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Extended Research Article

Improving outcomes for people with autism spectrum disorders by reducing mental health problems: the IAMHealth research programme including one RCT

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This article

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Abstract

Background: Autism is a neurodevelopmental condition whose core symptoms include impairments in social communication, restricted and repetitive behaviours and sensory atypicalities, which can have varying severity. Most autistic people experience additional, impairing mental health and behavioural problems, but these are often under-recognised by healthcare professionals, autistic people and their caretakers.

Objective(s): We aim to improve identification of mental health problems by developing a tool for clinical use, which can also be used to monitor treatment response.

Design: Work package 1: we developed and validated a new instrument to provide improved detection of mental health and behavioural problems in autistic people from childhood through to adult life. Work package 2: we explored how autistic young adults understand and manage their mental health. Work package 3: we undertook a cohort study to identify risk and protective factors for mental health and behavioural problems in autistic adolescents. Work package 4: we undertook a pilot feasibility randomised controlled trial of Predictive Parenting compared to group-based psychoeducation and active control intervention. It was not the aim of the pilot feasibility randomised controlled trial to undertake hypothesis testing.

Setting: Participants in work package 1 were ascertained through clinical sites within London and Liverpool and through specialist autism schools in London. In work package 2, participants were selected from a cohort originally ascertained from 11 regions across south-east England. Participants were drawn from London Boroughs of Bromley and Lewisham (work packages 3 and 4) and London Borough of Lambeth (work package 4).

Participants: Work package 1: 255 parents of autistic children/adolescent; work package 2: 19 autistic young adults; work package 3: QUEST cohort of 277 children; work package: 62 children.

Intervention: Predictive Parenting – a novel parent-mediated intervention.

Main outcome measure: Work package 4: a blinded observational measure of child behaviours that challenge.

Results: We developed the Assessment of Concerning Behaviour to be completed by parents/caretakers, autistic children/young people/adults and teachers, and showed it has two reliable and valid subscales reflecting emotional and behavioural problems. We identified that poor or incomplete understanding of autism affected young adults' and parents' understanding, discernment and management of mental health difficulties. We showed strong continuity of emotional and behavioural problems as well as attention deficit hyperactivity disorder from early childhood to late adolescence, with prediction being largely within domain (emotional, behavioural or attention deficit hyperactivity disorder). Early childhood attention deficit hyperactivity disorder symptoms had a significant negative impact on adolescent everyday functioning. At an individual level, parents' accounts suggested multiple factors may affect mental health trajectories and outcomes in the late teenage years. Our pilot feasibility trial of our new intervention, Predictive Parenting, directed at parents of young autistic children was highly acceptable and feasible to deliver.

Limitations: To date, only the parent version of the Assessment of Concerning Behaviour has had its psychometric properties ascertained. We combined clinical and non-clinical samples and the scale could have different psychometric properties for these two groups. The qualitative work in work package 2 was limited to young adults without an intellectual disability and there was under-representation of females and non-white ethnicity, as well as those with severe mental health problems. The QUEST cohort in work package 3 was derived from those receiving an early autism diagnosis, who are more likely to have severe autistic presentations and intellectual disability, so the results may not generalise to the full autistic population. The pilot feasibility study had a small sample size and hence modest power to detect group differences; the lack of an objective rating of intervention fidelity; the lack of a treatment as usual group to track the natural trajectory of child and parent behaviours over time; and the fact that although the researchers who coded the observational measure were blinded to intervention allocation, they were not blinded to time point.

Conclusions: The research undertaken in the current programme shows that mental health and behavioural problems are more common in autistic people and are strongly persistent over time, even when they commence in the early

childhood period. Interventions for mental health and behavioural problems are a priority for autistic people and their families. However, we showed that autistic people and their families often find it difficult to discern the difference between autistic features and mental health and behavioural problems.

Future work: A definitive randomised controlled trial including an economic evaluation is needed to determine the effectiveness and cost-effectiveness of Predictive Parenting. Future longitudinal research could focus on modifiable risk and resilience factors related to mental health problems in autistic people and could determine whether routine use of mental health screening questionnaires increases the identification and treatment of mental health problems in autistic children and young people.

Trial registration: This trial is registered as Current Controlled Trials ISRCTN91411078.

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Report Supplementary Material 1 Autism Spectrum Treatment and Resilience (ASTAR) study protocol

Supplementary material can be found on the NIHR Journals Library report page (https://doi.org/10.3310/YRKP9867).

Supplementary material has been provided by the authors to support the report and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.

List of abbreviations

ABI	Autism Behaviour Inventory
ACB	Assessment of Concerning Behaviours
ADHD	attention deficit hyperactivity disorder
ANCOVA	analysis of covariance
ASD	autism spectrum disorder
ASTAR	Autism Spectrum Treatment and Resilience, the name of the study in work package 4
BTC	behaviours that challenge others
CAPA	Child and Adolescent Psychiatric Assessment
CFA	confirmatory factor analysis
CFI	Comparative Fit Index
CYP	children and young people
DQ	developmental quotient
EBP	emotional and behavioural problems
EFA	exploratory factor analysis
HSQ-ASD	Home Situations Questionnaire – autism spectrum disorder version
IAMHealth	Improving Mental Health for Autistic People (acronym given for this programme)
ID	intellectual disability
MHBP	mental health and behavioural problems, including behaviours that challenge others; this term is used to encapsulate both mental health problems and also behaviours that challenge others
MHP	mental health problems
MOAS	Modified Overt Aggression Scale
NAS	National Autistic Society
NICE	National Institute for Health and Care Excellence
OCD	obsessive–compulsive disorder
OSCA-AB	Observation Schedule for Children with Autism-Anxiety, Behaviour and Parenting
PAPA	Preschool Age Psychiatric Assessment
PCI	parent–child interaction measure
PE	psychoeducation
PP	Predictive Parenting intervention, used in work package 4
PPI	patient and public involvement
PS	parenting stress
QUEST	QUEST is a longitudinal cohort study whose participants were studied in work packages 1 and 3
RCT	randomised controlled trial
RMSEA	root-mean-square error of approximation
SAP	statistical analysis plan
SCQ	Social Communication Questionnaire
SD	standard deviation
SEM	structural equation modelling
SMART	Severe Maladaptive Behaviour Rating Tool
TAU	treatment as usual
TD	typically developing, in this context non-autistic
WP	work package
YP	young people, typically in adolescent age range 12–18 years

Plain language summary

Background

Two-thirds of autistic people have mental health disorders. These disorders are distressing to autistic people and their families/caretakers, may limit access to education and reduce employment opportunities and community participation. Autistic people and their families prioritise research that will improve their mental health.

Methods

We wanted to better understand how autistic people and their families recognise and seek help for mental health problems. To identify early risk factors for ongoing health problems, we followed a group of young autistic children to adolescence. To reduce distressing mental health and behavioural problems, we undertook a small pilot feasibility randomised controlled trial of a novel parent-mediated group intervention for young autistic children to see whether parents were interested and could take part in the intervention.

Results

We discovered that autistic young adults found it difficult to distinguish between autism and mental health. They were less likely to seek help for their mental health problems. Our new measure of mental health and concerning behaviours, co-produced with autistic people and parents, shows good reliability and validity. From childhood to adolescence, mental health and behaviour problems are likely to persist rather than go away on their own. Parents' accounts indicate that many factors may affect an autistic child or teenager's mental health – both in positive and negative ways. Our novel intervention showed high rates of completion and satisfaction.

Conclusions

Mental health and behaviour problems in autistic people are common and persist over time. Better identification and effective, targeted interventions are required to improve outcomes. These should start in early childhood. It is important to ensure autistic people and their families know about mental health problems. Mental health questionnaires that are easy for autistic people to complete could improve recognition by autistic people, parents/caretakers and professionals alike.

Scientific summary

Background

Autism involves pervasive impairments of reciprocal social interaction and communication as well as repetitive behaviours and interests and sensory atypicalities, including hyper- and hypo-sensitivity to different stimuli. Autism is common, occurring in ~1–1.5% of the population, lifelong and hugely expensive. Currently, there are very limited treatments for its core symptoms. There are also widely divergent views on whether core autistic traits should be a target for intervention or rather that societies and environments should be more flexible to accommodate neurodivergence (or both). However, previous research and consultation with autistic people and their families/caretakers highlighted the importance of commonly associated mental health problems (MHP). Referred to as mental health and behavioural problems (MHBP), these can lead to exclusion from everyday family life, educational and community activities, poor quality of life and increased stress for family members as well as high costs in service use and lost opportunities.

Previous research has shown elevated rates of MHBP at all ages among autistic people, affecting up to two-thirds of individuals, but at the inception of this programme, it was not known whether these problems persisted over time in the same individuals, nor what are the risk factors for persistence.

Aims and objectives

This programme focused on decreasing MHBP as a strategy for improving outcomes for autistic people and their families. These outcomes include improved mental health, quality of life and community participation for autistic people; reduced family stress; and decreased economic costs by ultimately lowering the need for high-cost (often residential) care and integration into the community. To achieve this, we focused on improved recognition, early intervention and identification of the factors that predict MHBP and influence transitions to adolescence/early adult life. Autism is a lifelong condition, and this programme reflected this through work packages focusing on key time points from early childhood to young adult life.

To achieve our aims, we addressed the following objectives:

1. We developed and validated a measure of MHBP in autism, to assist professionals in detecting these problems, identifying their causes and monitoring treatment/intervention. (Work package 1 – instrument development.)
2. We interviewed young adults and parents of autistic young people and young adults, in order to understand and describe their perception of the emergence of MHP their experiences of seeking help; and the impact of these on their lives. (Work package 2 – biographies.)
3. We undertook a longitudinal study of a cohort of autistic adolescents in order to identify the personal, family and wider environmental risk/protective factors related to persistence/desistence of MHBP from early childhood to late adolescence. A nested qualitative study investigated parents' accounts of their child's mental health trajectories. (Work package 3 – predictors.)
4. We developed and completed a pilot feasibility randomised controlled trial (RCT) of a novel intervention for parents of recently diagnosed children aimed at reducing MHBP, enhancing child and family functioning and decreasing parental stress. We compared it to a control intervention. (Work package 4 – treatment.)

Work package 1: instrument development

Methods

We undertook focus groups with autistic adolescents and adults and their parents/caretakers as well as mental health professionals. With autistic people and their parents, we wanted to identify the most effective and understandable

ways of conveying item content and appropriate scoring. To assess the instrument, participants were identified through mental health and paediatric clinics, schools for autistic children and schools with special units for autistic children. We then asked autistic people, their parents and teachers to complete the questionnaire. A subset completed the questionnaire on two occasions to obtain test–retest reliability. Exploratory factor analysis (EFA) identified the structure which was replicated in an independent sample using confirmatory factor analysis (CFA). Reliability and validity were assessed for the final solution, for each factor separately. Convergent and discriminant validity were measured against existing measures.

Key findings

Item content, presentation and response format are very important to autistic people. The Assessment of Concerning Behaviour (ACB) was completed by 255 parents, 149 autistic children and young people and 30 teachers; test–retest data were available from 121 parents and 61 children/young people. Target participants (across all respondents) had an age range of 7–29 years; self-reports were completed by youth aged 8–14 years. Male preponderance varied from 75% to 83.6%. Mean IQ varied from 63.8 to 77.8 with a range from the profound intellectual disability (ID) range to superior IQ. EFA supported a two-factor model as providing the best fit [χ^2/degrees of freedom (df) = 1.7, root-mean-square error of approximation (RMSEA) = 0.053, Comparative Fit Index (CFI) = 0.91] compared to a one- or three-factor model. This was validated by CFA on a second sample (χ^2/df = 1.7, RMSEA = 0.057, CFI = 0.88) which was compared to a one-factor model. Within-factor reliability and stability were judged satisfactory with Cronbach's weighted kappas ranging from 0.51 to 0.72 and per cent agreement from 83% to 95.5%. Concurrent, convergent and discriminant validity was supported by the pattern of correlations with other measures.

Limitations

There were relatively low completion rates by children, adolescents, and young adults, as well as teachers, in comparison with parents, meaning that a full psychometric profile could only be generated for the parent version. However, up till adult life, among autistic populations, it is usual to rely on parent report as the primary informant.

Interpretation

Co-design of a questionnaire with autistic people and their families led to a different structure and response format than is typical for questionnaires about MHBP. The ACB was subjected to stringent psychometric evaluation, including replication of the structure in a second sample, and was found to be robust.

Work package 2: biographies

Methods

Using an existing research cohort, we purposively sampled autistic young adults with previous experience of a range of MHBP. Nineteen autistic young adults aged 23–24 years were recruited. Parallel interviews were undertaken with parents. In-depth interviews explored how they understood and managed MHP. Data were analysed thematically, and this framework was shared at an early stage with the patient and public involvement (PPI) panels.

Key findings

Young adults adopted self-management strategies rather than seeking advice or intervention from more conventional sources, including clinical services. Factors contributing to this included beliefs about the causes of MHP and increased vulnerability with the context of a diagnosis of autism, knowledge of self-management and, based on prior experiences, a view that professional support or intervention was unavailable or inadequate. Where help was sought, this was only at the point of psychological distress becoming very apparent to parents (typically due to concomitant physical symptoms such as significant weight loss) who typically either initiated or supported help-seeking.

Limitations

The study focused on young adults without learning difficulties (IQ < 70). There was an under-representation of females and people from ethnic minority backgrounds in the cohort from which we recruited. This means that we have only a partial understanding of these issues for autistic adults.

Interpretation

Young autistic adults and their families may hold erroneous beliefs about autism and mental health, and, as a result, struggle to discern when they might need mental health support. Negative or unhelpful experiences of mental health support during childhood and the teenage years may engender a suspicion or reluctance to seek help from mental health services. There were few systematic opportunities for autistic young people or their parents to learn about autism, including its implications for mental health. In addition, health and social care professionals need to be aware of the high rate of MHBP in autistic people and that autistic people may not recognise their own MHBP or feel confident in seeking professional help for them.

Work package 3: predictors

Methods

We followed up the QUEST cohort, a sample of 277 autistic children first assessed at age 4–9 (Wave 1) and followed up at ages 11–16 (Wave 2) and 13–18 years (Wave 3). A particular focus was on the role of family factors, including maternal stress and mental health and family child-rearing practices, alongside wider environmental experiences, such as type of schooling and bullying, on MHBP. MHBP were assessed with parent- and teacher-reported questionnaire measures at Wave 2 and parent- and self-reported questionnaires and parental psychiatric interview for the intensive subset at Wave 3. These were conceptualised in three domains: emotional problems, behavioural problems and attention deficit hyperactivity disorder (ADHD) symptoms. Parents reported on their own MHP at each Wave.

Regression analysis and structural equation modelling were used to examine longitudinal relationships.

A nested qualitative study of parents (n = 33) of autistic teenagers (15–19 years), purposively recruited from the cohort, sought to collect parents' accounts of their child's mental health from diagnosis to the present, their beliefs and observations about the factors which affected it, and the impacts of MHBP on them as parents.

Key findings

We demonstrated moderate to strong persistence of mental health symptoms and diagnoses in autistic children over more than 10 years. Once initial comorbidity of symptom domains was accounted for, stability was largely within domain. Adolescent adaptive functioning was predicted not only by early childhood autistic symptoms and IQ and ADHD symptoms.

Higher parental MHP at Wave 1 was found to be associated with lower child IQ (β = 0.2), but not autistic symptoms.

The nested qualitative study revealed that multiple factors may protect against, or increase the risk of, MHBP during a child's life. These include bio-psychological (e.g. IQ, communication skills, puberty, social and cognitive development) and social ecological factors (e.g. parenting skills, family and school environment) factors.

Parents described feeling skilled and competent in supporting their autistic child until the early teenage years, when they encountered new, more challenging difficulties.

Limitations

The QUEST cohort is ascertained from a population of children diagnosed in two London boroughs before age 4 years. Thus, while this is a carefully characterised population, it reflects children diagnosed early in life and does not include those with more subtle presentations who may only be recognised as having autism later. The nested qualitative study focused only on parents' accounts.

Interpretation

Mental health and behavioural problems showed moderate to strong stability from early childhood to adolescence, supporting the importance of early detection and appropriate intervention. While parents self-report high levels of MHP, these do not appear to be strong predictors of subsequent child MHBP. Nevertheless, the association between parent MHP and child IQ suggests that clinicians should attend to the well-being of parents, especially those whose

children have ID. Efforts to minimise the risk of MHBP among autistic children and teenagers need to be multifaceted with interventions and support available for children, parents and schools.

Work package 4: treatment

Methods

This was a pilot feasibility RCT comparing a 12-week group behavioural parenting intervention [Predictive Parenting (PP)] to an attention control [psychoeducation (PE)]. Parents of 62 4- to 8-year-old autistic children were randomised to PP (*n* = 31) or PE (*n* = 31). The primary outcome was a blinded observational measure of child behaviours that challenge. Secondary outcomes included observed child compliance and parenting behaviours; parent- and teacher- reported child emotional and behavioural problems; self-reported parenting practices, parental stress, self-efficacy and well-being.

Key findings

Recruitment, retention, completion of measures, treatment fidelity and parental satisfaction were high for both interventions. There were no significant differences on other measures.

Limitations

Predictive Parenting was compared to an active intervention of PE delivered by experienced clinicians. Although recommended by many professionals, PE is not routinely available as treatment as usual and thus this comparison does not reflect the potential augmentation of current practice that could be conferred by PP. This is a pilot feasibility trial that requires a definitive evaluation including estimation of cost-effectiveness.

Interpretation

Predictive Parenting is an acceptable and feasible intervention to deliver. The MHBP it is tackling are important targets for intervention.

Conclusions

We have shown that MHBP in autistic people at different time points show high levels of persistence in the same individuals, highlighting the importance of early recognition and targeted, autism-specific interventions. Furthermore, our finding that young autistic adults may have difficulty recognising MHP as distinct from autistic symptoms increases the need for autism-specific instruments to detect MHBP, such as the ACB. Co-design of instruments with autistic people and their parents may be important in using language and formats that assist autistic people and those informing on their symptoms to provide accurate accounts leading to timely help. Interventions should be offered from early childhood and more work is required to identify the most effective and cost-effective treatments.

Study registration

This study is registered as Current Controlled Trials ISRCTN91411078.

Funding

This award was funded by the National Institute for Health and Care Research (NIHR) Programme Grants for Applied Research programme (NIHR award ref: RP-PG-1211-20016) and is published in full in *Programme Grants for Applied Research*; Vol. 13, No. 5. See the NIHR Funding and Awards website for further award information.

