The All-Wales Forensic Adolescent Consultation and Treatment Service (FACTS): a 5-year referral cohort study

Natasha Kalebic[1], Sarah Argent[1,2], Harry Austin[1], Lachlan Bramley[1], Gwen O'Connor[2], Caroline Hoskins[2], Abigail Willis[3], Julie Withecomb[2], Andrew Forrester[1], Peter Morgan[1], Pamela J Taylor[1]

1 Cardiff University, UK

2 FACTS, Cwm Taf Morgannwg University Health Board,Bridgend, UK

3 Betsi Cadwaladr University Health Board, UK

Abstract

Background: FACTS is a Wales-wide mental health service for 10-17-year-olds with needs beyond the remit of mainstream child and adolescent mental health services (CAMHS). As a purely consultation-liaison service, it differs from other UK services in the field.

Aims: To describe a complete cohort of referrals to FACTS 2013-2017 with service exit by June 2018.

Methods: Clinical, social and offending data were extracted from FACTS records.

Results: Eighty young people completed a FACTS episode, averaging nearly a year (309 days; range 13-859 days). Mostly boys (65, 81%) of mean age 15.4 years (range 9-18), two-thirds (n=53) had three or more referral reasons, one invariably being threatened/actual harm to others; only half were criminal-justice involved. Half (41, 51%) were committing sexually harmful acts. Half were self-harming (41, 51%). All but seven had had at least one adverse childhood experience (ACE), nearly half (35, 44%) four or more. Nevertheless, posttraumatic stress disorder (PTSD) was rarely diagnosed (7, 9%); just over one-quarter (23, 29%) had no diagnosis at all. Correspondence analyses endorsed two distinct ADHD groups, distinguished by presence/absence of evidenced brain damage or dysfunction. Suicide-related behaviours clustered with the other diagnoses, flashbacks and psychotic symptoms with no diagnosis. Change in home circumstances during a FACTS episode was slight.

Conclusions: The complexity of presenting problems and service involvement evidences need for FACTS. The extent of persistently harmful sexual behaviours is a novel finding, suggesting need for more expert input for this at other service levels. Rarity of PTSD diagnoses was surprising given the extent of ACEs. This raises concerns that services focus on disorder signs rather than the child's inner life. Given the extent of problems, minimal change may be a positive outcome – especially when remaining in the community. Further development of this service should include explicit case-by-case goals and indicative outcome markers.

Background

When children and adolescents with mental disorder pose serious harms to others and/or themselves they both present and face complexity. Having multiple problems, they also face a multiplicity of independent systems and laws, designed primarily to help with each problem separately. In the UK, health, welfare, education and youth justice each provide different intervention streams, supported, as necessary, by three distinct legislative provisions - mental health, welfare and justice laws. Troubled children are rarely without health problems generally and mental health problems specifically, but there is understandable reluctance to label them with diagnoses that may carry pessimism and stigma or to over-medicalise problems. Further, their clinical state may fluctuate faster than in adults, rendering even provisional diagnosis difficult. Nevertheless, diagnosis is generally required for access to clinical services. Concerns about sub-optimal treatment options led to conceptualization of new provision in the UK (Hindley, Lengua and White, 2017), with resultant development of about 55 services UK-wide (Peto, Dent, Griffin and Hindley, 2015). The latter survey found considerable variation between them - from substantial comprehensive services to small, *ad hoc* specialist input. Just 35 of the 48 survey responders confirmed community services.

In Wales, recognition of such needs drove organisation of mental health services for young people along broad principles as elsewhere, with up to four tiers of provision. Tier 1 offers primary care input in the community. Tier 2 includes some specialist clinical input and generally some multidisciplinary healthcare. Tier 3 means that treatment is run by specialist Child and Adolescent Mental Health Service (CAMHS) teams. Tier 4 adds more specialisms. In Wales, in an important difference from other UK services, Tier 4 was designed as a consultation-liaison service (Withecomb and Argent, 2021). Accordingly, the FACTS team never fully takes over a case, but rather works alongside CAMHS, supporting CAMHS staff and inter-agency links. FACTS rarely works directly with the young person; rarely, it facilitates access to medium secure inpatient services in England. FACTS was set up in 2009. Here, we focus on years by which it was well established and little-changing: 2013-2017, although from 2015, some direct work with Youth Offending Teams was started.

As the Wales FACTS may be unique in its consultation-liaison model of working, our aim was, first, to describe a cohort of referrals by reason for referral, demographics, adverse childhood experience (ACE) history and diagnoses. Given the importance of diagnosis as a key to clinical services, our second aim was to explore how symptoms, signs, history of ACEs and reason for referral related to diagnoses recorded by clinicians. Finally, we explored outcomes as documented change or stability between referral to and discharge from FACTS.

Methods

The project relied on routinely collected clinical data, so was undertaken as a service evaluation, endorsed by Cwm Taf Morgannwg University Health Board's Research and Development Department (CT/888/17/18).

Procedure

A retrospective records survey of all new referrals to FACTS for the five years 2013-2017, with a completed episode by June 2018. A completed episode means discharge from FACTS but not necessarily from CAMHS or other services.

Data were extracted from full multidisciplinary records by non-clinical researchers, trained to do so by a member of FACTS (G O'C), anonymised and recorded on a purpose designed datasheet which drew on previous work by Griffin, Hussain & Pittam (2010). Data collected included demographics, reason(s) for referral, family and home life, ACEs, education, prior health service involvement, presenting symptoms and signs, drug or alcohol use, prior violence or other behavioural problems, recorded diagnoses and FACTS input (see online supplement 1 for the full datasheet). All data were entered into an SPSS database.

Planned analyses

Comparisons between categorical variables were made using chi-squared (X^2) or Fisher's exact statistics in SPSS Version26, with $p<0.05$ indicating significance.

Hierarchical cluster analyses were conducted, using Ward's method (Ward, 1963) with the angular cosine distance measure. These exploratory analyses amalgamate variables such that the members of each resultant cluster are more similar to one another than to those in the other clusters. Clustering was carried out between ACEs and, separately, between symptoms and signs (see also online supplement 2).

Correspondence analyses were then used to explore relationships between diagnostic groups and symptoms and signs and also between diagnostic groups and ACEs, to test which of these variables are important in the diagnostic description of the individuals. Finally, a preliminary test of the validity of the cluster-diagnosis group relationships was made using a mosaic plot.

The cluster and correspondence analyses and mosaic plots were conducted in R (Core Team, 2018). As attention and concentration difficulty ratings were almost coterminous, we treated these as a single combined variable.

