



**Population Health Sciences
Institute**

**Biostatistics Research
Group**

Evaluation of ‘Building Underdeveloped Sensorimotor Systems’ (BUSS®) for children who have experienced disruption to their early development

Final report

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Plain English Summary

What is BUSS®?

BUSS® stands for *Building Underdeveloped Sensorimotor Systems*. It is a short programme that helps children who experienced difficult experiences early in life. BUSS® works by teaching parents and carers simple, playful activities that use movement, touch and nurturing interaction. These games help the child feel safe in their body, build trust in their caregiver, and strengthen the foundations needed for learning, behaviour and relationships. Although families and professionals have spoken positively about BUSS®, there had not yet been a study to measure whether it works.

Who took part in this study?

This evaluation looked at information already collected by the BUSS® team over four years (2021–2025) comparing outcomes measured before and after BUSS®. We looked at data from **468 male and female** children and young people aged **2 to 19**, most of whom were **adopted** or in **special guardianship**. Just under half had a **known or suspected neurodivergent condition** such as ADHD, autism or FASD.

What did we find?

Nearly 90% of families completed the programme, which is very high for interventions of this kind. Children and young people who completed BUSS® showed **clear improvements in behaviour, emotions, relationships, daily functioning, and specific goals** like core strength, emotional regulation, or feeling safe with movement. Children of all ages, both boys and girls, showed similar improvements, although the size of the improvement differed and some, but not all, had statistically significant changes for every group.

What does this mean for families and services?

The findings suggest that BUSS® is **helpful** for many children with early trauma; **low cost** compared with many other therapies; **practical and doable** for families; **suitable for children with complex needs**. BUSS® appears to give children a stronger foundation in their bodies and relationships which could help them for life.

What are the limitations of this study?

This type of study could be measuring improvements that happen by chance, or naturally as part of a child's development. We used statistical tests to show that improvements were '**statistically significant**', meaning they were unlikely to be due to chance.



Glossary

Abbreviation	Meaning
ASGSF	Adoption and Special Guardianship Support Fund
BAC	Brief Assessment Checklists
BUSS®	Building Underdeveloped Sensorimotor Systems
CAO	Child Arrangement Order
CYP	Children and Young People
DDP	Dyadic Developmental Psychotherapy
GBO	Goal-Based Outcomes
LA	Local Authority
PTSD	Post Traumatic Stress Disorder
RAA	Regional Adoption Agency
SDQ	Strengths and Difficulties Questionnaires
SGO	Special Guardianship Order
SMART	Sensory Motor Arousal Regulation Treatment
SPD	Sensory Processing Disorder
TAYC-R	Thinking About Your Child – Revised

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Executive Summary

Background to the Research

The BUSS® (*Building Underdeveloped Sensorimotor Systems*) model is an innovative intervention designed for children who have experienced early developmental disruption, including trauma, neglect, prenatal substance exposure, prematurity, and prolonged hospitalisation. BUSS® was developed by an Occupational Therapist with extensive experience in CAMHS. BUSS® is designed to be delivered by practitioners with expertise in developmental trauma. The intervention supports parents and caregivers to use structured, playful touch, rhythm, and movement activities within nurturing relationships to develop the three foundation sensorimotor systems, where development is affected by disruption. The *tactile system* supports the understanding of our environment and information coming from outside our body; the *vestibular system* gives the body a foundation of core strength and gravitational security (a feeling of wellbeing when we're moving) that supports the development of more complex movement; the *proprioceptive system* is concerned with modulation and coordination of movement, so that we're able to do familiar tasks without much conscious attention. Working within the parent - child relationship supports the development of this relationship.

Previous BUSS® evaluations have demonstrated agreement among adoptive, special guardian, and foster families that the model is highly acceptable, and is regarded by professionals as being feasible and deliverable, with a high degree of 'fidelity' to training; in other words, professionals can be trained to use BUSS® in a way that is faithful to the original. This evaluation, commissioned by BUSS® and conducted by Newcastle University, represents the first large-scale analysis of routinely collected quantitative outcome data. The aim was to assess whether BUSS® improves bodily regulation and related developmental, emotional and relational outcomes for children and young people (CYP) aged 2–19.



Methods Used in the Evaluation

The evaluation analysed anonymised routine clinical data collected between April 2021 and March 2025 from 468 children enrolled in BUSS®. Ethical approval was granted in 2024. Four validated outcome measures are collected by BUSS®. These are specified by Department for Education for the Adoption and special guardianship support fund (ASGSF). They were analysed as pre- and post-intervention matched pairs:

1. **Goal-Based Outcomes (GBO)**
2. **Strengths and Difficulties Questionnaires (SDQ)** for ages 2–4, 4–17 and self-complete 11–17
3. **Brief Assessment Checklists** (BAC-C for 4–11; BAC-A for 12–17)
4. **Thinking About Your Child – Revised (TAYC-R)**

TAYC-R and BAC-C/BAC-A were only introduced in September 2023, after SDQ and GBO, so the following results have different counts in matched data for each of the outcomes. Descriptive statistics and regression modelling were used to assess differences before and after intervention across age, gender and goal categories. Families completed 11 sessions, mostly online, with high completion and data return rates.

Key Findings

Cohort Characteristics

- 468 children aged 2–19; majority aged 4–11
- 62% male
- 89% living with adoptive parents
- High levels of neurodivergence (22% diagnosed; 27% suspected)
- 49% had a known exposure to drugs and/or alcohol in utero

Completion

- **86%** completed the BUSS® programme
- Most common reason for non/incompletion was caregiver capacity (10%), and only 5 children (1%) did not consent



Outcome Improvements

1. Strengths and Difficulties Questionnaire (SDQ)

- *Ages 2-4 (parent/carer-rated)*: Significant reductions in total difficulties, internalising behaviours, hyperactivity/inattention, and peer problems and significant increases in kind and helpful behaviours.
- *Ages 4-17 (parent/carer-rated)*: Highly significant reductions across all domains (emotional distress, conduct, hyperactivity, peer problems) and increased prosocial behaviours.
- *Ages 11-17 (self-complete)*: Too few cases to detect broad effects, but significant improvements in emotional distress and impact on daily life.

2. Brief Assessment Checklists (BAC-C and BAC-A)

- Significant reductions in total difficulties for both children (4-11) and adolescents (12-17).

3. Thinking About Your Child – Revised (TAYC-R)

- Significant improvements in parent skills/understanding, parent-child relationships, and child's responsiveness to care.

4. Goal-Based Outcomes (GBO)

- Very strong improvements across **all** domains
- Largest gains in building gravitational security (vestibular system)
- Benefits consistent across ages and genders.

Overall conclusion from findings

Among children who complete BUSS[®], **statistically significant improvements** were observed in emotional regulation, sensorimotor functioning, behaviour, parent-child relationships, and goal attainment.



Barriers and Challenges to the Evaluation

- **Lack of a control group:** Limits ability to attribute outcomes solely to BUSS® or rule out natural developmental progression.
- **Potential unknown differences between completers and non-completers:** Those who completed BUSS® had similar demographic characteristics to those who did not complete it but there may have been characteristics that we did not measure which may contribute to changes in the outcomes.
- **Routinely collected data limitations:** Possible inconsistencies in diagnostic reporting (e.g., suspected vs. confirmed neurodivergence).
- **Concurrent interventions:** The evaluation could not fully account for other therapies or supports families may have been accessing concurrently. However, as a rule, the BUSS® team does not offer or recommend BUSS® to be undertaken at the same time as other therapeutic interventions, with the occasional exception of therapeutic parenting.

Despite these limitations, high-quality data entry, strong completion rates, outcome measurements using a range of different questionnaires, and the involvement of many practitioners strengthened the reliability of findings.