Synopsis

Research summary

Autism is a common disorder, occurring in more than 1% of the population world-wide[1] with lifetime support costs estimated at £1.5 million per individual.[2] The focus of this research programme was to ultimately enhance outcomes for autistic people by improving their mental health. At the time of the application, the high prevalence and persistence of mental health problems (MHP) among autistic people had only recently been appreciated among researchers and less so by clinicians.[3] In particular, there was an absence of clinical response to this public health concern, including lack of knowledge of how to identify and treat mental health and behavioural problems (MHBP) in autistic people of all ages and how to target prevention and intervention to those most likely to develop severe and or persistent problems.[4]

With these factors in mind, our programme had the following aims:

1. Develop and evaluate a measure of MHP in autism, suitable for the full age range, to assist professionals in detecting these problems, identifying their causes and monitoring treatment/intervention. (Work package 1 – instrument development.)
2. Understand and describe the emergence of MHP from the perspectives of adolescents, young adults and parents/caretakers; their experiences of seeking help; and the impact of these on their lives. (Work package 2 – biographies.)
3. Identify the personal, family and wider environmental risk/protective factors for MHBP that persist/escalate from childhood to adolescence so that future interventions can be personalised to target those at greatest risk. (Work package 3 – predictors.)
4. Develop and assess the acceptability and feasibility of delivering a novel intervention for parents of recently diagnosed children aimed at reducing MHP, enhancing child and family functioning and decreasing stress. (Work package 4 – treatment.)

The timings and interplay between the different work packages (WPs) are depicted in *Figure 1*. Importantly, both outputs from Instrument Development and Biographies informed the research in Predictors and Treatment. Specifically, the instrument developed [Assessment of Concerning Behaviour (ACB)] was used in Predictors Wave 3 and as a secondary outcome measure in Treatment. Conversely, the Wave 3 ACB data from predictors provided the validation

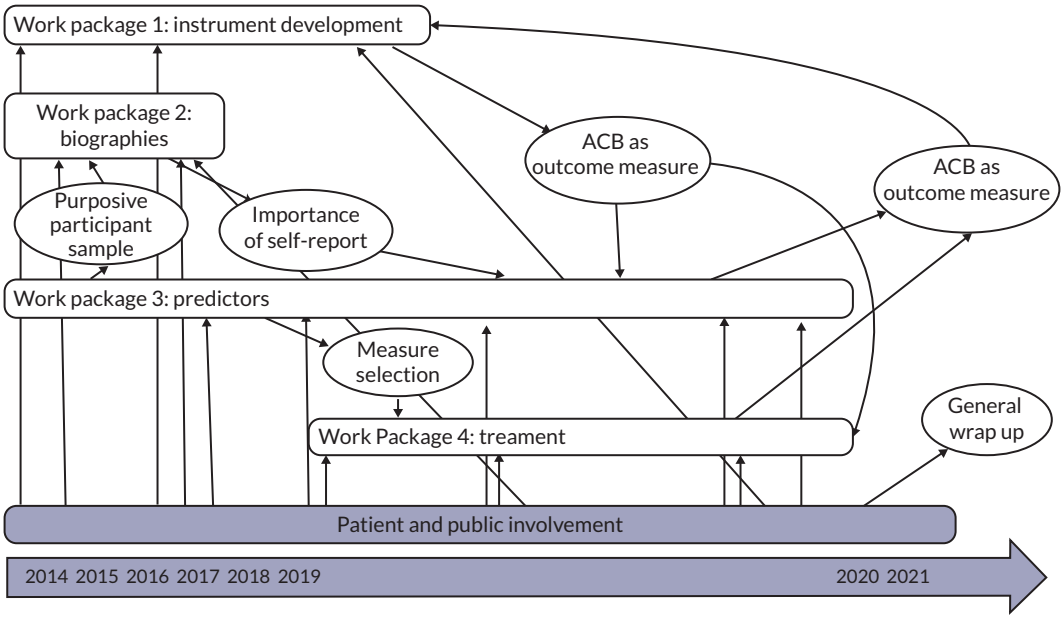

FIGURE 1 Inter-relationship between WPs.

sample for the psychometric analysis in Instrument Development. Themes identified in Biographies informed the choice of additional measures for Predictors Wave 3. The measures selected and analysed for Waves 1 and 2 Predictors influenced the choice of instruments used in Treatment, both for baseline characteristics and outcome measures. Wherever possible and appropriate, we aimed to use overlapping measures in order to allow us to compare and contrast across studies and draw wider inferences where appropriate.

Research pathway

Programme oversight and organisation

A Programme Steering Committee, chaired by Prof Jonathan Green (University of Manchester), included Prof Sue Leekam (University of Cardiff), Dr Matthew Sydes (Biostatistician, University College London) and two members of the patient and public involvement (PPI) panel (one parent of an autistic child, one autistic adult, varying for different meetings) were invited to every meeting. For most meetings, the National Institute for Health and Care Research (NIHR) Programme Manager also attended. The Programme Steering Committee met on four occasions: January 2015, October 2016, January 2018 and October 2018. Following consultation with the funders, we decided to set up a separate Trial Steering Committee (TSC), which was chaired by Prof Alan Stein (University of Oxford) with Dr Jacqui Rodgers (University of Newcastle) and Dr Matthew Sydes (University College London) as academic members. Two independent parents (separate from the PPI panels) were lay members. Following review of the procedure for other pilot feasibility trials and after consultation with the NIHR Programme Manager, it was agreed not to have a separate Data Monitoring Committee as this was a pilot feasibility trial and the TSC included a biostatistician.

The TSC met at the outset to approve the protocol (September 2017), prior to analysis to approve the statistical analysis plan (SAP; January 2019) and prior to sign-off of the SAP and following completion of statistical analysis to review the findings and discuss their interpretation (October 2019).

Senior Investigator meetings included the leads of all four WPs (WP1: Santosh, Simonoff; WP2: Beresford, Baird; WP3: Charman, Simonoff; WP4: Scott, Charman), as well as the PPI lead (Slonims), the trial statistician (Pickles), the health economics lead (Knapp) and dissemination lead (Povey, NAS). Pre- and post-doctoral researchers were encouraged to present findings and MSc and BSc students attached to the programme were also encouraged to attend.

Alterations to research design and aims

There were no alterations to the Programme's overarching aims. Changes in protocol to address time frames and new knowledge were as follows:

1. WP1, Instrument Development: Delays in acquisition of sufficient data to undertake the psychometric validation meant that the instrument was deployed in WP3 and WP4 prior to validation. Data from WP3 were added to the final validation. This
2. In WP 3, Wave 3, we included several experimental measures aiming to tap underpinning anxiety, intolerance of uncertainty and frustration. We also added self-report questionnaires in Wave 3, completed by a subset of young people (YP) thought to have the verbal skills to give reliable information.

Changes in research design were discussed and agreed with the Programme Steering Committee.

Work package 1: instrument development

Overview

In this WP, we developed and validated a new instrument to provide improved detection of MHBP in autistic people from childhood through to adult life. Initial work involved: scoping the literature; undertaking focus groups on item content and response format with autistic people, their parents/caretakers and mental health professionals; and completing cognitive interviews to check item understanding. Good reliability and validity of the instrument, called the ACB, was demonstrated in a primary sample of 225 parents and confirmed in a secondary sample of 210 parents.

The protocol[5] and validation of the instrument have also been published.[6]

Introduction

Observational studies reveal a number of comorbid psychiatric conditions and concerning behaviours in autistic people.[7] These include anxiety, phobias, obsessive–compulsive disorder (OCD), depression, suicidal ideation or attempted suicide and sleep disorders. Behavioural problems such as oppositional defiant disorder and coexisting neurodevelopmental disorders such as attention deficit hyperactivity disorder (ADHD) are also common.

Autistic people and their families report difficulty in differentiating core autistic symptoms from coexisting MHBP. Furthermore, clinicians may lack confidence in identifying and evaluating these concerns. As a result, many mental health services exclude autistic people, despite the injunction against this from the Department of Health and National Service Framework.[8] Clinicians may also struggle with identifying and treating coexisting MHBP in autistic people, as these can present very differently from manifestations in typically developing (TD) populations.[9]

Early and accurate identification of concerning behaviours in autistic people is paramount given that these may be more amenable to intervention compared to core autistic symptoms. Furthermore, established concerning behaviours may be more resistant to treatment and late diagnosis of MHBP is related to increased risk of hospitalisation.[10]

To the best of our knowledge, no single scale existed that is autism sympathetic, includes self-report versions, and is able to screen for risk behaviours as well as MHBP. There are many challenges to assessing behavioural concerns in autistic individuals including the wide range of IQ and verbal and communicative abilities, as well as impaired emotional literacy and the complex interplay with core symptoms of autism that impact on behaviour.

This study therefore aimed to develop a comprehensive measure that takes account of the different manifestations of MHBP and risky behaviours in autistic people and the ways in which they describe and recognise these manifestations.

Challenges

We experienced difficulties with recruitment to the instrument completion stage of his study, especially from non-clinical populations. The aim had been to include autistic children, YP and adults, parents/caretakers and teachers, ascertained from both clinical and non-clinical settings. This was because clinical care for autistic children and young people (CYP) focuses on those with mental health issues and only including clinical populations would not give the range of item endorsements and symptom profiles that reflect the entire autistic population. To identify CYP through non-clinical routes, we approached London schools that were described as special schools catering for autistic students. However, this meant that the route to consent was indirect, requiring schools first to approve the project and then to contact parents for their consent.

To identify autistic adults who might participate, we contacted a national autism research database. However, access was delayed and a very small number of adults participated. NIHR Clinoical Research Network engagement facilitated recruitment.

Some parents were reluctant to have their autistic CYP complete the instrument. We have not experienced this difficulty before. Some parents pointed to item content, including that around risky behaviours and mental health symptoms, expressing a concern that these questions might elicit new maladaptive behaviours. The item content of this instrument includes more severe mental health symptoms and risky behaviours than some questionnaires. We reflect on the potential benefits and limitations of this.

Changes to this study

In the application, we envisage the measure being named SMART (Severe Maladaptive Behaviour Rating Tool). Discussion with our PPI panels led to the suggested alternative name.

We planned to examine the questionnaire's sensitivity to symptom change by undertaking a follow-up of clinical participants ~4–6 months after initial completion. However, we decided to focus on obtaining sufficient test–retest data to establish the instrument's reliability. It was unclear how many of the participants were in active therapy that might lead to meaningful symptom change and whether there was available another, gold standard measure of symptomatic change against which to evaluate the ACB.

The WP3 ACB data were used in the psychometric evaluation of the instrument, as described below.

Methods

Literature review

A systematic review of the peer-reviewed literature of co-occurring psychiatric problems in autistic individuals identified relevant measures from which a list of symptoms and behaviours was identified for possible inclusion in the instrument. Following feedback from a clinical panel, the review led to a list of 220 potential questionnaire items that covered 53 domains of behaviour and functioning were identified as potential items.

Focus groups and instrument development

Five focus groups were conducted with autistic CYP (n = 4), autistic adults (n = 4), parents/caretakers of autistic individuals (n = 5), clinicians from relevant mental health settings (n = 5), and teachers with experience of working within special educational settings (n = 5). Following open-ended questions, participants were also presented with the 220 draft questionnaire items from the literature review and were asked for their feedback on the relevance and importance of the domains and the wording of items. Domains considered to be less important were excluded. Feedback was also sought on a range of response scales to be incorporated into the measure. Focus groups suggested and provided feedback on behavioural examples for each item. Parallel versions of the instrument were developed for parent, teacher and self-reports.

Instrument testing

Main sample

We invited parents of autistic CYP aged 7 years or above ascertained through clinics, specialist schools for autistic CYP or parent support groups to participate in the study. The questionnaire battery comprised the newly developed ACB, other standardised questionnaires for validation purposes and a treatment report form detailing current medication/therapy/intervention status.

Participant medical records were accessed to confirm autism diagnosis and results of cognitive (IQ) testing. For CYP where IQ results were unavailable, a researcher completed the Wechsler Abbreviated Scale of Intelligence-2™ (WASI-2™[11]) from which a developmental quotient (DQ) indexing IQ was generated. CYP with documented or strongly suspected intellectual disability (ID) were not asked to complete self-report questionnaires. Where self-report questionnaires were administered at home, parents were advised to support their autistic CYP if necessary but not to influence their answers to questions. With parental consent, teachers were also invited to complete the ACB.

Test–retest reliability

A subset of participants complete the ACB again 1 week after their initial completion to provide a measure of test–retest reliability.

Measures for convergent and discriminant validity

Corresponding scales from the Achenbach System of Empirically-based Assessment (Achenbach and Rescorla[12]), the Aberrant Behavior Checklist (Aman[13]), Home Situations Questionnaire – ASD version (HSQ-ASD; Chowdhury *et al.*[14]) and Modified Overt Aggression Scale (MOAS; Yudofsky *et al.*[15]) were administered.

Secondary sample

As part of WP3, ACB data were collected in the QUEST cohort follow-up study at Wave 3 from parents of autistic YP. These data were used in confirmatory factor analysis (CFA) following exploratory factor analysis (EFA) results on the primary sample.

Statistical analysis

The analytic approach is described in detail in our publication and is only summarised here. The following steps were followed:

1. Identify problematic items, pre-defined as items showing high floor or ceiling effects in the response frequencies, low test–retest reliability or very low internal consistency. Items meeting any of these criteria were reviewed by the Improving Mental Health for Autistic People (IAMHealth) clinicians and statistician to determine whether they should remain in the scale. The final ACB scale for further analysis consisted of 35 items.
2. Item factor analysis. EFA for categorical items (item factor analysis) used parents' data from the primary sample to identify problematic items by factor loading pattern. Then both EFA and CFA based on these results was undertaken in the secondary QUEST sample.
3. Assessment of reliability and validity for the final solution for each factor separately. Reliability was assessed with Cronbach's alpha coefficient. Stability was evaluated with Cohen's weighted kappa for each ordinal categorical item along with the percentage of agreement. To evaluate the validity of the total factor scores, Pearson correlation coefficients, *t*-test and one-way analysis of variances were used. DQ and autistic symptoms, measured on the Social Communication Questionnaire (SCQ; Rutter *et al.*[16]) were included to examine whether these factors influenced symptom severity. We compared the ACB according to DQ < 70 and ≥ 70 and the correlations between measures compared across groups.

Results

Figure 2 shows the participant recruitment of parents, children (< 12 years) and adolescents (12–18 years) into the primary sample. The parental version was completed by 225 parents. The secondary sample comprised 210 parents.

In terms of participant characteristics, for parent-reported ACB the age of their CYP was M_{age} = 12.8 years [standard deviation (SD) 3.3]; range 7–29; 75.1% were male, and ethnicity was 84.5% white, 5.5% black, 2.7% Asian and 7.1% other. The QUEST sample were M_{age} = 15.4 years, SD = 1.11, range = 13.2–17.9; ethnicity comprised white 49.5%, black 26.1%, Asian 2.8% and other 21.6%; 17.1% were female. We focus here on results from the parental reports.

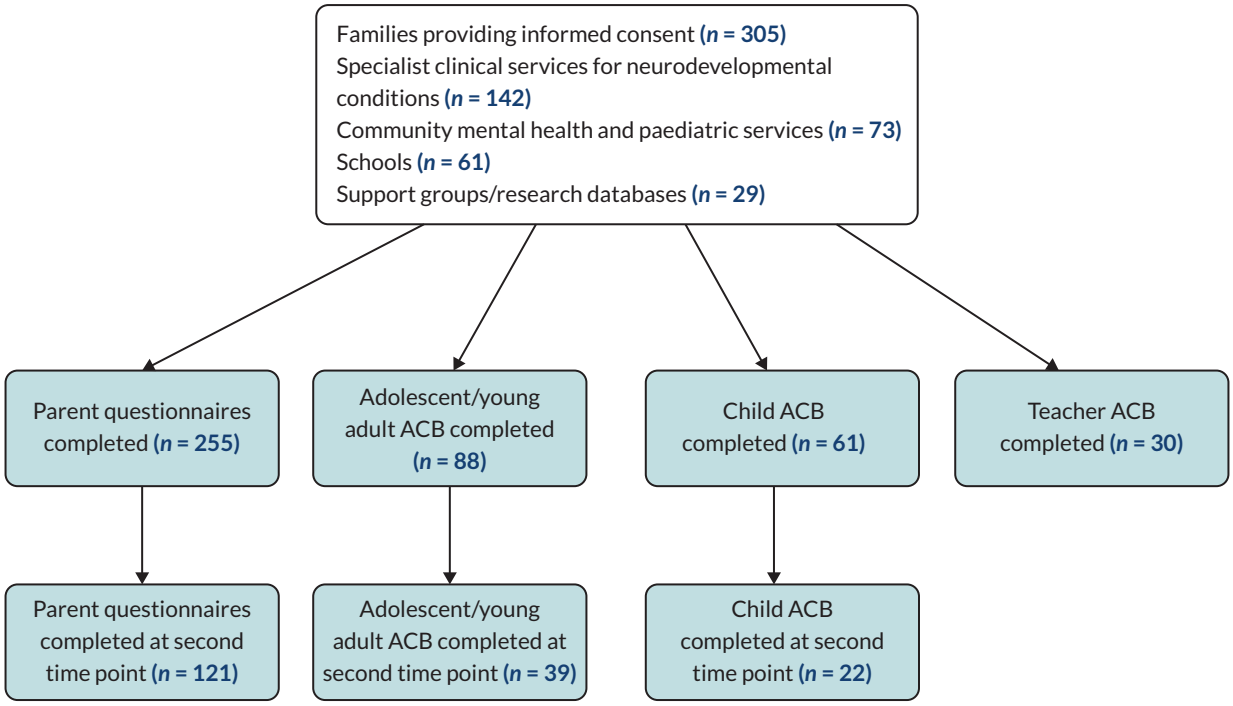

FIGURE 2 Participant flow into ACB primary sample.

Item endorsement

Item ratings were scored from 0 (not at all) to 4 (very much). There was a tendency for items to receive extreme ratings; in the primary sample the modal response was four for eight items and nine for the rest. In the secondary (population-based) sample, all bar one item had a modal response of zero.

Factor analysis

The EFA revealed a two-factor solution providing good-fit statistics and conforming to the conceptual framework of internalising (emotional) and externalising (behavioural) factors. CFA with the QUEST sample suggested a good fit of the same two-factor model on two of the three fit metrics. Lower item endorsement in the QUEST population-based sample was thought to explain the poorer fit, but the 'problematic' items were retained because of their clinical importance. The final item selection and their factor assignment are shown in *Table 1*.

Reliability and validity

All measures of item reliability showed good psychometric properties. Cronbach's alpha was 0.86 and 0.88 for the internalising and externalising scales, respectively. The correlation between the factors was 0.50, consistent with the frequent co-occurrence of emotional and behavioural symptoms. Correlations with relevant scales and subscales of other measures indexing internalising and externalising symptoms show the expected pattern of associations, with correlations on same domain measures ranging from 0.56 to 0.83 and cross domains ranging from 0.36 to 0.46. Correlations with autistic symptoms (0.26, 0.30 for internalising and externalising factors) were small to moderate.

In comparing those with DQ < 70 versus DQ ≥ 70, the only significant differences were between the auto-aggression subscale of the MOAS and ACB externalising was smaller in the DQ ≥ 70 group compared to the DQ < 70 and no parent estimate of DQ groups (r = 0.29 vs. r = 0.53 and 0.57 respectively).