Results

General description of the cohort

Eighty young people were referred to FACTS in the five years 2013-2017 and completed their FACTS episode by June 2018, 46 in South Wales, with a base population of about 2.2 million, and 34 in North Wales with a base population of about 700,000. All but seven had been referred by CAMHS; youth justice agencies referred these seven in the three later years. For most, at least two agencies were involved on referral. Calculating for the three main agency groups – health, social service and justice – 27 (34%) were involved with all three, 38 (48%) with two and 13 (16%) with just one (2 unrecorded). Average age on referral was 15.39 years (standard deviation [SD] 1.87y; range 9.0-

17.85 y). Under one fifth were girls (14, 17.5%). One third (25, 31%) were living with their birth family, one fifth were in a children's home (17, 21%) and one fifth (17, 21%) in secure accommodation, whether local authority, hospital or prison; a small number were in other arrangements (table 1). There were no significant differences between the North and South Wales subgroups in demographics or referral reasons, so we examined all referrals as a single cohort.

Table 1 about here

Reasons for referral to the service

Table 2 shows the reasons for referral. All but three had been designated at imminent risk of harming others; those three had had intrusive thoughts of doing so but had not yet acted on them. Over half of the cohort had made explicit, intrusive and distressing threats to others. It was rare for anyone to pose only one type of risk to others; excluding verbal threats, five (6.3%) had already been violent, sexually assaultive, set fires *and* been cruel to animals; 12 (15%) had three of these behaviours and 21 (26.3%) had two. Twenty-nine (36.3%) had both violently and sexually harmed others; all 17 who had been cruel to animals had committed at least one other aggressive act (assault n=13, 76%; sexual harms n=10, 59%; fire-setting n=8, 47%). The sexual harms included three rapes or sexual assaults, but more commonly encompassed a range of touching and masturbatory behaviours with at least one other person, often another family member, internet porn seeking, explicitly sexual photo sharing and/or fetish-related behaviours.

Only half of these young people were technically offenders. Forty-two (53%) had been charged with or convicted of an index offence; fewer had had prior youth offending service involvement (31, 39%) but most had had some police contact (49, 61%).

All were, however, also extremely vulnerable. The largest vulnerability group was of young people harming themselves, or making credible threats to do so (n=34, 42.5%). Nearly one fifth were repeat absconders from their usual home/placement and eight were considered at risk of exploitation.

Overall, the association between referral for any harm to others and any such measured vulnerability was not significant (X^2 = 2.444, p = 0.118), but there was a trend towards a relationship between referral for violence towards others and self-harm (X^2 (1, 80) = 3.342, p = 0.068).

Table 2 about here

Early vulnerabilities

Sixty-nine (86%) of these 80 young people had experienced at least one of the nine major ACEs measured in the Wales general population survey (Bellis et al, 2015). Our extended list included serious neglect, close family bereavement and extended parental hospitalisation. When all these were included 73 (91%) had at least one ACE. Over half the cohort (43, 54%) had four or more of the extended ACE list, 22 (28%) had two or three whilst just eight (10%) had a single ACE (see table 3).

Table 3 about here

In the exploratory hierarchical cluster analysis of ACEs (figure 1), at the lowest level each ACE is treated, in effect, as a cluster. At the next level, the distance measure (height in the dendrogram) indicates how far apart the clusters are when they join. Thus, for example, domestic violence and separation cluster closely and then, at the next level up, to physical abuse of the child. Finally, the two highest level clusters are, first, of intrusive and abusive family behaviours with mental illness and substance use and the second of loss through death, hospitalisation or parental incarceration.

Figure 1 about here

Symptoms, signs and disorders of mental health among young people in the FACTS cohort

Everyone had signs and all but four had symptoms from a wide range recorded (online supplements 3 and 4 respectively). All the latter four showed 'inappropriate sexual behaviour', alone in one case but with other interpersonal difficulties in the other three, and suicide related behaviours in two. The most frequently reported symptoms were anxiety (n=41, 51%), low mood (n=34, 43%), sleep

problems (n=34, 43%) or suicidal thoughts (n=32, 40%). Nearly one third (25, 31%) reported auditory hallucinations, but other psychotic symptoms were rarely recorded.

There was no record of *observed* anxiety or psychotic features; signs of depression were recorded for only three young people. By contrast, observed behaviours suggested that volunteered suicidal thoughts probably under-estimated potential for self-harm. Thirty-four of the young people were recorded as having spoken about suicide but just over half (n=41, 51%) had actually self-harmed; it was explicit that 25 (31%) had made a suicide attempt.

Other signs were all reflective of interpersonal problems including 52 (65%) recorded as showing 'inappropriate sexual behaviours', 44 (68%) of the boys and seven (50%) of the girls. For nearly half of the cohort, callous and unemotional traits were recorded (39, 49%) and for one third controlling behaviours (27, 34%), although neither of these descriptors was based on systematic, scale-based assessment. Autistic traits were documented for a quarter of the cohort (n=20), as was, separately, hyperactivity. 'Relationship problems' were documented for nearly one-third (26, 33%) and antisocial behaviours for nearly two-thirds of these young people (49, 61%).

Cluster analysis of symptoms and signs revealed three main clusters (figure 2): one of flashbacks and psychotic features, one of mood and sleep problems with suicide-related behaviours and one of interpersonal relationship problems with anxiety.

Figure 2 about here

Diagnoses

Over one quarter of the cohort had no recorded diagnosis (23, 29%), although over 90% of them had four or more symptoms and/or signs. Attention deficit hyperactivity disorder (ADHD) was the most common diagnosis (n=35, 44% of the total). One quarter (21, 26%) had been diagnosed with autistic spectrum disorder (ASD), sixteen of them also with ADHD; only two young people with ASD had no other diagnosis. Other diagnoses were rarely made; of particular note, given the high prevalence of

ACEs and observed anxiety, post-traumatic stress disorder (PTSD) was diagnosed in just seven cases, one in conjunction with ADHD. A diagnosis of conduct disorder *alone* was very rare (n=2). In order to simplify the data for analyses, we grouped according to diagnostic mix, as shown in table 4.

Table 4 about here

Relationships between diagnoses, symptom and sign profiles, ACEs and reasons for referral

Figure 3 shows the results of the correspondence analysis of symptoms, signs and diagnostic groups, excluding the seven who had *both* ADHD/ADHD+ features *and* PTSD/anxiety disorder. Whether allowing for the number of patients contributing a particular sign or symptom or by entering all recorded signs or symptoms, the model was similar, accounting for 78.2% of the inertia (variation). For both columns and rows, the greater the distance between markers, the more likely the characteristics are to be independent and the closer, the more likely to be linked. Between column and row categories, the more acute the angle of the arrow and the longer the arrow, the stronger the association. Dimension 1, accounting for 49.8% of the variation, seems to indicate the extent to which symptoms or signs are more internally experienced or more 'externally directed'. Dimension 2, accounting for a further 22.2% of the variation, seems to be capturing the extent to which symptoms, signs or diagnoses are accepted as unequivocal clinical problems or as of clinical interest but with more lay connotations too; reported hallucinations are the only outliers from this interpretation. The 'no diagnosis' group is clearly towards the 'clinically equivocal' pole as is, in this context, ADHD without organic markers. PTSD, 'other diagnoses' and ADHD with organic markers (ADHD+), by contrast, are clearly in the clinical zone. This does tend to confirm the distinctiveness of ADHD and ADHD+. Autistic traits are the signs that characterise the ADHD children as within the clinical range, whereas hyperactivity, callous, inappropriate or antisocial behaviours leave them more equivocally placed. Suicide-related behaviours and sleep problems cluster around PTSD and other diagnoses in the internalising and unequivocally clinical quadrant. Flashbacks, in just nine

records, seemed unrelated to other features, strongly placed at the extreme of the internalising but clinically equivocal axes.

