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Complete List of Authors:	Meiser-Stedman, Richard; Institute of Psychiatry, King's College London, Psychology Smith, Patrick; Institute of Psychiatry, King's College London, Psychology Glucksman, Edward; King's College Hospital, Accident & Emergency Yule, William; Institute of Psychiatry, King's College London, Psychology Dalgleish, Tim; MRC Cognition and Brain Sciences
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The post-traumatic stress disorder (PTSD) diagnosis in pre-school and elementary school-aged children exposed to motor vehicle accidents.

Richard Meiser-Stedman, PhD Patrick Smith, PhD, Edward Glucksman, FCEM, William Yule, PhD, and Tim Dalgleish, PhD.

Location of work and address for reprints: Department of Psychology, Institute of Psychiatry, King's College London, De Crespigny Park, London, SE5 8AF, UK. E-mail: r.meiser-stedman@iop.kcl.ac.uk

Tim Dalgleish is at the Medical Research Council Cognition and Brain Sciences Unit, Cambridge, UK; Edward Glucksman is at King's College Hospital, London, UK.

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Abstract

Objective: Psychiatric diagnoses are increasingly being applied downwards to young, even pre-school children. This raises questions about how symptom algorithms for individual disorders are modified to be appropriate to younger age groups, how psychopathology is best detected at an early stage, and how to make use of multiple informants. These issues were addressed with respect to post-traumatic stress diagnoses in pre-school and elementary school children. In particular, a recently proposed alternative diagnostic algorithm (PTSD-AA) was compared to the standard DSM-IV algorithms of posttraumatic stress disorder (PTSD) and acute stress disorder (ASD). Method: The study comprised a prospective-longitudinal assessment of 2-10 year-old children (n = 114) exposed to motor vehicle accidents. Parents and older children completed structured interviews at 2-4 weeks (T1) and 6 months post-trauma (T2). Results: At T1 11.5% of children met criteria for parent-report PTSD-AA, with 13.9% at T2, a rate much higher than for ASD or PTSD. Among 7-10 year olds parent-child agreement for PTSD-AA and ASD/PTSD was poor. The use of combined-report for 7-10 year olds resulted in an increased number of cases being identified relative to parent-report alone. Parent-reported PTSD-AA was a more sensitive predictor of later caseness than ASD for 2-6 year olds, but for the 7-10 year olds a combined-report diagnosis (using both parent and child report) was optimal when predicting later caseness. Conclusions: Our data lend support to the application of PTSD-AA to pre-school children, and suggest it to be a stable diagnosis from the acute phase onwards. For 7-10 year olds, when both parent- and child-report are available, PTSD-AA and the extant DSM-IV diagnoses have broadly comparable validity. However, in the absence of information from the child, parent-report PTSD-AA seems optimal. The broader diagnostic implications of these findings for the field are discussed.

There is a growing consensus that many adult psychiatric disorders have their origins in childhood and adolescence (1). Consistent with this broader perspective, within developmental psychiatry there has been a move towards identifying disorders in ever-younger groups of children (2). Consequently, the DSM-IV criteria are increasingly 'down-aged' to diagnose psychopathology in children as young as pre-school age (3), even though it remains unclear what the best diagnostic criteria for these age groups are (4). This shift of focus to younger populations highlights a number of key issues that have implications for developmental psychiatry more broadly. We examine three such issues here.

The first is that, even if there is a growing consensus that the broad architecture of the DSM-IV may be applicable to younger age groups (5), there are important questions about whether the symptom algorithms for individual disorders require modification (e.g. 6) to avoid under- and/or mis-diagnosis in the early years. The validation of alternative symptom algorithms in the very young has implications for the assessment of older children, and indeed adults, where the new algorithms may possess greater validity than extant DSM-IV criteria or be more practical to apply (7).

The second issue concerns the early detection of psychopathology in the young. This has two related facets: detecting conditions with a potential lifetime course as early as possible in development; and detecting conditions that may have a more limited course in a given age group as early as possible in their evolution. Both bear on the critical issue of the prevention of chronic problems in childhood and adolescence (4).

