Title: Outcomes from a community speech and language therapy service treatment waiting list: The natural history of 525 children with identified speech and language needs

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Abstract

Background

Understanding the natural history of developmental speech and language impairments can support the selection of children whose difficulties are persistent rather than transitory. It can also provide information against which the effectiveness of intervention can be evaluated. However, natural history data is difficult to collect ethically. Furthermore, as soon as an impairment is identified, the behaviour of those around changes, thus creating some level of intervention. Longitudinal cohort studies, where intervention is minimal, or the control arm of randomised trials have provided the best evidence. However, occasional opportunities arise where service waiting lists can provide data about the progress of children who have not received intervention. This natural history study arose within an ethnically diverse, community paediatric speech and language therapy service in the UK where levels of social disadvantage are high.

Aims:

To identify (i) characteristics of the children who attended initial assessment and were selected for treatment (ii) differences between children who did and did not attend reassessment (iii) factors associated with outcomes.

Methods and Procedures

A cohort of 545 children were referred and assessed as in need of therapy. Due to resource constraints, intervention was not available for an average of 12 months. Children were invited to attend for a reassessment of need. Initial and follow-up assessments were conducted by

experienced clinicians using service guidelines and the Therapy Outcomes Measures Impairment Scale (TOM-I). Descriptive and multivariate regression analyses examined child outcomes for changes in communication impairment, demographic factors, and length of wait.

Outcomes & Results

At initial assessment, 55% of children presented with severe and profound communication impairments. Children offered appointments at clinics in areas of high social disadvantage were less likely to attend reassessment. By reassessment, 54% of children showed spontaneous improvement (mean TOM-I rating change 0.58). However, 83% were still judged to require therapy. Approximately 20% of children changed their diagnostic category. Age and impairment severity at initial assessment were the best predictors of continuing requirement for input.

Conclusions and Implications:

Although children do make spontaneous progress post-assessment and without intervention, it is likely that the majority will continue to be assigned case status by a Speech and Language Therapist. However, when evaluating the effectiveness of interventions, clinicians need to factor in the progress that a proportion of the caseload will make spontaneously. Services should be mindful that a lengthy wait may disproportionately impact children who already face health and educational inequalities**.**

WHAT THIS PAPER ADDS

What is already known on the subject:

Data from longitudinal cohorts (where intervention has been minimal) and the no treatment control arms of randomised controlled trials have provided the best evidence of the natural

progression of speech and language impairments in children. These studies provide a varied rate of resolution and progress depending on the case definitions and measurements used.

What this paper adds to existing knowledge

Uniquely, this study has evaluated the natural history of a large cohort of children who had been waiting for treatment for up to 18 months. Data showed that, over a period of waiting for intervention, the majority of those identified as a case by a Speech and Language Therapist remained a case. Using the Therapy Outcome Measure, on average children in the cohort made just over half a rating point progress during their waiting period.

What are the potential or actual clinical implications of this work

The maintenance of treatment waiting lists is probably an unhelpful service strategy for two reasons: firstly, the case status of the majority of the children is unlikely to change whilst they await intervention and thus children and their families are subjected to further limbo waiting time; secondly, the drop out from the waiting list may disproportionately affect children who are offered appointments in clinics where there are higher levels of social disadvantage, thus exacerbating inequalities in the system.

Currently, a suggested reasonable outcome of intervention is a 0.5 rating change in one domain of TOMs. Study findings suggest this is insufficiently stringent for a paediatric community clinic caseload. There is a need to evaluate spontaneous improvement which may occur in other TOM domains (i.e., Activity, Participation and Well-being) and to agree an appropriate change metric for a community paediatric caseload.

Key words

Outcomes, natural history, developmental speech and language disorders

Introduction

This paper presents natural history data opportunistically gathered within a children's speech and language therapy (slt) service in the UK. Between December 2011 – December 2013, children with identified speech and language impairments were placed on the city-wide treatment waiting list. Due to a mismatch between the demand for services and staffing resources, long waiting times occurred between each child's initial and follow-up assessments. The slt service, with support from their National Health Service (NHS) Trust, commissioned a review to identify those children who had improved spontaneously from those who continued to present with communication difficulties. This paper first reviews what is known about the natural history of speech and language disorders and then considers the contribution made by this study.

Natural history of communication development and its role in supporting clinical decision making

Speech and language impairment is a high prevalence condition (e.g., McLeod & Harrison, 2009) and children experiencing persistent difficulties are at increased risk of long-term academic underachievement, socio-emotional difficulties, and poorer employment outcomes (e.g., McKean et al., 2017; Wren et al., 2021). To understand the benefit of intervening, it is necessary to evaluate change that is likely to occur spontaneously. Speech and Language Therapists (SLTs) are tasked with identifying children who require intervention whilst avoiding raising concern about those with transitory difficulties. However, children are generally referred to services in the developmentally noisy preschool period and are typically a heterogenous group. When selecting children for treatment, SLTs draw on their own knowledge and experience and on protocols

espoused by their service. Research on 'natural history', which examines the progress of a condition in the absence of intervention, should have an important role in informing and supporting SLT decision making.

Law et al., (2000) note that large-scale prospective same-age cohort longitudinal studies offer the best evidence of the natural history of communication development and fluctuation or persistence of case status whilst acknowledging that intervention will occur for some children – typically, non-specific general advice - that may facilitate change (e.g., Roulstone et al., 2003). Nevertheless, this body of literature can offer pointers in terms of who to select for treatment (e.g., To et al., 2022). The predominant trajectory is one of stability over time especially for children over 4-6 yrs. (e.g., Bishop et al., 2017; Norbury et al., 2017; Roulstone et al., 2009). However, identifying persistence is problematic, particularly in children younger than 4 years. Many late talkers catch up without intervention especially if their difficulty is predominantly expressive. However, Law et al., (2000) suggests that even within this group, possibly 25% do not resolve. At greater risk of experiencing ongoing impairment are pre-schoolers with poor language comprehension, poor use of gesture and / or a positive family history (Bishop et al., 2016, 2017). Even here, identification of individual at risk children is unreliable. By 4-5 years, predicting persistence is less problematic but the picture is still complex. Children with severe levels of both receptive and expressive language difficulties are more likely to experience continuing difficulty (Bishop et al., 2016). However, some school-aged children with language disorder were not slow to talk (e.g., Zambrana et al., 2014) and some children appear to move in and out of developmental patterns presenting as delayed at some, but not all, points in time (e.g., Zubrick et al., 2015). McKean et al., (2017) identify three language trajectories from their longitudinal study of 1,910 Australian children followed up from 4-11 years; 'stable' (94% of their participants), 'low-improving' (mostly associated with environmental risks) and 'low decreasing' (associated with mainly biological

risks). However, they conclude that 'by 4 years, services can be confident that most children with low language will remain low until 11 years'.