Figure 3 about here

The mosaic plot showed a similar pattern whether entering only the 73 young people whose diagnoses showed no overlap between the four main categories or all 80 in the cohort; the latter only is shown in figure 4 and was highly significant (X^2_8 = 28.217, p<0.0004). This confirmed that the low mood/sleep problem/suicide related behaviour cluster was under-represented and the interpersonal problem cluster over-represented in the ADHD+ group, while the reverse was true for the PTSD group. The vivid experience cluster of flashbacks and psychotic symptoms was over-represented in the no diagnosis group.

Figure 4 about here

Results of the correspondence analysis between diagnostic groups and the ACEs is shown in online supplement 5, but a mosaic plot between diagnostic groups and ACE clusters failed to support significance.

Outcomes

FACTS' involvement with these young people averaged nearly a year (309 days) but with considerable variation (range 13 - 859 days). It was similar between North and South Wales (North [n=32, 4 missing] mean 314.31 days, SD 210.87; South [n=42] mean 305.64 days, SD 198.47; t(72) -0.181, p=0.857). Supplementary clinical assessments accounted for much of the work. Over one-third of the young people had a formal assessment of risk of harm to others (30, 38%); nearly half had other specialist needs, cognitive or trauma assessments (36, 45%).

Other achievements are harder to quantify. A given task is supporting multi-agency co-ordination. Overall, 72 (90%) had health service involvement, 57 (71%) social services involvement and 41 (51%) criminal justice involvement at the point of referral (details in online supplement 6). Explicit

negatives on service involvement were rarely recorded at the point of discharge. Thus, while there is a suggestion of less mental health, social or youth/criminal justice involvement on discharge compared with on referral, we are not confident that such activity had ceased.

Living circumstances changed little. With data unrecorded for only five cases on referral and ten at discharge, nearly half (39, 49%) were living in the wider community at both stages. Most of the wider community group at discharge were with their birth family (22, 69%); eight were in other family arrangements, including fostering or adoption, and three in (semi-)independent accommodation (details in Table 1). Twenty-three (24 on discharge) were in social care accommodation, in four cases secure homes. Few were hospital inpatients (9 referrals, 8 discharges) or in the criminal justice system (4 referrals; 5 discharges). Of importance for such a cohort, no young person died in the period and there is no record of any new offence.

Discussion

Consistent with its designation as a consultation-liaison service, FACTS did not take over cases. Nevertheless, it gave substantial input for up to a year in many cases and over two years for some. It is difficult to evaluate the impact of any consultation-liaison service with, by definition, a limited clinical role per case, but this lengthy involvement raises questions both about the extent to which other services have sufficient resource to manage exceptionally complex presentations and about need for further FACTS development. The extent to which referrals were accepted and carried without a recorded diagnosis is reassuring as it suggests both adherence to a needs-based approach and avoidance of potentially stigmatising 'conduct disorder' style labels.

Informing an outcomes based approach

The FACTS team is small but, as a national service, the only service of its kind for a population of over three million, demand led and evolving accordingly. Its highly specialist resources are one full time

equivalent (FTE) consultant psychiatrist, 2.15 FTE clinical psychologists, 0.5 FTE clinical nurse specialist, 0.2 FTE specialist in treating sexually harmful behaviour, 0.2 FTE systemic therapist and 1 FTE administrative support. Given the nature and extent of difficulties posed by the young clientele and the length of FACTS involvement, is this staffing qualitatively or quantitatively sufficient? Perhaps a robust, national needs assessment should explore this further. It seems highly desirable to maintain young people in mainstream services and in community living. Given that those are the broad goals of the service, the current service is fulfilling its brief. Despite everyone in the cohort having presented actual threat to others, and about half also to themselves, most had remained in the community with little change in living arrangements. Numbers known to be in secure accommodation of some kind had almost halved by the end of the FACTS involvement (from 20 to 13). From a researcher perspective, however, the service and its further evaluation would be helped by fuller recording of the FACTS formulation and plan after the multi-agency meeting that invariably follows referral. Documentation of the agreed roles for FACTS in each specific case, now more generally done, together with expected resultant outcomes and/or explicit gaps in service would both help confirm current service value and identify continuing or new gaps in service.

A further service development question arises from these data. The number and proportion of young people referred with serious sexual behaviour problems was unexpectedly high. Given the paucity of services for sexual offending more generally, the fact that many of these young people were transgressing against others, generally other minors, the consequent complexities of reporting requirements and a general clinical reluctance to engage with sex offenders, was this the factor that tipped the balance to the Tier 4 referral? Could there be a substantive educative role to other clinical services and agencies relating to sexual problems?

The exceptional difficulties of consultation-liaison model cases

A similar survey in England captured many more comparably referred cases (1406) over nearly three years (Lane et al, 2021). The difference in sample size fits with the differences in country

populations. Save for ethnicity, (proportionately fewer people overall are in ethnic minority groups in Wales), the demographics were similar between these countries. Differences in service organisation were apparent in the relatively low rate of CAMHS involvement in England (Wales 89%, England 63%). The apparently more problematic presentations of the Welsh cohort may only reflect this difference in service organisation. In Wales, only one third were still with their birth family compared with nearly 60% of the English cohort. On reasons for referral, the Welsh cohort appeared more challenging; *all* were referred with concerns about credible threat(s) to harm or actual violence compared to 80% in the English cohort. Over half had shown sexually harmful behaviours in the Welsh cohort but 30% of the English, and 25% fire-setting compared with 10% of the English cohort. While these differences flag the importance of designing highly specialised services according to accurate knowledge of the population to be served, they raise interesting questions. Where purpose designed consultation-liaison alone is offered, does this indeed facilitate service management of all but the most difficult cases? Or is there less tolerance of offender-patients or less capacity in England's CAMH services, creating a lower threshold for specialist forensic referrals?

Some apparent differences between the cohorts may be reflective of considered clinical style. While comorbidity featured in both cohorts, in the English nearly half were diagnosed with conduct disorder while in the Welsh cohort it was just 14%. In Wales, notwithstanding the low rate of PTSD *diagnosis*, the service is explicitly trauma informed. Other differences were less striking, excepting the absence of a 'no diagnosis' group in the English cohort while it accounted for 29% of the Welsh cohort. The diagnosis-symptom mapping exercise we conducted for the Welsh cohort suggested preliminary validation of a practical way of dispersing services. ADHD was at least one of the diagnoses for 34 (43%) of the Welsh cohort, compared with 28% of the English. A key further finding, however, was the difference in presentations according to whether or not there was clear independent evidence of brain damage or dysfunction. Ensuring sufficient specific expertise for different treatment and management paths may help optimise services.