The final issue concerns the optimal use of multiple informants for deriving diagnoses in younger children. For pre-school children, there is clearly a limited role for child self-report (8). However, the utility of child self-report in diagnosing elementary school children, with its potential to supplement parent- and/or teacher-report with non-overlapping

information remains relatively unexplored. Furthermore, integration of child and parent-report in older children provides a means by which to estimate the extent to which parent-report alone may underestimate symptoms in younger children.

In the current study these three issues were examined with respect to the diagnosis of Posttraumatic Stress Disorder (PTSD) in pre-school and elementary school children (aged 2-10 years) involved in motor vehicle accidents (MVAs), a common trauma in young people.

An alternative algorithm for PTSD (PTSD-AA)

In the one known large-scale community survey of PTSD in pre-school children (2-5 years), the prevalence according to DSM-III-R criteria was 0.1% (9), compared with 1-3.5% in comparable surveys of adults (10;11) and 3-6% in adolescents (12;13). These data suggest that PTSD in younger children may not be optimally reflected by the current DSM algorithm. An alternative algorithm (PTSD-AA) in pre-school children, based on parent-report, has been proposed and has received encouraging preliminary support to date (8;14-16). PTSD-AA comprises reductions in the requisite number of endorsed avoidance symptoms from three to one, along with removal of Criterion A2 concerning emotion at the time of the trauma. Preliminary proposals have also been put forward to extend PTSD-AA to older, elementary school-aged children (7-11 years), though at present empirical support for this is more limited (8).

Adoption of any new algorithm for conceptualizing psychopathology in younger populations constitutes a major nosological shift. It is therefore critical that the empirical foundation for such decisions is comprehensive. Despite considerable progress in developing PTSD-AA (8;14-16), there remain significant gaps in our validation of the diagnosis.

Firstly, to our knowledge, there have been no attempts to examine the validity of PTSD-AA in the *acute* post-trauma phase (i.e. within the first month post-trauma) in children, nor to compare PTSD-AA to the established DSM-IV diagnosis for this acute period - acute

stress disorder (ASD). In the case of pre-school children, this is unsurprising as, to the best of our knowledge, there are no studies examining the validity of any formal diagnosis of posttraumatic stress in the acute aftermath of trauma.

The present study therefore compared the prevalence rates of parent-report PTSD-AA and ASD (and PTSD without the duration criterion) in the first 4 weeks post-trauma in our sample. We also assessed the convergent validity of all 3 diagnoses with respect to a standardized parent-report instrument of post-traumatic stress.

Secondly, although there exist longitudinal studies on the course of posttraumatic reactions in pre-school children (17;18), we know of only one study (19) reporting longitudinal data addressing the course of PTSD-AA. However, this study used a carefully selected sample of children already showing symptoms of PTSD-AA at baseline (some 2 months post-trauma) and showed no diagnostic continuity for PTSD-AA at 1 year follow-up. There are no longitudinal studies, to our knowledge, that have demonstrated diagnostic stability for PTSD-AA at less than 2 year follow-up. Given widespread concern about the stability of psychiatric diagnoses in younger age groups because of the rapidity of developmental changes (20), it is critical to demonstrate diagnostic continuity for any proposed algorithm. The present study examined this issue by following up our sample of children to 6 months post-trauma.

The third identified gap concerns the validity of PTSD-AA in pre-adolescent (elementary) school children. This relates to the generalizability of novel algorithms validated in the very young. Although there exists one preliminary study examining PTSD-AA in this older age group (8), this study was cross-sectional and suffered from a small sample size (n = 11). Further studies of parent report PTSD-AA in pre-adolescent children, with appropriate comparisons to the established DSM-IV diagnoses of ASD and PTSD, are needed to more fully explore the broader developmental implications of this alternative algorithm.

Early detection

An important challenge in posttraumatic stress research is identifying those individuals in the acute post-trauma phase who are likely to experience chronic difficulties and present with PTSD in the future. Indeed, one reason for the introduction of ASD in the DSM-IV was as a way of identifying survivors in the first month post-trauma who were most at risk for later PTSD (21). To this end, the ASD diagnosis requires the presence of dissociative symptoms which were seen as key predictors of longer-term psychopathology (e.g. 22). However, the utility of the dissociation symptom cluster, and consequently of ASD as a diagnosis, in the early detection of those most at risk have been called into question in both adults (23) and older children (24-26). However, to our knowledge there are no studies examining the prognostic power of ASD in younger children (aged 2-10), nor whether PTSD-AA in this age group offers a superior means of detecting children most at risk of later post-traumatic stress. This was therefore a focus of the present research.