Recommendations and Conclusions

- **For Statutory Adoption Bodies (Adoption England, National Adoption Service (Wales), Scottish Government, Adoption Authority of Ireland)**
 - Recognise BUSS® as a low-cost, high-value intervention with measurable benefits across emotional, behavioural, and relational domains.
 - Support continued national access and consider strategic investment in scaling training and materials.
- **For Regional Adoption Agencies (RAAs) and Local Authorities (LAs):**
 - Prioritise BUSS® as part of multi-disciplinary support pathways, particularly for children who struggle to access talking therapies.
 - Ensure practitioners are trained and supervised to maintain model fidelity.
- **For Families:**
 - BUSS® provides a structured, relationship-based approach that many families found acceptable, feasible and beneficial.
 - Parents may wish to access their own supportive therapies alongside BUSS® to enhance capacity and resilience.
- **For Future Research:**
 - Further controlled studies to strengthen evidence around causality and long-term benefits.
 - Research examining subgroups (e.g., neurodivergence, age brackets) using higher-quality diagnostic data.
 - Exploration of long-term outcomes such as educational attainment, mental health trajectories, and placement stability.

Conclusion

The evaluation provides the first quantitative evidence that BUSS® may be an effective, accessible and acceptable intervention for children who have experienced significant early adversity. It supports sensorimotor development, enhances emotional and behavioural outcomes, and strengthens parent-child relationships. BUSS® appears to be a promising, cost-effective component of therapeutic provision for adoptive, foster and special guardianship families.



Introduction

This service evaluation was commissioned by BUSS[®] Model Ltd, a limited company responsible for the design and delivery of an intervention known as ‘Building Underdeveloped Sensorimotor Systems’ (BUSS[®]) for children who have experienced disruption to their early development. The evaluation was undertaken across a 4-month period from June to October 2025 using data collected routinely as part of clinical practice from April 2021 to March 2025. This report is presented in four main sections. The first outlines the BUSS[®] Model and places the evaluation in the context of the wider knowledge base on therapeutic interventions and funding for children who are adopted or under special guardianship. The second section outlines the methods used and their benefits and limitations, and the third reports the overall findings of the evaluation, organised by therapeutic focus. Finally, section four offers discussion and recommendations for Adoption England and similar bodies, Local Authorities, Regional Adoption Agencies, and NHS Trusts for consideration.

The views expressed are those of the authors and do not necessarily reflect the views of BUSS[®] Model Ltd. The study was developed in collaboration with BUSS[®] Model Ltd who assisted with data access and data cleaning. All analysis and interpretation was conducted independently of BUSS[®] Model Ltd.

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Background to the service evaluation

1.1 What is BUSS®?

BUSS® (Building Underdeveloped Sensorimotor Systems) is an innovative model for children who have experienced developmental trauma (Lloyd, 2023). It is a brief intervention which is delivered by parents or caregivers who are supported to play structured, playful touch, rhythm and movement games with their child. Structured support is given to the families by an Accredited BUSS® Practitioner over a period of four months. The games build the attachment between the parent and child and aim to stimulate the development of the sensorimotor systems, where development has been impacted by developmental trauma, by building a foundation of 'bodily regulation'. Bodily regulation gives the developing child a platform on which emotional regulation, learning, play and relationships can grow. BUSS® has the potential to lead to long-term measurable improvements in:

- Educational attendance and attainment,
- Mental health outcomes for child and family members,
- Physical health outcomes (via reduction in falls and risky behaviours), and
- Family stability (via reductions in adoption disruption or foster care placement breakdown).

Training fidelity has been established which means that there is evidence that a range of different practitioners can be trained to deliver the BUSS® model in the same way to every family, to the same high standards. The BUSS® model is currently being delivered to adopted and fostered children, both face-to-face and online, and is funded either by local authorities (LAs) or via a government scheme to provide financial support for therapies for adopted children (Adoption and Special Guardianship Support Fund, ASGSF). All outcome measures have been specified by ASGSF policy makers as a condition of funding and are routinely collected as part of service provision. Individual signed permission is granted by parents/caregivers to report anonymised data to funders, policy makers, and researchers, as part of a service level agreement.

Several qualitative research studies have been conducted, but this will be the first study to evaluate the pre- and post-intervention quantitative data that has been routinely collected over 4 years for over 400 children.

1.2 How does BUSS® work?

Children who have been in frightening or harmful environments in utero, or as babies, are unlikely to have had the care, nurture, touch and movement experiences that feed



the foundation sensorimotor systems (tactile, vestibular, and proprioceptive) towards good bodily regulation.

Brain mapping has demonstrated measurable changes to the brain following trauma, but the relationship with the body, and the potential to heal through safe relationship-based activities is less well understood. The BUSS® intervention is based on the hypothesis that a safe relationship allows the sensorimotor systems to mature from defensive functioning and immature state of development to a system which enables the child to be in the moment of an experience and open to play, relating and learning. Another way of thinking of this shift is from *survive to thrive*.

Bodily regulation comprises two functions; making sense of information from the world around us, and information from inside our body. We do this using three different sensorimotor systems; the *tactile system* supports our understanding of our environment and information coming from outside our body; the *vestibular system* gives the body a foundation of core strength and gravitational security (a feeling of wellbeing when we're moving) that supports the development of more complex movement; the *proprioceptive system* is concerned with modulation and coordination of movement, so that we're able to do familiar tasks without much conscious attention.

Combined, these allow us to plan our actions - how much pressure or force to use when doing something, knowing what auditory information we need to alert to and what can be ignored, understanding the signals from inside our body, like hunger, anxiety or tiredness. This allows our body to take care of the 'doing' part of everyday life so that our minds are freed up to think, plan, learn, or create. Things like abuse, neglect, prematurity, and serious illness that happen in the first few years of life can interfere with the development of the foundation sensorimotor skills that underpin bodily regulation. This leads to different challenges for children and families and multiple problems in every-day life, education, and friendships.

It is important to note that the BUSS® model offers a different approach to other work with children who have a sensory processing disorder (SPD). A child with underdeveloped sensorimotor systems may move in a similar way to a child with SPD. But rather than treating this as a disorder, BUSS takes as its starting point the idea that because of the disruption in the early part of the child's life, the brain and central nervous system will not have had the input it needed for bodily regulation to develop. BUSS supports parents to go back and fill in the gaps in the child's experience to build bodily regulation.



1.3 BUSS® Goals and Objectives:

1. Support parents to understand bodily regulation, the impact developmental trauma has had on its development, and the hopefulness that it's never too late to develop bodily regulation.
2. Work with parents and children to go back and fill in any gaps in touch, nurture, rhythm and movement experiences, using games and activities that are of interest and motivating to the child.
3. Work towards the child's and parent/caregivers' goals in building foundation sensorimotor systems and relationships.

1.4 BUSS® Target Population:

Any child for whom there has been disruption at the beginning of life, from conception through their early childhood, and where the child is now living in a safe, nurturing environment. We define disruption as circumstances which severely and repeatedly disrupt the normal process of development of the baby and young child, from conception onwards. These circumstances include exposure to drugs and alcohol in utero, high maternal stress, domestic violence, abuse and neglect, as well as painful medical procedures. This typically includes all children who are or have previously been looked after, but also includes children born prematurely, and children who have had extensive periods in hospital in the first year of their life.

1.5 BUSS® Activities:

A referral for BUSS® is typically made either by a social worker, or a parent/caregiver. Before funding is agreed by the LA or ASGSF, the pre-intervention measures and consent forms are emailed to the family. As soon as they are returned and funding is agreed, a practitioner is allocated and a plan of work is scheduled with the family.

- The intervention involves nine 60-90 minute sessions with the practitioner, CYP (where appropriate) and parent/caregiver and sessions are face to face and/or online (depending on user preferences and geographics). Therapeutic summary letters (and resources to facilitate the activities where appropriate) are sent to parents after these sessions.

Two additional sessions typically include an end of intervention review with the referrer and parent/caregiver and professional liaison, usually with school or nursery. The 'end of intervention' measures are sent out to parents/caregivers to complete after the penultimate session (session 8) and before the final reassessment.