Pragmatic understanding of disorder

The likelihood of seriously adverse experiences in earlier childhood is common ground across studies of young people with at least one of the presenting problems of this FACTS cohort - offending (e.g. Graf, Chihuri, Blow and Li, 2021), mental disorder (e.g. Lee, Kim and Terry, 2020) or suicide related behaviour (e.g. Isohookana, Riala, Hakko and Räsänen, 2013). The English FCAMHS survey found similar rates of trauma histories (Lane et al, 2021). Of most importance, rates of ACEs in the FACTS cohort far exceeded those in the underlying Welsh population over about the same period (Bellis et al, 2015). It is commonly assumed that adverse experiences exclusively contribute to later problems and evidence for explanatory mechanisms tends to support this (e.g. Rasmussen, Moffitt, Arseneault et al, 2020), but the dynamics of relationships when a child has a primary behavioural difficulty must also be considered. Untreated or inadequately managed adverse child behaviours may trigger adverse responses from parent figures. Thus, verbal abuse, physical neglect and parental separation, which clustered with 'ADHD plus' in our study, may need understanding in the context of the difficulties enountered while parenting a child with such conditions. In a possible parallel, it is acknowledged that 'high expressed emotion' from close relatives/carers of a person with schizophrenia is associated with poorer outcomes (e.g. Leff & Vaughn, 1985). It was not really, however, until it was established that high expressed emotion could develop in professional staff in some specific long-term clinical relationships with patients (Berry et al, 2011) that the problem was considered to be part of an interpersonal dynamic, and to be resolved in that context. The importance of considering the family as a whole rather than the child in isolation is indicated.

We were surprised that so little PTSD was recorded. In England, nearly 20% of the cohort had 'post-traumatic' features, but for nearly one-quarter there was no record one way or another. At least, however, clinical services are recognising the problem. In a substantial pan-national young offender cohort with some similar demographics and some acknowledged mental health problems nad trauma histories, there was no mention of PTSD at all (Hillege et al, 2017). While it may just be that

in the plethora of problems faced by these young people and their families others take priority, since there are specific interventions for helping PTSD, it should be considered more in custodial and healthcare settings.

Limitations

The main limitations were that we were working with records only and the cohort was small. As with most clinical records, 'significant negatives' were rarely explicit. Positive statements of the presence of a characteristic or problem were reliable, but absence of reference did not necessarily mean absence of the characteristic. Thus, the extent of threat to self and others, of signs and symptoms of mental disorder and ACEs is the minimum. We think more service involvement than recorded was likely. Despite having a complete five-year cohort data, numbers were small and the correspondence analyses is explicitly exploratory.

Conclusions

Young people who pose a serious risk to others, and often themselves, in the context of probable mental illness and/or developmental disorders, face complex legal and service arrangements in addition to their core problems. Specialist services to help navigate through all this are still developing and can learn from each other, given some important differences in approaches. These differences may account for differences in problem prevalence between such services, and must be taken into account in considering outcomes. In the consultation-liaison style service surveyed here a key finding was the exceptionally high rate of sexually harmful behaviours, suggesting that lower service tiers may need more help in assessing and treating such problems in young people with mental disorders. The rarity of diagnosing PTSD may reflect the problem-oriented approach of the service, given trauma orientation, but given the extent of trauma histories and some neglect of this in related literature this should receive more future research attention.

Acknowledgements

Immense thanks to Allie Price, Cwm Taf Morgannwg University Health Board and Jonathan Williams and Jo Kennedy, Betsi Cadwaladr University Health Board for all their support in data collection. Also to George Raywood-Burke and Dimitra Mastaka, undergraduate psychology students who contributed to project discussions and gave general support.

References

Bellis MA, Ashton K, Hughes K, Ford K, Bishop J and Paranjothy S. (2015) *Welsh Adverse Childhood Experience (ACE). Adverse Childhood Experiences and their impact on health-harming behaviours in the Welsh adult population.* Public Health Wales: Cardiff and Centre for Public Health, John Moore's University: Liverpool. https://phw.nhs.wales/files/aces/aces-and-their-impact-on-health-harming-behaviours-in-the-welsh-adult-population-pdf/

Berry K, Barrowclough C and Haddock G (2011) The role of expressed emotion in relationships between psychiatric staff and people with a diagnosis of psychosis: A review of the literature. *Schizophrenia Bulletin,* 37(5) 958-972. doi:10.1093/schbul/sbp162

Core Team (2018). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

Graf GH-J, Chihuri S, Blow M and Li G. (2021) Adverse Childhood Experiences and Justice System Contact: A Systematic Review. *Pediatrics,* 147 (1): e2020021030. https://doi.org/10.1542/peds.2020-021030

Griffin M, Hussain N and Pittam G. (2010) Evaluation of a pilot community forensic child and adolescent mental health service (FCAMHS) for Hampshire and the Isle of Wight (HIoW). *Oxford:* Solutions for Public Health. https://www.sph.nhs.uk/wp-content/uploads/2017/07/HIoW-FCAMHS-Evaluation-Report-vfinal.pdf retrieved 26 01 2022.

Hillege SL, Brand EFJM, Mulder EA, Vermeiron RRJM and van Domburgh L. (2017) Serious juvenile offenders: classification into subgroups based on static and dynamic characteristics. Child and Adolescent Psychiatry and Mental Health, 11: 67. doi.org/10.1186/s13034-017-0201-4

Hindley N, Lengua C and White O. (2017) Forensic mental health services for children and adolescents: rationale and development. *BJPsych Advances,* 23: 36–43. doi: 10.1192/apt.bp.114.013979

Isohookana R, Riala K, Hakko H and Räsänen P. (2013) Adverse childhood experiences and suicidal behavior of adolescent psychiatric inpatients. *European Child & Adolescent Psychiatry* **22:** 13–22. doi: 10.1007/s00787-012-0311-8

Lane R, D'Souza S, Singleton R, Hindley N, Bevington D, White O, Jacob J, Wheeler J and Edbrooke-Childs J. (2021) Characteristics of young people accessing recently implemented Community Forensic Child and Adolescent Mental Health Services (F:CAMHS) in England: insights from national service activity data. *European Child & Adolescent Psychiatry.* doi.org/10.1007/s00787-021-01870-y

Lee H, Kim Y and Terry J. (2020) Adverse childhood experiences (ACEs) on mental disorders in young adulthood: Latent classes and community violence exposure. Preventive Medicine 134 doi.org/10.1016/j.ypmed.2020.106039

Leff J and Vaughn C (1985) *Expressed Emotion in Families: Its Significance for Mental Illness.* London: Guilford Press.

