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Audit of outcomes following a community-based early intensive behaviour intervention program for children with autism in Australia

Sarah Wood, **Mary P. Christian, and Amanda Sampson**

Learning for Life Autism Centre, Melbourne, Victoria, Australia

Abstract

Objective: Research studies have shown that early intensive behaviour intervention is an effective treatment for children with autism spectrum disorder (ASD). However a research-to-practice gap exists, whereby the interventions effective in university-based studies are not implemented effectively in community settings. The current study is an audit of outcomes achieved by children with ASD who have completed a community-based early intensive behaviour intervention program in Australia. **Method:** The educational placement of 45 participants, following an average 20 hr of intervention per week for 24 months is reported. Standardised assessment results at entry and exit from intervention are reported for a subset of 32 participants. **Results:** On average the 32 participants demonstrated statistically significant increases in receptive and expressive language, cognitive, and adaptive behaviour skills. Three outcome groups emerged; a 'substantial gain' group (45%), 'moderate gain' group (27.5%), and a 'minimal gain' group (27.5%). **Conclusions:** The results demonstrate that by implementing 'best practice' early intensive behaviour intervention in a not-for-profit, community-based setting, children with ASD can achieve outcomes comparable to those reported in university-based research.

Key words: applied behaviour analysis, autism spectrum disorder, early intensive behaviour intervention, outcome, school placement, standardised assessments

What is already known about this topic?

- Children with autism spectrum disorder require intervention as early as possible.
- Early intensive behaviour intervention based on the principles of applied behaviour analysis is the intervention that currently has the strongest supporting evidence.
- Most research into the effectiveness of early intensive behaviour intervention is conducted in university-affiliated settings.

What this topic adds

- This topic demonstrates the outcomes achieved by an Australian group of children with an autism spectrum disorder following early intensive behaviour intervention.
- This topic demonstrates that comparable outcomes to those reported in university-based settings are possible within a community-based not-for-profit setting.
- Provides evidence for the importance of community-based settings ensuring that their early intervention programs are meeting internationally agreed standards of best practice.

Autism spectrum disorder (ASD) affects the development of social and communication skills and includes the presence of restricted and stereotyped behaviours (American Psychiatric Association, 2013). ASD is often diagnosed by the time a child is 4 years of age (Center for Disease Control and Prevention, 2012). Research has focused on early interventions designed to address the core deficits associated with ASD (Prior, Roberts, Rodger, Williams, & Sutherland, 2011). One such intervention known as early intensive behaviour intervention (EIBI) is based on the principles of applied behaviour analysis (ABA). A review funded by the Australian Government categorised many early interventions for ASD, based on theoretical approaches and quality of research (Prior et al., 2011). EIBI was the only intervention categorised as 'established/eligible based on evidence' (Prior et al., 2011).

Correspondence: Sarah Wood, Learning for Life Autism Centre, 25-27 High St, Kew Vic, Melbourne, Victoria 3101, Australia. Email: sarah@learningforlife.com.au

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The review outlined many best practice guidelines for ASD intervention in the Australian context. A minimum of 15–25 hr of therapy a week across 2–3 years is recommended (Prior & Roberts, 2006). Additional guidelines include; individualisation of intervention based on the child's strengths and needs, an assessment process and regular program review and adjustment. The guidelines also stipulate that programs should: address the core deficits in ASD (e.g., language, play, and social skills) and include functional approaches to challenging behaviours (Prior et al., 2011; refer to Appendix F, pp. 126–132).

Despite EIBI being a well-established intervention for children with ASD (Matson, Tureck, Turygin, Beighley, & Rieske, 2012), a difference is observed between the EIBI analysed in the research and the intervention provided in the community. The EIBI effective in research settings is not typically implemented within community settings (Dingfelder & Mandell, 2011). This is of concern as most children with ASD receive community-based intervention. Such a research-to-practice gap may occur because community-based settings are often unable to implement interventions as designed and shown to be effective (Dingfelder & Mandell, 2011). This is particularly true of EIBI where implementing best practice intervention is comprehensive and costly.