A further source of natural history data is available from randomised controlled trials (RCTs) where the untreated control condition amounts to a natural history period. Broomfield and Dodd (2011) and Roulstone et al., (2003) both reported spontaneous improvement for some of their untreated control children but found that most were still eligible for intervention with very few achieving normal levels of speech and language.

The role of risk factors in predicting transience and persistence

Bishop et al., (2017) define risk factors as biological or environmental factors statistically associated with but not robustly predictive of language disorder and which may differ depending on the child's age and on whether epidemiological or clinical samples are considered. Risk factors they identify as commonly occurring in the literature include a family history of language or literacy difficulties, being male, fewer years of parental education and being a younger sibling in a large family.

As yet, consensus has not been reached about which risk factors, singly or in combination, are most predictive nor of their nature, progression and relationship with other factors. Increasingly, studies highlight the importance of multiple risk factors (e.g., Eadie et al., 2022; Taylor et al., 2020; Wren et al., 2016) and report that higher levels of risk are associated with greater numbers of risk factors. For instance, Eadie et al., (2022) conclude that an accumulation of 'early life factors' (they identified 12) increased the likelihood of children having low language skills at 7 years; for instance, children with 6 or more risks were 17 times greater at risk than children with 2 or less risks.

In conclusion, evidence regarding the likely persistence of speech and language impairment, particularly once a child reaches school age, is now accepted. However, research showing the nature and amount of possible spontaneous progress is still sparse. Accordingly, distinguishing between persistent and resolving communication impairment continues to challenge clinicians and researchers. Bishop et al., (2016) recommend the development of methods for addressing this issue as a priority.

Aims and objectives.

This study examines the natural history of speech/language impairment in a clinical cohort of children and explores implications for the selection of children for intervention. Specific objectives are:

❖ To describe characteristics of the children selected for treatment after initial assessment to provide (i) a baseline against which spontaneous progress can be evaluated (ii) information about those who remain active on a waiting list and (iii) an evaluation of any inequalities in the system.

❖ To examine outcomes for the children who attended for reassessment in terms of changes in the severity and nature of their speech/language impairment.

❖ To explore factors associated with the children's outcomes and improvement.

Method

This study is based on an opportunistic clinical cohort of children referred to and assessed by experienced paediatric SLTs working from five community clinics (east, west, southeast,

southwest, north) spread across the City of Birmingham, UK. Data used for analysis were routinely collected within the context of normal service delivery.

Birmingham has the largest Local Authority in the UK and is one of the most deprived areas in England with one in three children living in poverty. In some wards, up to 80% of residents are from Black, Asian and Minority Ethnic groups. On average, the overall health, wellbeing, and development of Birmingham's children at the end of their first year in school are all worse than the national average (Sustainability and Transformation strategy (Draft), accessed 09.22). According to census figures for the year of this study, 43% of Birmingham's children had a home language other than English with over a hundred different languages being spoken (DfE 2013).

Participants

During December 2011 to December 2013, all children referred to the community clinic team received a standard 60-minute diagnostic / triage assessment. Children were then either discharged or placed on the treatment waiting list. Families were provided with a written report summarising assessment findings and advice discussed within the session. Due to concerns about wait times, a review of the treatment waiting list was subsequently commissioned and parents / carers invited by letter to contact the service if they still had worries about their child's communication development. Families were approached in order, starting with those who had waited longest. Reassessment was offered to those who responded (see Figure 1 for details of participant flow).

Figure 1 about here

Anonymised data were included from all Birmingham children who met the following criteria:

- ❖ Placed on the treatment waiting list between December 2011 – December 2013.

- ❖ Waiting time between initial and reassessment ranging from 6 -18 months.

- ❖ No input from the local slt service during the waiting period.

- ❖ Required community clinic or mainstream school-based intervention with the focus being receptive / expressive language and/or speech and/or fluency.

Children were excluded if they required therapy from specialist therapists, if their main problem was voice, if their initial or reassessment data were incomplete, or if they had moved from the area.

Procedures

Initial assessments were delivered by experienced SLTs within the service who worked to agreed guidelines and who met regularly to discuss clinical work and to standardise practice. Follow-up reassessments were delivered by experienced locum SLTs who had access to the initial assessment data and were tasked with deciding whether the reassessed children still required intervention.

An audit conducted in March 2015, three months after the end of the study, identified which of the children who had not contacted and / or attended for reassessment had been re-referred.

Assessment Protocol

Whilst formal and informal assessment materials appropriate to the child's age and presentation were recommended, as is good practice in the clinical context, SLTs could select other materials as necessary. Following their assessment, SLTs allocated one of eight severity descriptors (i.e.,

profound, severe-profound, severe, moderate-severe, moderate, mild-moderate, mild, no difficulty) to each of four communication domains - receptive language, expressive language, speech, and fluency - and recorded their findings on a standard assessment summary sheet. The first author used these severity descriptors to identify the proportions of children who had at least a mild level of impairment in one, two, three or all four communication domains.

All SLTs, including locums, were trained in the use of the various scales and supporting protocols by the first author. Inter-therapist reliability was checked using 6 vignettes constructed to provide a range of scores. Following training, SLTs independently rated these vignettes on two separate occasions. The intraclass correlation (single measures: 0.929; average measures: 0.996) for their ratings showed strong correlation suggesting excellent inter-therapist reliability (p=0.001).

The following variables were extracted from each child's case notes for the data set: the nature and severity of their communication impairment, TOM-I rating, gender, age at initial assessment, length of wait, postcode and whether the main language spoken at home was English.

Measures

❖ **Therapy Outcome Measures - Impairment Scale (TOMs-I) (Enderby et al., 2006)**
Following analysis of assessment findings, SLTs selected the best fit TOM-I rating to represent each child's overall communication impairment. This summary measure consists of a 0-5 scale (11 rating points, including half points) with '5' representing no difficulty with communication and a rating of '0' representing a profound level of impairment across at least 2 communication domains. A profound level of difficulty in a single communication domain (e.g. speech) would receive a rating of 1. The TOM Impairment scale used in this study included additional examples of diagnoses mapped against whole and half rating points (see appendix) to facilitate consistent rating selection by the participating SLTs. The TOMs is a flexible tool, and scale adaptation for

local purposes is permitted as long as in accordance with TOMs' principles (Enderby, 2018).

Professor Pam Enderby, author of TOMs, was approached and approved changes that had been

made. Whilst ordinal data is generally analysed using nonparametric statistics, Enderby et al.

(2018) report that there is general agreement that some ordinal data, such as that generated by

TOM, is less 'qualitative' as it has sufficient definition to perceive the different points on the scale

in the same way. Such data can therefore be treated as interval data.

❖ **Diagnostic categorisation**

Children were assigned a diagnostic category by the first author and by the last author

independently with complete agreement. These were allocated (see Box 1 for coding criteria)

based on the severity descriptors (see 'Assessment Protocol', above) provided by the assessing

SLT.