Multiple informants

It is now standard practice within developmental psychiatry to use multiple informants to derive diagnoses (4;27). However, for elementary school-aged children (7-10 years) the database concerning informant validity is less extensive (2) and it is significantly impoverished in the case of PTSD (28) and absent in the case of PTSD-AA where the only study is on adolescents (11-18 years; 8). This shortfall was addressed here by deriving child-report (-CR), parent-report (-PR) and combined parent-child-report (-CO) diagnoses for the 7-10 year old children in the study (for both PTSD-AA and the DSM-IV diagnoses) in order to examine relative prevalence estimates, to assess levels of inter-informant agreement and to provide a way of assessing the degree to which parent-report alone may be underestimating the prevalence in younger age groups where valid child-report is not possible.

A key issue concerns how to evaluate the relative importance/validity of information from children and parents when evaluating psychopathology in young samples. One way to examine this is to assess the prognostic power of different informants' reports to predict later problems within longitudinal designs (29). As yet there is a paucity of such data in developmental psychiatry and no such data for posttrauma psychopathology in young children. Evaluating the relative prognostic power of different informants' perspectives, assessed in the acute post-trauma phase, in the prediction of later PTSD for the first time in the present study therefore has potentially broad implications for the discipline and was consequently the final focus of the research.

Method

Participants

Children attending three London emergency departments (EDs) following MVAs, age 2-10 years, were eligible for participation. These EDs are situated in some of the poorer boroughs in England, characterized by high rates of immigration and deprivation. Exclusion criteria were inability of a child's parent/caregiver to speak English, mental retardation, and moderate to severe traumatic brain injury (i.e., posttraumatic amnesia [an inability to recollect events post-trauma] ≥ 24 hours).

In total 312 children were eligible to participate. Of these, the families of 120 (38.5%) could not be contacted due to incomplete or inaccurate details in the ED. Of 192 families contacted, 72 (37.5%) did not have time to participate or were not interested, 6 (3.2%) did not want to participate for fear of upsetting their child, while 114 (60.0%) agreed to participate and were assessed at T1, 2-4 weeks post-trauma (mean 25.1 days, SD = 7.3). There were no significant differences in age, sex, or triage category (the ED rating of the child's injury severity) between participants and non-participants (including children who could not be contacted; *p*s > .05).

Of the 114 participating children at T1 (mean age 6.7 years, SD = 2.7; 2-6 years, n=62; 7-10 years, n=52), 54 (47.4%) were female and 72 (63.2%) belonged to a minority ethnic group or were mixed race. Forty-seven (41.2%) children had been pedestrians involved in an MVA, 54 (47.4%) had been car passengers, 6 (5.3%) had been cyclists, 6 (5.3%) had been bus passengers, and 1 (.9%) had been riding on a moped. Participants received relatively mild injuries, with 28 (24.6%) having no injury, 80 (70.2%) having soft tissue injuries, and 6 (5.3%) sustaining some kind of fracture. Eighteen (15.8%) were admitted to hospital, and 7 (6.1%) lost consciousness during or shortly after the MVA. This is typical of this area of London where, due to the volume of traffic, high-speed MVAs are rare.

One hundred nine (95.6%; 2-6 years, n=60; 7-10 years, n=49) of the 114 participating families completed a second assessment (T2) at 6 months post-trauma (mean 204.3 days, SD = 21.2). There were no differences between children who did or did not complete the T2 assessment in terms of sex, age, or triage category (*p*s > .1).

Measures

The primary measures were the structured interviews completed by children and their parents/caregivers at T1 (PTSD-AA, ASD, PTSD minus the duration criterion) and T2 (PTSD-AA, PTSD). Parents completed the PTSD Semi-Structured Interview and Observational Record for Infants and Young Children (IOR-YC; 14;15;16;19). This measure was used to derive the PTSD-AA-PR diagnosis. The IOR-YC possesses good inter-rater reliability (14).