Results from University studies demonstrate that a large proportion of children make marked gains following EIBI (e.g., Birnbrauer & Leach, 1993; Cohen, Amerine-Dickens, & Smith, 2006; Lovaas, 1987; Sallows & Graupner, 2005). Three similar outcome groups are consistently identified. For educational placement, typically the top group transition into mainstream education settings with no support, the middle group transition to mainstream education with some support and the lowest group transition to special education settings (Harris & Handleman, 2000). When outcome is measured by standardised assessments typically the top group demonstrate results in the average range, the middle group have results in the low average range and the lowest group show results in the below average range or are unable to complete the assessments (Lovaas, 1987). Regardless of outcome measurements, approximately 50% of ASD children show 'substantial gains', 25% demonstrate 'moderate gains' and 25% make 'minimal gains' following EIBI (Ben-Itzchak & Zachor, 2007; Harris & Handleman, 2000).

Similar outcome groups have been identified in some community studies. However understanding of intervention in the community setting is limited as few 'real world' studies have been conducted on early intervention for children with ASD (Lord et al., 2005). Leaf, Taubman, McEachin, Leaf, and Tsuji (2011) reported on 64 participants who averaged 21.7 hr (range 10–40 hr) of EIBI a week over 40.5 months (range 12–116 months). Seventy per cent of participants were categorised into one of two 'best' outcome groups based on cognitive skills and educational placement at exit. Perry et al. (2008) examined 332 children who received between 20 and 40 hr a week of EIBI in community settings over 4–47 months. This study classified a greater number of outcome groups, however, comparison with the three typical outcome groups indicate less favourable results. Most of the participant outcomes were equivalent to the 'moderate gains' group (Perry et al., 2008). Both studies show that it is possible for children with ASD who receive EIBI within the community to make gains, however, the magnitude of these gains is unclear.

The comprehensive nature of EIBI; in particular the intensity and duration of intervention and the need to provide individualised programs that address the heterogeneity of ASD, should be considered when assessing an intervention. Reporting on how 'best practice' guidelines were addressed along with therapist adherence to protocols may reduce the research-to-practice gap. In addition, comparing participants within the same organisation (e.g., Leaf et al., 2011) may mean that confidence can be placed in the fact that participants received a comparable quality of intervention. This would allow for more accurate comparisons of outcomes for children with ASD receiving EIBI in community or university settings.

The Learning for Life (L4L) Autism Centre is a not-for-profit, community-based, EIBI provider in Melbourne, Australia. L4L offers a full service model (FSM) program of EIBI that provides families with everything necessary to run an EIBI program. The centre employs and trains all therapists, organises individual children's intervention timetables, has a clear hierarchy of staff, and ensures regular review of individual programs and centre policies. The centre endeavours to ensure that the FSM program meets 'best practice' guidelines for EIBI for children with ASD. The current study is an audit of the outcomes achieved by children with ASD who completed L4L's FSM program between January 2004 and June 2016.

METHODS

Participants

Sixty-four children enrolled in L4L's FSM EIBI program between January 2004 and June 2016. Children were diagnosed with ASD prior to enrolment from a variety of external settings. Fifty-one children completed the EIBI program over 9–36 months. Thirteen children did not complete the program due to: family circumstances (three); pursuit of alternative intervention (six); relocation away from the centre (four).

This study reports the educational placement of the 45 children who completed the program alongside the

results 32 of the participants achieved on entry and exit assessments for cognitive, receptive and expressive language, and adaptive functioning. The 13 children who completed the FSM program but were excluded from the standardised assessment stage of the study included participants with: incomplete assessments (e.g., entry or exit; seven), a different EIBI provider prior to enrolment (five); no ASD diagnosis (one).

The sample of 45 children ranged from 24 to 64 months at the time of enrolment and 78% were male. On average, children received 20 hr (standard deviation (*SD*) = 6.22) of intervention per week, for 24 months' (*SD* = 9.74; Table 1). The 32 participants with assessment data included 24 boys and 8 girls with a mean Childhood Autism Rating Scale (CARS) score of 35.76 (*SD* = 3.83) at entry. No significant differences in intensity or duration of EIBI were identified between the sample of 45 children or the group of 32 participants (Table 1).