Insert Box 1 about here

❖ **Income Deprivation Affecting Children Index (IDACI)**

The IDACI (Noble et al., 2019) is a supplementary index of the 'The Index of Multiple Deprivation'

(IMD), which measures deprivation at neighbourhood level known as Lower Super Output Areas

(LSOAs). There are 32,844 LSOAs in England, each containing approximately 1,500 people.

Individual neighbourhoods are ranked from 1 (most deprived neighbourhood) to 32,844 (least

deprived neighbourhood) with the mean ranking for all of England being 16,422. The IDACI was

selected as the measure of socioeconomic status most relevant for this study as it specifically

identifies the proportion of children aged 0 to 15 living in income deprived families (e.g., in receipt

of Income Support) at any particular postcode.

Data management and analysis.

Anonymised data from the initial and follow-up assessments were entered on to data sheets and coded by the first author. Data were entered onto an Excel spreadsheet by a data entry clerk and then checked and corrected for accuracy by the first author. Statistical analyses were carried out using SPSS version 28. Analyses included descriptive measures of means, range, standard deviation, and interquartile range as appropriate to the data with the use of chi square test of association, the independent samples t-test and the one-way Analysis of Variance (ANOVA)to test for between-group differences. Univariable and multivariable regression and logistic regression analyses were used to explore variables that were predictive of outcomes. Generally, the 5% level is used to determine whether variables are significantly associated. However, full p values and confidence intervals are given to avoid missing associations of importance in recognition that the 5% level is an arbitrary cut-off (Sterne & Davey-Smith 2001).

Results

The results are organised in three sections: the first examines cohort baseline data; the second compares children who attended for reassessment with those who did not; the third presents outcomes for those who attended for reassessment, investigates factors associated with improvement and reviews the characteristics of children who were / were not offered treatment.

Characteristics of the waiting list cohort at initial assessment

Seven hundred and twenty-two children were placed on the treatment waiting list following their initial assessment. Of these, 525 met inclusion criteria (Figure 1). Children were aged between 20 months and 16 years 7 months, (mean: 53.7 months; median; 46 months; SD: 26.4), mostly of preschool age but with a minority (13%) aged 6 years and above. The proportion of boys to girls followed the common pattern with 75% being boys. Children came from across the social range (IDACI rank mean: 7436; range 10-31529; SD:7480). However, there were significant differences

in the mean IDACI rank for children attending the five clinics of the NHS Trust (f (4,517) = 22.46, p<0.001). A post hoc Tukey analysis shows that the mean IDACI ranking in the north is significantly higher than each of the other four areas (p<0.001 for all comparisons; all t values were above 6) and the mean ranking in the southwest is significantly higher than the east (t=2.93; p = 0.029) and west (t-3.21; p=0.012). The majority of children seen for initial assessment reported English as their only language (74%). The mean IDACI ranking for children in families who reported using only English was significantly higher than that for children in bilingual families (f (1,520) = 9.09, p=0.003; CI:0.002 to 0.045; df=1). There were no statistically significant age effects (p=0.40) or gender (p=0.18) differences between children using English only (EO) and children using English as an additional language (EAL).

Just over 27% of children had a communication impairment in one domain, 44% in two domains, 28% in three and 1% in all four domains (i.e., receptive and expressive language, speech and fluency). Children were assigned to a diagnostic category on the basis of the severity descriptors provided by the assessing SLTs and the criteria described in Box 1; 49% of children to receptive language, 13% to expressive, 28% to speech and 10% to fluency. Table 1 provides descriptive data for the cohort according to their diagnostic category including the proportion of boys, age at baseline, their IDACI rank, the proportion of EAL children and mean scores at baseline on TOM-I.

Insert Table 1 about here

In a series of multivariable binary logistic regression analyses, associations between these characteristics and diagnostic category were explored, comparing each diagnostic category in turn with the rest of the cohort. Gender was not associated with diagnostic category. Children's age at baseline, their IDACI rank and whether they used English at home were statistically associated (all at p<0.001) with the receptive language category. These children were more likely

to be younger than children in the rest of the cohort (p<0.001; OR: 1.03; CI: 1.02 to 1.05), to have a lower IDACI ranking (OR: 1.83; CI: 1.39 to 2.42) and 4 times more likely to be from a bilingual background (OR: 4.72; CI: 2.91 to 7.63). Children in the expressive category were also younger than the rest of the cohort (p = 0.04; OR: 1.01; CI: 1.001 to 1.03) but were more likely to be from an English-speaking family (p = 0.02; OR: 2.31; CI: 1.14 to 4.68). Children in the speech category were more likely to be from a more advantaged area (p<0.001; OR: 1.57; CI:1.22 to 2.04) and more likely to be from a family using only English at home (p<0.001; OR: 9.38; CI: 4.24 to 20.77). Finally, children in the fluency category were more likely to be older than the rest of the cohort (p<0.001; OR: 1.06; CI:1.05 to 1.08).

Looking at overall impairment severity, the average TOM-I rating was 1.6; 55% of children had a profound or severe rating (TOM-I 0-1.5), 29% had a moderate-severe impairment (TOM-I: 2 – 2.5), 15% had a moderate rating (TOM-I: 3- 3.5) and 1 % had a mild rating (TOM 4 - 4.5). Those with severe or profound TOM ratings were predominantly from the receptive language category (Figure 2).

Insert Figure 2 about here

Analysis using univariable linear regression showed a strong association between TOM-I at baseline and the child's age, diagnostic category, IDACI rank and whether only English was spoken at home. Gender was not associated with TOM-I at baseline. When these variables were combined in a multivariable linear regression, variation in TOM-I was best predicted by diagnostic category (p<0.001) and IDACI rank (p<0.001). The differences in age profile (p=0.82) were no longer important predictors and the differences between children who spoke only English and those from bilingual homes failed to reach statistical significance at the 5% level (p=0.064)

Comparison of those lost to follow-up with those who attended reassessment.

Of the 525 children initially assessed, 307 (58%) attended for reassessment (Figure 1). On average, they had waited 11.9 months for a reassessment. Table 2 provides descriptive data and p-values for the two groups (those who did / did not attend follow-up). No statistically significant differences were observed in terms of gender, age, home language use, diagnostic category and mean TOM-I at initial assessment. The slightly higher proportion of boys attending fails to rule out the null hypothesis at the 5% level (p=0.09). Whilst mean IDACI rankings did not differ significantly between the two groups, there was significantly less take-up for reassessment by families from the different areas of the NHS Trust (p<0.001) with approximately 45% attending from areas with low IDACI scores (east and west) and around 65% attending from the higher scoring areas (north, southeast and southwest) (Table 3).