Peto LM, Dent M, Griffin M and Hindley N. (2015) Community-based forensic child and adolescent mental health services in England, Scotland and Wales: a national mapping exercise. *The Journal of Forensic Psychiatry & Psychology*, 26 (3): 283–296. doi.org/10.1080/14789949.2015.1004635

Rasmussen LJH, Moffitt TE, Arseneault L, Danese A, Eugen-Olsen J, Fisher HL, Harrington H, Houts R, Matthews T, Sugden K, Williams B and Caspi A. (2020) Association of Adverse Experiences and Exposure to Violence in Childhood and Adolescence With Inflammatory Burden in Young People *JAMA Pediatrics*, 174(1):38-47. doi:10.1001/jamapediatrics.2019.3875

Ward JH Jr. (1963) Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, 48: 236-244. DOI: 10.1080/01621459.1963.10500845

Withecomb J. and Argent S. (2021) FACTS-The Forensic Adolescent Consultation and Treatment Service–an all Wales mental health service for children and adolescents with the most complex and

challenging behavioural problems. Can we meet needs without over-medicalising? *Criminal Behaviour and Mental Health*, 31(5): 293-296. doi.org/10.1002/cbm.2218

Table 1: Living arrangements before and after referral to FACTS

Wider community living	**T1 referral**	**T2 discharge[d]**	**Details of placement on discharge (numbers given are of n in category at referral) [Additional discharge cases' (ADC) referral origin]**
Birth family	25	22	21 (84%) no change; 1 NR[a] on discharge; 3 social services children's home (SSCH) [ADC: 1 NR]
Adopted family	2	2	2 (100%) no change
Foster family	4	3	3 (75%) no change; 1 SSCH
Other family arrangement	6	3	3 (50%) no change; 1 Secure SSCH; 2 NR
[Semi-]independent living[b]	2	3	1 no change; 1 living independently [ADC: 1 Secure SSCH]
Institutional living			
Social Services Children's Home	17	20	13 (76%) no change; 1 YOI;1 Secure SSCH; 1 medium-secure hospital; 1 NR [ADC: 3 birth family; 1 foster family; 1 Secure SSCH; 1 MSHU; 1NR]
Secure Social Services Children's Home (Secure SSCH)	6	4	2 no change; 1 low security hospital; 1 semi-independent living; 1 SSCH; 1 NR [ADC: 1 SSCH; 1 other family]
Open in-patient unit	2	1	1 no change; 1 MSHU
Low secure hospital unit (LSHU)	3	3	1 no change; 1 MHSU; 1 NR [ADC: 1 Secure SSCH; 1 MSHU]
Medium secure hospital unit (MSHU)	4	4	1 no change; 1 low-secure hospital; 1 SSCH; 1 YOI [ADC: 1 LSHU; 1 open hospital inpatient; 1 SSCH]
Young offender institute (YOI) [c]	4	5	3 no change; 1 NR on discharge [ADC: 1 SSCH; 1MSHU]
Missing/incomplete Data	5	10	
Totals	80	80	

[a]NR: not recorded.
[b]Semi-independent living was in a room or hostel without residential staff but with professional supervision.
[c]YOI: 'young offender institution' – is a specialist prison or wing of a prison for those under the age of 18 sent to await trial or sentencing by a criminal court or serving a custodial sentence.
[d]The numbers in column 2 are not a subset of the numbers in column 1, although there is considerable overlap; a person may move from one line item to another - for example, not be living in a SSCH at first, but move there. Movement details are given in the third column.

Table 2: Main reasons for referral to FACTS

Referral Reasons[a]	**n**	**%**
Harms to others		
Aggression/assault	60	75.0
Threats	46	57.5
Sexually harmful behaviours	41	51.2
Fire-setting	20	25.0
Cruelty to animals	17	21.3
Non-violent offending	24	30.0
Vulnerabilities		
Risk of harm to self	34	42.5
Repeated absconding	14	17.5
Risk of exploitation to harm	8	10.0
Testing fitness for police interview	5	6.3
Other[b]	7	8.8

[a]Reasons not mutually exclusive

[b]'other' referrals (n=7) Suspected grooming of a child via social media (currently unconfirmed); Hoax calls to police; Criminal damage; internet threats/aliases of murderers; thoughts of harming others (x3)

Table 3: Prevalence of all 16 adverse childhood experiences (ACES) recorded for the FACTS cohort

Type of ACE[a]	n	%
Verbal abuse [b]	18	22.5
Physical abuse [b]	39	48.8
Sexual abuse [b]	28	35
Emotional neglect	32	40
Physical neglect	20	25
Parental separation [b]	39	48.8
Drug use in the household [b]	28	35
Alcohol misuse in the household [b]	28	35
Domestic violence in the household [b]	41	51.2
Household mental illness [b]	31	38.8
Household incarceration [b]	12	15
Father deceased	6	7.5
Mother deceased	1	1.3
Sibling deceased	3	3.8
Other significant bereavement	10	12.5
Parental hospitalisation	5	6.3

[a]categories not mutually exclusive

[b] indicates ACE as recorded in the Welsh Adverse Childhood (ACE) Experience Study (Bellis et al, 2015)

Table 4: Distribution of diagnoses in a 5-year cohort of young people referred to the All-Wales Forensic Adolescent Consultancy and Treatment Service (FACTS)

ADHD with diagnostic indicators[a] of organic brain damage or dysfunction 'ADHD+'	**ADHD alone or with diagnoses other than those indicative of organic brain damage or dysfunction**	**PTSD, anxiety or depression in the absence of ADHD or indicators of organic brain damage or dysfunction**	**Other diagnoses**	**No diagnosis on record**
Total n=12 definite +6[b] removed for correspondence analysis, overlapping with group 3	**Total** n=16 definite cases + 1[c] removed for correspondence analysis overlapping with group 3	**Total** n=10 cases	**Total** n=12 cases	**Total** n=23 cases
4 +specific LD +dyslexia	2 +ODD	7 PTSD +attachment dis.,+ emerging personality disorders	13 oppositional defiant disorder + emergent personality disorder	1
8 +ASD	6	33 *+reactive attachment* + cannabis related disorders	20 ASD only	5
10 +ASD	19	37 anxiety disorder	22 Tourette's only	9
15 +ASD + ID, test IQ 63	24	59 depression alone	30 conduct disorder only	11
17 +ASD +Tourette's +bipolar	25	66 PTSD +mood +dissociative +emerging personality disorders	31 conduct disorder only	12
32 +ASD +Tourette's	29	68 PTSD + emerging PD + psychoactive substance disorders	40 intellectual disability (ID) only	14
39 +ASD	35 +conduct disorder	70 anxiety disorder	44 ID +chromosomal abnormality [XXYY] *+mood disorder +anxiety*	16
48 +ASD + CD	41 +ODD	71 attachment disorder +mixed conduct & emotional disorder *+ psychosis*	45 cannabis related disorder only	18
51 +ASD	43 +conduct disorder	78 PTSD +CD + emerging PD *+ epilepsy*	46 -ASD + *depression +* conduct disorder	21
54 +ASD +ID	52 + conduct disorder	79 PTSD +attachment disorder	49 ASD + ID + dyspraxia + psychosis	23
60 +ASD +ID +CD	53		56 ASD alone	26

74 +ASD +ID	57		64 ASD + *attachment disorder + psychosis*	27
	62			34
	63			36
				42
	67			47
	80 + CD			58
				65
				69
				73
				75
				76
				77

[a] N**umbers given in each column are research ID numbers**

[b]Cases likely to be in both group 1 and Group 3

3 +ID +ASD +dyslexia *+anxiety*

28 +ASD *+mood disorder*

38 +ID +conduct disorder *+mood disorder*

50 ADHD + PTSD + ID + ASD + CD + harmful use of substances

55 +ASD +ID +*attachment disorder*

61 +ASD +ID *+attachment disorder +anxiety*

[c]Case likely to be in both group 2 and group 3

72 ADHD + *PTSD*

Glossary: ADHD Attentional Deficit Hyperactivity Disorder (ADHD); Intellectual (learning) disability ID/LD; Autistic Spectrum Disorder (ASD); Conduct Disorder (CD); Oppositional Defiant Disorder (ODD); Post-Traumatic Stress Disorder (PTSD).