Setting

L4L is a community-based EIBI provider in Melbourne, Australia. All therapists and supervisors were employed by L4L and underwent standardised training as developed by the Lovaas Institute for Early Intervention (LIFE; USA). Therapists completed 8 hr of group theory training and dependant on previous experience, between 16 and 30 hr of individual practical training. At completion of training each therapist sat an exam (required pass rate 80%). A practical evaluation was conducted following a year of employment with performance assessed across five areas (e.g., reinforcement) with a required pass rate of 80% across all areas. Less formally therapist adherence to protocols was assessed through direct observation during fortnightly meetings and regular review of the data collected during therapy sessions.

Between 2004 and 2016 L4L employed nine program supervisors, who were overseen by a clinical director. All supervisors completed therapist training as described above. Depending on prior ABA experience and tertiary qualifications they were employed as therapists for 2–5 years before progressing through the levels of team leader and co-supervisor before becoming supervisors. Most supervisors had relevant tertiary qualifications; bachelor's degrees with a psychology major (two), a fourth-year psychology course (three) and registered psychologists (three). The clinical director had 10 years' experience as an ABA therapist and supervisor when employed as the clinical director in 2008. The CEO of LIFE visited annually to review each child's progress and consult on program development. The program supervisor was responsible for designing a comprehensive EIBI program covering all facets of early development and overseeing its delivery by a team of 3–5 therapists.

Table 1 Intervention data for the overall group and standardised assessment group

	Overall group (n = 45)		Assessment group (n = 32)	
Category	*M*	*SD*	*M*	*SD*
Age at Intake (months)	40.67	9.93	39.81	9.87
Age at exit (months)	64.70	9.37	62.81	9.30
Duration of EIBI (months)	24.28	9.74	23.32	8.40
Average intensity of EIBI (average hr/week)[a]				
Overall	20.25	6.22	20.13	6.05
First 3 months	14.87	7.58	14.33	7.43
Final 3 months	14.61	6.99	15.37	6.90

[a] Missing average intensity for four participants, none of which are in the group of 32.

Some participants also received services from allied health professionals (e.g., occupational therapists). The type and frequency of these services varied across participants and fluctuated throughout the period of EIBI. Under some circumstances L4L recommended that a child engage with an allied health professional (e.g., speech therapy once the child had developed some verbal language). Where appropriate and necessary, goals and techniques from these professionals were incorporated into the participants EIBI program.

The model of EIBI implemented by L4L closely resembles that of the UCLA Young Autism Project as described by Leaf et al. (2011) and Shull (2013). Programs were developmentally sequenced and applied the principles of ABA. The early programs typically involved structured learning opportunities using the format of 'discrete trials' (Smith, Buch, & Gamby, 2000). This involved the therapist delivering a specific instruction, the child demonstrating a response and receiving reinforcement for correct responses (Steege, Mace, Perry, & Longenecker, 2007). Additionally, principles such as systematic reinforcement, stimulus control, motivational operations, and generalisation were also applied (Hayward, Gale, & Eikeseth, 2009). As a child's skills developed the programs became more complex and generalisation became the focus.

Children began EIBI at low intensity and built up to high intensity until the final months of intervention, when the hours were often systematically reduced (Table 1). Intervention primarily began 1:1 in the participant's home before generalisation to other settings such as playgrounds, shopping centres, and educational facilities occurred. Program supervisors met with the child, parent(s) and their team of therapists on average 1 hr/week for direct supervision. During the final year of EIBI most children participated in a mainstream group learning environment (e.g., 4-year-old kindergarten) with the support of a L4L therapist.

A constraint of providing EIBI in a community setting is meeting the best practice guideline of 15–25 hr of EIBI per week (Prior & Roberts, 2006) because intensity is

constrained by the funding available to families. As a not-for-profit EIBI provider, L4L aimed to negate the effect of funding limitations on intervention hours by seeking grants from philanthropic groups and through community fund raising efforts. Since L4L's inception 47% of FSM clients have received subsidies. This enabled therapy intensity to be determined primarily by assessment of the individual child, taking age and learning requirements into consideration. As such most children received the clinically recommended hours.