Three months after the end of the study, an audit established that 24 (i.e., 11%) of the 218 children lost to follow-up had been re-referred to the service and reassessed. Comparatively, at baseline, they had been marginally older (mean age 55 months), had included more English only speaking children (83%), a higher proportion were categorised as receptive language (63%), and their TOM-I score had been marginally more severe (mean 1.52; range 0-3.5) than the full cohort. All were judged to require intervention.

Insert Tables 2 and 3

Outcomes for the children who attended reassessment.

Outcomes are examined in three ways: firstly, which children continued to need intervention; secondly, changes that occurred in the severity of impairment; finally, changes that occurred in the nature of impairment.

Outcomes: continuing need for intervention

Of the 307 children reassessed, 51 (16.6%) were considered by the assessing SLT to no longer need intervention. Ninety percent of this group had made gains of at least 0.5 on the TOM-I scale with an average improvement of nearly two ratings. Their mean rating of 3.9 (range 0-5; SD 0.88) suggested, overall, that the level of impairment for these children was now mild, with 11 children rated as a 5, (i.e., resolved); one rated as 0 (i.e., profound impairment). By comparison, 47% of the children recommended for intervention had also made gains of at least 0.5 on the TOM-I scale. The average improvement was 0.33, with a mean TOM-I rating of 1.8 (range 0-4; SDS: 1.11). Whilst, overall, this suggested severe impairment, a few children had ratings of 3.5 and 4, indicating mild impairment. The two groups, (those discharged and those offered intervention) were then compared in terms of their gender, age at initial assessment, home language, IDACI rank, length of wait and TOM-I rating using univariable and multivariable binary logistic regression analyses. The results (Table 4) indicate that the TOM-I score at baseline was strongly associated with outcome (p<0.001) in both univariable and multivariable models; the child's age at baseline was also associated with outcomes (p=0.036) in the multivariable model suggesting that younger children with lower levels of impairment (i.e., higher TOM-I ratings) were more likely to be discharged when reassessed. The odds ratio suggests that a one-point increase on the TOM-I doubles the odds of being discharged (odds ratio = 1.99; CI: 1.39 to 2.86)

Insert Table 4 about here

Outcomes: severity of communication impairment at follow-up (TOM-I score)

The average change in the TOM-I rating for the 307 children who attended follow-up was 0.58; 54% of children improved their rating by at least 0.5 point, 25% saw no change and 21% received a more severe rating. Of those whose score had improved by at least 0.5, 72% still needed intervention. To reduce the possibility of achieving a false positive (and at the risk of achieving a

false negative) result it was decided to use a higher criterion than 0.5 as an indicator of change.
Accordingly, the higher change criterion of one or more points on the TOM-I was adopted. Using
this criterion, of course, produced a more conservative estimate of change with 38% of the cohort
showing improvement, 52% stasis and 10% deterioration. Associations between this measure of
outcome and baseline characteristics were investigated using a binary outcome of improvement
or stasis / decline. Table 5 shows the descriptive data, odds ratios, confidence intervals and p
values for the univariable and multivariable binary logistic regression analyses. In the univariable
analysis, the mean age of the children who made improvement was significantly younger than
those who had not improved (p=0.028: see Figure 3). Significant associations were also found in
univariable analyses between the improvement criterion and TOM-I at baseline, with the IDACI
rank being of borderline statistical significance.

In the multivariable analysis, improvement of 1 or more TOM-I score at follow-up was best
explained by the IDACI ranking and TOM-I at baseline: improvement was made by more children
from more advantaged backgrounds and those with more severe scores on the TOM-I. In the
multivariable analyses, the children's age was no longer significantly associated with
improvement.

Insert Table 5 and Figure 3 about here

Outcomes: nature of communication impairment at follow-up

Another way to understand outcomes is to compare diagnostic categories assigned based on the
initial assessment with those assigned after follow-up. Over the waiting period, the proportions of
children within the diagnostic categories remained similar with just 20% of children changing
diagnostic category (Table 6). Reassignment occurred in a higher proportion of children originally

categorised as expressive language (48%) compared with the other categories (receptive language: 20%; speech: 8%; fluency: 6%). Children moving from the receptive language category were reassigned predominantly to the expressive category (12%) but 8% moved to the speech category. Similar numbers of children from the expressive language category moved to receptive language (n=8) and to the speech category (n=7). Children moving from the speech category predominantly moved to the expressive language category, with only one child being reassigned to the receptive language category, and as indicated above, there was the least movement from the fluency category with only two children reassigned to another category.

Table 6 about here

Table 7 shows the levels of severity over time in the four diagnostic categories. As reported above (Figure 2), children in the receptive language category had the lowest (i.e., most severe) TOM-I ratings at baseline, followed by those in the expressive language category, then speech, with the children in the fluency category being rated with the least impairment; this pattern remained the same at follow-up. Although there were no statistically significant differences in the average amount of change in the TOM-I scores across the four diagnostic categories (p=0.76), more children in the expressive language category and fewer children in the fluency category improved by one or more TOM-I points (p=0.016). Similarly, more children in the expressive language and fewer in the fluency categories were discharged at follow-up (p = 0.043).

Table 7 about here

Discussion

The Royal College of Speech and Language Therapists (RCSLT) state that an important responsibility of slt services is to ensure that their reach and access meet the needs of the population they serve (RCSLT 2018). The first part of this discussion focuses on issues concerning cohort characteristics and service access; the second part focuses on child outcomes and associated factors. Findings have the potential to contribute to our understanding of the natural history of developmental language disorder and to inform SLTs' caseload management.

Cohort characteristics and slt service access

Children were mostly of pre-school age at initial assessment. However, a small but important proportion were 6 years and above. It is not known whether they had previously accessed the service, whether their identification was late or whether they were presenting with late onset speech and language impairment in accordance with trajectories identified in Mc Kean et al., (2017). These older children were more likely to be categorised as fluency but were represented within all four diagnostic groups. Given the 'high level principle' of early identification and treatment (RCSLT, 2018) and the more stable language trajectory of children beyond 5-6 years of age (Norbury et al., 2017), their seemingly late referral may be of concern. An action point for services could be to query the early history of any child referred after school entry.

Within this study, the largest proportion of children were assigned to the diagnostic category with the poorest prognosis, receptive language. These children were predominantly young and from areas of high deprivation. In line with other studies (e.g., Wiefferink et al., 2020; Stow & Dodd 2005), a demographic disparity was observed with children from bilingual homes over-represented in the receptive diagnostic category and under-represented in the expressive language and speech categories. One explanation might be that young bilingual children are

more susceptible to experiencing high levels of severe receptive language impairment. However, within this cohort, a larger proportion of bilingual than EO children came from areas of high deprivation. Poverty rather than bilingualism may therefore be the key explanatory factor (e.g., Law et al., 2017; McKean et al., 2015; Strand & Lindsay, 2009). Bilingualism, although associated with different rates of language learning, does not cause communication disorder. An examination of processes such as referral and assessment procedures might offer further pointers as to the nature of the observed association.