- Following assessment, each session focuses on reviewing activities/games that the CYP and parent/caregiver will be asked to do together as much as possible in daily life. Most BUSS® interventions focus on developing the vestibular and tactile systems.
- In relation to the vestibular system, the focus may be on supporting the body to have a foundation of core strength (head, neck, shoulder girdle and trunk) which gives the body a platform for the development of more complex movement, and/or on the development of gravitational security, which is a feeling of wellbeing when we move.
- In terms of tactile development, this might include supporting the child to make sense of information that is coming from outside their body, like touch, sound, taste, without over or under responding to that information. A lot of work is also done around building oral motor strength where early interaction and feeding experiences have been less than ideal. Good oral motor strength enables speech and language development.
- All games and activities are led by the parent/caregiver and are designed to support the parent-child relationship and also support children to be in the moment of an experience and manage someone else being in charge.

1.6 Carers, parents, professionals and the experience of BUSS®

BUSS® was developed to bring together the importance of safe, loving relationships with the development of bodily regulation (Wrench, 2025). One of the cornerstones of BUSS® is that the relationship between the parents/caregivers and the CYP is given the highest priority. Parents and carers are taught in the sessions how to apply BUSS® so that they can support the development of their child's foundation sensorimotor systems in their own homes. Parents and carers are seen as being the main agents of change. The BUSS® Model can enhance the practice of professionals working with children who have experienced disruption in their early lives. It is not intended to be an alternative to other ways of working, but rather to sit alongside the skills and expertise of professionals working with children. There is a training programme for professionals who wish to develop their skills in using this model with children and families so that high standards and fidelity to the model are maintained. All Accredited BUSS® Practitioners must have their BUSS® clinical work supervised by a BUSS® Consultant.



1.7 Funding for BUSS®

Currently, the majority of referrals to BUSS® come from social workers who plan to make applications for funding from the Adoption and Special Guardianship Support Fund (ASGSF). The BUSS® programme cost envelope falls within the ASGSF's current fair access limit (FAL) of £3,000. CYP aged 21 or younger (or up to 25 if they have an education, health and care plan) who live in England may be eligible for the ASGSF if they:

- have been placed for adoption (before the adoption order is made) and are waiting for adoption
- were adopted from local authority care in the UK
- were adopted from abroad with a recognised adoption status
- were in care before a special guardianship order (SGO) was made
- left care under a SGO that became an adoption order, or vice versa
- were previously looked after and are under a residency order or child arrangement order (CAO)
- were previously looked after but where the adoption, special guardianship, residency or CAO placement has broken down

Foster and Kinship carers can self-fund the intervention, with the permission of the Local Authority at a cost of £3,000 (excluding VAT), however this is usually funded by the responsible local authority. For adoptive parents looking to self-fund, the regulations around Post-Adoption Support for adoptees are more complex where there has been an assessment of post adoption support needs. This requires providers to be registered with Ofsted or to provide support that has been commissioned through an Ofsted registered Adoption Support agency.

1.8 How does BUSS® fit within a multi-disciplinary therapeutic plan?

The BUSS® model applies a working hypothesis, grounded in the latest evidence about the plasticity of the brain, that building bodily regulation is a good starting point for any therapeutic intervention and that children may be better able to make use of psychological therapies or attachment focused interventions once they are better regulated on a bodily level (Lanius et al. 2015; Harricharan et al. 2017). The majority of families who access BUSS® hold a belief that their child is so dysregulated that they would be unable to fully access talking or creative therapies of any kind. Qualitative evidence (Grindheim, 2019; Haslam, 2020; Robinson, 2021; Smith, 2022) strongly supports the view that BUSS® provides a foundation for the child and family on which other forms of therapy such as Dyadic Developmental Psychotherapy (DDP) can build. It is currently not known whether BUSS® could influence outcomes if delivered in parallel, or following other forms of therapy, but the current recommendation is that families do not embark on other forms of family therapy during BUSS® in order to



minimise the burden on parents and caregivers. It is however acknowledged that it may benefit some parents and caregivers to access their own supportive therapies while their CYP undergoes BUSS® therapy to support their own parenting resources and capacity.

1.9 Current evidence about therapies based on bodily regulation

Recent service evaluation projects (SEPs) commissioned by BUSS® have been conducted by social workers as part of their postgraduate studies and clinical psychologists in training, using qualitative methods with foster carers, adoptive parents, and social workers. This body of work established that the method is experienced as being acceptable, feasible and appropriate to the complex needs of CYP. Some of the findings included that following a BUSS® intervention, CYP seemed better able to access psychological therapies for their needs (Grindheim, 2019). Caregivers were more able to offer attuned caregiving as a result of developing a more nuanced understanding of the neurosequential impact of trauma (Haslam, 2020) and developed a better understanding of early childhood development (Robinson, 2021). There were also perceived improvements in the development of foundation sensorimotor systems and social and emotional development (Smith, 2022). There have been no evaluations to date using quantitative data to understand whether, and by how much, BUSS® improves outcomes for CYP.

Looking more broadly at other therapies that, like BUSS®, are based on bodily regulation theories, these largely fall into a category of 'paediatric trauma-informed occupational therapy', although many therapeutic practitioners in other fields, such as psychotherapy, also use a wide variety of techniques to integrate body and mind in their practices (Fraser et al, 2019). The evidence for the effectiveness of these therapies is largely missing and what evidence exists appears to be of poor quality, although there is a general indication that these have the potential to improve behaviours and symptoms of Post Traumatic Stress Disorder (PTSD) (Warner, 2014). Recent systematic reviews of paediatric trauma-informed occupational therapy (Joseph et al, 2021; Lehr et al, 2023) demonstrated a range of treatment modalities, none of which were embedded within the context of the adult-child relationship. Treatment plans included individualised sensory 'diets' involving the use of aids and equipment (e.g. Whiting, 2018), sensory rooms and groups (e.g. Gorman and Kohl (2016), and breathing exercises (e.g. LeBel et al. 2010), around which various treatment protocols have been developed.

Protocols include SMART (Sensory Motor Arousal Regulation Treatment) which has demonstrated improvements in behaviour among CYP in American residential facilities (Warner, 2014) and is currently the subject of a large, randomised trial of Canadian adults with PTSD (<https://clinicaltrials.gov/study/NCT06035809#study->



plan). Another such protocol is the SAFE PLACE systems model developed in USA (May-Benson, 2019), which, although it shares relational aspects to BUSS®, is much more resource intensive (24 weeks of 60 minute treatment sessions involving the parent, child, and practitioner) and does not yet have a firm evidence base (a feasibility study of n=1 family). Another recent systematic review focused on ‘sensory-based’ interventions for children with developmental disorders but did not differentiate between children with or without developmental disruption or trauma (Piller, 2025). Here, the team identified strong evidence supporting deep pressure tactile input and caregiver training in sensory strategies, and moderate evidence supporting approaches that target more than one sensory system. All of these elements are included within the BUSS® model, thus providing further support for the focus on bodily regulation as a growth modality.

1.9.1 Conclusions and key questions

There are many available therapies, and no consensus treatment pathways, for children and young people who have experienced disruption in their early lives. Many of the therapies are difficult for some CYP to access because of their inability to regulate their bodies sufficiently well to sit in a room with others and be receptive to growth. BUSS® is an innovative model which uses bodily regulation as a foundation for relationship-based growth with the potential to give families a firm basis on which to build with later talking-based therapies, if they are needed. Compared to other models, it has the potential to be a low-cost, low-parent burden, high-value intervention for complex CYP and families. Qualitative evaluation demonstrates the feasibility and acceptability of the model and suggests potential benefit in relation to key factors including education, social needs, attachment and lower risk of adoption disruption or multiple foster placements. In the time since BUSS® was introduced, legislation about funding for adopted children has changed and the model has adapted to ensure it can be delivered within current funding constraints without compromising the quality of the offer to families. The evaluation that follows is the first study to evaluate the outcomes of BUSS®, comparing those before and after engaging in a BUSS® intervention.