Measures

Diagnostic evaluation

Prior to the onset of intervention, the Childhood Autism Rating Scale, second edition, standard version (CARS-2); was conducted with 25 of the participants. The CARS-2 is a measure of 15 ASD symptomology areas that are observed and discussed with parents of children aged 2 years and above. An overall rating between 15 and 60 is provided, with ratings above 30 being consistent with a diagnosis of ASD (Schopler, Bourgondien, Wellmann, & Love, 2010).

Receptive and expressive language

Twenty-three children completed the Reynell Developmental Language Scales III and nine completed the New Reynell Developmental Language Scales to assess expressive language and comprehension. Children between 1 and 7.6 years of age completed a range of activities and received separate expressive and comprehension scores. Version III scores have a mean of 50 and a *SD* of 10 (Edwards et al., 1997) while scores on the new version have a mean of 100 and a *SD* of 15 (Edwards, Letts, & Sinka, 2011). To allow comparisons the *t*-scores from version three were converted into standardised scores ($M = 100$, $SD = 15$).

Cognitive development

Prior to EIBI, children ≤3.5 years completed the Bayley Scales of Infant and Toddler Development, third edition (BSID-III) as a measure of cognitive functioning. Children engaged in activities with an assessor and received a series of scores. The Cognitive Composite Score ($M = 100$, $SD = 15$; Bayley, 2006) had a correlation of .79 with the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) full scale IQ (FSIQ) (Bayley, 2006). Ten children were above the ceiling age for the BSID-III; eight completed the WPPSI-III, and two completed the Psycho-educational Profile, third edition (PEP-III). The WPPSI-III is a measure of cognitive functioning for children between 2.6 and 7.3 years of age that yields a range of scores, including a FSIQ ($M = 100$, $SD = 15$) (Wechsler, 2004). The PEP-III is designed to assess the functioning of children (aged 6 months to 7 years) with ASD (Schopler, Lansing, Reichler, & Lee, 2005).

Adaptive functioning

Children's parents completed the Vineland Adaptive Behaviour Scales (VABS-II) to evaluate adaptive functioning in Communication, Daily Living Skills, Socialisation and Motor Skill. Domain and an overall composite score ($M = 100$, $SD = 15$) were derived (Sparrow, Cicchetti, & Balla, 2005).

Procedures

This study is an audit of the outcomes achieved on assessments routinely conducted as part of the FSM program. Therefore formal ethics approval was not required (National Health & Medical Research Council, 2003). However, at the time of enrolment parents were asked whether they consented to their child's data being used for research.

Prior to enrolment in the FSM program, children received a diagnosis of ASD from a range of independent professionals. Sometimes the diagnostic process included the standardised assessments required by L4L. Available results were used and the remaining required assessments were typically conducted through one of two psychology organisations who employed a few psychologists aware that L4L children were enrolled in EIBI.

Children repeated assessments after approximately 1 year of intervention and as they prepared to exit from intervention. Children who completed less than 24 months of intervention typically completed only two rounds of assessments to reduce practice effects. Assessments were conducted through one of the two psychology organisations and included the Reynell Developmental Language Scales, the VABS-II and a cognitive assessment.

Exit criteria

Children in Victoria are required to attend school in the year they turn six (Victoria State Government: Education & Training, 2014). Therefore, most children completed the FSM program around this age because once they started school, the intensity of 15–25 hr of intervention a week was no longer attainable. Some children demonstrated an ability to learn new skills in generalised environments (i.e., 'clinical graduation skills') and achieved assessment results that enabled exit from EIBI before turning six. All children were retained in this study regardless of exiting EIBI due to 'clinical graduation skills' or reaching 6 years of age. These children represent a sample typical of the community setting where some children start EIBI at 5 years of age and are therefore unable to complete the recommended 2–3 years of EIBI because they transition to school.

Classification of outcome

Thirty-two participants with entry and exit assessments were classified into one of three outcome groups

('Substantial', 'Moderate' or 'Minimal" gains). Classification was determined by standardised assessment results at exit and school placement of mainstream school (with or without support) or specialist school. This ensured the subjective school placement measure was considered alongside objective assessment results. The 'substantial gain' group achieved at least three of the four standardised assessment results within one *SD* of the mean and transitioned to mainstream kindergarten (or school) with no support. The 'moderate gain' group completed all four assessments at exit and demonstrated no more than two results within three *SD*s of the mean. The 'minimal gain' group was defined as unable to achieve the basal level of all four assessments.