Children who did and did not attend for follow-up.

Data is not available for families who did not opt in for their initial appointment. The mean IDACI ranking for families who did opt in was well below the national average suggesting that many children within this study would face negative sequalae associated with social deprivation (Law et al., 2017). Of interest, is that mean IDACI rankings were similar for those who did and who did not attend follow-up. On the face of it, this suggests no relationship between social disadvantage and re-engagement with the slt service. However, this relationship is complex. Families from the two City areas with higher levels of social deprivation and the largest population of children from bilingual homes showed a lower rate of re-attendance than families from the other three City areas. Our data does not provide answers as to why this might be the case. It appears that the additional hurdles of the long wait and having to opt back in had differentially created barriers to service access for families from these areas. Detailed engagement with families is needed to understand their obstacles more fully. This suggests that measures such as IDACI in isolation should be interpreted with caution. It cannot be assumed that families within similarly ranked neighbourhoods will have the same opportunities and beliefs and will act in a similar manner.

It is not credible that the communication impairments of the children lost to follow-up had mostly resolved. At baseline, children within the two groups were similar in terms of nature and severity of impairment, age, gender and home language use. Given that most of the reassessed children still required intervention, the assumption must be that a large proportion of those who were not followed-up would also have warranted input, implying a high level of unmet need. This supposition is supported by the audit of children who were re-referred within the lifetime of the project - they all continued to require intervention.

Child outcomes and associated factors

A major challenge when assessing a child is to estimate the likelihood that their communication impairment will persist. Important factors to weigh up include the child's age and the nature of their difficulties, case history information and the child's progress since referral. However, reliable data are rarely available for this natural history period. With the caveat that advice given by SLTs after initial assessment may well have accelerated development, this study provides information concerning the type and amount of spontaneous progress that children with identified speech / language impairments made whilst waiting an average of 12 months for intervention. It is important to note that changes in children's profile could be due – in part – to regression to the mean and ceiling effects meaning that conclusions regarding which children showed the most and least improvement need cautious interpretation.

For obvious ethical reasons, few empirical studies have been able to evaluate the progress of a large group of untreated children for a length of time comparable to this study. However, two RCTs (Broomfield & Dodd 2011; Roulstone et al., 2003) conducted in Community Paediatric Services, were able to randomise their cohorts to create non-intervention groups. Some similarities in outcome were observed. For instance, Broomfield & Dodd reported proportions of

improvement, resolution, stasis and deterioration within their untreated control group comparable to the current study and Roulstone et al., reported similar proportions of children staying within and switching from their original diagnostic categorisation. This comparability of finding is interesting, but there is no assumption that replication might occur in other situations. Nevertheless, across all three studies, most of the untreated children - including those under 3 years, where teasing out 'late bloomers' from those with burgeoning communication impairments is a notoriously challenging task - still required intervention at follow-up. This suggests that most children selected for treatment by SLTs are indeed unlikely to resolve without input.

A key finding from this study is that most subgroups of children (except those older than 72M and / or categorised as fluency) made an average gain of just over 0.5 on the TOM Impairment domain in the absence of a treatment regime and irrespective of their length of wait, age, gender, home language use, IDACI score or diagnostic categorisation. Gains may well also have occurred in other TOM domains as impairment change (e.g., clearer speech) may increase effectiveness of communication (Activity), willingness to join in (Participation) and reduce frustration (Wellbeing). However, these other TOM scales were not used by the service at the time of this study. Enderby (2018) states that an improvement of 0.5 rating in one domain represents clinically significant change and is a reasonable outcome of treatment. This metric was established within RCTs which related TOM change scores to other measures of patient outcome (Palmer et al., 2019). However, these studies concerned adult populations where spontaneous improvement was less likely to occur. Recent outcome studies using a TOMs national dataset have used 0.5 as indicative of clinically significant change with paediatric caseloads (Enderby et al., 2018; Moyse et al., 2020) although Enderby suggests (private correspondence) that generalising from one client group to another may be inappropriate and that there is a need to establish whether a 0.5 change is clinically significant for each client

group. Given that this was the average gain made during the period of waiting by the children in this cohort, we suggest that the 0.5 metric in one domain as an indicator of clinically significant change is insufficiently stringent for a community paediatric caseload. Data from this study can be used to estimate spontaneous improvement in impairment within a paediatric caseload over a 6M+ period and, accordingly, should support SLT Services, ROOT (The RCSLT Online Outcome Tool ; https://www.rcslt-root.org) and future studies using TOMs as an outcome measure to evaluate the clinical significance of change following their interventions.

In terms of predicting case selection, the demographic factors used within this study were not significant either singly or in combination. The baseline TOM-I score was a significant predictor of discharge, but the range of scores in both discharged and non-discharged groups suggests that impairment severity is not the only factor that SLTs consider. Roulstone et al., (2003) found similar indications of other factors influencing decisions although there was considerable overlap in children's assessment scores between those whose parents opted for further intervention and those who did not. A child with a profound communication impairment might be discharged due to factors such as timeliness, whereas, conversely, a child with a mild communication impairment might be selected due to the impact of their communication impairment on their well-being and daily functioning. The influence of the impact of the communication impairment on the decision was demonstrated in Roulstone et al., (2003) where the TOM 'Disability' rating (now renamed 'Activity') was significant as a discharge predictor. It is likely that TOM domains other than Impairment would also have been useful predictors in this study. So, although the discovery of a predictive algorithm was beyond the reach of this study, TOM-I ratings, that capture the judgement of SLTs, appear to have useful validity over time.

Implications and recommendations

This study took place in a service context and could be replicated by other slt services that carry treatment waiting lists and use the TOM scales. Contributions from services to develop understanding of natural history could facilitate the comparison of different models of service delivery thus supporting therapy effectiveness. Generalisability of findings would be enhanced by the agreement of a standard assessment battery and a methodology for diagnostic categorisation.

A key contribution of this study concerns the identification of spontaneous change as measured by the TOM Impairment scale over a 6–12-month period. This should support clinicians to estimate how far their interventions – both for individual children and at a caseload level – are likely to be driving improvement. Furthermore, this study identifies a need to evaluate spontaneous change in the other TOMs domains (i.e., Activity, Participation and Wellbeing) and raises the issue of what constitutes a more appropriate change metric for a community paediatric caseload following treatment.

The Royal College of Speech & Language Therapists recommends that clinicians and managers explore the composition of their local caseload and be alert to any apparent demographic inequalities in children referred and recommended for intervention. This study identifies inequalities of access for children living in areas of social deprivation and highlights the possible confounding of bilingualism with social deprivation. It raises the issue that many children who did not return for follow-up were likely to be experiencing communication problems similar in nature and severity to those who did return. As recommended by RCSLT (2018), findings from this study highlight that non-attendance should be treated as a trigger for investigation and action should be taken to identify and remove barriers to access.