Summary

We achieved our primary objectives of developing a new instrument to measure MHBP in autistic people. The psychometric properties of the instrument were established in a primary sample of 255 parents of autistic people aged

TABLE 1 Results from EFA on parent-reported ACB, primary sample

Internalising items	Externalising items
8. Spend a lot of the day worried	26. Hit or hurt people
15. Scared when meeting people that don't know	13. Damage items
27. Aches, pains and/or lack energy	24. Refuse to follow rules
5. Dislike him/herself	46. Does things without thinking
20. Thoughts and beliefs which are not real	32. Enjoy hurting people or animals
19. Hard to be happy with self or other people	21. Shout at or threaten
34. Ritual that must do to stop feeling upset	14. Too much energy
31. Worry about getting fat	12. Mood changes very quickly
45. Think and behave in set way	40. Control people
43. Dislike being separated from certain people	22. Does not care to upset
36. See or hear things that others cannot	16. Short attention span
3. Nightmares	10. Hurt or injure
29. Scared of animals or situations	33. Eat too much
25. Senses seem to bother	9. Do not acceptable things on the internet
18. Stopped enjoying things or lost interest	6. Movements speeded up or slowed down
39. Hard to wake up sleepy during the day	28. Sexual behaviours bother others
1. Part of body hurts or itches	
7. Very interested and think about a lot of time	
42. People force him/her to do things that doesn't want	

7–29 years and its structure validated in the secondary, well-characterised, population-based sample. Unlike many questionnaires, it is specifically designed to detect clinically relevant symptoms. Thus, for many of the individual items, the modal response was zero, even though autistic individuals have high rates of co-occurring psychiatric conditions.[7] Despite the relatively low endorsement rates of individual items, the psychometric evaluation indicated that the internalising and externalising scales were robust, validating across samples and showing convergent and discriminant validity with independent measures. It is reassuring that the scales were not strongly influenced by either intellectual level or autistic symptoms.

Successes

The instrument's development was supported by a comprehensive literature review to identify the full range of potential items. Coproduction was achieved by input from focus groups comprised of autistic people, parents, teachers and clinicians who played an essential role in reducing the item pool. Feedback from autistic people and their parents highlighted the need for clarification on item meaning. The specific behavioural exemplars were generated in part by autistic people and their parents. This questionnaire item format may have played a role in eliciting the robust psychometric properties reported in this study.[17,18]

Limitations

To date, psychometric properties have only been established in the parent-reported version of the ACB. This version was prioritised for data collection and psychometric evaluation because parents/caretakers of autistic people are often the most important informants, even among autistic adults.[19] Next steps should be to establish the psychometric properties of the self- and teacher-report version.

An original aspiration had been to determine the instrument's sensitivity to change in MHBP. To achieve this, it will be necessary to follow a clinical sample serially and also to compare changes in ACB scores to a gold standard measure. Currently, there is no consensus regarding gold standard measures of clinical change in MHBP for autistic populations.

Future plans

Further research should establish the full range of psychometric properties for self-, teacher and clinician reports including the clinical cut-offs for the internalising and externalising scales of the ACB. This could be achieved using additional data from the QUEST cohort.

Work package 2: biographies recognising mental health problems and help-seeking among autistic young adults

The key findings of this WP are published in Coleman-Fountain, Coleman-Fountain.[20–22]

Overview

To explore how autistic young adults understand and manage their mental health. A particular interest was in the way in which autistic people and their parents/family members understand mental health within the context of an autism diagnosis, and their views about accessing mental health services.

Introduction

Mental health problems in autistic people often become most apparent in adolescence or early adulthood. However, for autistic YP and young adults to be able to manage their mental health, including accessing, when appropriate, mental health services, they (and their parents) need to understand their mental health within the context of an autism diagnosis.

Research on barriers to mental health help-seeking among autistic people is very limited but suggests that several factors may be at play. First, it may be difficult to differentiate ongoing distress in everyday life that is related to core autistic symptoms (e.g. sensory atypicalities, unpredictability) from emerging mental health symptoms (e.g. anxiety). This may be exacerbated by impairments in emotional literacy (alexithymia) and differences in communication style, hinder recognition and sharing experiences with others. We also know that autistic people are more likely to find access to primary health care difficult to negotiate and may avoid consultations as a result.[23]

Research aims

This study explored how autistic young adults and their parents understand and manage emotional distress and mental health difficulties.

Methods

The sample was recruited from the Special Needs and Autism Project, a well-characterised cohort of autistic people followed longitudinally from childhood to adult life, including assessments of mental health.[24,25] Thirty-six autistic young adults without learning disabilities, aged 23–24 years were approached who had a history of some MHBP but no current severe or distressing symptoms. Nineteen completed the study alongside their parents who participated in parallel interviews. In-depth, semistructured interviews explored how they understood and managed their own MHP as well as any use of mental health services. Thematic analysis identified a range of themes, which were validated within the research team to generate a framework, and this was shared with the PPI panels.

Results

Anxiety and depression were the most commonly reported MHP, and the key findings pertain largely to these domains.

1. Participants expressed beliefs that their mental health difficulties differed from those of non-autistic people by being longer in duration, more frequent or more intense, and triggered by autism-specific features such as social situations or uncertainty.
2. Participants expressed the view that autism increased their vulnerability to MHP and that autistic traits make it more difficult for them to manage these symptoms.
3. All had developed strategies to self-manage or minimise the impact of emotional distress. For almost all, this without any support from mental health professionals. In addition, it was typically a very private endeavour or struggle, with little recourse to informal sources of information or support, such as autistic peers, friends or family. As a result, mental health difficulties could remain hidden from others.
4. Very few had ever sought or received professional help with their mental health. Some of them expressed concerns that clinical services may not be appropriate for them as autistic people. Some had doubts that mental health interventions could offer them any benefit. Unhelpful or negative experiences of mental health when they were younger reduced increased reluctance to seek help.
5. Where support with mental health was sought (via, initially, contact with primary care), parents were important in influencing this choice.

Summary

Our findings indicate that the autistic young adult participants viewed their mental health difficulties as an inevitable accompaniment to autism. Making sense of, and learning to manage, emotional distress was something which took place with no, or very limited, input from formal or informal sources of support. Typically, study participants were sceptical about the value and appropriateness of available mental health services and reluctant to approach professionals to access these.

Given that autistic people are at substantially increased risk of MHBP such as anxiety and depression, these findings raise concerns that autistic YP and young adults may not be sufficiently informed and knowledgeable about mental health and how being autistic may affect this. They also need effective mental health self-management skills (including knowing when to seek mental health support). However, our findings highlight a deficiency in preventive mental health support for autistic YP and young adults, some of which may need to be parent-directed. In addition, a number of barriers to accessing both primary and secondary care were identified, a key one being whether generic (i.e. non-autism-specialist) services were appropriate.

Successes

Recruitment to the study was very good. The interviews with the autistic young adults generated rich information. The study offers new insights into how autistic young adults make sense of their emotions and mental health, how they manage their mental health, and their views about mental health services.

Limitations

The focus of the study was on young adults with IQ > 70. While representing the characteristics of the cohort from which they were recruited, women, and those from minority groups, are under-represented. For study design and ethical reasons, those with current severe MHP were not included. Their experiences of mental health services could be different.

Work package 3: predictors of mental health and behavioural problems

Overview

This WP aimed to identify risk and protective factors for MHBP in autistic adolescents. This is a time when MHBP can become severe, with impacts on education, family life, community participation and longer-term opportunities. We wanted to provide more accurate prediction of which CYP will experience persistent/accelerating MHBP and should therefore be prioritised for early interventions before these difficulties become entrenched. To achieve this aim, we utilised a population-based cohort of autistic CYP first assessed at ages 4–8 years (Wave 1) who were entering adolescence, when MHBP become particularly problematic. We aimed to examine the child, parent/family and wider environmental characteristics that predicted MHBP in mid-to-late adolescence. A particular interest was to understand the interplay between family factors and parental MHP and MHBP in their autistic offspring. Data previously collected at Wave 1 focused predominantly on child characteristics and we augmented these with measures at Wave 2 with information about parental mental health, parenting style and wider social and family environment. At Wave 3, both questionnaire and diagnostic information was collected to determine MHP and diagnoses in YP as the primary outcomes from this work. Due to reduced capacity, we were not able to complete analyses exploring the economic impact of child MHBP. A nested qualitative study captured parents' accounts of the child's mental health trajectories through childhood and adolescence and their views of the factors which influenced the development, exacerbation, maintenance or resolution of MHBP.

Introduction

Although research consistently shows higher rates of MHBP in autistic people compared to TD populations,[3,7,26] as well as higher rates of co-occurrence across domains,[3,27] relatively few studies have examined the patterns of stability and change over time and the factors that influence these. In a previous longitudinal analysis, we showed stability over a 4-year period within the domains of conduct, emotional and ADHD symptoms.[25,28] Among the longitudinal studies in autism examining the course of mental health and related problems from childhood/adolescence to adult life, three studies report an overall decline in observable and maladaptive symptoms[29–31] while a fourth study found increased anxiety and depression symptoms from age 13 to 24 years.[32] Much less is known about stability and change in MHBP from early childhood to adolescence. Qualitative evidence on the views and experiences of parents of autistic teenagers is limited and predominantly concerned with transition.[31,33–35]

Parental and family factors

Parents of autistic children show greater levels of both MHP and parenting stress (PS) compared to both the general population and to parents of children belonging to other clinical groups.[36] The level of MHBP in autistic children is associated with parental MHP and PS in both cross-sectional[37,38] and longitudinal research.[39]

Studies in TD and other clinical populations show predictive relationships between suboptimal parenting style (e.g. high levels of criticism, lack of clear expectations and inconsistent application of management strategies) and offspring MHBP.[40,41] Cross-sectional research suggests parents of autistic adolescents may be more 'lax' in their style (fewer rules, less discipline) than parents of TD children, and this parenting style is associated with offspring behavioural problems.[42] One longitudinal study found predictive effects for parental criticism, low warmth and praise on overall behaviour problems from adolescence to adult life.[43]

While longitudinal studies have begun to identify predictive relationships, it is recognised that parents and offspring exert reciprocal, interactive effects on each other's behaviours whereby more challenging behaviours in children may lead to more negative parenting styles. This has been demonstrated in TD and other clinical populations but is less well understood in autistic populations. Much of the available research focuses on the adolescent and early adult period,

although we know that parents spend most time with their children when they are young and likely exert significant effects during early and mid-childhood.

Child characteristics

Autistic traits potentially confer a risk for different domains of MHBP. Common associated differences in autistic people include higher rates of ID (up to 50% compared to ~3%; Charman *et al.*[44]), and decreased adaptive function (everyday living skills; Tillmann *et al.*[45]). IQ and adaptive function in mid-childhood predicted adolescent ADHD symptoms.[28] Impairments in executive function are associated with emotional problems[46] and ADHD symptoms,[47] while behavioural symptoms are linked to social cognition impairments.[48]

Other factors influencing mental health and behavioural problems

Few contextual factors have been associated with MHBP and their persistence over time. Of note, parental education predicted higher levels of behavioural problems and neighbourhood deprivation was linked to behavioural problems in adolescence (but also relative improvement in early adulthood).[3,25]

Changes

Two PhD students undertook their empirical work on the QUEST cohort, which allowed us to make several beneficial additions.

1. *Systematic review* of the relationship between parental MHP/PS and offspring MHBP in autistic children. Isabel Yorke undertook her PhD on this topic and completed a systematic review and meta-analysis of the relevant literature.[49] This revealed small to moderate pooled correlations between parental MHP/PS and child MHBP, which were reduced when shared method variance was accounted for. Longitudinal studies showed mixed evidence for bidirectional predictive relationships between child MHBP and parent variables.
2. *Development and implementation of a novel parent–child interaction measure (PCI) at Wave 2*. To address the concerns of shared method variance, we developed a new set of tasks. We collaborated with Prof Dale Hay from Cardiff University. Based on her experience we developed two tasks tapping cooperation during a joint activity and parental strategies to maintain emotional regulation. We developed tasks suitable for childhood to early adolescence and for non-/minimally verbal versus verbally fluent CYP. We demonstrated inter-rater reliability and discriminant and convergent validity. The PCI took about 20 minutes and was administered to the intensive sample (see below, *Participants*).
3. *Addition of experimental measures at Wave 3*. As part of our aim to address the issue of shared method variance and increase the modalities for assessing MHBP in autistic CYP, we included several experimental tasks in Waves 2 and 3. We included experimental tasks designed to tap elements of core autistic symptoms: social cognition (theory of mind, emotion recognition); cognitive flexibility and sensory atypicalities. Eye tracking and electroencephalography were used, in order to limit the dependence on verbal responses. Findings from these tasks formed a major component of the PhD dissertation of Virginia Carter Leno and many of the results have been published Carter Leno; Carter Leno; Carter Leno.[50–52]

For Wave 3, we included two experimental tasks designed to tap anxiety (attention to threat stimuli, intolerance of uncertainty) and one eliciting frustration. These tasks were combined with physiological measurement of Heart rate and galvanic skin response, to index arousal level. The results with respect to indexing irritability have been published Carter Leno.[53]

Challenges

The greatest challenge of this WP was the tracing of the sample and retention over multiple Waves. At Wave 1, we had not obtained consent to re-contact the cohort for future research. Our ethics approval at Wave 2 allowed us to write to participants to request their consent for further involvement. However, where we received no response from the family and/or where they appear to have moved address, we had to seek consent from the Confidential Advisory Group

to use NHS records to identify a new address. This resulted in final Clinical Advisory Group approval in February 2021, after data collection had been completed. It is, nevertheless, advantageous to have this approval in case the cohort is followed up in early adult life.

The wide ability range meant that different forms of measurement were optimal for those with average intelligence to mild ID and fluent verbal communication compared to those with severe ID and very limited communication. We decided to add self-report measures of MHBP at Wave 3 but limited these to the former group.

Methods

Participants

QUEST[27] is a longitudinal community sample recruited at age 4–8 years and followed up throughout adolescence as part of this Programme. The target population (N = 447) for the study was all children with a clinical diagnosis of autism born between 1 September 2000 and 31 August 2004, living in two London boroughs. The 277 children participating in Wave 1 were split into an 'intensive' (n = 101) and an 'extensive' (n = 176) study group. The intensive group was selected to over-represent females to allow for sex comparisons. Males were randomly selected, stratified to provide equal numbers on the following characteristics (1) IQ (< 70/≥ 70); (2) child's age (4.5–6.7/6.8–9.9 years); and (3) SCQ total score (< 21/≥ 22). This sampling structure was retained for the subsequent two waves, in which the intensive sample were invited to participate in in-person assessments (including the experimental tasks at Waves 2 and 3 and parent-reported research psychiatric interviews at Wave 3).

Wave 2 of the study was conducted at ages 11–15 years, and Wave 3 at ages 13–17 years. All participants had a clinical diagnosis of autism at recruitment, and the intensive group had their diagnosis confirmed at Wave 2 with the Autism Diagnostic Observation Schedule-2[54] [and a subset (n = 53) also with the Autism Diagnostic Interview-Revised (ADI-R; Rutter *et al.*[55])]. Participant flow across the three waves is shown in *Figure 3*.

Measures

For QUEST, all non-experimental measures across the data collection Waves are shown in *Appendix 1*.

Analysis

Different methods have been used across the varying analyses, including simple correlation and t-tests for descriptive purposes, linear, logistic and ordinal logistic regression for predictive analyses and structural equation modelling (SEM) to account for multiple relationships and test model fit. Analyses were undertaken in Stata® (StataCorp LP, College Station, TX, USA; Stata Statistical Software: Release 15; 2017)[56] and Mplus (Muthén & Muthén, Los Angeles, CA, USA).[57] For analyses where data are only available on the intensive sample, inverse probability weights or auxiliary variables were generated to account for the study design.

Results

The flow diagram illustrates the retention over time; 76% and 77% of the original samples were retained at Waves 2 and 3, respectively. Attrition analysis found a significant difference only for teacher data at Wave 2, where those without teacher data had a lower IQ, reflecting the greater difficulty obtaining teacher reports from special schools. At Wave 1, 33% of the sample had an estimated IQ in the ID range (< 70; this increased to 36% at Wave 2). Sample characteristics and attrition over time are shown in *Appendix 2*.

Prevalence and stability of mental health and behavioural problems and psychiatric disorders

The Preschool Age Psychiatric Assessment (PAPA)[57] was administered to the parents of 101 CYP at Wave 1; 72 of these parents completed the Child and Adolescent Psychiatric Assessment (CAPA)[59] at Wave 3. Both instruments are semistructured interviews developed by the same researchers and therefore take the same approach to eliciting and

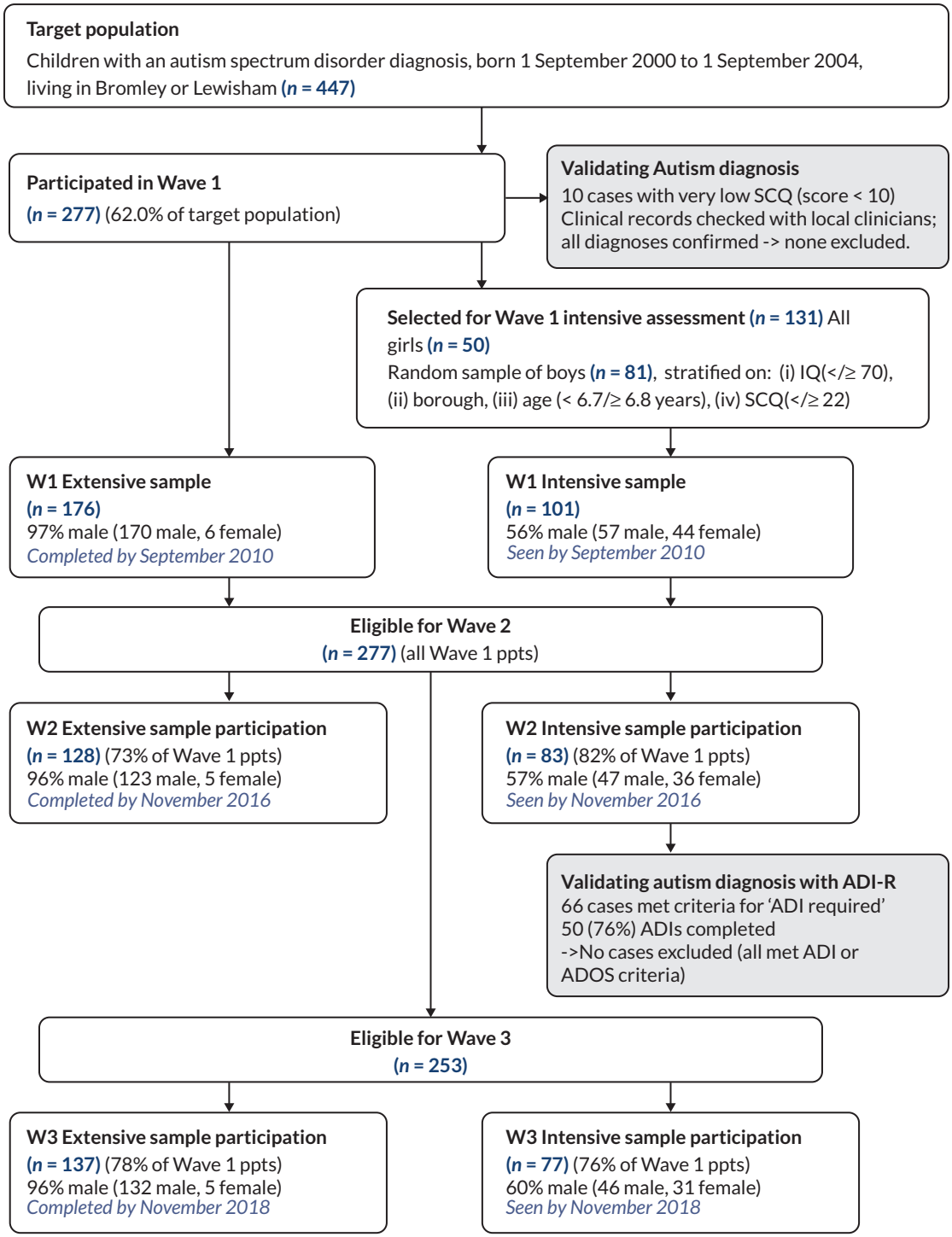

FIGURE 3 QUEST cohort flow diagram: Waves 1, 2 and 3. ADOS, Autism Diagnostic Observation Schedule.

recording psychopathology. Individual disorders were clustered into emotional (anxiety and depression), behavioural (oppositional defiant and conduct disorder) and ADHD domains. Our previous report from Wave 1 indicated that 90% of CYP met criteria for at least one disorder, with emotional disorders accounting for the majority (80%), behavioural disorders 59% and ADHD 29%.[27] The PAPA is recognised to produce high rates of emotional disorders in particular. At age 13–17 years (Wave 3), diagnostic rates remained high, although all had declined.[60] Within each domain, very few new cases emerged at Wave 3. Having a disorder at Wave 1 predicted having a disorder in the same domain at Wave 3 for emotional and behavioural disorders; for ADHD this fell just short of statistical significance. Neither IQ nor sex predicted Wave 3 diagnostic status.