Data management

Some of the 32 participants did not have three rounds of assessments due to (1) exiting EIBI before 24 months of intervention, (2) assessments not conducted for clinical reasons, or (3) unavailable scores due to participant inability to complete enough aspects of the assessment. Eleven participants exited the program before completing 24 months of intervention and had two assessments. Of these, five had acquired clinical graduation skills and the remaining six children turned six and were required to start school (Victoria State Government: Education & Training, 2014). The second (final) round of assessment results were considered for these 11 participants alongside the remaining participant's third round of assessments, allowing consideration of changes in assessment data over the course of EIBI. Participants who completed more than 24 months of intervention but had an incomplete dataset for the third round of assessments were removed from the statistical analysis.

Statistical analysis

A priori power analysis was conducted using GPower, set at .80 and $\alpha = .05$ and revealed that a minimum sample size of 27 was required to detect a medium effect size (Faul, Erdfelder, Lang, & Buchner, 2007). Analyses were conducted for each dependent variable, including receptive and expressive language, cognitive and adaptive functioning at entry and exit from EIBI. Paired sample t-tests or Wilcoxon signed rank tests were used to evaluate the effect of EIBI on the participants' scores. Screening prior to analysis revealed all adaptive functioning and cognitive data were distributed normally. Language variables, however, violated the assumption of normality so non-parametric analysis were conducted.

RESULTS

Statistical analysis

To assess cognitive skills, adaptive functioning and expressive and receptive language following EIBI, scores were compared for the VABS, IQ and Reynell expressive and comprehension language scales at entry versus exit (Table 2). Paired sample *t*-tests revealed statistically significant increases with medium to large effect sizes for adaptive functioning and cognitive skills. Participants demonstrated higher VABS scores following EIBI ($M = 85.88$, $SD = 21.22$) than at entry ($M = 74.92$, $SD = 11.31$, $t(25) = -3.11$, $p < .01$, $r = .53$; Table 2). The VABS subdomains of Communication and Socialisation also revealed statistically significant increases with large effect sizes between entry and exit (Table 2). Similarly, for the cognitive assessments, participants demonstrated greater scores at exit from EIBI ($M = 84.81$, $SD = 23.95$) compared to entry scores ($M = 70.86$, $SD = 16.0$, $t(20) = -2.30$, $p < .05$, $r = .46$; Table 2).

Wilcoxon signed rank tests revealed statistically significant increases with large effect sizes for both receptive and expressive language. Participants had greater Reynell comprehension scores following EIBI ($M = 82.23$, $SD = 19.84$) than at entry ($M = 72.24$, $SD = 8.34$); Ws = −2.94, $p < .05$, $r = .59$. The participants Reynell expressive scores were also

Table 2 Paired sample *t*-test and Wilcoxon signed rank test between the entry and exit round of standardised assessments for the overall group of 32 participants

	Entry		Exit					
Standardised assessment	M	*SD*	M	*SD*	95% Confidence interval for *M* differences	Effect size	*t*/*z*	*df*
VABS[a]	74.92	11.31	85.88	21.22	−18.21, −3.71	0.53	−3.11**	25
Communication	72.84	13.84	87.08	24.96	−22.96, −5.52	0.57	−3.37**	24
Socialisation	75.12	10.31	88.84	22.80	−22.45, −4.99	0.55	−3.24**	24
Daily Living	80.16	16.67	84.96	20.81	−13.00, 3.40	0.06	−1.21	24
Motor Skills	85.25	13.99	86.38	15.58	−6.51, 4.26	0.09	−0.43	23
Cognitive[a]	70.86	16.00	84.81	23.95	−26.60, −1.30	0.46	−2.30*	20
Reynell CLS[b]	72.24	8.34	82.23	19.84		0.59	−2.94*	25
Reynell ELS[b]	72.36	10.31	85.08	21.27		0.60	−2.90*	23

Note. VABS = Vineland Adaptive Behaviour Scales; CLS = comprehension language scale; ELS = expressive language scale.