Strengths and limitations

Data in this study were opportunistically gathered from a community paediatric slt service that, due to resource constraints, held long waiting lists for intervention. Whilst this situation is common, data are not routinely captured, analysed, and reported. Data from this study are therefore unique.

The service in this study is not representative of all paediatric slt services and findings cannot necessarily be generalised. However, the baseline characteristics of the children are described in some detail facilitating an estimation of the applicability of findings to other caseloads.

Since this study uses routine clinical data, the measures were not specified a priori. Nonetheless, the service went to considerable lengths to standardise initial assessment processes which enabled replication for follow-up assessment. Good levels of inter-therapist reliability provide some assurance of the robustness of the study data.

Conclusions

Increasing our understanding of the natural history of speech and language impairments is critical to the provision of appropriate and timely support for children and their families. This study suggests that many children on slt treatment waiting lists will spontaneously show some improvement but will continue to experience significant communication problems emphasising the importance of providing effective interventions. This study also highlights issues of accessing services and highlights the need to explore ways of identifying and redressing inequalities.

Acknowledgments

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Box 1. Diagnostic categorisation criteria

Receptive language:

(i)   receptive language is at least moderately-severely impaired (e.g., moderate-severe

receptive language disorder with severe expressive language disorder and severe

dysfluency)

or

(ii)   receptive language more impaired or equally impaired to expressive language and /or

speech and / or fluency   (e.g., moderate receptive and,   expressive language

disorder and speech   disorder)

Expressive Language:

(i)   expressive language is the most impaired area of communication with receptive

language no more than moderately impaired (e.g., moderate receptive and moderate-

severe expressive language disorder)

or

(ii)   expressive language equally impaired to speech and / or fluency (e.g., severe

expressive language and severe speech disorder with moderate receptive language

disorder)

Speech:

(i)   speech the most impaired area of communication with receptive language no more

than moderately impaired (e.g., moderate-severe speech disorder and moderate-

severe dysfluency with moderate receptive and expressive language disorder

or

(ii)   speech equally impaired to fluency (e.g., severe speech and severe fluency disorder)

Fluency:

Fluency is the most impaired area of communication with receptive language no more than moderately impaired (e.g., moderate receptive and expressive language and moderate-severe fluency disorder)
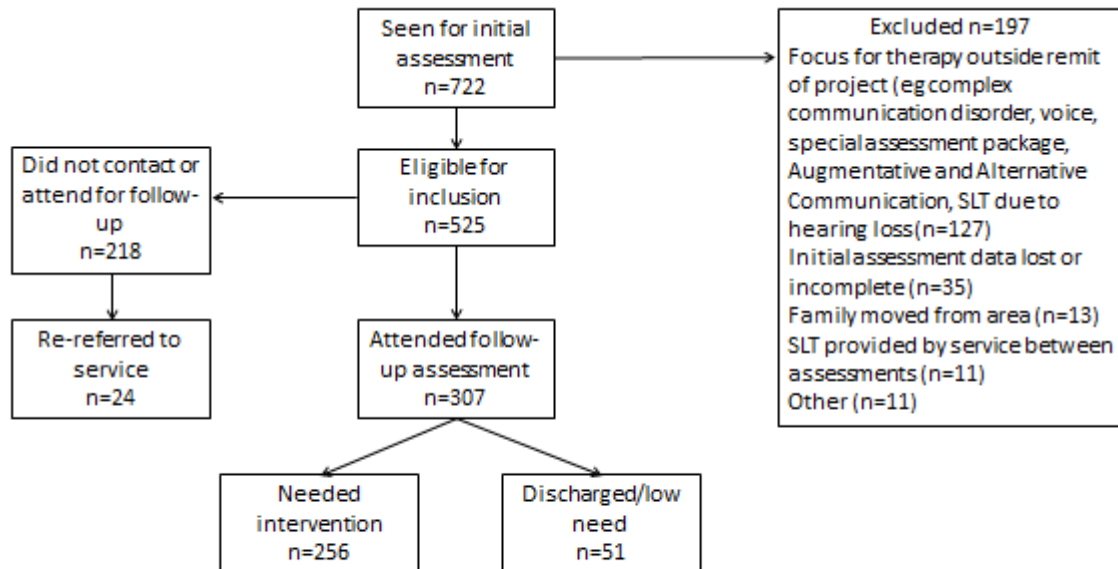
Figure 1. Participant flow