In order to derive a DSM-IV PTSD-PR diagnosis, parents also completed the PTSD schedule of the Anxiety Disorder Interview Schedule for children (ADIS-C/P; 30) - a structured interview assessment of anxiety disorders in children, with excellent test-retest reliability (31). In addition, we included previously developed dissociation items (26;32) at T1 to provide an ASD-PR diagnosis.

The vast majority of children aged 7-10 years (n = 48 [92.3%] at T1; n = 45 [91.8%] at T2) completed the Clinician Administered PTSD Scale for Children and Adolescents (CAPS-CA; 33). The CAPS-CA is a well-validated structured interview for assessing PTSD-CR, where children report both the frequency and intensity of DSM-IV PTSD symptoms (one child struggled with the CAPS-CA and completed the ADIS-C/P instead). At T1, additional interview items (32) were included to derive an ASD-CR diagnosis. A PTSD-AA-CR diagnosis was derived from 7-10 year old children's responses to the CAPS-CA with application of the appropriate symptom counts algorithm.

For all interview measures, assessed impairment of functioning was explicitly linked to the symptoms that had been endorsed for a given diagnosis.

A parent-report questionnaire was used to examine convergent validity for the parent-report interviews. The Pediatric Emotional Distress Scale (PEDS) is a 21-item questionnaire for assessing child post-traumatic stress symptoms in 2-10 year olds (34). The PEDS has good internal and test-retest reliability, and can discriminate between trauma-exposed and non-trauma-exposed children.

Procedure

The parents/caregivers of children meeting inclusion criteria were initially contacted by letter 2-4 days after attendance at the ED, then by telephone at 7-8 days to arrange the T1 assessment. Provisional T2 assessment appointments were made at the end of the T1 assessment and confirmed by telephone nearer the time. T2 assessments were then conducted 6 months post-trauma. Parent/caregiver written, informed consent, and the consent of the children themselves (over 6 years) were required for participation. Assessments were conducted in the child's own home by the first author (RMS). Assessments were either with the mother (85.1%), father (7.9%), grandparent (2.6%) or other caregiver (4.4%). Diagnostic reliability for RMS was established pre-study via blind rating of tape-recorded interviews of

21 children by the second author (PS), a highly experienced child assessor. There was 100% consensus on diagnostic status. At T1, parents answered additional questions about their child's accident. Further information, e.g. degree of injury, was obtained from the EDs.

Results

The prevalence and course of PTSD-AA

The prevalences of PTSD-AA criteria and diagnoses, differentiated by respondent, age group, and time point, are displayed in Table 1. The prevalences of PTSD-AA-CO diagnoses for 7-10 year olds based on the "or" rule are displayed in Table 2. For these diagnoses a criterion is met if either the parent or child endorses the requisite symptoms. These prevalence rates ranged from 11.5% (PTSD-AA-PR at T1) to 50% (PTSD-AA-CO at T1). There were no significant changes in the prevalence rates of PTSD-AA, for either age group, however assessed, between T1 and T2 (all *p*s > .05). Correlations of presence/absence of diagnosis between T1 and T2 were significant in all cases except PTSD-AA-CR in 7-10 year olds, and stability (proportion of those diagnosed at T1 who were also diagnosed at T2; Positive Predictive Value [PPV]) was generally high as were the proportions of children not diagnosed at T1 who remained diagnosis free at T2 (Negative Predictive Value [NPV]) (Tables 1, 2 and 4; 35).

The prevalence and course of DSM-IV ASD and PTSD

The prevalences of DSM-IV ASD (T1) and PTSD (T2) diagnoses, differentiated by respondent and age group, are displayed in Tables 2 and 3. In the case of parent-report, the prevalence rates were uniformly low with the highest being 3.9% for ASD-PR in 7-10 year olds at T1. Child- and combined-report prevalence rates in 7-10 year olds for the DSM-IV diagnoses were higher, ranging from 13.3% (PTSD-CR in 7-10 years olds at T2) to 29.2% (ASD-CO at T1). To verify that these low rates of ASD-PR at T1 were not simply because parents were failing to detect the dissociation symptoms, we also derived a T1 PTSD-PR

diagnosis according to the DSM-IV criteria minus the duration mandate (see Table 3). As can be seen, these prevalence rates were even lower than for ASD-PR at T1.