[a] Paired sample *t*-test

[b] Wilcoxon signed rank test.

*$p < .05$, **$p < .01$.

greater at exit (M = 85.08, SD = 21.27) than at entry (M = 72.36, SD = 10.31); Ws = −2.90, $p < .05$, $r = .60$ (Table 2).

Outcome groups

School placement information were available for the group of 45 participants. Twenty-one participants (48%) transitioned to a mainstream educational setting with no support (eight into 4-year-old kindergarten and 13 into school). The remaining 24 participants transitioned to a mainstream educational setting with some support (25%) or to a specialist school (27%). Twenty-Nine participants had complete assessment datasets at exit and could therefore be categorised into one of three outcome groups (substantial, moderate, or minimal gains). Thirteen (45%) were classified in the substantial gain group, 8 (27.5%) in the moderate gain group and 8 (27.5%) in the minimal gain group. All the participants in the 'moderate gain' group transitioned to a mainstream school, four without and four with support. Two participants in the 'minimal gain' group transitioned to mainstream schools with support and six participants transitioned to special schools. The three participants who could not be classified into an outcome group due to incomplete data sets at exit transitioned to a mainstream school without support (one), with support (one) and a specialist school (one).

Average assessment scores at entry and exit from EIBI are provided in Table 3. All three groups had similar entry mean CARS scores; 36.17 (SD = 6.18) for the substantial gain group, 34.71 (SD = 2.18) for the moderate gain group and 37.67 (SD = 4.36) for the minimal gain group. Different trends are evident in the three groups assessment results (Table 3). The minimal gain group demonstrated no increases on the receptive and expressive language scores and the cognitive and VABS scores were lower at exit than entry. The moderate gain group demonstrated minimal improvements on all assessments, except for the VABS where the average score increased from 75 at entry to 85.25 at exit. The substantial gain group demonstrated gains across all four assessments between entry and exit.

DISCUSSION

This audit describes the outcomes achieved by a group of children with ASD following exit from a community based EIBI program. On average, all participants developed new skills over the course of their EIBI program. These skills were demonstrated in the areas of cognitive skills, adaptive functioning and both receptive and expressive language. The improvement in the adaptive functioning results indicates participants skills were generalised to home and community environments. This was particularly evident in the VABS-II subdomain areas of communication and

Table 3 Mean standardised assessment scores for the whole group of 32 participants and the three outcome groups

	Total group (n = 32)				Substantial group (n = 13)				Moderate group (n = 8)				Minimal group (n = 8)			
	Entry		Exit		Entry		Exit		Entry		Exit		Entry		Exit	
Standardised assessment	M (SD)	n	M (SD)	n	M (SD)	n	M (SD)	n	M (SD)	n	M (SD)	n	M (SD)	n	M (SD)	n
Cognitive	70.31 (17.88)	29	80.41 (26.65)	24	75.91 (18.65)	12	102.6 (19.21)	10	76 (14.32)	8	74.63 (10.84)	8	55 (14.68)	6	39 (10.84)	4
Receptive	72.24 (8.47)	29	82.76 (20.06)	26	73.92 (8.20)	12	96.75 (21.55)	12	69 (0)[a]	8	70.22 (2.07)	9	69 (0)[a]	7	69 (0)	5
Expressive	72.36 (10.31)	28	85.08 (21.27)	24	72.92 (8.49)	12	98.25 (22.44)	12	69 (0)[a]	8	73.38 (9.65)	8	69 (0)[a]	6	69 (0)	4
Vineland	73.07 (12.00)	30	87.15 (19.65)	28	78.54 (10.37)	13	100.92 (13.30)	12	75 (13.61)	6	85.25 (11.07)	8	64.63 (9.16)	8	59.2 (13.66)	5

Note. Three of the participants did not have a complete battery of assessments at exit so could not be classified into an outcome group.
[a] The lowest possible standard score on the Reynell Developmental Language Scale is 69.

socialisation. Such findings were expected given the participants' diagnosis of ASD which typically includes deficits in communication and social skills. Participants' skills in the VABS-II subdomain areas of motor and daily living skills also improved, however, these areas did not reflect a statistically significant change. Overall such results show that children who completed an EIBI program within the community demonstrated similar positive outcomes to those reported in university-based research (Cohen et al., 2006; Lovaas, 1987).