Evaluation Methods

2.1. Summary of methods

The aim of this service evaluation was to establish the extent to which the BUSS[®] intervention achieves its aim of improving bodily regulation in children and young people (CYP) who have experienced developmental trauma, and to investigate if this in turn has a positive impact on quality of life, mental health, emotional regulation, learning, and parent/carer relationships with CYP. This service evaluation commenced in June 2024, with the following preparatory steps:

- Ethical approval was granted by Newcastle University Ethics Committee in May 2024.
- An initial online meeting was held with the project team and the BUSS[®] senior leadership team to gather background information about available data.
- An initial routine dataset was sent securely to the project team.
- Data cleaning and quality checks were conducted.
- A final dataset was closed in July 2025.
- Analysis of the data was conducted.

2.2 Data Collection

The BUSS[®] team routinely collects data at the point of referral or self-referral, immediately prior to treatment. The routinely collected, anonymised dataset includes demographic and clinical data including age at time of intervention, gender, neuro-disability, prematurity, significant life events occurring during the intervention, adoptive/SGO/foster/birth family status, and presence of drug/alcohol exposure in utero. The dataset incorporates 4 validated outcome measures (listed below) that are required by the Department for Education for evaluation of the Adoption and Special Guardianship Support Fund (ASGSF). Parents are sent online forms for Outcomes 2, 3, & 4 in advance of the initial assessment. Outcome 1 is completed by a practitioner in collaboration with a parent/caregiver at the post assessment check in, after initial assessment of the child, but before starting the intervention. Data has been routinely collected for the past 3 years.

1. Goal Based Outcomes (GBO)
2. Strengths and Difficulties Questionnaire (Parent/carer completed 2-4yrs; 4-17 yrs; Child and Young Person completed 11-17yrs) (SDQ)
3. Brief Assessment Checklist for Children (BAC-C) (4-11yrs) & Brief Assessment Checklist for Adolescents (BAC-A) (12-17yrs)
4. Thinking about your Child - Revised (TAYC-R)



2.3 Data Analysis

The statistical analysis plan was based on the hypothesis generating nature of the study to explore differences in outcomes comparing pre- and post-treatment data. In addition to overall descriptive statistics for each child and family, statistical regression modelling was used to examine differences in outcomes comparing pre- and post-treatment data and comparing ages and genders. Further modelling was not appropriate for this type of service evaluation.

Differences in average outcome scores are presented and interpreted according to the direction of each scale. Most scales are designed to be interpreted as indicating an **improvement** via a **decrease** in scores (for example, SDQ externalising difficulties). However, a small number of scales indicate an **improvement** via an **increase** in scores (for example, SDQ prosocial scores). To ensure consistent interpretation, scales where higher scores indicate improvement are not included in total scores or their differences and are instead reported separately.



Findings

3.1 Demographic and clinical description

We examined routinely collected data from 468 adopted or care-experienced children aged between 2-19 years who were enrolled on the BUSS[®] programme between April 2021 and March 2025. At the time of enrolment, only 7% of the cohort was aged between 2-4 years, with the majority aged 4-7 years (45%), followed by 8-11 years (34%) and age 12+ years (14%) and a mean age of 7.8 years (median 7 years). The cohort was predominantly male (62%) while one child identified as transgender male. The majority of children were living with adoptive parents (89%), while the remainder had special guardianship orders (7%), were in foster care (3%), with birth family (1%), or in kinship care arrangements(1%).

A total of 22% of children had a confirmed neurodivergent diagnosis (of the total cohort: ASD 6%, ADHD 6%, FASD 2%, more than one comorbidity 7%), while a further 27% had a suspected neurodivergent diagnosis (of the total cohort: ASD 6%, ADHD 7%, FASD 6%, more than one comorbidity 8%). Half of the cohort (49%) reported drug and/or alcohol use in utero. A total of 25% of the cohort reported physical health needs or learning disability, and 17% were born prematurely.

TABLE 1: Demographic Characteristics of children and young people who enrolled for BUSS[®] according to Intervention Status

BUSS Intervention Status	Complete	Incomplete	Did not Start BUSS	Awaiting discharge
N (%)	403 (86.1%)	47 (10%)	12 (2.6%)	6 (1.3%)
Age (mean, SD, range)	7.6(3.1, 4-17)	9.7(3.7, 5-11)	10.3 (3.8, 2-19)	7.2(2.4, 2-19)
Sex ¹ (%)				
Female	37.2%	44.7%	50%	33.3%
Male	62.8%	53.2%	50%	66.7%
Neurodivergence ²	15%	29.8%	33.3%	33.3%
Suspected	23.9%	21.3%	50%	0%
Neurodivergence ³				
Physical or learning disability	26.1%	17%	16.7%	16.7%
Family status				
Adopted	90.3%	78.7%	75	100
Fostered	3%	4.3%	0	0
Birth family	1%	0%	0	0
Special guardianship	5.2%	17%	25	0
Drug/alcohol exposure in utero (%)	47.4%	61.7%	50%	67%
Premature birth	14.7%	14.9%	8.3%	33.3%

1. Gender not reported as numbers in some sub-groups were low, thus threatening anonymity.

2. ASC/FASD/ADHD Diagnosis



3.2 Completion rates for families using BUSS®

A total of 403 (86%) families who were referred to the team completed their interventions (Table 1). A total of 12 families were referred to the BUSS® programme and completed initial clinical questionnaires but did not start the programme itself. Of these, one child did not consent to the intervention, and the remainder cited 'caregiver capacity' as the reason for not starting. Of those who started but did not complete the intervention, the main reason was cited as 'caregiver capacity' (78%) or 'child did not consent' (8%). Children who did not start, or complete, the intervention were slightly older than those who completed the intervention (mean age 9.7yrs, median 10yrs (range 2-19yrs) vs 7yrs, median 7.5yrs (range 2-19yrs)) with 52.5% males in the group who did not start or complete the intervention compared to 62.8% males in the group who completed the intervention. Of those who did not start or complete, the majority had severe, complex physical, genetic, or learning disabilities although numbers are too small to report these. Completion rates were high for adoptive families and foster families (90% and 86% respectively) but lower for special guardianship families (66%).

The majority of interventions were delivered exclusively online (62%) compared to 38% where sessions were in person. During the intervention period, 24% of families reported a significant life event experienced by the child/family during the intervention period, the most common being bereavement, followed by safeguarding concerns. Parents and caregivers completed up to four validated questionnaires depending on the age of the child, both before and after completing the BUSS® programme. These considered strengths and difficulties, mental health, parent skills and understanding, parent/child relationship, child's responsiveness to being cared for, and family stability. Goals relevant to the development of foundation sensorimotor systems were also agreed.

3.3 Strength and Difficulties Questionnaire (SDQ) completed by parents/carers 2-4 yrs

There were a total of 103 children with data on this outcome measure. Of these, 65% had matched pre- and post- responses. The questionnaire scores overall stress, emotional symptoms and peer relationship problems (classed as internalising difficulties), conduct problems and hyperactivity/inattention (classed as externalising difficulties), pro-social behaviour, and the impact of any difficulties on the CYP's life. There was a statistically significant reduction (indicating an improvement) in the total



Summary: For this questionnaire there were 67 pairs. Statistically significant reductions post-intervention were seen for the total difficulties (overall stress) and internalising scales. Across the individual SDQ subscale scores, reductions following intervention were seen in all individual subscale scores except for prosocial score. Statistically significant reductions were seen for hyperactivity/inattention (mean 0.5 95%CI 0.1 to 0.9) and peer problems score (mean 0.6, 95%CI 0.2 to 1.1). An increase in prosocial score indicates an improvement; a statistically significant increase was seen only for prosocial (increase of 0.6 95%CI 0.3 to 1.0). There were no statistically significant differences when comparing the scores of male and female children.