Figure 1: Exploration of Adverse Childhood Event (ACE) clustering (n=80)

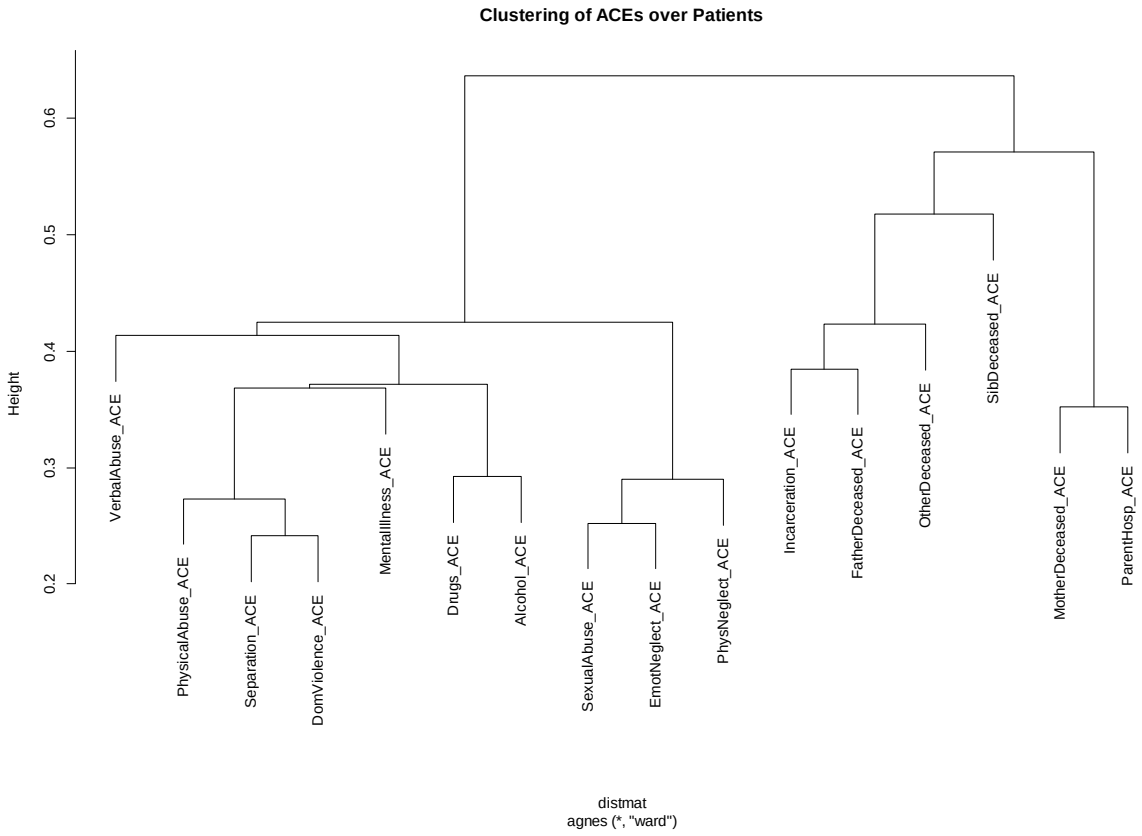


Figure 2: Cluster analysis of symptoms and signs (n=80)

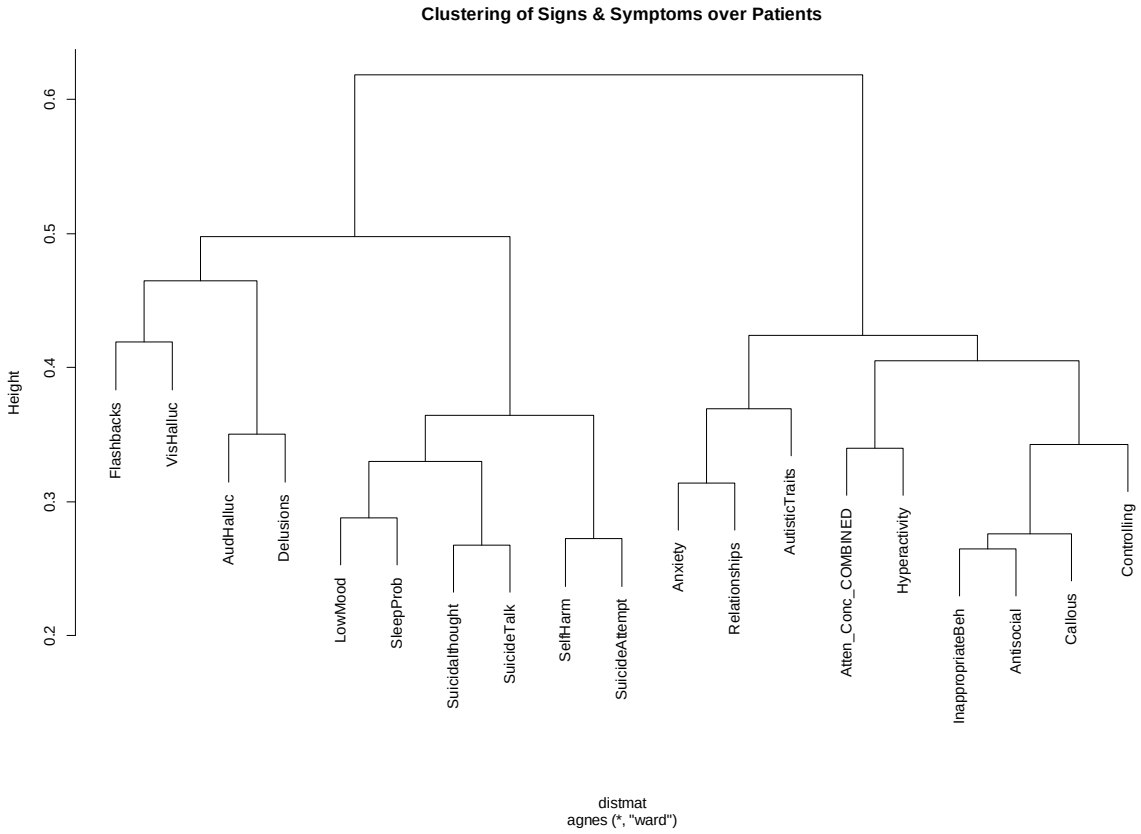
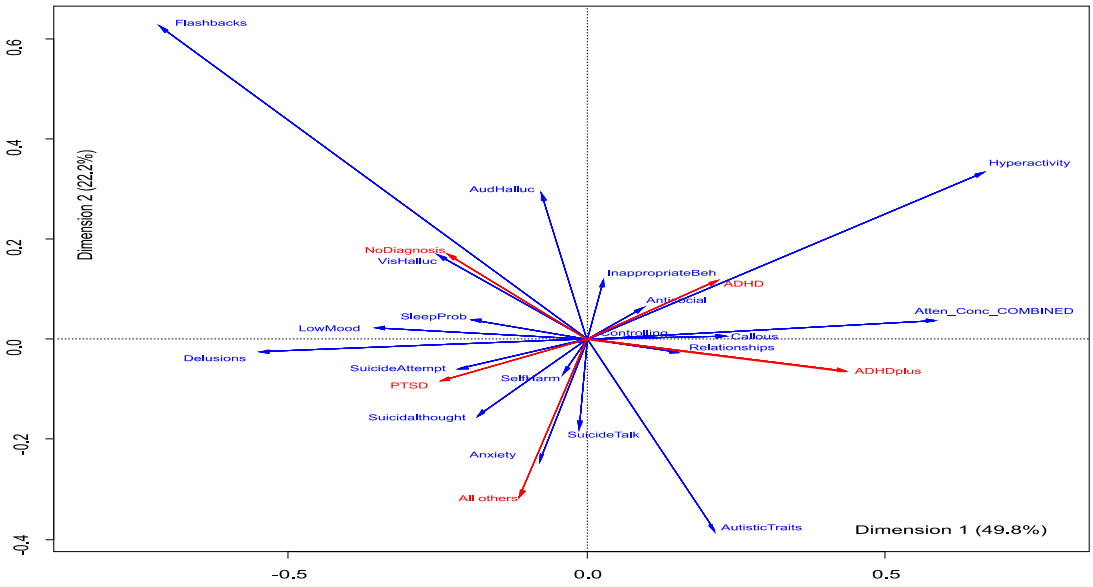