We examined the within- and cross-domain continuity of symptom counts in the three domains from Wave 1 to 3.[18,61] All within-domain pathways were significant. Although patterns of cross-domain continuity were found in unadjusted models, the only one that remained significant following adjustment for other domains at Wave 1 was that from Wave 1 emotional symptoms to Wave 3 ADHD symptoms. The apparent cross-domain continuity is accounted for by high levels of co-occurrence; at Wave 1, 21% of CYP met diagnostic criteria in all three domains and 35% in two domains.

Predictors of adolescent adaptive function

Autistic people frequently have impairments in everyday functional skills when they are compared to what would be expected based on IQ[62] and the reasons for this are not fully understood. Previous research has focused on autistic symptoms in driving this effect, showing that impairments in social communication are associated with relative impairments in adaptive function.[45]

We examined the role of MHBP in early childhood (Wave 1) in predicting adaptive behaviour measured on the Adaptive Behavior Assessment System[63] 9 years later (Wave 2), while accounting for current MHBP Chandler.[64] Using SEM, we examined the impact of Wave 1 emotional, behavioural and ADHD symptoms, alongside Wave 1 IQ and autistic symptoms (social communication and restricted, repetitive behaviours separately), and the mediation through these same domains as measured at Wave 2. Our final model had a good fit and showed that Wave 1 ADHD symptoms were strongly predictive of adaptive behaviour, with a pathway through current ADHD symptoms and a further path directly from Wave 1 symptoms. Within QUEST, information on ADHD medication was limited to the intensively studied subgroup, where only a small number were currently receiving medication. The findings point to ADHD symptoms as a modifiable risk factor for poor adaptive functioning. ADHD is a common disorder in autistic CYP but remains under-recognised, despite the fact that treatment is effective in reducing symptoms.[65]

The relationship between parental mental health problems and child mental health and behavioural problems

An important question was to understand the role of parental MHP in the longitudinal pathway of their children's MHBP – both as an influence on and response to their child's state. Below we present analyses from Waves 1 and 2 on the intensive sample only, submitted as part of the PhD for Isabel Yorke.

Use of parent- and teacher-reported child MHBP accounted for shared method variance and parent's reported on their own MHP measured on the Kessler 10-item psychological distress scale (K10).[66] Each MHBP domain was explored independently.

The exemplar full model is shown in *Figure 4*. This includes the contribution of child IQ and autistic symptoms and allows all characteristics to be correlated at Wave 1. The latter two are largely 'control' variables, to provide more accurate path estimates. While the parent informant is mostly the mother at both waves, teachers will be different.

Best-fitting final models are depicted below.

For emotional symptoms (*Figure 5*), there was reasonable within-domain stability for parental MHP and child emotional symptoms, interestingly for teacher as well as parental report. Cross-lagged pathways are of particular interest in understanding reciprocal effect but where not significant are removed. The prediction from teacher Wave 1 emotional symptoms to Wave 3 parental MHP was unexpected.

For behavioural symptoms, domain stability was seen for parental MHP and parent-reported but not teacher-reported behavioural symptoms. Wave 1 parental MHP predicted later child behaviour problems as reported by both parents and teachers. This effect suggests the finding is likely robust (*Figure 6*).

For ADHD symptoms (*Figure 7*), there was strong stability based on parent report, but not teacher reports. There were no significant cross-lagged relationships.

These results are preliminary and underpowered, as they only make use of the intensive sample, which means that paths could be excluded from the models due to smaller effect sizes. Bearing this in mind, we found relatively little

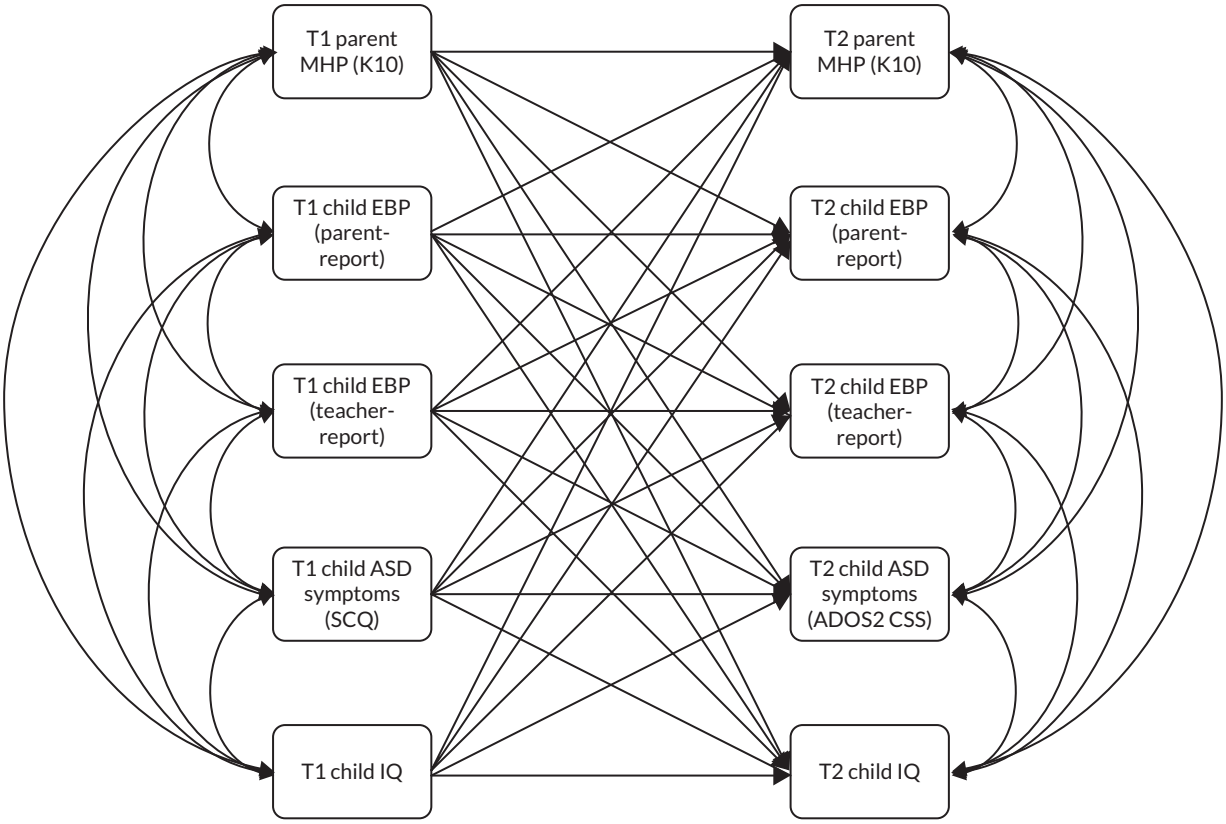

FIGURE 4 Full model for exploring the relationship between parental MHP and child MHBP. ADOS-2, Autism Diagnostic Observation Schedule – 2nd edition; CSS, calibrated severity score; EBP, emotional and behavioural problems.

evidence for cross-lagged paths suggesting longer-term influences between parental MHP and child MHBP. These models account for cross-sectional relationships at baseline and for emotional and behavioural symptoms, parental MHP are corelated with child IQ (but not child autistic symptoms), Only for ADHD was there a significant baseline association between parental MHP and parent-reported child MHBP in these full models.

The nested qualitative study

Here, the objective was to investigate how parents' views on what factors related to, or had affected, their child's MHBP during childhood and adolescence. The Unified Theory of Development[67–69] was a key theoretical framework informing study design and data analysis. The sample was recruited from QUEST cohort parents who had consented to contact about additional or follow-on studies. They were purposively sampled to ensure the following characteristics were represented: stability (or not) of emotional and behavioural problems (EBP) across waves; gender; ID; type of school (mainstream or specialist) at each wave. The target sample size was 30 and 31 interviews were achieved. The recruited sample populated the sampling frame (see *Table 2*). Data analysis was thematic, incorporating constant comparative methods.

Headline findings include:

- Adolescence was typically experienced as a turning point, with a decline observed in the child's mental well-being and emergence of new MHBP. Alongside, parents' self-perceived ability to manage MHBP and support their child was challenged and deteriorated. Parents identified the teenage years as more stressful than any other period in their child's life. Despite this, families were typically invisible to autism specialist and mental health services, even when MHBP were severe.
- Grounded in their own experiences, a wide range of risk and protective factors for MHBP were identified by parents. These included autistic traits, cognitive and sociocommunication skills, cognitive and socioemotional development,

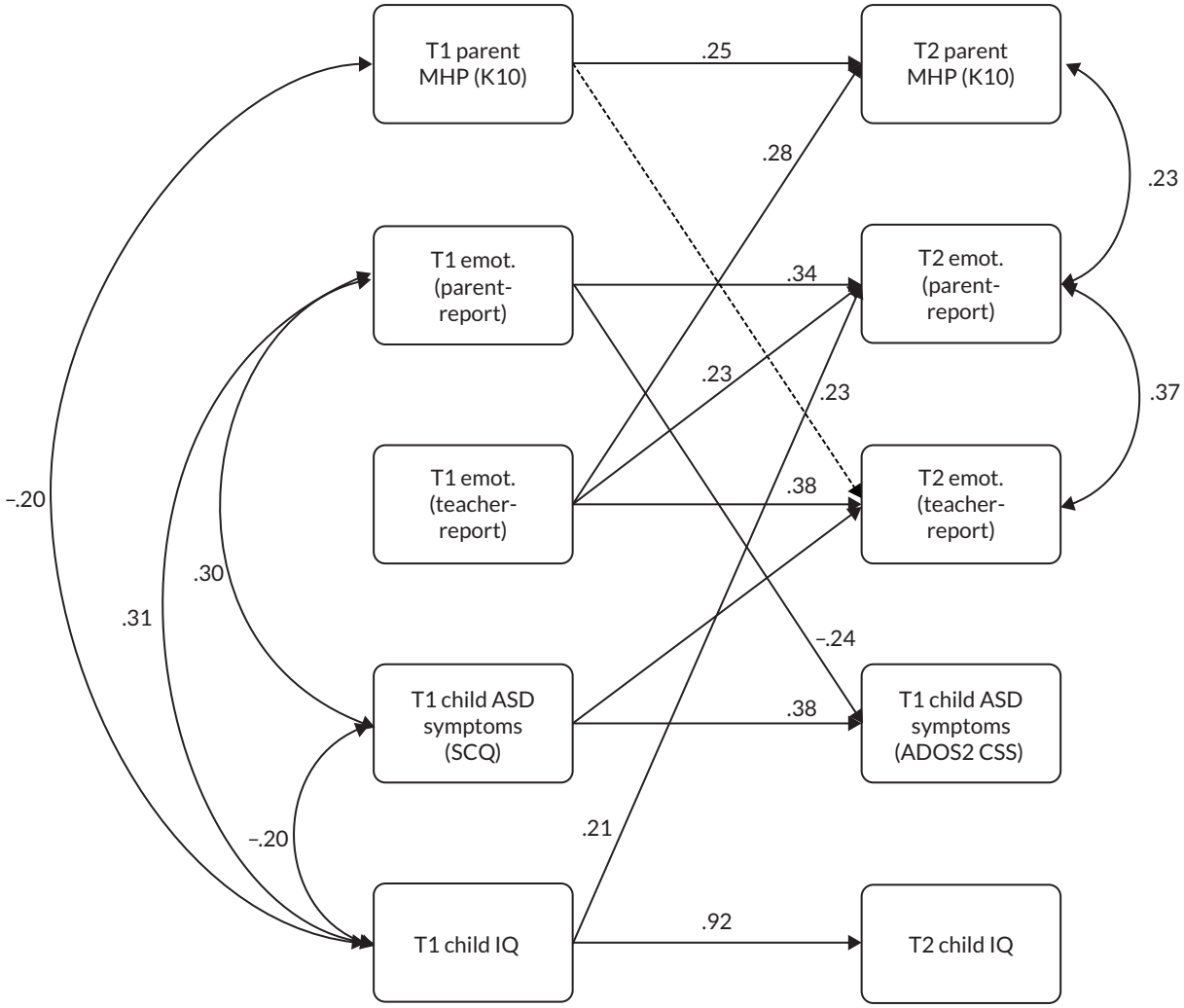

FIGURE 5 Final best-fit model for relationship between parental MHP and child emotional symptoms. ADOS-2, Autism Diagnostic Observation Schedule – 2nd edition; CSS, calibrated severity score.

physical growth and puberty, and parenting skills, family composition and resources, the school environment, access to extracurricular activities and services, and access to, and the quality of support.
- Loss of key figures in a child's life (e.g. through death, illness, marital separation) was believed to trigger or increase MHBP. Parents believed autism further increased vulnerability to such risk factors because autistic YP have smaller social networks and these losses have impacts on daily routines.
- Impacts of living with MHBP on parents were wide-ranging, including social isolation, physical and mental health, self-efficacy and financial situation. The teenage years were regarded as increasing the risk for adverse outcomes in these domains of parents' lives.

The findings identify risk and protective factors which future studies may wish to investigate so that we understand more completely the factors that influence MHBP. They support a multifaceted, cross-sector approach to reducing MHBP in autistic people.

Summary

This is one of the first studies to explore MHBP in autistic CYP from early childhood into mid and late adolescence. We have shown that there is very substantial stability in MHBP over a 10-year period. While there is a decrease in clinical symptoms when comparing diagnoses and symptom counts on the PAPA versus CAPA, rates of endorsement are still very high, remaining approximately fivefold higher in adolescence than those reported in same-aged TD populations.[70]

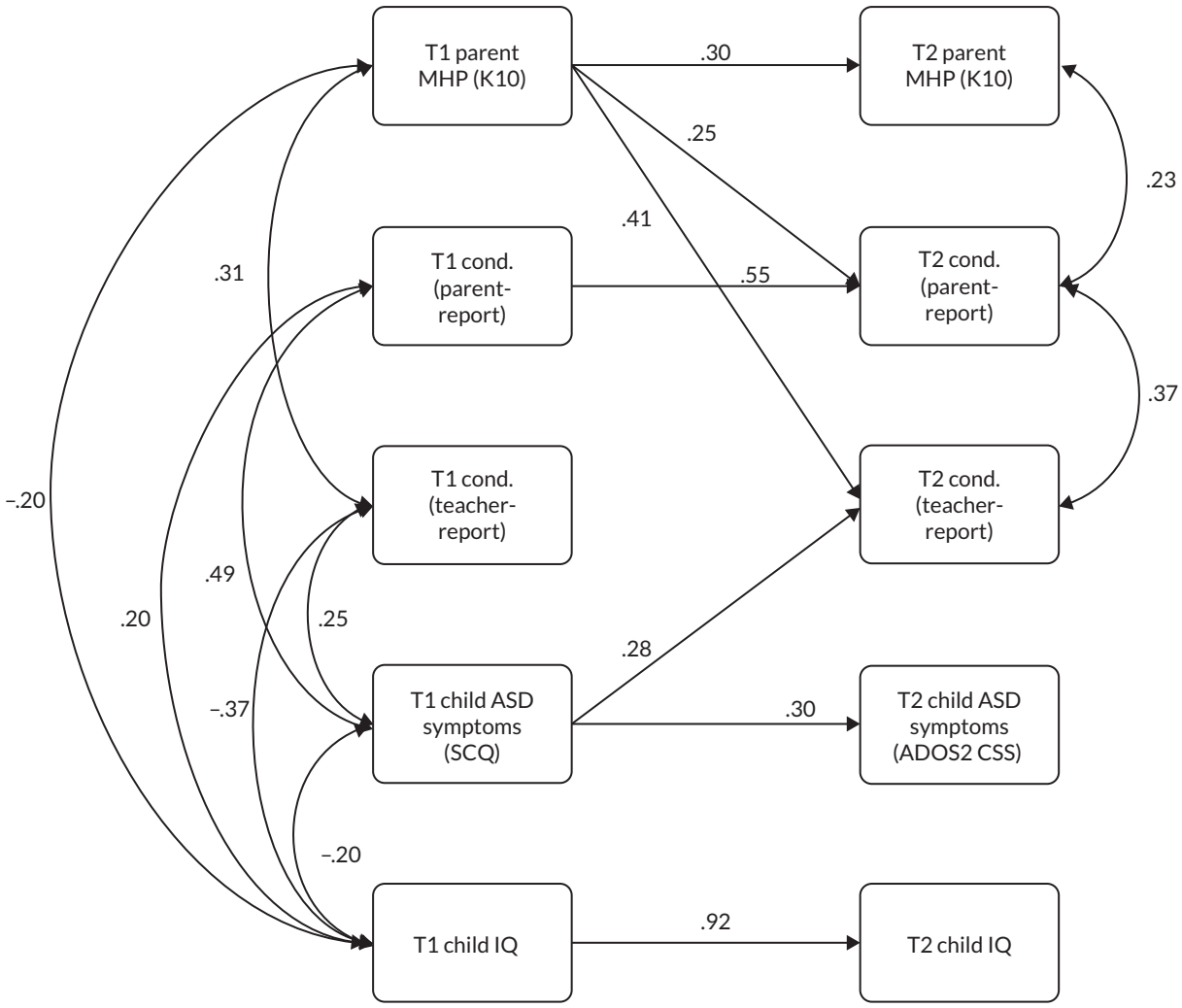

FIGURE 6 Final best-fit model for relationship between parental MHP and child behavioural symptoms. ADOS-2, Autism Diagnostic Observation Schedule – 2nd edition; CSS, calibrated severity score.