3.4 SDQ completed by parents/carers (4-17yrs)

There was a total of 468 children with data on this outcome measure, of which there were 242 (52%) matched pre- and post-data, for children aged between 4-17 years (median 8 (range 6, 10)) (figure 1). There was a statistically significant reduction (indicating an improvement) in the total difficulties (overall stress) scores between pre- and post- questionnaire ($p<0.001$). On average, the scores reduced by 3.4 (95%CI 2.6 to 4.1) units post-intervention. Taking the externalising and internalising difficulties separately, there was a statistically significant reduction in the internalising scores between pre- and post-questionnaire ($p<0.001$) AND in the externalising scores ($p<0.001$).

Breaking this down further into the individual components (Figure 1), there were statistically significant reductions (again indicating an improvement) in ALL individual domains; emotional distress ($p<0.001$), conduct problems ($p<0.0001$), hyperactivity and concentration difficulties ($p<0.001$), difficulties getting along with other children ($p<0.001$), and a statistically significant increase (indicating an improvement) in kind and helpful behaviour (prosocial score) ($p<0.001$) (see table 2b).

TABLE 2b: DIFFERENCES IN SDQ scores (4-17yrs) Pre and Post BUSS®

Measure (n)	Average score pre-BUSS® (mean, SD)	Average score post-BUSS® (mean, SD)	Average difference in score (mean, 95% CI)	Statistical significance ¹
Strengths and Difficulties Questionnaire (SDQ) Completed by Parents/Carers Scores (4-17yrs) (n=241)				
Total difficulties (Overall stress) ^A	23.1 (6.1)	18.8 (7.0)	3.4 (2.6, 4.1)	P<0.001
Internalising difficulties ^B	9.6 (4.0)	7.6 (4.1)	1.5 (1.1, 1.9)	P<0.001
Externalising difficulties ^C	13.4 (3.7)	11.2 (4.1)	1.9 (1.5, 2.3)	P<0.001
Individual Scores				
Emotional distress ^B	5.5 (2.6)	4.2 (2.7)	1.0 (0.7, 1.3)	P<0.001
Behavioural Difficulties ^C	5.0 (2.5)	4.0 (2.4)	0.8 (0.6, 1.0)	P<0.001
Hyperactivity and concentration difficulties ^C	8.4 (2.0)	7.2 (2.4)	1.3 (0.9, 1.4)	P<0.001
Difficulties getting along with other children ^B	4.2 (2.5)	3.5 (2.4)	0.4 (0.2, 0.6)	P<0.001
Kind and helpful behaviour	5.8 (2.3)	6.5 (2.2)	-0.6 (-0.8, -0.4)	P<0.001
Impact of any difficulties on the child's life ^D	5.5 (2.6)	4.2 (2.7)	1.1 (0.8, 1.4)	P<0.001

- Total difficulties equivalent to Overall stress is the sum of four individual scores (Emotional Distress (Emotional symptoms score), Behavioural Difficulties (Conduct problems score), Hyperactivity and concentration difficulties (Hyperactivity / inattention score) and Difficulties getting along with other children (Peer problems score)). Score range 0 to 40
- Internalising score is sum of two individual scores (Emotional Distress (Emotional symptoms score) and Difficulties getting along with other children (Peer problems score)). Score range 0 to 20
- Externalising score is sum of two individual scores (Behavioural Difficulties (Conduct problems score) and Hyperactivity and concentration difficulties (Hyperactivity / inattention score)). Score range 0 to 20
- Total impact score is equivalent to (Impact of any difficulties on the child's life (Impact score)). Score range 0 to 10



A sub-group analysis showed there were no statistically significant differences between male and female results, but there was a statistically significant difference between age groups for reductions in internalising behaviours ($p=0.022$), with the largest reduction in scores seen in the 8-11 age group (mean difference 2.1 compared to 0.9 for ages 4-7, and 1.7 for age 12+) (see Table 3 and Table 4).

TABLE 3: Sub-group Analysis of differences between SDQ (4-17 yrs) scores pre- and post- BUSS[®] according to Sex (comparing Male and Female)

Measure	Average difference in score (mean, 95% CI)	Significance
Total difficulties (Overall stress) ^A	-0.5 (-3.1, 2.2)	P=0.737
Internalising difficulties ^B	-0.2 (-1.9, 1.4)	P=0.779
Externalising difficulties ^C	-0.1 (-1.6, 1.5)	P=0.942
Impact of any difficulties on the child's life ^D	0.8 (-0.5, 2.0)	P=0.219
Total difficulties (Overall stress) ^A	0.2 (-1.4, 1.6)	P=0.846
Internalising difficulties ^B	-0.1 (-1.0, 0.8)	P=0.854
Externalising difficulties ^C	0.2 (-0.7, 1.0)	P=0.649
Impact of any difficulties on the child's life ^D	0.4 (-0.3, 1.0)	P=0.276

- A. Total difficulties equivalent to Overall stress is the sum of four individual scores (Emotional Distress (Emotional symptoms score), Behavioural Difficulties (Conduct problems score), Hyperactivity and concentration difficulties (Hyperactivity / inattention score) and Difficulties getting along with other children (Peer problems score)). Score range 0 to 40
- B. Internalising score is sum of two individual scores (Emotional Distress (Emotional symptoms score) and Difficulties getting along with other children (Peer problems score)). Score range 0 to 20
- C. Externalising score is sum of two individual scores (Behavioural Difficulties (Conduct problems score) and Hyperactivity and concentration difficulties (Hyperactivity / inattention score)). Score range 0 to 20
- D. Total impact score is equivalent to (Impact of any difficulties on the child's life (Impact score)). Score range 0 to 10

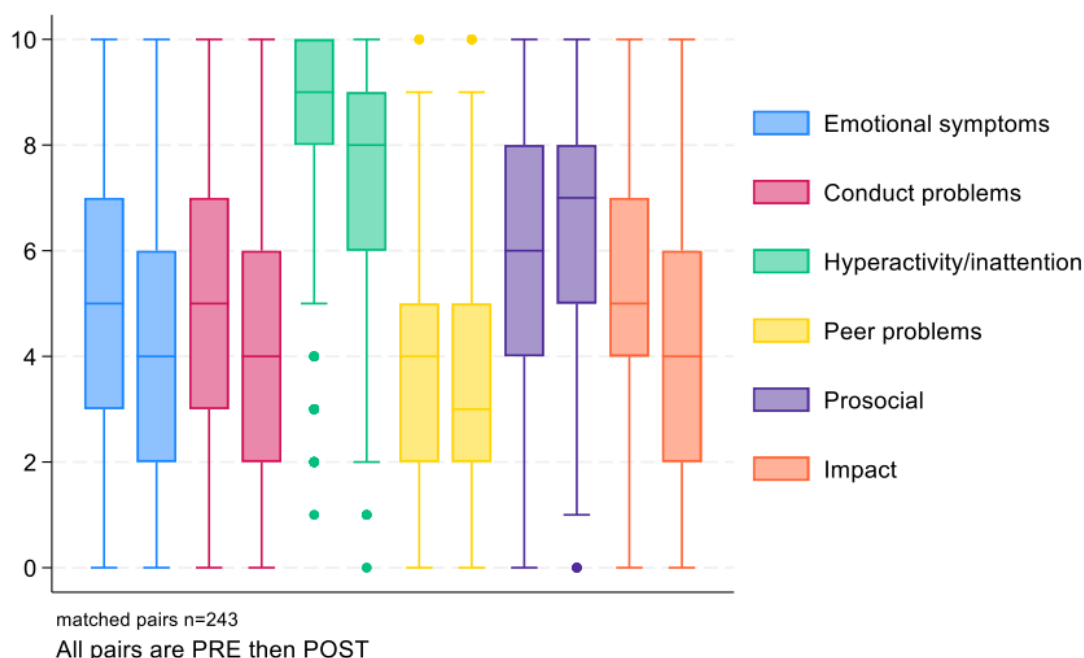
TABLE 4: Sub-group Analysis of differences between SDQ (4-17 yrs) scores Pre and Post BUSS[®] according to Age Group

SDQ average difference between PRE and POST scores (mean, SD)	4 to 7 yrs (n=114)	8 to 11 yrs (n=98)	12+ yrs (n=32)	Significance*
Total difficulties (Overall stress) ^A	2.7 (5.2)	4.0 (5.9)	3.6 (6.2)	P=0.220
Internalising difficulties ^B	0.9 (2.9)	2.1 (3.3)	1.7 (3.7)	P=0.022
Externalising difficulties ^C	1.9 (3.3)	2.0 (3.2)	1.9 (2.8)	P=0.980
Impact of any difficulties on the child's life ^D	0.7 (2.6)	1.4 (2.4)	1.4 (2.2)	P=0.104

* One way ANOVA test



Figure 1: Boxplot showing distribution of SDQ (4-17 yrs) pre- and post-score for six individual categories



3.5 Strength and Difficulties Questionnaire (SDQ) self complete (11-17yrs)

There were only 33 children with data on this outcome measure, of which there were 9 (27%) matched pre- and post-data, for children aged between 11-19 years (there was one self-reported questionnaire from a young person aged 18 at Pre data score so this has been added to the 11-17 data). There was no statistically significant reduction in the total difficulties (overall stress) scores between pre- and post-questionnaire ($p=0.157$), and no statistically significant reductions in internalising or externalising scores.