Comparisons between T1 ASD and T2 PTSD revealed no significant differences in the proportions with a positive diagnosis across time points, regardless of age range and informant, and despite the different symptom profiles for ASD and PTSD. Only (presence/absence) of child- and combined-report diagnoses in 7-10 years olds were significantly correlated across time points however, and, with the exception of combined report diagnoses, stability was poor (Tables 2 and 3).

To investigate whether the prevalence rates for T2 PTSD-AA diagnoses were higher than for T2 PTSD diagnoses simply because the former algorithm requires fewer endorsed symptoms, we examined the mean numbers of symptoms in the positive cases for each diagnosis, split by informant. There were no significant differences for the majority of child- (7-10 year olds - PTSD-AA-CR: M = 9.14, SD = 1.77; PTSD-CR: M = 10.14, SD = 2.19), parent- (2-6 year olds - PTSD-AA-PR: M = 11.00, SD = 4.15; PTSD-PR: M = 10.00, n=1) or combined-report (7-10 year olds - PTSD-AA-CO: M = 11.00, SD = 3.74; PTSD-CO: M = 11.56, SD = 1.59) diagnoses, *t*s<1.35, *P* >.34. The only significant differences was in parent-report for the 7-10 year olds, where in fact those diagnosed with the revised algorithm were allocated more symptoms on average (PTSD-AA-PR: M = 11.00, SD = 4.58; PTSD-PR: M = 7.00, n=1, t(8) = 2.62, P<.05). Similar comparisons at T1 were deemed unnecessary as ASD in fact requires fewer symptoms than PTSD-AA.

Construct validity

Construct validity for parent-report diagnoses was examined by investigating associations with the PEDS. Analyses were only conducted for parents (*n*= 82 at T1; *n* =72 at T2) who completed this questionnaire. This meant that no correlation with T2 PTSD-PR could be calculated as there were no PTSD-PR-positive cases at follow-up where parents had

also completed the PEDS. PEDS scores at T1 were correlated with T1 PTSD-AA-PR (r= .52, p<.0001) and T1 ASD-PR (r=.41, p<.0002), and PEDS scores at T2 were correlated with T2 PTSD-AA-PR (r=.30, p<.02).

Prediction of T2 diagnoses

We examined the prognostic power of the different T1 diagnoses with respect to our best estimates of 'true' diagnostic status at T2 (36). For 2-6 year olds these were based on parent report and for 7-10 year olds they were based on combined-report. The sensitivity, specificity, PPV and NPV are displayed in Table 4 along with the results of logistic regressions of diagnostic status at T2 as the dependent variable onto status at T1 as the predictor. As our primary interest is in early detection of later caseness, we placed most weight on sensitivity when evaluating this information.

On this basis for 2-6 year olds, the age group for which the PTSD-AA-PR was originally proposed (14;15), T1 PTSD-AA-PR was only a modestly sensitive predictor of T2 PTSD-AA-PR, missing 50% of the T2 cases. However, it was clearly superior to the ability of ASD-PR at T1 to predict PTSD-PR.

For 7-10 years olds, PTSD-AA-PR at T1 was a more sensitive and accurate predictor of T2 PTSD-AA-CO than was PTSD-AA-CR, where the low positive predictive value (PPV) and poorer specificity suggest that child-reporters are "over-detecting" cases at T1 (that were not subsequently cases at T2). However, in both instances more than 55% of cases at T2 remained undetected. PTSD-AA-CO diagnoses at T1 fared much better than diagnoses based on either informant considered alone, detecting almost three quarters of PTSD-AA-CO cases at T2. However, this was at the cost of relatively lower PPV and specificity compared to T1 PTSD-AA-PR, stemming from the integration of the child-report information.