There is often a clinical view that MHBP in early childhood will resolve, especially once children are engaged in more structured environments, such as that afforded by education. Our findings refute that opinion by showing strong within-domain continuity.

The importance of ADHD symptoms in predicting poorer adaptive functioning highlights the relevance of early identification of MHBP, as recommended in National Institute for Health and Care Excellence (NICE) guidance.[71]

Our preliminary findings on the relationship between parental MHP and child MHBP provide relatively little support for a longer-term role of reciprocal influences between the two. Nevertheless, parents of autistic children experience high levels of MHP; in our study, this appeared most related to child's IQ, but this is not the case for all other studies.[72] As many of the interventions in early childhood for MHBP are based on the involvement of parents, it is essential to understand the factors influencing their mental health and stress levels.

Our nested qualitative study demonstrated the new challenges that arise in adolescence and the importance of contextual factors for individual YP.

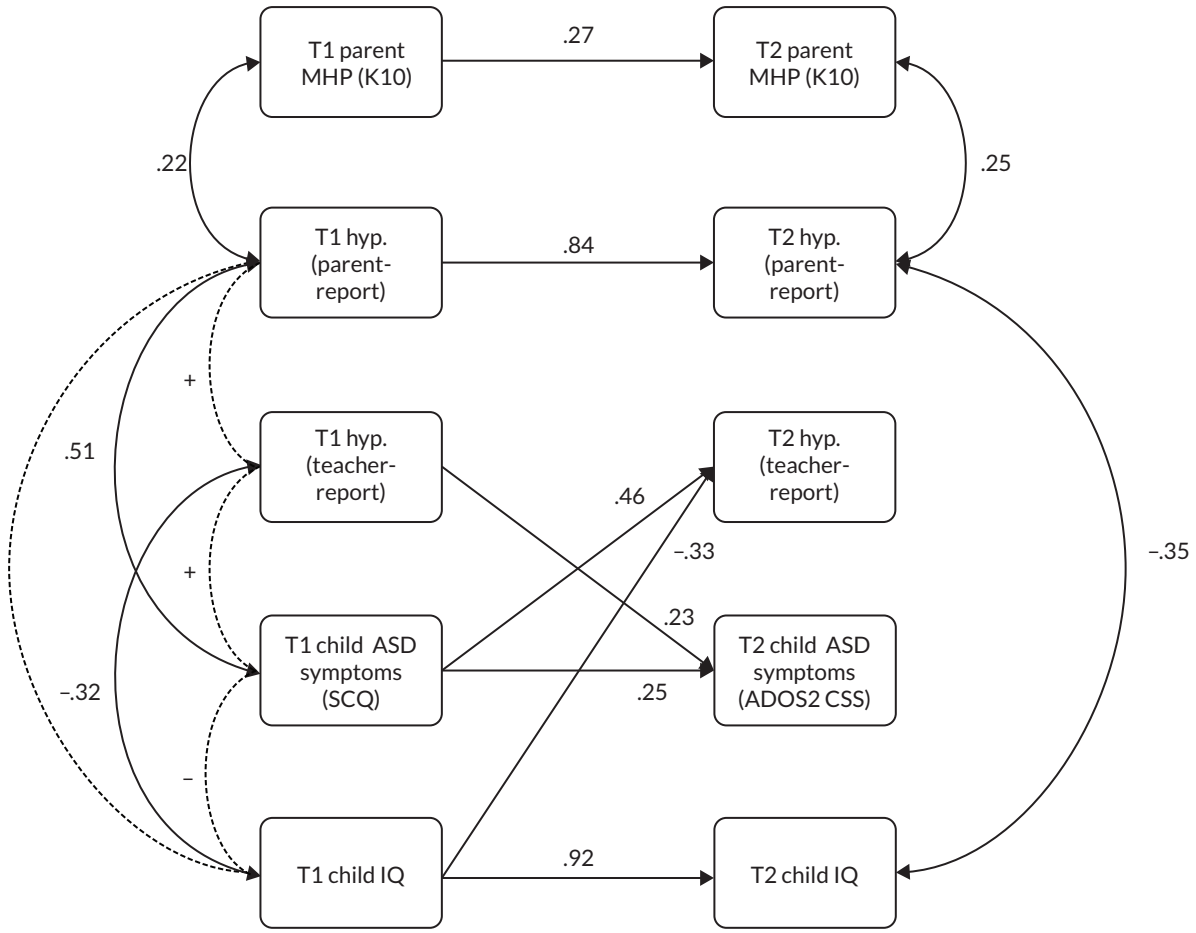

FIGURE 7 Final best-fit model for relationship between parental MHP and child ADHD symptoms. ADOS-2, Autism Diagnostic Observation Schedule – 2nd edition; CSS, calibrated severity score.

TABLE 2 Characteristics of children represented and study participants

Characteristics of children represented in study	
Age at time of interview	
Median (range)	17 (15–19)
Age at time of diagnosis	
Median (range)	42 months (20 months–8 years)
Gender	
Male	21
Female	20
Learning disability (IQ < 70)	
Learning disability	10
No learning disability	21
Mental health trajectory profile [above vs. below cut-off: Developmental Behaviour Checklist (Waves 1 and 2) & strengths and difficulties questionnaire (Wave 3)]	
Moves between above and below (various patterns represented)	17

continued

TABLE 2 Characteristics of children represented and study participants (*continued*)

Consistently above cut-off points	11
Consistently below cut-off points	3
Types of school/colleges attended	
Mainstream only	15
Mix of mainstream and special	11
Special education only	5
Study participant characteristics (parents) (n = 33)	
Gender	
Female	30
Male	3
Marital status	
Married/co-habiting/civil partnership	26
Single	8
Ethnic background	
White British	17
Black/Black British	10
Other	3
Number of children	
Median (range)	2 (1–4)

Successes

We assessed the QUEST cohort at two further waves of data collection, over a 10-year period with 76–77% retention rates and minimal evidence of selective attrition. This is a particularly valuable cohort for understanding the trajectories of MHBP in autism.

The qualitative study identified new factors that should be explored in future research.

Limitations

A key limitation is some of the characteristics of the QUEST cohort. It is a moderately sized cohort (although our methods allow us to include all participating individuals from at least one wave) and therefore comparisons of subgroups are robust. A further limitation is that the cohort was drawn from children who received an autism diagnosis by age 4 years. This means that those with presentations that are either more subtle and/or overshadowed by other characteristics, such as being a looked after child, having high levels of family adversity or severe behavioural problems, are less likely to be included. The cohort is drawn from two London boroughs and there is uncertainty about the wider generalisability.

For the study of adaptive function, which showed the importance of ADHD symptoms as a predictor, we did not have information on ADHD treatment for the full cohort.

Future plans

Future research could explore the following issues, using the QUEST dataset as appropriate.

1. The impact of early childhood emotional dysregulation on later MHBP.
2. The impact of mainstream versus specialist educational placement on autistic symptoms and cognitive outcomes, specifically whether mainstream education is associated with different outcomes, taking account of possible confounders.
3. The independent and unique contribution of self-reports of MHBP in autistic youth.

Links with other work packages

Assessment of Concerning Behaviours data collected in QUEST has contributed to the instrument's validation. The findings on common MHBP at Wave 2 were used to inform development of the Predictive Parenting (PP) intervention in WP4.

Work package 4: Autism Spectrum Treatment and Resilience as a pilot feasibility randomised controlled trial of Predictive Parenting to reduce emotional and behavioural problems in young autistic children

Overview

Our previous work highlighted the high prevalence rates of mental health disorders in all three domains – emotional, behavioural and ADHD – in early childhood. Previous parent-based interventions for young autistic children have focused on behavioural problems and have not included strategies to manage anxiety disorders, which occurred in 80% of young children in the community-based QUEST cohort at age 5–9 years. We therefore developed a novel, group-based parenting intervention aimed at improving parents' understanding of and strategies to manage both emotional and behavioural components. We then undertook a pilot of PP, followed by a pilot feasibility randomised controlled trial (RCT) of PP compared to group-based psychoeducation (PE) and active control intervention. We analyse the results in an intention-to-treat design. Acceptability and feasibility were demonstrated. It was not the aim to undertake hypothesis testing, and the trial did not show benefit of PP compared to PE at the primary end point.

Introduction

Up to 80% of young autistic children have co-occurring psychiatric disorders, of which the most common are anxiety, oppositional behaviour and ADHD[27] and these have been shown to persist over time in older autistic CYP.[28]

Parent-mediated interventions based on behavioural principles are well-established psychosocial approaches for behavioural problems in non-autistic children[73] in both individual and group formats.[74] Such interventions have been adapted for parents of young autistic children and meta-analyses have found a moderate effect for behaviour problems[75] and some evidence for improvements in child hyperactivity and parent stress.[76]

However, there are limitations in the extant literature. Only one RCT[75] involved anxiety management techniques even though anxiety disorders are the most common co-occurring psychiatric diagnoses in autistic children. Most trials have evaluated programmes delivered individually to parents, although groups are more scalable and potentially cost-effective, and also provide a support network for parents. Primary outcomes have been parent-reported measures of child MHBPs (typically of behaviour problems), that are unblinded to intervention allocation and there is a need for blinded, objective measures of child outcomes. No trials in this area have estimated costs or explored cost-effectiveness.

To address these issues, we conducted a pilot feasibility RCT to evaluate the feasibility and cost-effectiveness of a novel group-based parenting intervention for young autistic children (PP), in comparison to an attention control (PE), using a novel blinded observational measure of child behaviours that challenge (BTC) as the primary outcome. of MHBP.

Changes

Very few changes were made to the original protocol. Parent group sizes were increased from six to eight parents, with a reduction in the total number of groups delivered but the same number of participants being randomised. This decision was based on the observation that larger group size was feasible and delivering fewer groups reduced the pressure on therapists.

Challenges

We were able to recruit participants successfully to the pilot feasibility trial on time. Clinicians were keen to identify potentially eligible families, as few interventions were routinely available. Parents were not blinded to and some expressed disappointment to be receiving PE rather than PP. There was some concern that parents in the different arms might know each other and exchange therapy materials, but there was no evidence that this actually happened.

Cluster randomisation proved challenging on several occasions because the intervention was delivered in locally defined areas.

Observational measure development

We give an overview of published work in Palmer *et al.*[77,78]

Previous research has demonstrated that unblinded parent-reported outcome measures lead to larger effect sizes than those reported with blinded measures,[79,80] raising the possibility of bias. To address this concern, we developed and validated a new observational measure designed to elicit anxiety and/or behaviours that can be challenging in younger autistic children. As the triggers for anxiety and behaviour that challenges can vary among autistic children, the aim was to provide a range of tasks with varying demands, but which also represent everyday activities that may be difficult for autistic children.

Investigators with clinical expertise of autistic children in this age group suggested a range of potential tasks. Following initial exploration, eight tasks were selected, with the content varying in two tasks for minimally verbal versus verbal children. Tasks assessed compliance with parental requests, cooperation on a joint activity, intolerance of uncertainty, separation and reunification with parent and frustration at not receiving a tangible reinforcer. Four independent codes were extracted: child behaviour that challenges, child compliance, facilitative parenting and non-facilitative parenting: the proportion of total parenting events that were facilitative was generated as a summary parenting variable. Attempts to generate a child anxiety code proved unreliable and this code was therefore excluded. The final measure takes 18–22 minutes to deliver.

The measure was then validated in the baseline Autism Spectrum Treatment and Resilience (ASTAR) evaluations. Participants were 83 parents/carers and their 4- to 8-year-old autistic children. The *Observation Schedule for Children with Autism – Anxiety, Behaviour and Parenting* (OSCA-ABP) demonstrated good variance and potential sensitivity to change. Child and parenting behaviour were reliably coded among verbal and minimally verbal children. Associations between reports from other informants and observed behaviour showed the measure had sufficient convergent validity to be used as the primary outcome in the ASTAR clinical trial.

Intervention development

A detailed description has been published by Hallett *et al.*[81]

This was led by the therapists employed on the pilot feasibility trial at its initiation (VH, JM) with support from senior investigators (TC, ES, SS, VS). Key aims were the implementation of evidence-based cognitive–behavioural therapy principles in the context of manifestations of EBP in autistic CYP. The intervention content was underpinned by a theoretical perspective that autistic CYP may have particular impairments in prediction and therefore focused on parental strategies that increase predictability and strategies to manage unpredictable situations. The intervention helped parents to predict their child's behaviour, based on an improved understanding of their child's symptom and skill profile. To ensure the intervention was appropriate for parents of children across the ability levels; content was differentiated for parents of non-verbal/minimally verbal versus verbally fluent CYP and group allocation maintained this distinction.

The IAMHealth PPI panels reviewed the content and made specific suggestions, for example, to the time-out.

The PE intervention was adapted from PE programmes and split into a similar number of sessions to that of PP. The aim was to provide a meaningful active control intervention without touching on MHBP.

Feasibility study

A feasibility study to test the acceptability and accessibility of the programme was initially conducted in which six parents each were enrolled in either the verbal or minimally verbal PP group. This evaluation was undertaken independently by the York team led by BB, who interviewed a subset of parents completing PP (*N* = 9), those who declined participation (*N* = 10) and one who dropped out.

Retention was good with two parents dropping out due to child care difficulties.

Feedback from parents was generally positive, in that they recognised the challenges being discussed and, in some cases, had instinctively began to use similar strategies, which they felt they were able to apply in a more extensive or refined manner. Parents also made suggestions for additional subject matter, such as the management of self-injurious behaviour, incorporated in revisions of the intervention for the pilot feasibility RCT. Fidelity to the intervention, measured by the therapists following each session, was shown to be excellent.

Pilot feasibility randomised controlled trial

The primary results of this pilot feasibility trial have been published and are described below.[82]

Introduction

This pilot feasibility trial compared PP to PE in a single-blind cluster-randomised design in order to (1) examine the feasibility of recruitment, retention, completion of research measures, fidelity of implementation of the intervention and parental satisfaction and (2) provide an indication of potential effectiveness on the primary and secondary outcome.

Methods

The trial protocol is provided in *Report Supplementary Material 1*.

Pilot feasibility trial design

The study is registered on ISRCTN: ISRCTN91411078. This was a two-site, two-group cluster-randomised single-blind pilot feasibility trial with groups stratified for parents of minimally verbal versus verbal children. Randomisation was conducted for blocks of 10–18 families and allocated 1 : 1 to PP versus PE. Baseline measures were collected up to 2 months prior to randomisation and outcome measures following completion of the intervention.

Participants

We recruited parents/caretakers of autistic children aged between 4 : 0 and 8 : 11 years with a confirmed clinical autism diagnosis and the following eligibility criteria: parent has sufficient spoken English to access the intervention; agreement to inform family doctor of involvement in the study; not currently participating in another parenting intervention; child does not have epileptic seizures more than weekly; no severe hearing or visual impairment in the parent or child; no active safeguarding concerns; no current severe parental psychiatric disorder; did not participate in the initial feasibility study. Participants were identified either through child health services or Child and Adolescent Mental Health Services, or specialist schools for autistic children.

Intervention

Predictive Parenting consisted of 12 group sessions with 6–8 parents/carers and two individual consultations, allowing parents to discuss specific concerns in more detail and/or refine management strategies. PE was comprised of 12 group-based sessions. The same therapists administered PP and PE. Fidelity to the intervention was recorded by therapists at the end of each session for PP.

Outcome measures

The primary outcome was the code of BTC from the OSCA-ABP, as the blinded measured outcome measure most closely linked to the ultimate aims of the pilot feasibility trial. Secondary outcome measures are shown in *Table 3*.

TABLE 3 Secondary outcome measures for ASTAR

Name	Modality/informant	Reporting on	Domain
OSCA-ABP	Observation (blinded)	Child	Child compliance
OSCA-ABP	Observation(blinded)	Parent	Facilitative parenting
OSCA-ABP	Observation (blinded)	Parent	Non-facilitative parenting
OSCA-ABP	Observation (blinded)	Parent	Proportion of facilitative parenting
ABC[83]	Parent-reported	Child	Irritability
ABC[83]	Parent-reported	Child	Hyperactivity
HSQ-ASD[14,17]	Parent-reported	Child	Disruptive behaviour
ACB	Parent-reported	Child	Disruptive behaviour
ACB	Parent-reported	Child	Emotional problems
Preschool Anxiety Scale – Revised (PASR)[84]	Parent-reported	Child	Anxiety
Parent-defined target problems[85]	Parent-reported	Child	Parental choice
Clinical Global Impression – Improvement (CGI-I)[85]	Parent/clinician	Child	Global
ABC[83]	Teacher-reported	Child	Irritability
ABC[83]	Teacher-reported	Child	Hyperactivity
Autism Parenting Stress Index (APSI)[86]	Parent-reported	Parent	Parental stress
Child Adjustment and Parent Efficacy Scale-Developmental Disability (CAPES-DD)[87]	Parent-reported	Parent	Parental efficacy

Analysis

The SAP is provided in the *Report Supplementary Material 1*.

All analyses were carried out partially blinded and using the intention-to-treat population. Allocation group, time (baseline or post intervention) and site were included as covariates; a random intercept for therapy group was included. The models were stratified by verbal ability group. The analysis model outcome included interaction terms for verbal ability strata with treatment and also time providing verbal ability stratum specific estimates of the treatment effect size, that were then pooled. Analysis for the secondary outcomes did not include these interactions, estimating overall treatment effects directly.

Standardised mean differences are given on the log-scale for log-transformed outcomes. Throughout, we reported 90% confidence intervals (CIs) to ensure that possible pilot effects are not missed as suggested by the Data Monitoring Committee (DMC) and described in the SAP; however, statistical significance is reported using the conventional $p < 0.05$.

Results

The majority of the 191 referrals came from local autism diagnostic teams in child development centres (n = 80, 41.9%) or child and adolescent mental health services (n = 55, 28.8%). Thirty-five (18.3%) families referred themselves for the study. The remaining 21 referrals (11.0%) were from specialist education provision. Of those contacted, just under half (n = 70/169, 41.4%) consented to take part.