Breaking this down further into the individual components there were statistically significant reductions (again indicating an improvement) only in emotional distress ($p<0.033$) and impact of difficulties in the child's life ($p=0.001$). Numbers were too small to analyse differences between age groups or sex and are too small to report in tabular form.

Summary: For this questionnaire there were only 9 pairs. Statistically significant reductions post-intervention were only seen for emotional distress and impact.



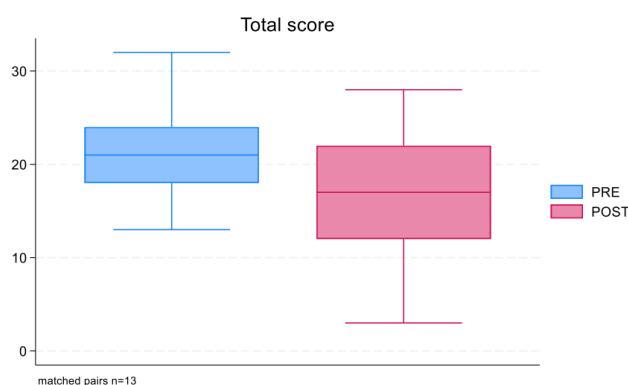
3.6 Brief Assessment Checklist for Children (BAC-C) parents or carers (4-11yrs)

There was a total of 151 children with data on this outcome measure, of which there were 93 (62%) matched pre- and post-data, for children aged between 3-12 years (median 7 (range 6, 10)). There was a statistically significant reduction (indicating an improvement) in the total scores between pre- and post-questionnaire ($p=0.0005$). On average, the scores reduce by 2.8 (95%CI 0.8 to 2.8) units post-intervention (see Table 5).

3.7 Brief Assessment Checklist for Adolescent (BAC-A) parents or carers (12-17yrs)

There were a total of 24 children with data on this outcome measure, of which there were 13 (54%) matched pre- and post-data, for children aged between 12-17 years (median 13 (range 12, 14)) (figure 2). There was a statistically significant reduction (indicating an improvement) in the total scores between pre- and post-questionnaire ($p=0.0022$) (see Figure 2). On average the scores reduce by 4.4 (95%CI 1.9 to 6.9) units post-intervention (see Table 5).

Figure 2: Boxplots showing distribution of BAC-A (12-17yrs) PRE and POST total scores.





3.8 Thinking About Your Child revised (TAYC-R) parents or carers

There was a total of 88 children with data on this outcome measure, of which there were 65 (74%) matched pre- and post-data, for children aged between 2-17 years (median age pre-intervention 7 years (range 5, 9)).

Figure 3: Boxplots showing distribution of TAYC-R (2-19yrs) PRE and POST child's responsiveness scores.

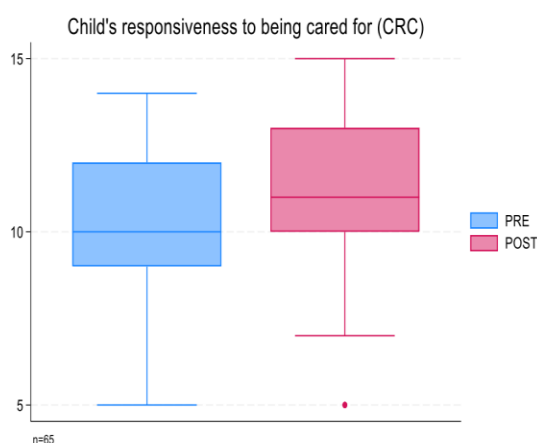
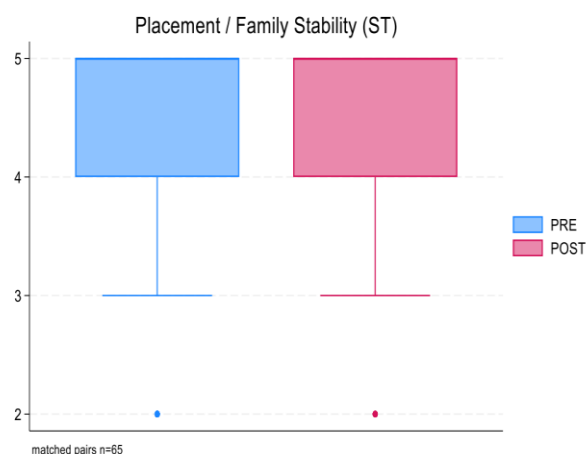


Figure 4: Boxplots showing distribution of TAYC-R (2-19yrs) PRE and POST Family Stability scores



There was a statistically significant increase (indicating an improvement) in the total scores between pre- and post- questionnaire ($p < 0.0001$). On average, the scores increased by 3.8 (95%CI 2.6 to 5.0) units post-intervention. Taking each domain in turn, there were statistically significant increases in three domains; parent skills and understanding (mean increase 2.0 (95%CI 1.4-2.6); parent-child relationships (mean increase 0.8 (95%CI 0.4-1.2); child's responsiveness to being cared for (mean increase 0.9 (95%CI 0.4-1.4). There was no statistically significant difference in family stability; family stability was high at the start of the intervention and this did not change at the end of the intervention (Out of a total score of 5, the mean score comparing pre- and post-intervention was 4.3 (SD 0.9) vs 4.4 (SD 0.8)) (see Table 5, figures 3 & 4).



TABLE 5: DIFFERENCES IN BAC-C, BAC-A, TAYC-R scores Pre and Post BUSS®

Measure (n)	Average score pre-BUSS® (mean, SD)	Average score post-BUSS® (mean, SD)	Average improvement in score (mean, 95% CI)	Statistical significance ¹
Brief Assessment Checklist for Children (BAC-C) parents or carers (4-11 years) (n=99)				
Total Score ^E	18.9 (7.3)	16.1 (7.5)	1.8 (0.8, 2.9)	P=0.0005
Brief Assessment Checklist for Adolescent (BAC-A) parents or carers (12-17 years) (n=13)				
Total Score ^E	22.7 (6.0)	16.6 (7.1)	4.4 (1.9, 6.9)	P=0.0022
Thinking About Your Child revised parents or carers (TAYC-R) (n=65)				
Total Score ^F	39.6 (5.7)	43.3 (6.8)	-3.8 (-5.0, -2.6)	P<0.0001
Parent skills and Understanding	13.5 (2.2)	15.5 (2.6)	-2.0 (-2.6, -1.4)	P<0.0001
Parent Child Relationship	11.5 (2.1)	12.3 (2.0)	0.8 (-1.2, -0.4)	P=0.0004
Childs responsiveness to being cared for	10.2 (2.2)	11.1 (2.3)	-0.9 (-1.4, -0.4)	P=0.0003
Placement Family Stability	4.3 (0.9)	4.4 (0.8)	-0.1 (-0.3, 0.1)	P=0.208

E. Total score is sum of all 20 questions (each question score is 0, 1 or 2). Score range 0 to 40

F. TAYC-R Total score is sum of all 11 questions (each question score = 1 to 5). Score range 1-55, low score indicates high difficulties, high score indicates low difficulties.