For the DSM-IV diagnoses in 7-10 year olds, T1 ASD-CR was superior to ASD-PR in predicting T2 PTSD-CO and indeed the parent-report diagnoses missed almost 90% of the

small number of T2 cases. As with PTSD-AA, the best predictor was the combined-report diagnosis which provided additional sensitivity over child-report alone without any loss of specificity, PPV or negative predictive value (NPV).

Comparing PTSD-AA with the extant DSM-IV diagnoses in terms of prognostic power in 7-10 year olds, where both informants are available, it appears that ASD-CO was overall a better predictor of PTSD-CO than T1 PTSD-AA-CO was of T2 PTSD-AA-CO, as although PPV and sensitivity were similar, ASD-CO showed better NPV and specificity and correctly classified more cases at T2.

Parent-child agreement

Parent-child agreement for PTSD-AA, ASD and PTSD for 7-10 year old children is displayed in Table 5. As can be seen, an inconsistent pattern was observed for individual criteria, and agreement at the level of diagnosis was poor.

Discussion

In this study we examined three key issues in diagnosing post-trauma psychopathology in young children, all with broader implications for developmental psychiatry. First, the study sought to replicate and extend research on the validity of an alternative symptom algorithm for PTSD in young children based on parent-report (PTSD-AA; 14;15). Secondly, the potentially complementary roles of parent and child informants in the diagnostic process were examined (27). Finally, the predictive utility of the alternative algorithm and of the extant DSM-IV diagnosis (ASD) in identifying those at risk of later PTSD/PTSD-AA were assessed and compared. The study benefited from the use of a large, untreated sample, the adoption of a longitudinal design, the use of formal diagnostic methods in both the acute and chronic phases, and the comparison of pre-schoolers and elementary school-aged children.

PTSD-AA-PR

In the current study, at 6 months post-trauma (T2), the prevalence rate for PTSD-AA-PR was consistent with existing findings (18;19), with around 14% meeting diagnostic criteria. In contrast, the prevalence of the established PTSD-PR diagnosis was less than 2%. This differential pattern of findings was similar in 2-6 year olds and 7-10 year olds. The higher prevalence of PTSD-AA-PR across the age range at T2 was not simply due to its reduced symptom requirements, as the number of symptoms endorsed for PTSD-AA-PR was not significantly fewer than for PTSD-PR.

In the acute post-trauma phase (2-4 weeks; T1) the prevalences of PTSD-AA-PR and the standard DSM-IV diagnosis (ASD-PR) in 2-6 year old children were 6.5% and 1.6%, respectively. These are the first such data reported in this age group. As with the findings at T2, there was a similar differential pattern in the 7-10 year old children (17.7% and 3.9%, respectively). The higher prevalences of PTSD-AA-PR at T1 were not simply a result of parents failing to report the requisite ASD-PR dissociative symptoms, because the prevalence of PTSD-PR at T1 (computed without the duration criterion), which does not require the presence of dissociation, was similarly low (< 4%).

The PTSD-AA-PR diagnosis was stable across time (35) with 69% of those diagnosed at T1 retaining a diagnosis at T2 (PPV), showing for the first time that a significant degree of psychopathology as indexed by this new algorithm persists over the first 6 months post-trauma in young children. This was not the case for the DSM-IV-PR diagnoses where no children diagnosed at T1 retained a diagnosis at T2. However, all parent-report diagnoses at both T1 and T2 showed good convergent validity with the PEDS.

To summarize, our data provide further support for the adoption of a new algorithm for PTSD based on parent-report (PTSD-AA-PR) in very young children (aged 2-6 years). The data replicate existing findings with this algorithm in this age range in the post-acute

phase (8;15), showing its superior ability in detecting clinically-significant psychopathology relative to the extant PTSD diagnosis. This pattern was mirrored by our data regarding PTSD-AA-PR in older children (7-10 years), thus replicating earlier preliminary findings (8), this time in a larger sample. Our results extend research on PTSD-AA-PR for the first time to the acute post-trauma phase, providing a comparison with ASD-PR, where again the new algorithm identified notably more cases. The present data also provide the first evidence of diagnostic stability for PTSD-AA-R in the first 6 months post-trauma, the first showing stability over a time span of less than 2 years (cf. 19), and the first in an untreated sample, where once more the new algorithm performed favorably relative to the existing DSM-IV algorithms. Demonstrating stability in any new symptom algorithm is a key criterion of illness validity (35) and is particularly important in younger populations given the rapidity of developmental changes.