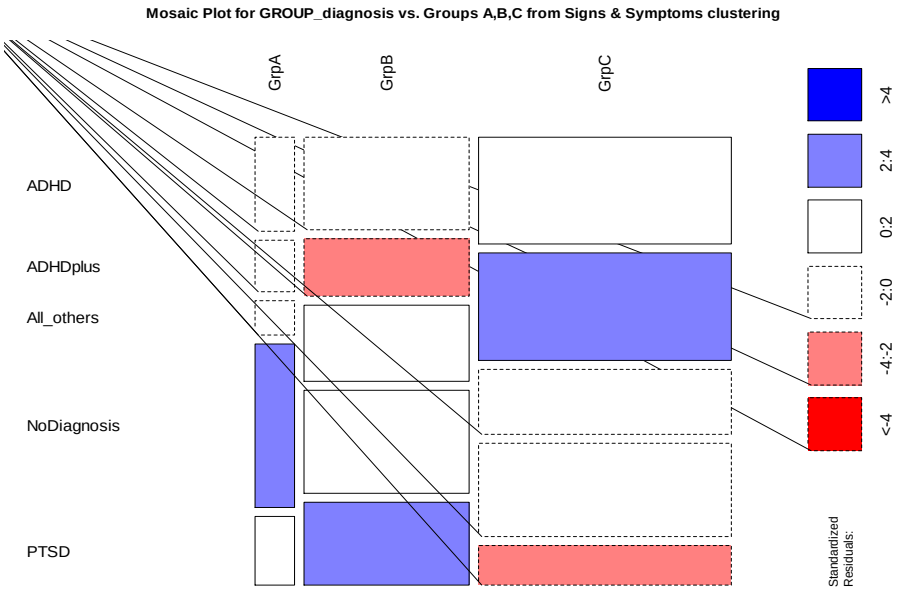
Figure 3: Correspondence analysis of symptoms, signs and main diagnostic groups (with diagnostic group overlapping cases removed, n=73)



	ADHD+[1] N=12	ADHD[2] N=16	PTSD N=10	Other diagnoses N=12	No diagnosis N=23
Symptoms & signs					
Flashbacks	0	1	2	0	6
Low mood	2	5	4	7	13
Anxiety	6	6	5	10	10
Sleep problems	2	9	6	6	10
Attention/concentration	8	9	3	2	3
Auditory hallucinations	3	6	3	2	9
Visual hallucinations	0	2	1	1	2
Delusions	0	1	2	1	2
Suicidal thoughts	4	5	7	6	8
Autistic traits	4	3	1	5	3
Inappropriate behaviour	8	12	5	7	16
Hyperactivity	5	7	1	0	3
Self-harm	4	11	9	6	7
Suicidal talk	6	6	7	6	7
Suicide attempt	3	4	7	3	6
Callous traits	8	10	3	6	9
Controlling	4	6	3	5	8
Antisocial	7	13	5	7	12
Relationship problems	4	7	3	4	5

($X^2_8 = 28.217$, $p<0.0004$); [1] 6 cases with ADHD+ and PTSD, anxiety or depressive disorder removed from this analysis; [2] one case with ADHD *and* PTSD removed

Figure 4: Mosaic plot of diagnostic groups and cluster analysis derived groups of signs and symptoms (n=80)



Online supplement 1: FACTS cohort records survey: data collection sheet (attached separately)

Online supplement 2: Extended explanation of cluster analyses

This technique was used purely as an exploratory tool to seek out any groupings within the Adverse Childhood Experiences (ACEs in Figure 1) and within Signs and Symptoms (Figure 2).

The dendrograms in Figures 1 and 2, were carried out using hierarchical clustering with the angular cosine distance measure (which, unlike the cosine dissimilarity, has all the properties of a true distance). Essentially, the distances will be smaller when the variables have more patients in common. In the case of the signs and symptoms, for example, two of these will be thought of as close together when more patients experience both of them. If the method of hierarchical clustering is varied by using different clustering methods such as complete linkage, or single linkage, Low Mood, Sleep Problems, Suicidal Thoughts, Suicidal Talk, Self Harm and Suicide Attempt, for example, remain clustered together. The same is true of Inappropriate, Callous and Antisocial behaviours.

A comparison of Figure 2 with Figure 3 shows that signs and symptoms which are in the same cluster are often associated in the correspondence analysis biplot. For example, Low Mood, Sleep Problems, Suicidal Thoughts, Suicidal Talk, Self Harm and Suicide Attempt are also grouped together in Figure 3 as are Inappropriate, Callous and Antisocial behaviours.