3.9 Goal Based Outcomes (GBO)

There were a total of 427 children with data on this outcome measure, of which there were 403 (94%) matched pre- and post-data, for children aged between 2-19 years (median pre-intervention 7; range 5, 10). This outcome measure invites children and parents/caregivers to set between 1- 5 goals per child within the categories of Vestibular System - Core Strength and Stability, Vestibular System - Gravitational Security, Proprioception, Tactile System - Oral Motor Strength, Tactile System - Making Sense of the World / Their Environment, Emotional Regulation / Building Relationships. The majority of families set a total of 3 goals (71%), giving a total of 1183 goals analysed as 'matched pairs' with pre- and post-scores (see Table 6, figure 5).



TABLE 6: Goal Categories (GBO) and their completion rates

Goal category	Number set	Number completed (%)	%Rate (set/completed)
Tactile - Making Sense of the World / Their Environment	403 ¹	372	92%
Vestibular - Core Strength and Stability	379	359	95%
Proprioception	207	199	96%
Tactile - Oral Motor Strength	155	146	94%
Emotional Regulation / Building Relationships	69	68	99%
Vestibular - Gravitational Security	44	39	89%
Total	1257 ¹	1183	(100%) 94%

¹ Four with missing initial scores are all 'Tactile - Making Sense of the World / Their Environment'

TABLE 7: Goal Categories (GBO) and the average difference in scores before and after BUSS

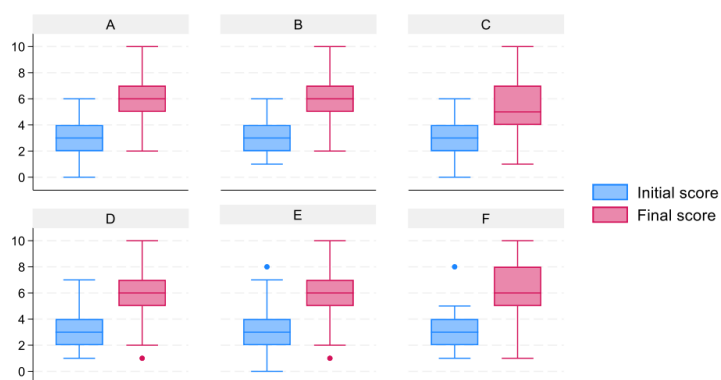
Goal category	Average improvement in score (mean, 95% CI) 2-4yrs	Average improvement in score (mean, 95% CI) 4-7yrs	Average improvement in score (mean, 95% CI) 8-11yrs	Average improvement in score (mean, 95% CI) 8-11yrs
Tactile - Making Sense of the World / Their Environment	2.0 (1.7)	2.6 (1.6)	2.6 (1.7)	2.8 (1.4)
Vestibular - Core Strength and Stability	3.1 (1.2)	3.0 (1.4)	3.1 (1.7)	2.5 (1.3)
Proprioception	3.0 (1.4)	2.4 (1.5)	2.9 (1.6)	3.1 (2.1)
Tactile - Oral Motor Strength	2.9 (1.4)	2.8 (2.0)	2.7 (1.4)	2.7 (1.4)
Emotional Regulation / Building Relationships	-	3.0 (1.5)	3.3 (1.6)	3.0 (1.5)
Vestibular - Gravitational Security	2.8 (0.8)	3.0 (1.5)	3.5 (1.8)	-
Overall Score	2.8 (1.4)	2.8 (1.6)	2.9 (1.7)	2.8 (1.6)

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There was an increase (indicating an improvement) in the total scores between pre- and post-questionnaire. On average, the scores increased by 2.8 (95%CI 2.7 to 2.9) units post-intervention. The scores increased across all domains, with the largest increase seen in goals set in the domain 'Vestibular – Gravitational Security' 3.3 (95%CI 2.7 to 3.9). Increased scores were seen across all age categories and both sexes, and there was little difference when comparing differences in age or sex sub-groups; the largest difference between males and females was in the domain 'Emotional regulation/Building relationships' (males 3.2 vs females 2.8).



Figure 5: Goal initial and final scores (GBOs) by goal category



Graphs by GOAL category (matched pairs) A: n=68, B: n=199, C: n=372, D: n=146, E: n=359, F: n=39.

A-Emotional Regulation / Building Relationships, B-Proprioception, C-Tactile - Making Sense of the World / Their Environment, D-Tactile - Oral Motor Strength, E-Vestibular - Core Strength and Stability, F- Vestibular - Gravitational Security



Discussion and Recommendations

4.1 Overview of evaluation and strengths and limitations of the study

This service evaluation clearly demonstrates that children who complete BUSS[®] have statistically significant improvements across a range of measures. Previous research on BUSS[®] was qualitative, and demonstrated that it was acceptable and feasible for a wide age range of children and young people. There is a limited evidence base for bodily regulation-based therapies in general. This evaluation adds to the previous research by providing new information about the benefits of BUSS[®] as measured by a range of outcomes that are specified by Department for Education as being important for the health and wellbeing of CYP and their families. The fact that almost 90% of families successfully completed the intervention adds weight to previous qualitative work that suggests the model is highly acceptable, low burden, and fun for families who report both immediate and sustained benefit to their relationship with the child, as well as to the outcomes for the child. This relational benefit is likely to be protective against adoption and fostering placement breakdown and this suggests the potential for large cost saving for local authorities. Findings suggest that the benefits of BUSS[®] may be achieved at low cost to families, local authorities and regional adoption agencies, and should be developed further. Further progress is likely to be enhanced by a systematic development and sharing of BUSS[®] materials, guidance and training across the UK.

The proportion of CYP in this cohort who were born prematurely was higher than the general population (15% vs 7.9% live births in England and Wales in 2022). We were unable to separate outcomes to compare prematurity to find out how BUSS[®] differentially impacts those born prematurely, but given that prematurity in itself can lead to underdeveloped sensory systems, this presents another important avenue of future enquiry. The fact that completion rates for BUSS[®] were higher for adoptive families than foster or special guardianship families is notable; it is possible that the greater stability afforded by adoption made it easier for those families to engage with the intervention over the treatment period. However, this does not suggest that it should not be offered to foster or SGO families as, on average, all families were equally stable at the start and end of the intervention, which demonstrates evidence that BUSS[®] does not adversely affect family stability by adding additional burdens upon parents and caregivers. Again this merits further investigation.

Any service evaluation of this type has some limitations. Firstly, we compared pre- and post-BUSS[®] outcome data only for those (high proportion) of families who completed the BUSS[®] treatment. This does not tell us anything about those who failed to



complete the treatment. There may be important differences between completers and non-completers that we don't yet understand which may have affected the outcomes. Secondly, an evaluation of this type is subject to bias because of the lack of a control group. Without a control group, we cannot be completely confident that the results did not happen by chance, or because of the developmental steps that CYP may have taken anyway as a result of being in a safe, stable environment. In particular, we were unable to follow up on families who did not complete the programme. It is possible that those families who completed the programme would have improved without it. Similarly, there is no way of knowing if improvements in outcomes were a result of other factors (for example, other therapies) that were not accounted for.

Given the service evaluation design, it was not appropriate to go further than we did to find out if particular sub-groups (such as those with neuro-disabilities) experienced lesser or greater improvements in outcomes. The dangers of doing so lie in the data quality of routinely collected data. A record of ASC for example in this case may reflect that a parent suspects it, but there is no diagnosis and the potential for errors in interpretation are high. However, it is important to report that many treated CYP were in fact those with diagnosed or suspected neurodivergent diagnoses meaning that BUSS[®] was appropriate and acceptable to them. The children in this cohort all had complex needs and more than half had a diagnosis or a suspected diagnosis of Autism, ADHD, and/or FASD. Although we were unable to differentiate between those with and without Sensory Processing Disorder, this often co-exists with neurodivergent diagnoses such as Autism. This suggests an important avenue of future enquiry to understand more about whether outcomes are positive for neurodivergent children and young people. Although a minority of the cohort were from the global majority, data was not routinely collected on this so we are unable to state the extent to which the intervention was acceptable or successful according to ethnic origin. This is an important next step to understand whether BUSS[®] can be appropriately culturally tailored.