TABLE 3 Secondary outcome measures for ASTAR (*continued*)

Name	Modality/informant	Reporting on	Domain
Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS)[88]	Parent-reported	Parent	Parental well-being
Parenting Scale (PS)[89]	Parent-reported	Parent	Parenting style
Client Service Receipt Inventory (CSRI)[90]	Parent-reported	Parent and child	Service use

ABC, Aberrant Behavior Checklist.

Intervention adherence was good with mean (SD) attendance of 8.6 (3.3) and 8.4 (3.7) of 12 therapy sessions and 28 (90%) and 24 (78%) families still participating at the end of the final session in PP and PE respectively. Overall, parental satisfaction was high; 91.3% and 81.8% 'very satisfied' and 8.7% and 13.6% 'satisfied' for PP and PE, respectively.

The primary outcome, BTC, was not significantly different between groups (Cohen's d = 0.18, 90% CI −0.44 to 0.08). Several secondary observational measures showed evidence of efficacy for PP: child compliance (d = 0.44, 90% CI 0.11 to 0.77) and facilitative parenting (d = 0.63, 90% CI 0.33 to 0.92) but no group difference for non-facilitative parenting. There was also evidence of a benefit of PP in researcher-rated parent-defined target problem measurement (d = −0.59, 90% CI −0.17 to −1.00). Groups did not differ on other observational measures, parent- or teacher-reported child MHBP measures, nor on measures of parenting, parent stress, self-efficacy, and well-being. There were no differences on measured adverse effects.

Summary

We showed that (1) it is possible to develop and implement reliable and valid direct measures of relevant child and parent behaviours; (2) both PP and PE were highly acceptable interventions, that could be delivered with fidelity and within the context of a clinical trial and (3) that the effect for PP against an active control intervention ranged from small (0.18) to moderately high (0.63), depending on the outcome measure.

Successes

Both interventions were highly valued by parents who received them, in a current care context in which there is no routine post-diagnostic support. We were able to recruit families on time, despite the additional challenges of cluster randomisation and the need to run separate parent groups for those whose children were verbal versus minimally verbal. The eligibility criteria were as inclusive as possible, in order to ensure the findings could be widely generalised. The group delivery mode means that the intervention is potentially scalable.

We developed two novel interventions for this pilot feasibility trial: PP and PE, each with a set of supporting materials to aid delivery in the future, should their value be demonstrated in a substantive efficacy trial. The PP intervention is informed by an autism-specific framework. It was developed with input from parents of autistic children and autistic parents.

The OSCA-ABP is reliable and valid across a broad range of developmental levels. The issue of wide-ranging ability and mental age is a key challenge in autism research, and many studies have limited eligibility to focus on a relatively narrow developmental band. ASTAR is the first pilot feasibility trial aimed at autistic children's MHBP to use a blinded outcome measure as the primary outcome. It is also the first intervention to targer anxiety as well as behaviour problems.

Limitations

This was designed as a pilot feasibility trial and the small sample size means that the results are not definitive, but rather give an indication of the sample size required to determine efficacy. The comparator arm was an active control, which reduces some sources of bias, due to differential input and negative attitudes to being on a waiting list. However, the lack of a treatment as usual (TAU) comparison arm means it is not possible to accurately estimate the potential benefits in the current real-world context.

While the therapists self-reported on treatment fidelity using a structured measure, these findings were not confirmed with an objective, independent evaluation.

Some of the children had low MHVP scores at baseline. The analytic strategy took account of this by using log-transformed scores, in which those with low scores are expected to show less change for the same effect. However, future tests of this and related interventions might consider requiring a minimum MHBP level.

Future plans

In Palmer *et al.*,[91] we collected additional, unplanned follow-up data from the ASTAR parents during the first COVID-related lockdown, during the summer of 2020, as part of a broader programme of work to understand how the social restrictions were affecting autistic children and their families. The PP arm continued to show improvement in both child MHBP and parental stress while the PE arm regressed to baseline leading to significant group differences in child MHNP, Cohen's d = −0.33, 95% CI −0.65 to −0.01, and PS, Cohen's d = −0.31, 95% CI −0.59 to −0.03. Future research should therefore consider the timing of trial endpoint and having a follow-up.

Links with other work packages

We used the ACB, developed in WP1, as one of the secondary outcome measures. In parallel, the baseline ACB data from ASTAR has been included in a further validation exercise that is ongoing.

Patient and public involvement

Aim

The overarching aim of consultation with our PPI groups was to obtain their views on the research questions outlined in the application in order to modify or extend these; to consult on details on the conduct of the research, including individual measures and recruitment strategy; and to aid in interpretation of the research findings. For each WP, investigators and researchers met with the PPI groups at the beginning of each study and towards the end, prior to write-up for publication and often at other time points. In addition to the presentations directly related to IAMHealth, the PPI groups also reviewed presentations from and gave feedback to two students applying for NIHR PhD studentships in autism research, one of which was successful.

Methods

The opportunity to join the IAMHealth PPI groups was advertised by the National Autistic Society (NAS). Interviews were undertaken by ES, VS and a representative from NAS. Interviews simulated the proposed structure and content of the PPI meetings. Group activities included reviewing alternative questionnaires and commenting on an exemplar study information sheet. This allowed prospective panellists to gain a better understanding of the types of tasks they would engage in and for the investigators to identify any prospective panellists who would have difficulty with these types of activities. Following the interviews, one prospective panellist opted out and the interviewers decided one would not be able to manage the shared activities.

Patient and public involvement meeting structure. Each PPI meeting included at least two presentations from different work packages, to ensure that all aspects of the work were shared with PPI colleagues at a stage where they could influence the work. Typically, parents of autistic children met in the morning, and, on the same day, autistic adults met in the afternoon, with a shared lunch break in the middle. The decision to have formal meetings separate for the two panels was based on feedback from panellists that they would be able to be more open within this framework.

Recommendations from PPI meetings were reviewed at study level, Senior Investigator meetings and the programme Steering Committee. The PPI groups met on 11 occasions across the life of the Programme (2014–20). In addition to PPI meetings, two members of the PPI groups (one parent, one autistic adult) attended our Programme Steering Committee meetings, supported by the professional lead for PPI (VS). Two independent parents of autistic children were appointed to the TSC for ASTAR. Finally, a parent of an autistic child participated in the appointment committee for the therapists for ASTAR.

Study results

Over the course of the Programme, one parent stopped attending meetings, due to moving to a distance and child care commitments. PPI members were allowed to join by video conferencing if travel was not possible. The last PPI meeting was held during COVID restrictions and was fully on video conference.

Examples of patient and public involvement influence on Improving Mental Health for Autistic People

Overarching. In the original application, we made reference to ‘severe maladaptive behaviour’ to describe the impact of autistic people’s MHP on their behaviour. We asked whether this term was acceptable and accurate. Autistic adults were generally happy with this term, but parents were not, highlighting that some problematic behaviours might be

adaptive for autistic people in their present environment. We agreed to use the phrase 'behaviour that challenges others' to reflect the impact of these behaviours.

Work package 1: In the development of the new questionnaire, the PPI panellists agreed the name (ACB), which had been described in the application as the SMART, reflecting changes in terminology across the Programme. They also reviewed the full list of potential questions, highlighted the need for exemplar behaviours and recommended the response format that was selected.

Work package 2: PPI panels reviewed the content for qualitative interviews. They co-produced the words used in the study sort task. Prior to publication, they reviewed the findings with the research team and assisted in interpretation, particularly relating to the challenges for autistic people and their parents/carers to differentiate core autism symptoms from additional MHBP and these views were incorporated in the publication.

Work package 3: The PPI panels commented on several of the measures, including the items used in the parent–child interaction tasks and alternative measure of parental autistic traits. We asked whether it would be intrusive for parents to report on their own personality/characteristics and were encouraged by feedback indicating this would be acceptable.

We sought panellists' views on using NHS tracing services to identify the most up-to-date address for families who were difficult to contact. The panellists expressed some concern that some families might not wish to be traced and suggested contact via an intermediary. We agreed that asking a general practitioner to pass on a letter to get in touch would be acceptable.

Work package 4: The PPI panels commented on the content of both interventions. They reviewed the proposed outcome measures, including the OSCA-ABP. The pilot feasibility trial results were shared with the panels who highlighted the importance of early intervention and the need to follow through to a definitive efficacy trial.

Reflections

Our interview and selection process were useful in matching expectations and personal characteristics for the role. It was important at the outset to identify any special needs of our panellists. These included assistance with travel and dietary needs.

Successes and limitations

We recognised the value of joining the panel as a way to become involved in research and gain a better understanding of research methodology. We were able to pay for one panel member to present findings at an international conference (Autism Europe) and she subsequently participated with investigators ES and VS on an NAS national panel. She was then employed as an autism researcher.

We had aimed to recruit a third PPI panel comprised of siblings of autistic people, to meet towards the end of the Programme, to reflect on the findings and their interpretation. We advertised on two occasions through the NAS but were unsuccessful in identifying a sufficient number to undertake these groups.

Conclusions

The overarching aim of the research programme was to improve outcomes and quality of life for autistic people through improved mental health. We identified several steps that were necessary prerequisites before this broader and ambitious goal could be met, namely: improved identification by autistic people, their parents and carers as well as clinicians through better tools; an understanding of perceived and real barriers and facilitators that underpin recognition of MHP as distinct from autistic features; an improved understanding of the stability of and predictors for additional MHP, especially in adolescence; and, finally, development and feasibility of an intervention targeting early manifestations of MHP.

Tools to recognise mental health problems in autistic people

At the time of submitting this application, there were no screening measures available to assess additional MHP specifically in autistic people. Alongside this, many clinicians lack confidence in disentangling autistic symptoms and MHBP, leading to failure to identify and treat the latter. The need for an autism-specific measure is to capture mental health symptoms in the way they manifest in autistic people, using items that reflect these presentations and therefore can be readily endorse by autistic people, carers and professionals. Furthermore, the measure needed to align with clinical diagnoses, as the latter provide the evidence base for effective interventions. For example, it has been shown that anxiety measures relying on the autistic person to express feelings of anxiety will detect lower rates of anxiety in those with impaired communication[92,93] and very few measures were considered suitable for use in this population.[94] For anxiety, this led to the development of an autism-specific anxiety rating scale, for example, the Parent-Rated Anxiety Scale for Youth With Autism Spectrum Disorders (PRAS-ASD), aimed at reports by parents of autistic children and YP.[95] This scale is potentially of great value, but it is limited to the measurement of anxiety symptoms and therefore requires those using it already to be considering the measurement of anxiety symptoms. Another development in the field is the Autism Behaviour Inventory (ABI),[96] which aims to provide a parent/carer account of both core autistic symptoms and associated problems, including mental health and sleep difficulties. Designed primarily for repeated completion in clinical trials, the ABI has been shown to be acceptable for regular completion by parents.[97] Both measures were primarily designed for use in clinical trials, rather than to assist in recognition and diagnosis, which is the main aim of the ACB. Neither the PRAS-ASD nor the ABI contains the range of mental health symptoms that map onto the wider range of clinical conditions, including depression, OCD and ADHD, as well as identifying behaviours that place the individual or others at risk. As such, the ACB is complementary to other measures that have been recently developed. Among these, the ACB is the only one to include a self-report version. This difference likely reflects cultural and scientific traditions underpinning the instruments' development. The PRAS-ASD and ABI were developed to provide more accurate measures for clinical trials, which previously used parent/caretaker reports as the gold standard. In contrast, the ACB was designed to support clinical triage and assessment across the age range. In the United Kingdom (UK), from late childhood onwards, clinicians are interested in incorporating the patient voice, wherever possible. Even within TD populations, the lack of clear consensus between parents/carers and children/adolescents (as well as those from teachers) on questionnaires and screening instruments is well recognised, although poorly understood.[98] This means that there is no consensus on how to combine accounts from different informants. To our knowledge, the ACB is the only comprehensive mental health questionnaire co-developed with autistic people and their parents. The rigorous psychometric evaluation of the parent version is an important first step for its future use.

Recognising mental health problems and help-seeking among autistic young adults

The present findings from WP2 support and extend the literature on the emergence and interpretation of MHBP in autistic people. Similar to other studies,[99] autistic adults experienced stress and anxiety as part of their 'own normal' rather than as a separate, treatable condition, which reduced their sense that intervention might be helpful. Furthermore, anxiety and related MHP themselves interfere with help-seeking, which can be compounded by other autistic differences.[100] For example, difficulties with unpredictability and sensory sensitivities may render attendance at health clinics particularly aversive. Differences or impairments in communication may mean that health professionals

do not understand their concerns, leading to an unsatisfactory or inappropriate response, creating a vicious negative cycle in which autistic people are less likely to seek help.[101] A recent systematic review highlighted the predominantly negative experience of mental health services by autistic adults and suggested several consistent themes.[102] Among those recognising MHP as distinct from autism, many found the experience of trying to access mental health care lonely and frustrating, with a sense that professionals did not understand how autism affected their mental health. They also described the interventions as inflexible and frequently not adapted for their own style. Some thought this led them to choose medication rather than a psychological intervention. Where intervention was viewed positively, collaboration and empowerment were highlighted as key components. These examples of positive experience can provide a pathway forward.

Prediction of mental health and behavioural problems

The present study is one of very few to follow autistic children from early childhood to adolescence in relation to MHBP. Our findings showed that stability occurred within domains of psychopathology (emotional problems, behavioural problems and ADHD) once co-occurrence of these separate domains was accounted for. These findings align with those seen in terms of continuity from later childhood to adult life.[25] This suggests that early targeting of symptoms could have long-term effects, although this requires further testing. An important finding was that parental mental health in early childhood predicted subsequent parent- and teacher-reported behaviour problems in early adolescence. This pattern did not apply to either emotional problems or ADHD, but the fact that the link was present with teacher reports suggests it is not due to shared method variance. Parental MHP are associated with MHBP in TD populations, for example.[103] There are several possible explanations. These include the impact of parental MHP on implementation of effective parenting, and gene–environment correlation, in which parental and child mental health/behavioural problems reflect shared underlying genetic liability. Longitudinal studies have previously shown the reciprocal effects of child MHBP and parental stress and MHP.[104] This highlights a possible target for future intervention, especially given the higher rates of parental stress and MHP among parents of autistic children.[36,105] Trials are currently under way to evaluate whether parental stress and MHP can be reduced in parents of autistic children.[106]

Parent/mediated intervention to reduce mental health and behavioural problems

Previous RCTs have assessed the efficacy of parent-mediated interventions to reduce MHBP in autistic children, with a meta-analytic effect size of 0.67 for disruptive behaviour.[76] The present PP intervention differed from others by including emotional symptoms, particularly anxiety, as a treatment target, based on the finding that rates of anxiety symptoms are very high in preschool autistic children[27,107] and that anxiety is often manifested as irritable or disruptive behaviour.[108,109] The cluster-randomised RCT undertaken in this programme was a pilot to demonstrate acceptability, feasibility and estimate likely effect sizes. The pilot RCT also differed from many of the others in the literature by using an active control group; at the time of the application, many families received post-diagnostic PE, placing this as an appropriate comparison. However, currently in the UK, practice is much more varied, with many families not receiving any support. In addition, we used a blinded, directly observed primary outcome measure to increase trial quality. Most of the previous trials have used a parent-reported outcome which was not blind to allocation and previous research has shown these inflate effect sizes.[80] Therefore, the pilot feasibility trial of PP should not be directly compared to most of the pre-existing trials.

Recommendations for future research

Below we highlight a number of research recommendations.

1. A definitive RCT including an economic evaluation is needed to determine the effectiveness and cost-effectiveness of PP. The present pilot feasibility trial suggests showed good acceptability and feasibility. About half of children with autism receive their diagnosis by age 7 years, indicating that an intervention aimed at parents of children aged 4–8 years will capture many of them. Given the lack of clarity over what post-diagnostic support should be offered, future research could seek to establish the effectiveness and cost-effectiveness of parent-mediated intervention in routine clinical practice. A TAU comparison arm may now be more appropriate in understanding the real-life impact of the intervention. Learnings from the pilot feasibility trial, as well as findings from other research groups, could be applied in a larger, definitive trial. Since the pilot feasibility trial was completed, the world has experienced the COVID pandemic, during which much of mental health therapy was delivered online. This could be considered as part of the modifications for a definitive trial. In-person versus online intervention could furthermore be an additional comparison that might help providers planning future care.
2. Future longitudinal research could focus on modifiable risk and resilience factors related to MHP in autistic people. The recent emphasis on neurodiversity approaches to autism emphasise the strengths of autistic people and the ways in which environments designed for neurotypical (TD) populations may play a key role in the development of MHP. Hence, research should also focus on the factors associated with good outcomes, which might be then more broadly generalised.
3. Our present findings on the role of ADHD symptoms in predicting poorer adaptive function are important because they highlight a potential modifiable risk factor, as ADHD symptoms respond to medication.[65] This finding should be replicated in other studies.
4. Given the higher rates of exposure to adverse experiences in autistic people adversity,[110,111] a particular focus could be on identifying resilience factors, that confer protection when exposed to adversity.
5. Future research could determine whether routine use of mental health screening questionnaires increases the identification and treatment of MHP in autistic children and YP. The present research shows the promise of an autism-specific, diagnostically informed brief questionnaire that provides, self-, parent and other-informant reports on MHBP and other concerning behaviours. However, this is only the first step in changing clinical practice to consider how it might be routinely implemented and whether any changes would be needed. Routine screening could be undertaken as part of the diagnostic assessment, as recommended by NICE[19] and subsequently in general practice. It would be important to assess its accuracy and cost-effectiveness.
6. Future research on the ACB should establish the psychometric properties of the self-, teacher and clinician versions and determine how well the subscales align across informants.
7. Relatedly, larger sample sizes will provide important psychometric information on the disorder-specific subscales which, if accurate, could help in clinical settings to obtain diagnostic determination more rapidly. Establishing clinical cut-offs of individual scores in the future could help clinicians prioritise patients for assessment.
8. Finally, with respect to the ACB, an important step for future research would be to determine q whether the measure is sensitive to change in symptom severity and hence can be used as an outcome monitoring tool and in influencing treatment decisions.

Implications for practice and any lessons learned

The research undertaken in the current programme shows that (1) MHBP are more common in autistic people;[3,7,26] (2) MHBP are strongly persistent over time, even when they commence in the early childhood period;[61,112] and (3) there is emerging evidence for the efficacy of interventions for MHBP in autistic people.[76,113,114] We also know that interventions for MHBP are a priority for autistic people and their families.[115] However, we showed that autistic people and their families often find it difficult to discern the difference between autistic features and MHBP. The wider research literature has demonstrated that mental health services are often not adapted to meet the needs of autistic people, leading to negative experiences of health care and some not seeking care until problems become severe, potentially requiring in-patient care. Based on these findings, health professionals and managers, alongside policy-makers should consider a number of challenges in the context of the NHS Long-term Plan, which includes the aspiration for annual health checks for autistic people. First, because WP2 showed that families had difficulty distinguishing MHBP from autistic symptoms, policy-makers should consider how they provide relevant information early on (because WP3 showed these difficulties start early and persist). This is a sensitive area where professionals will want to balance the risk of causing undue concern against that of providing parents and carers with information that will help them to access care at an early stage. There will be examples of this from other health promotion programmes, which could be harnessed here.