Referring again to Figure 2 for the signs and symptoms, there are two main clusters with Flashbacks, Visual Hallucinations, Auditory Hallucinations and Delusions forming a weaker cluster adjacent to Low Mood and the other depressive signs and symptoms. If we produce a contingency table showing the frequency of occurrence of the different diagnoses within these three groupings, we can produce a mosaic plot (Figure 4) of this table, which shows that the diagnosis is far from independent of these three categories and that the diagnostic profiles of these three symptom groups are very different. Since diagnosis was not used in the construction of the clusters, the fact that it is associated with the cluster groupings is some evidence of cluster validity.

For the ACEs, when we compare the Correspondence Analysis biplot in Online Supplement 4 and the dendrogram in Figure 1, we find, for example, that the rather loose cluster on the right of the dendrogram are all outliers in the biplot.

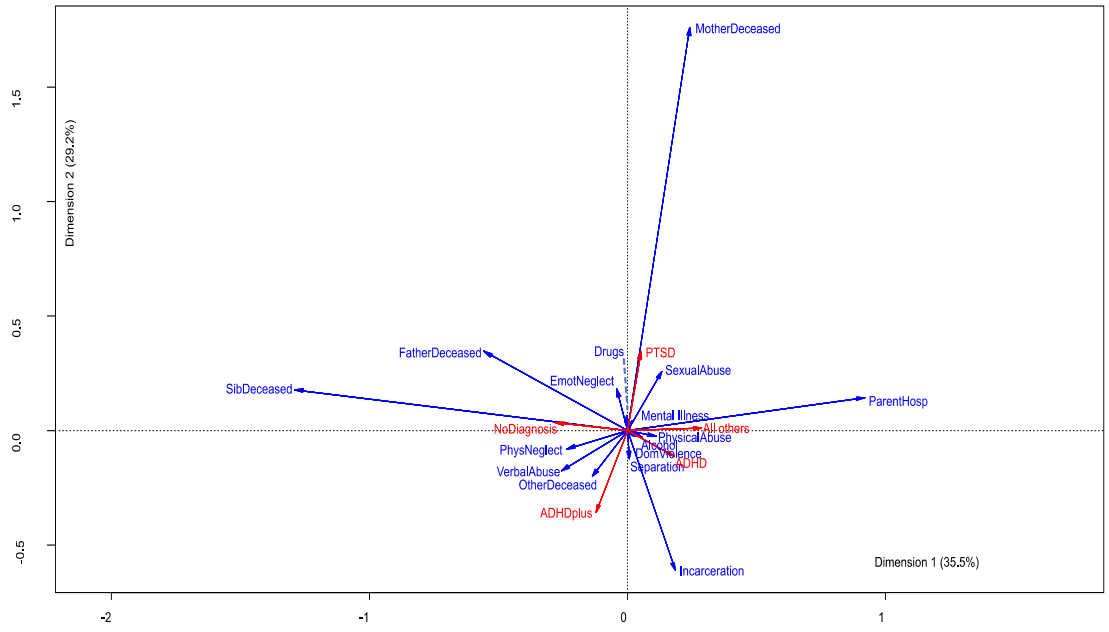
Online supplement 3: Documented range of signs of mental disorder

Sign	n	%
Looks sad	3	3.8
Hypervigilance	8	10
Controlling behaviours	27	33.8
Antisocial behaviour	49	61.3
Relationship problems	26	32.5
Autistic traits	20	25
Inappropriate sexual behaviours	52	65
Hyperactivity	20	25
Self-harm	41	51.2
Talks about suicide	34	42.5
Suicide attempt	25	31.3
Callous, unemotional traits	39	48.8
Other notable signs	19	23.8
No recorded signs	0	-

Online supplement 4: documented range of symptoms of mental disorder

Symptom	n	%
Flashbacks	9	11.3
Out of body experience	0	0.0
Frequent nightmares	4	5.0
Low mood	34	42.5
Anxiety	41	51.2
Sleep problems	34	42.5
Attention difficulties	19	23.8
Concentration difficulties	25	31.3
Auditory hallucinations	25	31.3
Visual hallucinations	7	8.8
Other hallucinations (smell, taste, touch)	0	0.0
Complex hallucinations	0	0.0
Delusions	7	8.8
Thought insertion/extraction	1	1.3
Suicidal thoughts	32	40.0
Other notable symptom	32	40.0
No recorded symptoms	4	3.8

Online supplement 5: Correspondence analysis of ACEs and main diagnostic groups (with diagnostic group overlapping cases removed [n=73] and showing mother deceased and sibling deceased as extreme outliers numerically [1 and 3 cases respectively])



	ADHD+[1] N=12	ADHD[2] N=16	PTSD N=10	Other diagnoses N=12	No diagnosis N=23
ACES					
Verbal abuse	4	3	3	1	5
Physical abuse	3	11	5	6	10
Sexual abuse	1	7	6	3	6
Emotional neglect	3	6	7	4	9
Physical neglect	3	4	3	1	6
Separation	6	10	6	4	9
Family drug use	2	6	4	4	8
Family alcohol use	3	7	4	5	8
Domestic violence	3	12	5	6	13
Family mental illness	3	7	5	5	9
Parental incarceration	2	5	0	1	2
Father deceased	0	1	1	0	3
Mother deceased	0	0	1	0	0
Sibling deceased	0	0	0	0	3
Other deceased	2	1	1	2	3
Parental hospitalisation	0	2	1	2	0

[1] 6 cases with ADHD+ and PTSD, anxiety or depressive disorder removed from this analysis; [2] one case with ADHD *and* PTSD removed

Online Supplement 6: Agencies involved with FACTS cohort cases

Service[1]	At referral n (%)	Previous contact n (%)	On discharge n (%)[2]
Mental Health Services			
Child and Adolescent Mental Health Services (CAMHS)	71 (88.8)	52 (35)	46
Secure hospital	4 (5.0)	3 (3.8)	4
Paediatrics	5 (6.3)	21 (26.3)	5
Substance misuse services	3 (3.8)	7 (8.8)	
Adult mental health services (only on discharge)			14
Social Services			
Any social service involvement	55 (68.8)	48 (60.0)	43
Secure Children's Home	9 (11.3)	8 (10.0)	4
Criminal Justice involvement			
Police	17 (21.3)	49 (61.3)	5
Youth Offending Services	33 (41.3)	31 (38.8)	16
Young Offenders' Institute (YOI [prison])	7 (8.8)	2 (2.5)	5
Multi-Agency Public Protection Arrangements (MAPPA)			3
Other[3]	29 (36.3)	29 (36.3)	20

1 not mutually exclusive

2 percentages not given in discharge agency column because of the risk of misleading as in so many cases these data were not recorded

3 Forensic Psychology (Assessment by court request); Tertiary Autism Team, St. David's Hospital, Triage support service, CITT, NSPCC, keyworker from school, visual impairment teacher, Intensive Family Support Service (IFSS), TAITH (specialist interventions for young people who have engaged in sexually harmful behaviour), The Yellow Project, short term residential placement, PICU ward adult rehab service, Speech and language therapy, Adult LD, Child and adolescent learning disability service (CALDS), Social communications disorders team, education, residential school, leaving care team, Crown Prosecution Service (CPS).