A strength of the evaluation was that many professionals were involved in delivering BUSS[®], meaning that any effect on outcomes is unlikely due to the skills of one practitioner, and that BUSS[®] training is likely to have fidelity across different LAs and RAAs. Another strength lies in the quality of the data; families were unable to start treatment without completing outcome questionnaires, meaning a very high completion rate at the start of treatment, and a high number of families completed BUSS[®], with strenuous efforts by the BUSS[®] team to ensure post-measures were completed in a timely way. Data cleaning showed that data entry was of a high quality with very few missing or inaccurate entries. The BUSS[®] team was committed to providing valuable insights and learning opportunities for future, more rigorous evaluations.



4.2 Recommendations and suggestions

Based on the above findings, the following recommendations and suggestions have been made to ensure that BUSS® is appropriately considered and prioritised.

For BUSS® Model Ltd:

- Refine routine data collection to include ethnic origin and religion of both CYP and parent/caregivers.
- Consider further examination of the reasons for non-completion, particularly for foster and special guardianship families.
- Consider other ways of capturing CYPs views on their outcomes and experiences.

For Adoption England and similar national bodies:

- Recognise BUSS® as a low-cost, high-value intervention with measurable benefits across emotional, behavioural, and relational domains.
- Support continued national access and consider strategic investment in scaling training and materials.

For Regional Adoption Agencies (RAAs) and Local Authorities (LAs):

- Prioritise BUSS® as part of multi-disciplinary support pathways, particularly for children who struggle to access talking therapies.
- Ensure practitioners are trained and supervised to maintain model fidelity.

For Families and Practitioners:

- BUSS® provides a structured, relationship-based approach that many families found acceptable, feasible and beneficial.
- Parents may wish to access their own supportive therapies alongside BUSS® to enhance capacity and resilience.

For Future Research:

- Further controlled studies to strengthen evidence around causality.
- Research examining sub-groups (e.g., neurodivergence, age brackets) using higher-quality diagnostic data.
- Exploration of long-term outcomes such as educational attainment, mental health trajectories, and placement stability.



- Exploration of cultural acceptability in global majority families.
- Exploration of the support needs of kinship and SGO families who may require a tailored approach.

4.3 Summary

This service evaluation has demonstrated the potential of BUSS® to improve bodily regulation and related developmental, emotional and relational outcomes for children and young people across all ages, sex, and neurodiversity. Other related interview studies assert that BUSS® offers a feasible, low-cost, highly acceptable treatment for CYP and families. The fact that more than 80% of families completed the programme provides strong support for this. The cost and time-efficient study design means that we cannot be completely confident that improvements were a direct result of BUSS®. However, the fact that improvements had statistical significance across a range of measures is important and allows us to state that, for those families who were treated, BUSS® is highly effective with potential to change lives. This provides a strong foundation for further studies and further roll-out of BUSS® so that more families can benefit.



Acknowledgements:

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References:

- Fraser, K., MacKenzie, D. & Versnel, J. (2019) What is the Current State of Occupational Therapy Practice with Children and Adolescents with Complex Trauma? *Occupational Therapy in Mental Health*, 35:4, 317-338, DOI: 10.1080/0164212X.2019.1652132
- Gorman, K., & Kohl, K. (2016). The role of sensory integration in recovery oriented trauma informed care. 13th Annual International Human Trafficking and Social Justice Conference
- Grindheim, K. (2019). The BUSS® Programme – an evaluation of the experience of foster carers and social workers. Leeds University Clinical Psychology Dissertation.
- Harricharan S, Nicholson AA, Densmore M, Theberge J, McKinnon MC, Neufeld RWJ, Lanius RA. Sensory overload and imbalance: Resting-state vestibular connectivity in PTSD and its dissociative subtype. *Neuropsychologia*. 2017 Nov;106:169-178. doi: 10.1016/j.neuropsychologia.2017.09.010. Epub 2017 Sep 11.
- Haslam, H. (2020). An exploratory study of the impact of the BUSS® model on the therapeutic skills set of carers. University of Huddersfield, Social Work MA Dissertation.
- Joseph RY, Casteleijn D, van der Linde J, Franzsen D. Sensory Modulation Dysfunction in Child Victims of Trauma: a Scoping Review. *J Child Adolesc Trauma*. 2021 Jan 26;14(4):455-470. doi: 10.1007/s40653-020-00333-x. PMID: 34824663; PMCID: PMC8586279.
- Lanius RA, Frewen PA, Tursich M, Jetly R, McKinnon MC. Restoring large-scale brain networks in PTSD and related disorders: a proposal for neuroscientifically-informed treatment interventions. *Eur J Psychotraumatol*. 2015 Mar 31;6:27313. doi: 10.3402/ejpt.v6.27313. eCollection 2015.
- LeBel, J., Champagne, T., Stromberg, N., & Coyle, R. (2010). Integrating sensory and trauma-informed interventions: Part 1. *American Association of Occupational Therapists Mental Health Special Interest Section Quarterly*, 33(1), 1–4
- Lehr, V., Sullivan, A., Tessier, T, Szklut. S. (2023). Trauma-Informed, Sensory-Based Pediatric Occupational Therapy Interventions: A Systematic Review. April 2023. Conference Poster: American Occupational Therapy Association Annual Conference
- Lloyd, S. (2023). An innovative approach to working with children who have experienced developmental trauma: An introduction to the Building Underdeveloped Sensorimotor Systems (BUSS®) model. *Adoption & Fostering*,



- 47(2), 157-173. <https://doi.org/10.1177/03085759231174902> (Original work published 2023)
- May-Benson, T. A., & Teasdale, A. (2019). Safe Place: Clinical Utility and Feasibility of a Multi-Disciplinary Intervention for Children with Sensory Processing Disorder and Complex Trauma - a Feasibility Study. *Journal of child & adolescent trauma*, 13(2), 207–216. <https://doi.org/10.1007/s40653-019-00281-1>
- Piller, A., McHugh Conlin, J., Glennon, T. J., Andelin, L., Auld-Wright, K., Teng, K., & Tarver, T. (2025). Systematic review of sensory-based interventions for children and youth (2015-2024). *Frontiers in pediatrics*, 13, 1720179. <https://doi.org/10.3389/fped.2025.1720179>
- Robinson, C. (2021). Learning from adoptive families: What are their experiences of children's development and the support they receive? University of Hull Clinical Psychology Dissertation.
- Smith, D. (2022). Building Underdeveloped Sensory Motor Systems (BUSS®) – A service evaluation project exploring the efficacy of the model as an early years groupwork programme for preschool children who have been adopted. University of Leeds Clinical Psychology Dissertation.
- Tomalski, P., & Johnson, M. (2010). The effects of early adversity on the adult and developing brain. *Current Opinion in Psychiatry*, 23(3), 233–238. doi:10.1097/YCO.0b013e3283387a8c
- Warner, E., Spinazzola, J., Westcott, A. (2014). The Body Can Change the Score: Empirical Support for Somatic Regulation in the Treatment of Traumatized Adolescents. *Journal of Children and Adolescents Trauma*, 7, 237–246. <https://doi.org/10.1007/s40653-014-0030-z>
- Whiting, C. C. (2018). Trauma and the role of the school-based occupational therapist. *Journal of Occupational Therapy, Schools, and Early Intervention*, 11(3), 291–301. <https://doi.org/10.1080/19411243.2018.1438327>.
- Wrench, K. (2025). BUSS® (Building Underdeveloped Sensorimotor Systems) with adolescents. *Foster*, 2025, Issue 16.



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