Second, decision-makers should consider whether the evidence from WP3 showing long-term persistence of MHBP, alongside the findings from WP4 and the wider literature supporting earlier parent-mediated interventions is sufficient for any of these to be implemented as part of routine, post-diagnostic care for autistic children and their families. While more research may be required to determine the best modality and range of content, the high levels of acceptability and feasibility from the present pilot feasibility trial, in the context of other positive trials, indicate MHBP in young autistic children may be responsive to interventions, which, if the effects are enduring, could change longer-term individual trajectories. Parents of young autistic children are keen to support their children's development, and this could be a particularly good developmental period for parent-mediated interventions, as children spend more time with their parents than at any other age. Currently there is no standard of post-diagnostic care in the UK, and many families receive no formal advice or intervention following diagnosis, despite the long-term challenges for autistic people and their families.

Third, the emerging evidence base for specially adapted interventions for autistic people places ongoing needs on professional training to deliver these and to provide autistic people and their families with the confidence in treatment understanding of autism and its interplay with mental health.[116–118]

Finally, as clinical scientists and researchers, we had not thought in advance about our role in managing MHP of our panellists and/or their children. There were several occasions in which we became aware of significant difficulties and explored whether we could help in any way. However, our ability to influence personal care was extremely limited. In future, we would recommend that the researchers discuss such issues at the outset and agree a set of principles with the PPI panels. It may be useful for NIHR to provide such guidance if this is an issue that arises frequently.

Additional information

Contributions of authors

Emily Simonoff (https://orcid.org/0000-0002-5450-0823) co-led WP1 and 3 and oversaw all other aspects of the programme, ensuring synergies between work packages.

Gillian Baird (https://orcid.org/0000-0002-7601-7074) co-led WP2 with Bryony Beresford and advised on patient and parent perspective for all the work.

Bryony Beresford (https://orcid.org/0000-0003-0716-2902) directed the qualitative analyses for WP2, 3 and 4.

Tony Charman (https://orcid.org/0000-0003-1993-6549) co-led WP3 and 4.

Martin Knapp (https://orcid.org/0000-0003-1427-0215) led all economic analyses for WP3 and 4.

Andrew Pickles (https://orcid.org/0000-0003-1283-0346) provided statistical analysis guidance for WP1, 3 and 4.

Carol Povey (https://orcid.org/0000-0002-8439-5788) from the National Autistic Society provided input on patient and public involvement, including supporting members of the autistic community and leading on meetings with stakeholders.

Tom Purser from the National Autistic Society provided input on patient and public involvement, including supporting members of the autistic community and leading on meetings with stakeholders.

Paramala Santosh (https://orcid.org/0000-0003-4830-5893) co-led WP1.

Vicky Slonims (https://orcid.org/0000-0003-3339-2365) supported the PPI work throughout the programme, hence contributing to all work packages.

Stephen Scott (https://orcid.org/0000-0003-4680-6213) co-led WP4.

Data-sharing statement

All data requests should be submitted to the corresponding author for consideration. Access to anonymised data may be granted following review.

Ethics statement

All studies including received ethical approval: Work package 1 REC reference 15/LO/0085; Work Package 2 REC reference 4/EM/1282;164375; Work Package 3 REC reference 17/LO/0397; Work package 4 REC reference 17/LO/0562.

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Disclosure of interests

Full disclosure of interests: Completed ICMJE forms for all authors, including all related interests, are available in the toolkit on the NIHR Journals Library report publication page at https://doi.org/10.3310/YRKP9867.

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Work package 1

Santosh P, Tarver J, Gibbons F, Vitoratou S, Simonoff E. Protocol for the development and validation of a questionnaire to assess concerning behaviours and mental health in individuals with autism spectrum disorders: the Assessment of Concerning Behaviour (ACB) scale. *BMJ Open* 2016;**6**:e010693. https://doi.org/10.1136/bmjopen-2015-010693

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Work package 2

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Carter Leno V. *Creation of Illustrations*. Collaborative Innovation Scheme for Early Career Researchers Event and IAMHealth Website, 2016.

Carter Leno V. *Exploring the Structure and Neurocognitive Correlates of Challenging Behaviour in Young People with Autism Spectrum Disorder*. Poster at International Meeting for Autism Research (IMFAR), Baltimore, 11–14 May 2016. 2016.

Carter Leno V. *Predicting Challenging Behaviours at 16 Years Old Using a Population-based Sample of Individuals with Autism Spectrum Disorder (ASD)*. Poster at International Meeting for Autism Research (IMFAR), Baltimore, 11–14 May 2016, 2016.

Chandler S. *Comparison of Two Screening Instruments for Additional Psychopathology in Children with Autism Spectrum Disorder*. Poster at International Meeting for Autism Research (IMFAR), Baltimore, 11–14 May 2016 & Autism Europe International Congress at the Edinburgh International Convention Centre, 2016.

Chandler S. *Quest Study: Identifying Emotional and Behavioural Difficulties in Young Children with ASD*. Presentation at Bromley Healthcare formal working group expert panel & Presentation at Research Autism's board meeting, 2016.

Chandler S. *The QUEST Study*. Presentation – Lewisham Community Paediatrics at Kaleidoscope Centre, Lewisham, 2016.

Chandler S, White P. *SIGNAL Meeting (Lewisham Parent Support Group)*. Presentation at Lewisham Parent Support Group, 2016.

Coleman-Fountain E. *How Do Young Adults with Autism Make Sense of Difficult Emotions?* Presentation: Autism Europe Congress, Edinburgh, 2016.

Coleman-Fountain E. *Screening for Co-occurring Psychopathology in Autism Spectrum Disorder*. Presentation – North London Community Paediatricians Group at Great Ormond Street Hospital, 2016.

Beresford B. *No Different? How Young Adults with Asperger Syndrome make Sense of their Mental Health?* Presentation at World Mental Health Day public engagement event, University of York, 2017.

Carter Leno V. *Taking a Neurocognitive Approach to Behaviour Problems in Young People with ASD*. Presentation at CAMHS Child Development Seminar, CAMHS Child Development Seminar, Michael Rutter Centre, London, 2017.

Coleman-Fountain E. *Uneasy Encounters: Youth, Social (Dis)comfort and the Autistic Self*. Presentation at BSA Medical Sociology Conference, University of York, UK, 2017.

Santosh P. *Development of an Assessment of Concerning Behaviour (ACB)*. Presentation at The Freemantles School Annual Conference in June 2017, 2017.

Yorke I. *Using an Observational Measure to Investigate the Relationship between Parenting Behaviours and Additional Psychopathological Symptoms in Children with Autism Spectrum Disorder (ASD)*. Presentation at Institute of Psychiatry, Psychology & Neuroscience Student Showcase event, London, 2017.

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Chandler S. *Stability and Persistence of Emotional and Behavioural Problems in Children with ASD*. Conference Poster at International Society for Autism Research, Annual Meeting 2018, Rotterdam, 2018.

Palmer M. *The Development of the Observation Schedule for Children with Autism Spectrum Disorders – Anxiety and Behaviour (OSCA-AB): A New Measure of Parent and Child Behaviour for Use with Children with ASD*. Conference Poster at International Society for Autism Research, Annual Meeting 2018, Rotterdam, 2018.

White P. *Stick or Switch? Factors that Influence Educational Placement over Time for Children with Autism*. Conference Poster at International Society for Autism Research, Annual Meeting 2018, Rotterdam, 2018.

Yorke I, White P. *'Improving Autism Mental Health Research Programme' Emotional and Behavioural Problems in Children with ASD: Perspectives from Home and School*. Presentation at Chaucer Centre, Merton Mencap Talk Autism forum, Morden, 2018.

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Carter Leno V. *Emotion Dysregulation in Autistic Adolescents: Underpinning Cognitive Mechanisms*. Conference Poster at International Society for Autism Research Annual Meeting, Montreal & Institute of Psychology, Psychiatry and Neuroscience – Autism ResearCH (ARCH) group, 2019.

Chandler S. *The Impact of Co-occurring Emotional and Behavioral Problems in ASD: From Childhood to Adolescence*. Presentation at Autistica, 2019.

Chandler S. *Update on the QUEST Follow-up Study*. Presentation at Bromley Healthcare annual Away Day, 2019.

Palmer M. *Development and Use of an Observational Measure of Parent-Child Interaction in Autism Spectrum Disorder: Relationships with Parent and Child Mental Health*. Conference Poster at International Society for Autism Research Annual Meeting, Montreal, 2019.

Palmer M. *Measuring Adverse Events in Trials of Parent-Mediated Interventions in Autism*. Poster at Autistica, 2019.

Yorke I. *Developing an Observational Measure for Assessing Elements of Parent-Child Interaction Relevant to Mental Health in Autistic Children and their Parents*. Conference Poster at Autistica Inaugural Annual Research Conference and Talk given to parents at Special Educational Needs Talk (SENT) group in Battersea, 2019.

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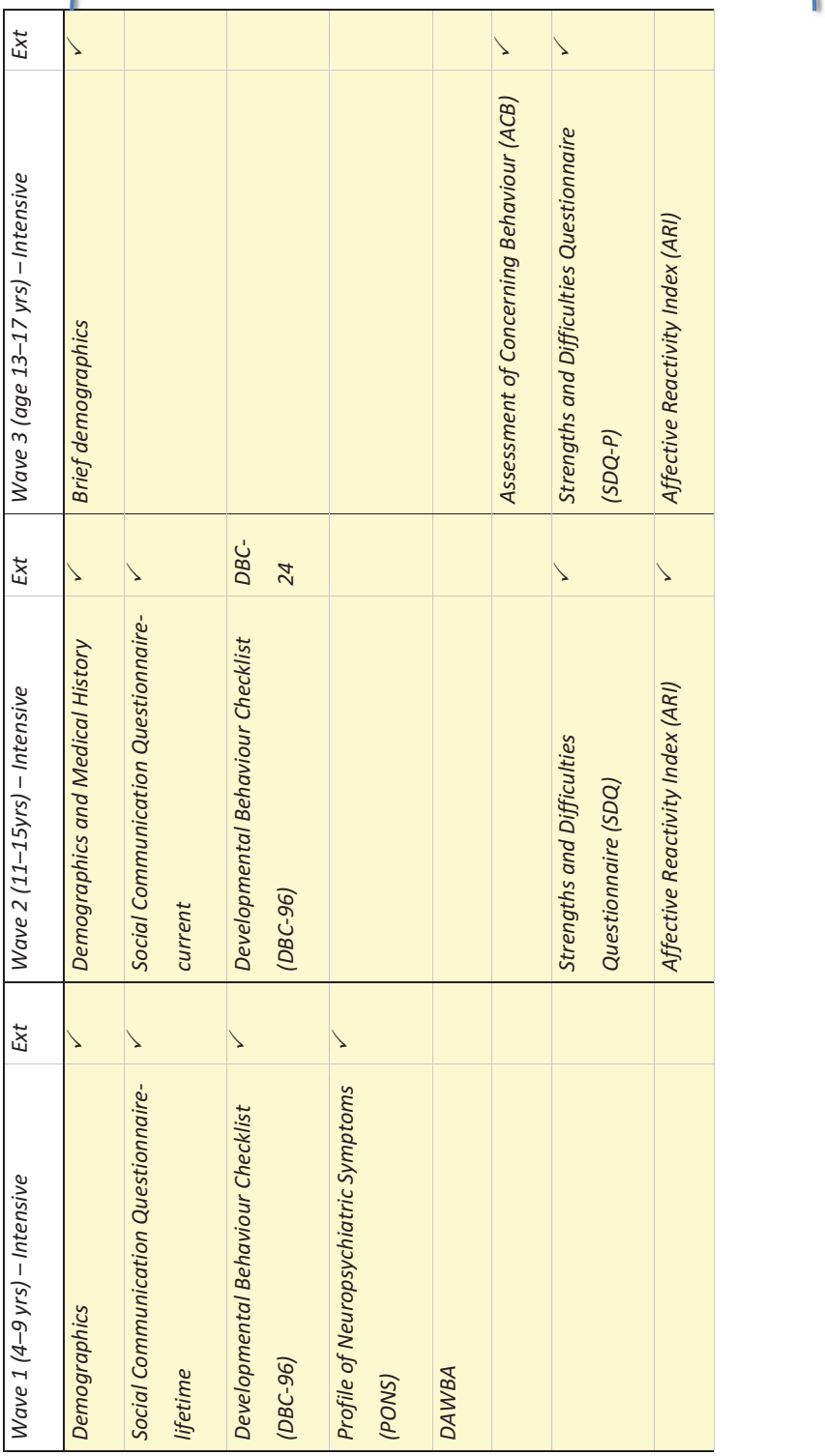
Appendix 1 QUEST cohort measures over Waves 1–3



Wave 1 (4–9 yrs) – Intensive	*Ext*	*Wave 2 (11–15yrs) – Intensive*	*Ext*	*Wave 3 (age 13–17 yrs) – Intensive*	*Ext*
Demographics	✓	*Demographics and Medical History*	✓	*Brief demographics*	✓
Social Communication Questionnaire-lifetime	✓	*Social Communication Questionnaire-current*	✓		
Developmental Behaviour Checklist (DBC-96)	✓	*Developmental Behaviour Checklist (DBC-96)*	*DBC-24*		
Profile of Neuropsychiatric Symptoms (PONS)	✓				
DAWBA					
				Assessment of Concerning Behaviour (ACB)	✓
		Strengths and Difficulties Questionnaire (SDQ)	✓	*Strengths and Difficulties Questionnaire (SDQ-P)*	✓
		Affective Reactivity Index (ARI)	✓	*Affective Reactivity Index (ARI)*	

				Aberrant Behaviour Checklist- Irritability Scale	
		Spence Children's Anxiety Scale (SCAS-P)	*subset*		
		Checklist of Unusual Experiences (CLUE)	✓		
		Inventory Of Callous-Unemotional Traits (ICU)			
		Subset of Repetitive Behaviour Scale - Revised	✓		
		Brief Sensory Experiences Questionnaire (SEQ)	✓		
		Life Events Questionnaire	✓		
		Adaptive Behaviour Assessment System (ABAS-II)	*comm*		
		Communication Aids	✓		
		Parenting Scale (13 Item version)	✓		

		Brief Parental Self-Efficacy Scale	✓		
		Chaos, Hubbub and Order Scale (CHAOS)	✓		
Kessler Psychological Distress Scale (K10)		*Kessler Psychological Distress Scale (K10)*	✓	*Kessler Psychological Distress Scale (K10)*	
		Autism Parenting Stress Index			
		Engagement and Confidence Scale	✓		
				Courting Behaviour Scale (Adapted)	
				EQ-5D (Quality of Life)	✓
				Warwick Edinburgh Mental Well-being Scale	✓
				Broader Autism Phenotype Questionnaire	
				ONS measure of life satisfaction	✓
				School Placement History	*current*
Preschool-Age Psychiatric Assessment (PAPA)				*Child & Adolescent Psychiatric Assessment (CAPA)*	

Parent interviews/assm

		Autism Specific Five Minute Speech Sample (ASFMSS)			
		Parent-Child Interaction			
		Autism Diagnostic Interview (if required)			
				Family service use	*subset*
				Parent Future Expectations	✓
IQ	✓	*IQ*			
Language (BPVS)	✓	*Language (ROWVT)*			
		Autism Diagnostic Observation Schedule (ADOS)			
		Experimental tasks +EEG		*Cognitive tasks + HR + GSR*	
		Questionnaires: SCAS-C and TAS		*Questionnaires: SDQ, ACB, SCAS-C, cyber-bullying*	
Teacher PONS and DBC	✓				
		Teacher SDQ	✓		
		School support questions	✓		

Child

Appendix 2 Characteristics of the QUEST cohort and attrition analysis

	Participants seen at T1	Participants seen at W1 and W2	Participants not seen at W2	Statistical difference	Participants seen at W1 and W3	Participants not seen at W3	Statistical difference
N	277	211	66		214	63	
Child characteristics							
Proportion male	0.82	0.81	0.86	χ = 1.14; p = 0.29	0.83	0.78	χ = 0.33 p = 0.33
School type (proportion mainstream)	274 0.78	210 0.78	64 0.81	χ = 0.38; p = 0.54	213 0.78	61 0.79	χ = 0.002; p = 0.96
IQ	273 72.58 (26.53); 19–129	208 72.50 (27.43)	65 72.85 (23.65)	T = 0.09; p = 0.93	211 73.94 (26.52)	62 67.95 (26.26)	T = −1.57; p = 0.12
ASD symptoms (SCQ total)	277 20.06 (7.43)	211 20.03 (7.46)	66 20.15 (7.38)	T = 0.12; p = 0.91	214 20.11 (7.54)	63 19.89 (7.09)	T = −0.20; p = 0.84
Parent-report emotional problems	277 12.95 (6.65)	211 12.85 (6.78)	66 13.26 (6.24)	T = 0.43; p = 0.67	214 12.92 (6.81)	63 13.04 (6.11)	T = 0.13; p = 0.89
Parent-report conduct problems	277 21.98 (10.79)	211 21.64 (11.19)	66 23.09 (9.37)	T = 0.96; p = 0.34	214 21.93 (11.15)	63 22.16 (9.53)	T = 0.15; p = 0.88
Parent-report ADHD symptoms	277 7.72 (3.15)	211 7.56 (3.19)	66 8.21 (2.97)	T = 1.46; p = 0.14	214 7.58 (3.24)	63 8.19 (2.78)	T = 1.36; p = 0.18
Parental characteristics							
Education (proportion GCSE or higher)	265 0.75	199 0.76	66 0.74	χ = 0.07; p = 0.79	203 0.75	62 0.76	χ = 0.005; p = 0.94
Employment (proportion at least one parent employed)	267 0.71	201 0.72	66 0.67	χ = 0.72; p = 0.40	206 0.73	61 0.64	χ = 1.80; p = 0.18
K10	85 (intensive) 20.02 (7.25)	72 19.89 (7.28)	13 20.77 (7.29)	T = 0.40; p = 0.69	66 20.16 (7.47)	19 19.53 (6.59)	T = −0.34; p = 0.74
Demographic characteristics							
Borough (proportion from Lewisham)	277 0.59	211 0.62	66 0.51	χ = 2.12; p = 0.15	214 0.60	63 0.57	χ = 0.14; p = 0.71
Ethnic diversity (proportion white)	268 0.51	203 0.51	65 0.52	χ = 0.05; p = 0.83	206 0.51	62 0.52	χ = 0.01; p = 0.93
Deprivation index (EIMD 2007)	277 26.09 (12.86)	211 26.16 (12.74)	66 25.84 (13.31)	T = 0.18; p = 0.86	214 26.09 (12.72)	63 26.09 (13.43)	T = 0.001; p = 0.99