Figure 2: Percentage of Severity descriptor within each diagnostic category
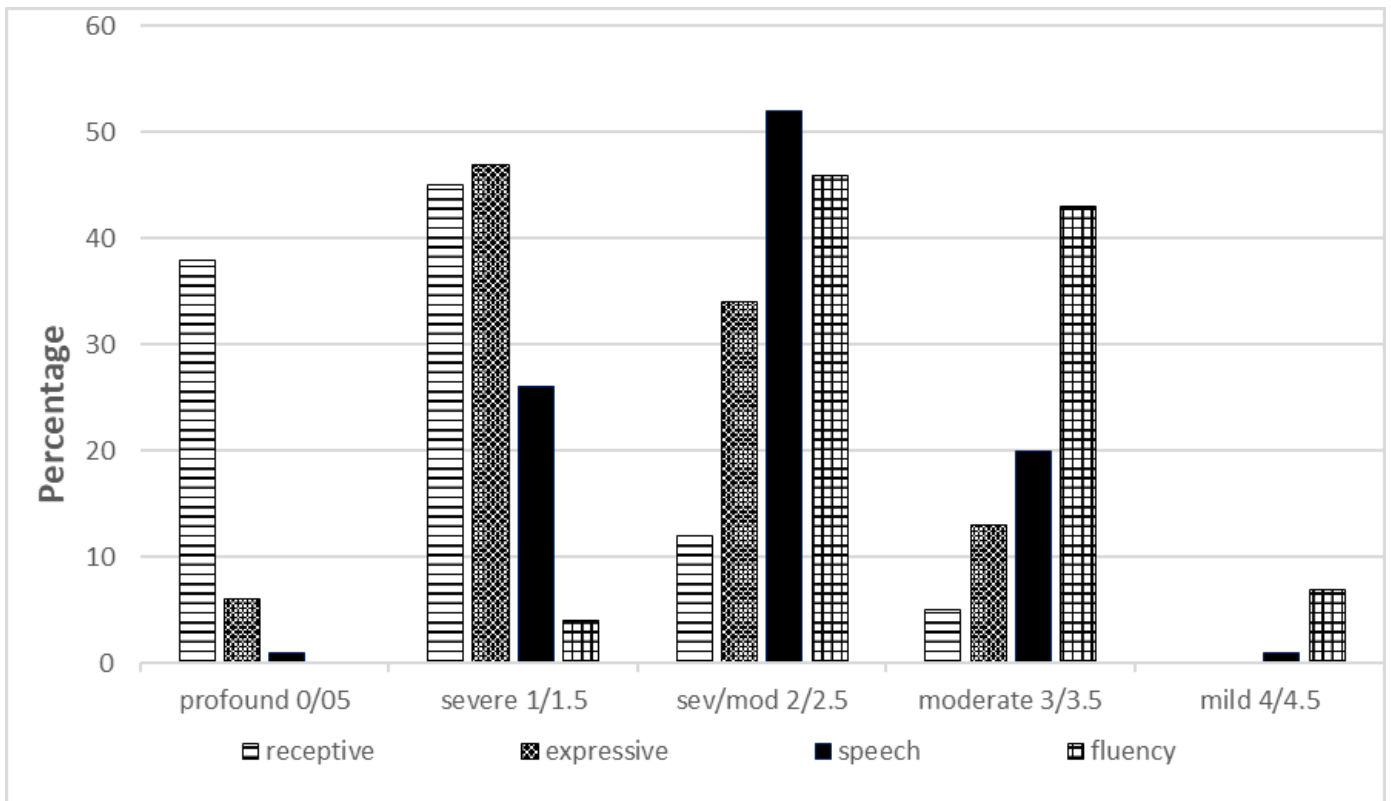
Figure 3: Age group at Initial Assessment and Improvement, Stasis and Decline at follow-up.
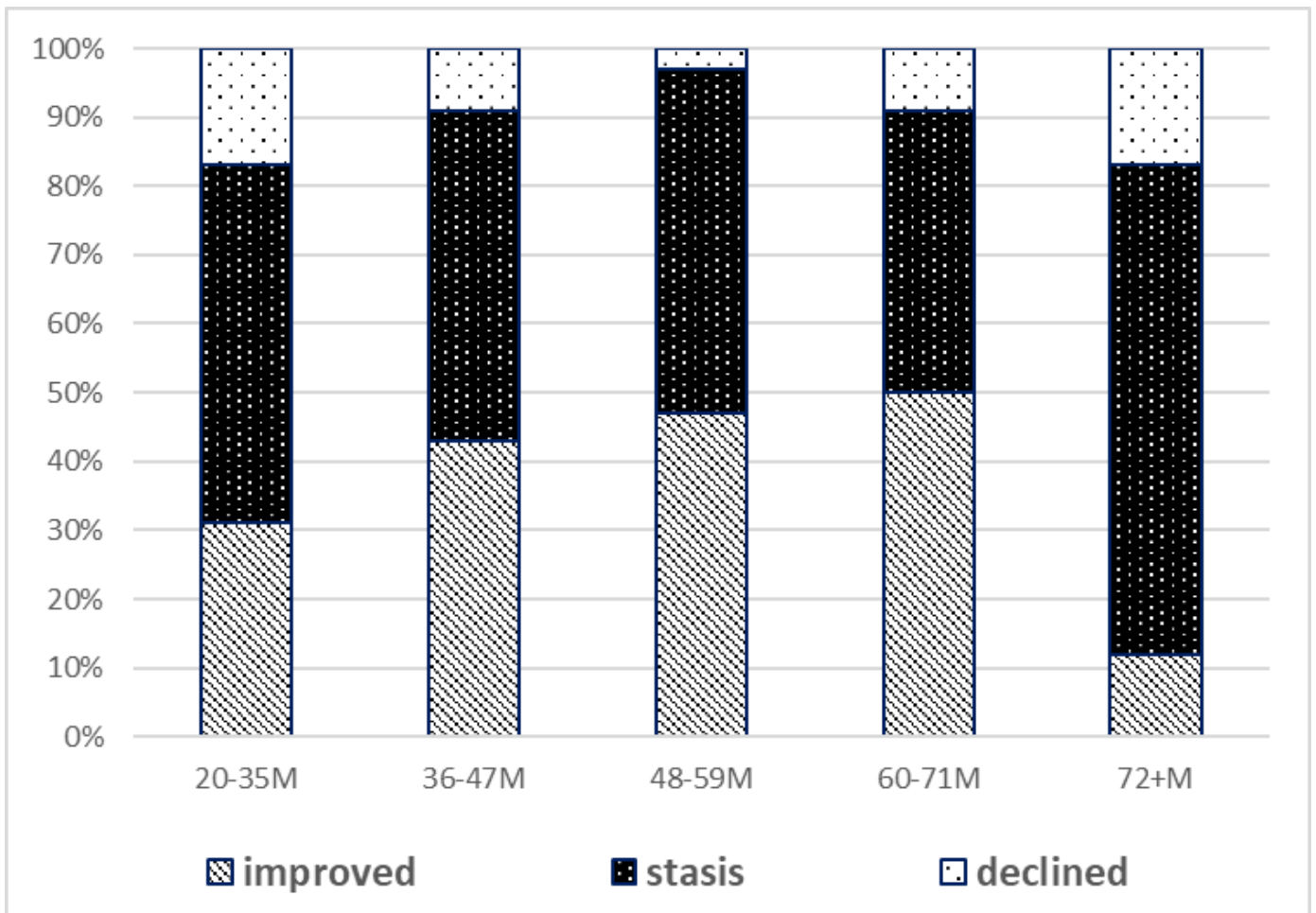
Table 1 Characteristics of children assigned to the four diagnostic codes at initial assessment.

Diagnostic category	Receptive language n = 257 (49%)	Expressive language n = 70 (13%)	Speech n = 144 (28%)	Fluency n = 54 (10%)	Full cohort n = 525
Boys n (%) Girls n (%)	190 (74%) 67 (26%)	50 (71%) 20 (29%)	108 (75%) 36 (25%)	43 (80%) 11 (20%)	391 (75%) 134 (25%)
Mean age in months (range)[SD] [interquartile range]	46.0 (24-145)[15.9] [36-53]	47.9 (20-99)[17.6] [34-61]	51.9 (26-145)[17.9] [41-58]	102.4 (40-199)[40.7] [66-132]	53.7 (20-199)[26.4] [38-59]
Mean IDACI rank (range)[SD] [interquartile range]	5838 (143-30423)[6322] [1514 – 8455]	8493 (10-31167)[8338] [2051-15519]	9697 (223-31529)[8523] [2927-13919]	7628 (10-24208)[6766] [1777-12442]	7436 (10-31529)[7480] [1948-11472]

EAL speakers n (%)	102 (40%)	10 (14%)	7 (5%)	16 (29%)	135 (26%)
TOM-I mean (range)[SD]	1.05 (0-3)[0.81]	1.77 (0-3)[0.77]	2.15 (0.5 - 4)[0.73]	2-77 (1-4)[0.63]	1.62 (0-4)[0.98]

Table 2. Comparison between children who attended follow-up assessment and those who did not.

