Phase IV, or translational research.

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