Missing teacher data

	Participants seen at W1	Participants with teacher data W1	Participants without teacher data W1	Statistical difference	Participants with teacher data W2	Participants without teacher data W2	Statistical difference
N	277	228	49		135	142	
Child characteristics							
Proportion male	277 0.82	228 0.80	49 0.90	χ = 2.48; *p* = 0.12	135 0.80	142 0.84	χ = 0.68; *p* = 0.41
School type (proportion mainstream)	274 0.78	228 0.78	46 0.83	χ = 0.56; *p* = 0.45	T1 data: 134 0.76 T2 data: 132 0.48	140 0.81 71 0.65	χ = 0.86; *p* = 0.36 χ = 5.40; *p* = 0.02
IQ	273 72.58 (26.53); 19–129	228 72.35 (27.16)	45 73.75 (23.34)	*T* = 0.32; *p* = 0.75	134 72.22 (27.64)	139 72.94 (25.52)	*T* = 0.22; *p* = 0.82
ASD symptoms (SCQ total)	277 20.06 (7.43)	228 20.11 (7.61)	49 19.80 (6.59)	*T* = −0.27; *p* = 0.79	135 20.16 (7.57)	142 19.96 (7.32)	*T* = −0.21; *p* = 0.83
Parent-report emotional problems	277 12.95 (6.65)	228 12.97 (6.69)	49 12.84 (6.51)	*T* = −0.13; *p* = 0.90	T1 DBC: 135 13.03 (6.90) T2 SDQ: 131 4.27 (2.58)	142 12.87 (6.42) 70 3.96 (2.79)	*T* = −0.20; *p* = 0.85 *T* = 0.81; *p* = 0.42
Parent-report conduct problems	277 21.98 (10.79)	228 21.51 (10.73)	49 24.18 (10.88)	*T* = 1.58; *p* = 0.12	T1 DBC: 135 21.94 (20.00) T2 SDQ: 131 2.40 (1.93)	142 22.02 (20.33) 70 2.16 (1.65)	*T* = 0.06; *p* = 0.95 *T* = −0.90; *p* = 0.36
Parent-report ADHD symptoms	277 7.72 (3.15)	228 7.64 (3.20)	49 8.08 (2.88)	*T* = 0.89; *p* = 0.37	T1 DBC: 135 7.51 (3.28) T2 SDQ: 131 6.01 (2.70)	142 7.92 (3.02) 70 5.80 (2.47)	*T* = 1.07; *p* = 0.29 *T* = −0.53; *p* = 0.59
Parental characteristics							
Education (proportion GCSE or higher)	265 0.75	219 0.76	46 0.74	χ = 0.04; *p* = 0.79	128 0.77	137 0.74	χ = 0.16; *p* = 0.69
Employment (proportion at least 1 parent employed)	267 0.71	221 0.71	46 0.70	χ = 0.04; *p* = 0.84	131 0.73	136 0.68	χ = 0.77; *p* = 0.38
K10	85 (intensive) 20.02 (7.25)	77 20.00 (7.33)	8 20.25 (6.80)	*T* = 0.09; *p* = 0.93	T2 K10: 128 18.31 (8.92)	69 17.09 (8.07)	*T* = −0.95; *p* = 0.34
Demographic characteristics							
Borough (proportion from Lewisham)	277 0.59	228 0.61	49 0.49	χ = 2.58; *p* = 0.11	135 0.60	142 0.58	χ = 0.07; *p* = 0.79
Ethnic diversity (proportion white)	268 0.51	221 0.51	47 0.49	χ = 0.11; *p* = 0.74	132 0.51	136 0.51	χ = 0.01; *p* = 0.91
Deprivation index (EIMD 2007–15)	277 26.09 (12.86)	228 26.09 (12.65)	49 25.24 (12.65)	*T* = −0.51; *p* = 0.61	130 23.79 (12.45)	126 24.13 (13.51)	*T* = 0.21; *p* = 0.83

Appendix 3 Work package 4: statistical analysis plan

Autism Spectrum Treatment and Resilience Trial

A randomised controlled pilot trial comparing a parent training intervention (ASTAR B) to attention control (ASTAR A) in parents/carers of a child aged 4–8 years diagnosed with ASD.

Statistical Analysis Plan

Version 0.03 17/01/2019

ISRCTN: ISRCTN91411078

Quantitative analysis plan

Principal investigators: Professor Tony Charman and Professor Stephen Scott

Trial project manager: Dr Melanie Palmer

Trial statisticians: Dominic Stringer, Professor Andrew Pickles

Description of the trial

This analysis plan should be read as a supplement to the trial protocol; as such a description of the trial design and other aspects of the trial will not be duplicated here. This analysis plan was written according to Trial Protocol V1.4 08.01.2019.

Measures covered by this analysis plan

Primary, secondary and exploratory outcome measures are described in the protocol. This section will only serve to outline which of these measures will be covered by this SAP and who is responsible for the analysis of each of these measures.

Primary and secondary outcomes listed below will be reported in the main paper and analysed by the trial statistician(s). Health economics outcomes will be analysed by the Health Economists. Any other outcomes are not covered by this SAP.

Primary outcome

Observed child behaviour as measured using the OSCA-AB (whether this measure will be used as the primary outcome is subject to approval by DMC and TSC following reliability and validity assessment). The frequency of a range of child behaviours that challenge (destructive behaviour, aggression towards themselves and others, frustrated vocalisations, non-compliance, avoidance and reassurance seeking) during the assessment are coded from video by blinded researchers and summed. This produces a semi-continuous score, potentially subject to a floor reflecting how some children show little challenging behaviour during observation. As the length of the observations vary, the rate of child behaviours that challenge per minute will be calculated.

Secondary outcomes

Observed child compliance during the OSCA-AB. The frequency of child compliance will be coded from video by blinded researchers. The rate of child compliance per minute will be calculated.

Observed parent behaviour during the OSCA-AB. The frequency of child-centred parenting behaviours (positive comments, clear commands, praise, and supportive physical guidance) and child-directive parenting behaviours

(negative comments, unclear commands, no opportunity to comply, and physical handling) are coded from video-recordings and summed. The proportion of child-centred parenting behaviour/child-centred and child-directive parenting behaviours will then be calculated.

Aberrant Behaviour Checklist Irritability and Hyperactivity subscales Total scores – parent and teacher rated.

Assessment of Concerning Behaviour Scale (ACB) Internalising and Externalising Total scores – parent and teacher rated.

Home Situations Questionnaire-ASD Mean Per-Item Severity score and Mean Per-Item Severity scores for the Demand Specific and Socially Inflexible subscales.

Preschool Anxiety Scale Revised (PASR) Total Scores.

Parent-Defined Target Symptoms score.

Clinical Global Impressions-Improvement Scale (CGI-I) score, based on Parent-Defined Target Symptoms and parental views of global improvement in their children.

Autism Parenting Stress Index Total Stress score.

Child Adjustment and Parent Efficacy Scale-Developmental Disability Parent Efficacy subscale (CAPES-DD Parent Efficacy) Total score.

Parenting Scale (PS) Mean score and Means for the Laxness and Overreactivity subscales.

Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS) Total score.

Adverse events.

Health Economic outcomes

Client Service Receipt Inventory (CSRI).

EuroQol-5 Dimensions, five-level version.

Office of National Statistics (ONS) Personal Wellbeing.

Therapist time use.

Exploratory/other measures.

Bespoke measures of acceptability/satisfaction and fidelity of the interventions.

Sample size estimation (including clinical significance)

We expect that retention will be approximately 90%, as reported by other trials of psychological intervention trials among young children with ASD that included recruits from our service areas. We expect a more modest effect size than the 1.3 reported by Sofronoff *et al.* (1) as this was for a parent-reported and thus unblinded measure. For the comparison of ASTAR A and ASTAR B, power was calculated by a non-central chi-squared method using a linear mixed model with baseline (baseline–outcome correlation assumed 0.7) as covariate for two-tailed $p = 0.05$ and intraclass correlation for within intervention group of 0.02 and 10% dropout. For an ES of 0.5, our study gives an expected 95% CI of 0.08 to 0.92 and power of 64%, while for an ES of 0.6 the expected 95% CI is 0.18 to 1.02 and 79% power.

Data analysis plan – data description

Recruitment and representativeness of recruited participants

A Consolidated Standards of Reporting Trials flow chart will be constructed (2) – see *Figure 2*. This will include the number of eligible participants, number of participants agreeing to enter the trial, number of participants refusing, then by treatment arm: the number continuing through the trial, the number withdrawing, the number lost to follow-up and the numbers excluded/analysed.

Baseline comparability of randomised groups

Baseline descriptions of participants by trial arm and overall: means and SD or numbers and proportions as appropriate. No significance testing will be used to test baseline difference between the randomised treatment groups.

Adherence to allocated treatment and treatment fidelity

Compliance with the therapy will be described in terms of number of therapy sessions attended. Reasons for withdrawal from therapy will be summarised.

Treatment fidelity will be summarised by trial arm. Checklists measuring intervention fidelity have been developed and are completed by the therapists after each session. The measure explores fidelity related to session content (six items) and 'group process' (six items), scored on a scale of 0–2 (0 = not covered; 1 = partially covered; 2 = fully covered).

Loss to follow-up and other missing data

The proportions of participants missing each variable will be summarised in each arm and at each time point.

The baseline characteristics of those missing follow-up will be compared to those with complete follow up.

The reasons for withdrawal from the trial will be summarised.

Adverse event reporting

Adverse events, adverse reactions, serious adverse events and serious adverse reactions will be summarised by arm.

Assessment of outcome measures (unblinding)

This is a single-blind study; the outcome assessors and the trial statisticians will be blind until the primary and secondary outcomes are analysed (prior to analysis of compliance).

Descriptive statistics for outcome measures

Each of the outcome measures will be described by treatment group. Means and SDs or medians and interquartile ranges will be used for continuous variables; Q–Q plots will be used to assess whether the distribution of a variable is normal. Frequencies and proportions will be used to describe categorical variables.

Satisfaction and fidelity of the intervention will be reported descriptively.

Data analysis plan – inferential analysis

Main analysis of treatment differences

The main analyses will use the intention-to-treat population, including all participants who were randomised according to the group they were allocated to. Statistical tests and CIs will be two-sided. Between-group comparisons will be calculated and presented with 95% CIs.

Analysis of primary outcomes

We will test for a between-group change in the primary outcome at the post-intervention. The distribution of the primary outcome at baseline will be examined for evidence of floor effects. Where present, an appropriate transformation and cut-point will be chosen to allow an assumption of left-censored Gaussian distribution to be applied. Dummy variables will be used to account for randomisation stratification and the clustering effects of group.

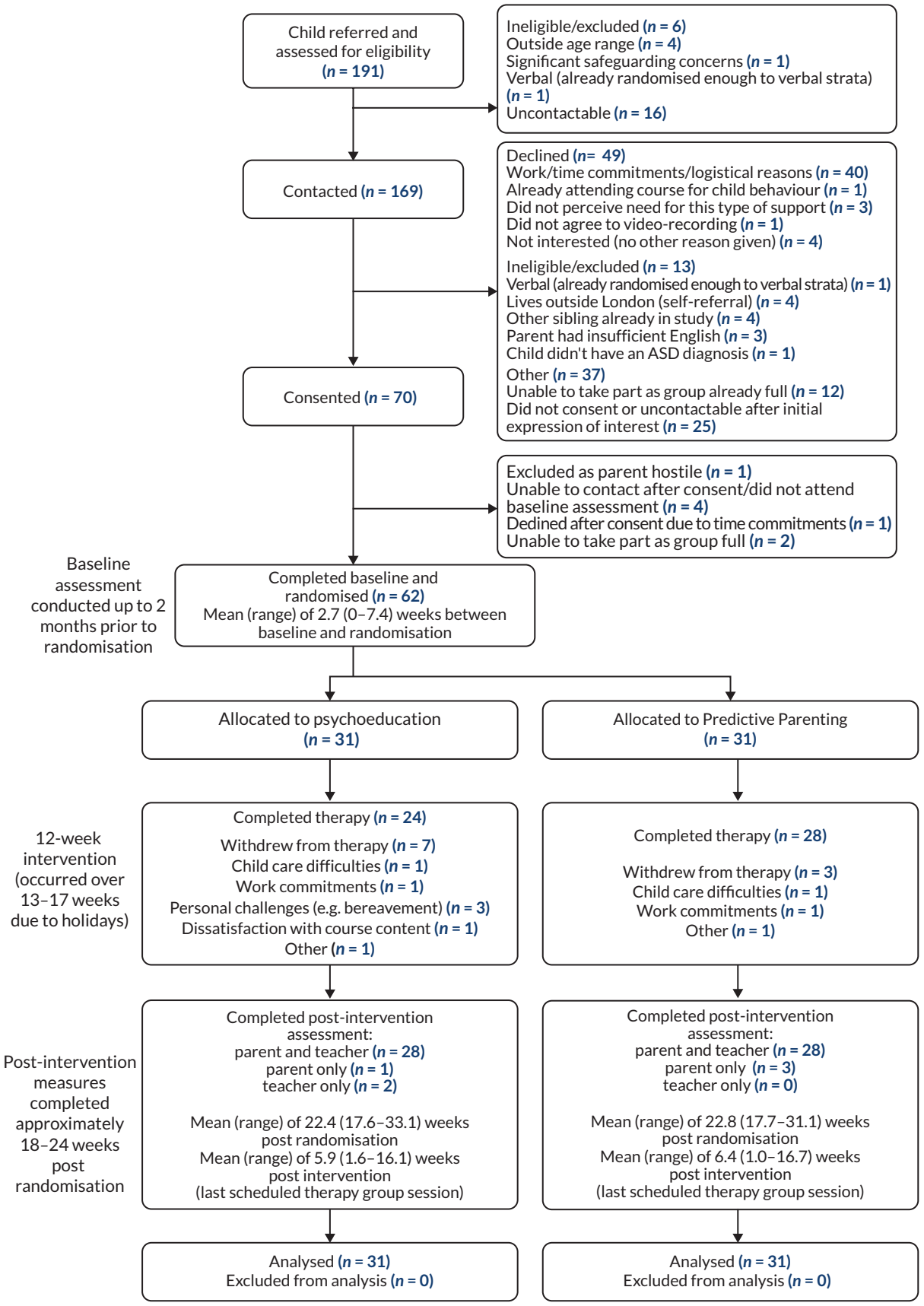


FIGURE 8 Template Consolidated Standards of Reporting Trials diagram for ASTAR trial.

Where floor effects are absent, the analysis will be an analysis of covariance (ANCOVA) regression predicting outcome where the end point is also covaried for baseline. Where floor effects are present, a generalised mixed model/SEM setup in which both baseline and end point are modelled as potentially censored response variables will be used, with a covariance between equations that yields the ANCOVA estimate of treatment effect in the absence of censoring.

Analysis of secondary outcomes
Secondary outcomes will be analysed in the same way as the primary outcome.

Statistical considerations
Time points
There are only two time points, baseline and post intervention; deviation of measurement of the planned post-intervention time point will be summarised by treatment group.

Stratification and clustering
Randomisation has been stratified by ADOS module and Site. Therefore, these will be included as covariates in the analysis. As interventions occur in groups, there is expected to be a group/therapist effect. The model will therefore account for clustering within group.

Missing items in scales and subscales
The number (%) with complete data will be reported. The ideal approach would be to use missing value guidance provided for scales, if provided by authors. As an alternative, scales will be pro-rated for an individual if 20% or fewer items are missing. For example, in a scale with 10 items, prorating will be applied to individuals with 1 or 2 items missing. The average value for the eight or nine complete items will be calculated for that individual and used to replace the missing values. The scale score will be calculated based on the complete values and these replacements.

Missing baseline data
Missing baseline data should not be an issue for the primary analysis. Some extensions to this analysis may use other baseline variables; if these contain missing data, the number with complete data will be reported and they will be imputed using a method suitable to the variable as per the recommendations of White and Thompson.[119]

Missing outcome data
If there is missing outcome data, we will investigate to see if any baseline variables are predictors of outcome missingness. Such variables could then be included as covariates in the model if deemed suitable for adjustment.

If post-treatment variables such as compliance (to therapy), or baseline variables that it would not be suitable to adjust for in the main analyses, are found to be predictive of dropout, multiple imputation will be considered.

Method for handling multiple comparisons
No adjustment will be considered for multiple comparisons, allowing reviewers to make their own adjustment to significance, precision and bias if they wish.

Method for handling non-compliance (per protocol/complier-average causal effect analyses)
None; non-compliance will be described only (in terms of number of therapy sessions attended).

Model assumption checks
The models assume normally distributed outcomes; this will have been checked when describing the data and if substantial departures from normality occur, transformations or bootstrapping of the standard errors will be considered. Residuals will be plotted to check for normality and inspected for highly influential observations.

Sensitivity analyses
Where it has been necessary to analyse the primary outcome within a model accounting for floor effects, the analysis will be repeated for a range of plausible thresholds for the instrument floor.

Planned subgroup analyses
None planned.

Exploratory analyses
None planned for the main paper and so not covered in this SAP.

Exploratory mediator and moderator analysis
None planned for the main paper and so not covered in this SAP.

Interim analysis
No interim analyses are planned of post-randomisation data, although baseline data will be used to test reliability and validity of the OSCA-AB outcome so that a decision can be made (with DMC/TSC) as to whether this should be the primary outcome measure.

Software
Data management: Data will be collected in SPSS databases and in the Delosis Psytools online system.

Analyses will be performed in Stata (4). R (5) may additionally be used for descriptives, report generation and/or production of graphs.

TABLE 4 Schedule of assessments and measures

Month	0/1	2	3	4	5/6
Research/home setting					
Baseline	Demographics; ADOS–2; SCQ; ABAS–3; OSCA–AB; ABC; ACB; HSD-ASD; PASR; APSI; CAPES-DD PE; PS; PTS; SWEMWBS; ONS well-being; EQ-5D-5L; CSRI				
Post-					OSCA–AB; ABC; ACB; HSD-ASD; PASR; APSI; CAPES-DD PE; PS; PTS; SWEMWBS; ONS well-being; EQ-5D-5L; CSRI; CGI-I; Adverse events
Education setting					
Baseline	ABC-T; ACB-T				
Post-					ABC-T; ACB-T
Clinic/home setting					
Intervention		12 group sessions 2 individual sessions (ASTAR B only)			

ABAS–3, Adaptive Behaviour Assessment System – 3rd edition; ADOS–2, Autism Diagnostic Observation Schedule – 2nd edition; APSI, Autism Parenting Stress Index; CAPES-DD, Child Adjustment and Parent Efficacy Scale-Developmental Disability; CGI-I, Clinical Global Impression-Improvement; CSRI, Client Service Receipt Inventory; ONS, Office of National Statistics; PASR, Preschool Anxiety Scale Revised; PTS, Parent Target Symptoms; SWEMWBS, Short Warwick-Edinburgh Mental Wellbeing Scale; SCQ, Social Communication Questionnaire.

EME
HSDR
HTA
PGfAR
PHR

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