The present data, combined with previous findings on PTSD-AA-PR (6;8) are a paradigmatic illustration of the benefits of considering alternative algorithms for the diagnosis of mental ill health in young children where there is increasing emphasis on the need for caution in simply 'down-ageing' the existing DSM taxonomy and in the application of categorical diagnosis at all (4;20). Furthermore, the current findings indicate that alternative algorithms validated in very young samples may offer comparable (and sometimes superior) validity for older children where DSM diagnoses have already been established but where the validity of alternative algorithms has rarely been examined.

Informant validity

For the 7-10 year old children in our sample we were able to examine the potentially complementary contributions of child and parent report. At the levels of diagnosis and individual symptom clusters, parent-child agreement was generally poor for PTSD-AA and ASD/PTSD, replicating previous findings for ASD and PTSD (28;37;38), and for anxiety

disorders in general (39), and extending them for the first time to PTSD-AA. This suggests that the two sets of informants were contributing different information to the diagnostic process (27). Indeed, children, according to their own report, met criteria for PTSD-AA-CR at T1 (35.4%) and T2 (17.8%), ASD-CR at T1 (22.9%), and PTSD-CR at T2 (13.3%), at significantly higher rates than according to their parents (see above). However, the stability of PTSD-AA-CR was notably lower than for the parent-report diagnosis, with only 31.3% of those diagnosed at T1 continuing to meet criteria at T2. ASD-CR/PTSD-CR stability was also modest (36.4%), but markedly better than for parent-report diagnoses.

The use of combined-parent-child report using the "or" rule for 7-10 year olds increased the prevalence rates relative to child-report, and a great deal relative to parent-report, and stability was greater than for child-report alone with more than half of the children diagnosed at T1 retaining their diagnosis at T2. This was regardless of whether ASD-CO/PTSD-CO or PTSD-AA-CO was used.

In summary, the use of child-report for 7-10 year olds and integration of child and parent-report using the "or" rule both result in an increased number of cases being identified relative to parent-report alone, though this led to reduced stability for PTSD-AA. These data further indicate the benefits of moving beyond single-informant diagnosis in order to provide a fuller picture of clinical need in the assessment of child psychopathology (27) and strongly suggest that in situations where only one informant is available (e.g. the 2-6 year old children in the present study), clinically-significant cases are being over-looked.

Early Detection

For 2-6 year olds PTSD-AA-PR assessed in the acute post-trauma was more sensitive in detecting caseness at 6 months than was ASD-PR, although even the new algorithm missed 50% of T2 positive cases. PTSD-AA-PR was also more sensitive than PTSD-AA-CR at

detecting cases in the 7-10 year old children, with the latter diagnosis only identifying a third of positive T2 cases. However, for the existing DSM-IV diagnoses the opposite pattern emerged in the older age group with ASD-CR being a more sensitive predictor (detecting 67% of cases at T2) than ASD-PR (11%).

Combined-report diagnoses were superior predictors compared with diagnoses based on either informant alone, with both PTSD-AA-CO and ASD-CO identifying over 70% of positive cases at T2. This improved sensitivity with combined report came at no cost in the case of ASD-CO, where PPV and specificity were comparable to the best single-informant diagnosis (ASD-CR). However, this was not true for PTSD-AA-CO, where the superior sensitivity was linked to markedly lower PPV and specificity, relative to the best single-informant diagnosis (PTSD-PR). This appears to have resulted from the influence of the integrated child-report data that suggest 'over-detection' by children of cases at T1 (that were not subsequently cases at T2).

Summarizing, these patterns indicate that for pre-school children where parent-report alone is used, PTSD-AA-PR is a better early-detection tool than ASD-PR but is nevertheless only modestly effective. For older elementary school-aged children, however, where both parent and child can be interviewed, our data indicate that combined-report diagnoses are optimal and that ASD-CO is if anything a better tool than PTSD-AA-CO as it is both more sensitive (detecting almost 80% of T2 cases) and more specific.