All children N=525	Attended for follow-up (58%) n=307	Did not attend (42%) N=218	P value (t test or chi square)
Mean age in months (range)(SD) [inter-quartile range]	53.7 (20-195)[25.7] [38-59]	53.7 (24-199)[27.5] [37-58]	t=0.04, df = 523, p = 0.97
Boys/Girls n (%)	237(61%) / 70 (52%)	154 (39%) / 64 (48%)	Chi square = 2.88, df = 1, p = 0.09
EO / Bilingual n (%)	230 (75%) / 77 (25%)	160 (73%) 58 (27%)	Chi square = 0.155, df = 1, p = 0.6940
Mean IDACI rank (range)[SD] [inter-quartile range]	7738 (143-31529)[7721] [2027-11748]	7014 (10-29678)[7128] [1743-11186]	t = 1.09, df = 520, p = 0.276
TOM-I mean score (range)[SD]	1.6 (0-4)[0.98]	1.7 (0-4)[0.98]	t = 1.80, df = 523, p = 0.072

Diagnostic category			Chi square = 1.772, df = 3, p =0.621
Receptive n (%)	143 (56%)	114 (45%)	
Expressive n (%)	43 (61%)	27 (39%)	
Speech n (%)	87 (60%)	57(40%)	
Fluency	34 (63%)	20 (37%)	

Table 3. Distribution of children across the community

Number (%) of children in each community clinic area (n=525)	East	West	Southeast	Southwest	North
	n=108 (21%)	n= 64 (12%)	n=116 (22%)	n=151 (29%)	n=86 (16%)
Mean (range)	4958	4183	7017	7526	13313
	(10-31529)	(158-30423)	(209-27320)	(207-29712)	(253-31167)
[SD]	[5390]	[5309]	[6476]	[7145]	[9444]
(Sample Size)	(n=107)	(n=63)	(n=116)	(n=150)	(n=86)
[inter-quartile range]	[1404-7156]	[1126-4538]	[2068-10029]	[1887-11808]	[4165-19839]

Numbers (%) attending follow-up appointment	48 (44%)	29 (45%)	78 (67%)	96 (64%)	56 (65%)
Number (%) of children with English as an Additional Language	39 (36%)	32 (50%)	40 (35%)	16 (11%)	8 (9%)

Table 4. Prediction of which children still needed speech and language therapy using univariable and multivariable binary logistic regression.

Initial assessment		Discharged 51	Ongoing need for SLT 256	univariable		multivariable	
				OR (95% CI)	p value	Odds ratio (95% CI)	p value
Gender	Boys n=237	37 (16%)	200 (84%)	1.35 (0.68, 2.67)	0.39	1.37 (0.67, 2.81)	0.39
	Girls n=70	14 (20%)	56 (80%)				
Mean age (months)		49.6	54.5	0.99 (0.98, 1.00)	0.22	0.98 (0.97, 0.999)	0.036
Language used at home	English only n=230	42 (18%)	188 (82%)	0.59 (0.27, 1.28)	0.18	0.80 (0.36, 1.80)	0.59
	EAL n=77	9 (12%)	68 (88%)				

mean IDACI* rank	9235	7436	1.32 (0.92, 1.89)	0.13	1.06 (0.72, 1.56)	0.76
Mean no of months waiting until follow-up	12.3	11.8	1.09 (0.96, 1.23)	0.17	1.08 (0.95, 1.24)	0.21
Mean TOM-I (initial assessment)	2.05	1.46	1.88 (1.38, 2.60)	<0.001	1.99 (1.39, 2.86)	<0.001

* For the regression analysis, the IDACI rank is divided by 10,000 to facilitate interpretation of the odds ratio

Table 5. Associations with Improvement in TOM-I score.

Group		Stayed the same or deteriorated (n=189)	Improved by =>1 TOM-I point (n=118)	univariable		multivariable	
				OR (95% CI)	p value	OR (95% CI)	p value
Gender	Boys (n=237)	143 (60%)	94 (40%)	0.79	0.42	0.87	0.68
	Girls (n=70)	46 (66%)	24 (34%	(0.4, 1.4)		(0.49, 1.59)	
Mean age in months		56 months	49 months	0.99 (0.98, 0.99)	0.028	0.99 (0.98, 1.01)	0.19
Language	English Only (n =230)	139 (60.1%)	91 (40.9%)	0.83 (0.48, 1.4)	0.48	0.70 (0.39, 1.26)	0.24
	Multilingual (n = 77)	50 (65.0%)	27 (35.0%)				
mean IDACI* rank		7057	8827	1.03 (1.0,1.1)	0.053	1.49 (1.09, 2.05)	0.012
Mean waiting time in months		11.8	11.9	1.01 (0.92, 1.11)	0.78	1.01 (0.92, 1.12)	0.77
TOM-I score at baseline		1.7	1.3	0.67 (0.53, 0.86)	0.002	0.62 (0.47, 0.82)	<0.001

* For the regression analysis, the IDACI rank is divided by 10,000 to facilitate interpretation of the odds ratio

Table 6. Tracing the diagnostic categories over time (excludes fluency category)

Diagnostic category assigned at initial assessment	Receptive n=257 (49%)	Expressive n=70 (13%)	Speech n=144 (28%)	Fluency n=54 (10%)	Totals 525
Attended follow-up N (%)	143 (56%)	43 (61%)	87 (60%)	34 (63%)	307
Further slt input needed	127 (89%)	31 (72%)	69 (79%)	29 (85%)	256 (83%)
Diagnostic category assigned at follow-up to those requiring SLT input					
Receptive	101 (80% remained in category)	8 (26% assigned to receptive)	1 (1% of assigned to receptive)	0	110 (43% assigned to receptive)
Expressive	15 (12% assigned to expressive)	16 (52% remained in category)	5 (7% assigned to expressive)	1 (3% assigned to expressive)	37 (14% assigned to expressive)
Speech	10 (8% assigned to speech)	7 (23% assigned to speech)	63 (91% remained in category)	1 (3% assigned to speech)	81 (32% assigned to speech)
Fluency	1	0	0	27 (93% remained in category)	28 (11% assigned to fluency)

Table 7. Diagnostic categories and TOM-I scores

	Mean TOM-I rating at initial assessment. (range)(SD)	Mean TOM-I rating at follow-up (range) (SD)	Mean TOM-I change in TOM-I rating (range)	Improved by 1+ TOM=I ratings n (%)	Discharged n (%)
Receptive language n=143	0.92 (0-3) (0.76)	1.58 (0-5) (1.32)	0.66	57 (40%)	16 (11%)
Expressive language n=43	1.74 (0-3) (0.79)	2.34 (0-5) (1.34)	0.59	21 (49%)	12 (28%)
Speech n=87	2.08 (0.5 - 4) (0.75)	2.75 (0.5 - 5) (1.09)	0.67	35 (40%)	18 (21%)
Fluency n=34	2.68 (1-4) (0.61)	2.68 (1-4) (0.87)	0.00	5 (15%)	5 (15%)