The clinical significance of these findings is of most interest. At the beginning of EIBI, on average, the participants' assessment results across all four areas fell well below the average range (Table 2). In comparison, at exit, on average the participants' assessment results on the VABS-II and the Reynell Expressive scale were within the average range. Additionally, both the cognitive assessments and the Reynell Receptive scale were approaching the average range. These findings are consistent with outcomes reported within university (Birnbrauer & Leach, 1993; Sallows & Graupner, 2005) and community settings (Leaf et al., 2011). They highlight that similar outcomes can be achieved by a group of children with ASD who received EIBI in the community. L4L's focus on achieving best practice guidelines regarding intensity and duration (Table 1) may have contributed to the outcomes achieved. These findings demonstrate that despite the difficulties in implementing EIBI in a community setting, the FSM intervention delivered by L4L helped children with ASD to make both statistically and clinically significant gains in a range of developmental areas.

The results also highlight the variability in how children respond to EIBI, with the size of the *SD*s (Table 2) for all variables larger at exit. Some children demonstrated minimal gains on the standardised assessments while others demonstrated large gains. All three assessments compared participants' skills to typically developing children. At entry to EIBI on average, all participants scored below the average range. Therefore, over the course of EIBI, the children in the 'substantial gain' group made gains in excess of what would be expected for same aged peers. Alternatively, the children in the 'minimal gain' group did not make gains expected of typically developing peers and appear to have made no progress or regressed. These assessment results, however, can be misleading. Many of the gains this group of children make during their EIBI program (e.g., toilet training, increased dietary variety, etc.) were not measured by the standardised assessments. Therefore the results do not provide a complete representation of gains for the lower outcome children. Nevertheless, acknowledgement that these participants did not make the marked gains that the 'substantial gain' participants achieved is important for future research.

A priori power analysis revealed that a total sample size of 159 would be required to explore the differences between the three groups at the recommended level of .80 (Cohen, 1992). Future studies to understand the differences between these groups, particularly when differences emerge, will be valuable. Such studies may provide clinicians with information to maximise each child's opportunity of reaching their full potential.

The nature of this research presents limitations, including small sample sizes and variation in intensity and duration of EIBI. The sample size is consistent with many studies in this field (e.g., Birnbrauer & Leach, 1993; Lovaas, 1987). All participants were retained in this study as the variability in intensity and duration reflects the reality of community-based EIBI. Many children do not start EIBI until a late age, due to delayed diagnosis or first trialling less intensive interventions (e.g., speech therapy). Intensity can also fluctuate due to wider family circumstances (e.g., financial situation). L4L aims to minimise this by offering children subsidised intervention, ensuring intensity reflects the clinically recommended hours. This may be why the current sample has less variability in intensity than duration of EIBI (Table 1). The heterogeneity of ASD also affects intervention intensity and duration. Some children quickly demonstrate large gains following the onset of EIBI (Sallows & Graupner, 2005) meaning that building to high hours or continuing intervention for several years is not necessary. Therefore, the current sample may reflect clinically appropriate variations in intensity.

Further limitations include the use of the CARS to assess ASD symptoms and that it was not repeated at exit. In 2013, the CARS was replaced with the ADOS-2, a gold standard diagnostic measure (Falkmer, Anderson, Falkmer, & Horlin, 2013) which is also repeated at exit to provide a more thorough assessment of children's progress. The potential conflict of interest due to the primary researchers program supervisor role at L4L was minimised by ensuring standardised assessments were conducted externally. Another limitation is the absence of data on the type and duration of additional services. Although the intensity of additional services are minimal compared to that of EIBI, they may be of interest when seeking to understand the outcomes of children following EIBI.

It is important to identify whether the favourable outcomes following university-based EIBI are achievable in the community because most children with ASD receive intervention in this setting. This study contributes to the smaller body of research examining community-based outcomes (Perry et al., 2008). Despite the challenges and constraints of delivering community-based EIBI, a large proportion of children with ASD can achieve clinically and statistically significant gains which help to maximise their chance of transitioning to the least restrictive school setting possible.

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