The relatively stronger predictive data for combined-report diagnoses again testifies to the importance of aggregating data across different informants. Nevertheless, the overall modest levels of specificity for full diagnoses derived using clinical interview at T1, combined with the relative difficulty in obtaining such diagnoses easily and quickly in the clinic, indicate that more research is required to develop valid and sensitive simple detection

instruments, perhaps involving identification of a small number of key symptoms (24) or the use of readily administered questionnaire instruments (40).

The present study is not without its limitations. The use of a sample exposed to a common, single incident stressor necessarily suggests caution in generalizing to survivors of more chronic trauma, such as abuse, or of large-scale natural disasters. The fact that the clinical assessments at T2 were conducted by the same assessor at T1, whilst providing continuity, meant that T2 assessments were not conducted blind to T1 status. Finally, the study would have benefited from more data on comorbid diagnoses post-trauma.

In conclusion, the present study provides clear support for the adoption of PTSD-AA-PR in 2-6 year old children in place of the existing DSM diagnoses. PTSD-AA-PR identifies more cases, and not simply because it requires a lower symptom count, and shows better predictive validity and stability over 6 months. However, for 7-10 year old children, assuming parent and child information is available, the data aggregating across informants suggest that the new algorithm offers no clear advantage over ASD-CO/PTSD-CO. There is thus no compelling case in this older age range for relinquishing the established diagnoses.

Table 1. Frequency of parent- and child-reported PTSD-AA diagnosis and criteria, by time point and age group

	Parent report			Child report
	2-6 years	7-10 years	All	7-10 years
T1 (2-4 weeks post-MVA):	n=62	n=51[1]	n=113	n=48
Re-experiencing	31 (50.0%)	24 (47.1%)	55 (48.7%)	31 (64.6%)
Avoidance	16 (25.8%)[†]	31 (60.8%)[†]	47 (41.2%)	32 (68.1%)
Hyperarousal	22 (35.5%)	17 (33.3%)	39 (34.5%)	22 (45.8%)
Impairment	17 (27.4%)	16 (31.4%)[‡]	33 (29.2%)	28 (58.3%)[‡]
PTSD-AA	4 (6.5%)	9 (17.7%)[‡]	13 (11.5%)	17 (35.4%)[‡]
T2 (6 months post-MVA):	n=60	n=48[1]	n=108	n=45
Re-experiencing	21 (35.0%)	20 (41.7%)	41 (38.0%)	18 (40.0%)
Avoidance	11 (18.3%)	16 (33.3%)	27 (25.0%)	26 (57.8%)
Hyperarousal	19 (31.7%)	21 (43.8%)	40 (37.0%)	16 (35.6%)
Impairment	11 (18.3%)	17 (35.4%)	28 (25.9%)	21 (46.7%)
PTSD-AA	6 (10.0%)	9 (18.8%)	15 (13.9%)	8 (17.8%)
Phi coefficient (T1 and T2 PTSD-AA)	.58*	.59*	.59*	.26
Positive predictive value	75.0%	66.7%	69.2%	31.3%
Negative predictive value	94.6%	92.3%	93.7%	89.3%

PTO for Table note

Table 1 note

† Indicates significant age-related difference (for parent-report data) within the same row. ‡ Indicates significant parent-child difference (for 7-10 year olds) within the same row. For these comparisons a Bonferroni corrected level of alpha (.0125) was used for the individual criteria, while a conventional alpha level (.05) was applied for the diagnoses. [1] One parent did not complete the interviews at T1 and T2 although the child did. * = $p < .0001$

Positive predictive value = probability that someone with the full diagnosis at T1 would retain the diagnosis at T2. Negative predictive value = probability that someone without that diagnosis at T1 would remain diagnosis free at T2.

Table 2. Frequency of symptom criteria and diagnoses according to combined parent-child report in 7-10 year olds

	Diagnostic tool, n (%)	
	PTSD-AA-CO	ASD-CO / PTSD-CO[2]
T1:	n = 48	n = 48
Stressor	n/a[1]	43 (89.6%)
Dissociation	n/a[1]	24 (52.2%)
Re-experiencing	35 (72.9%)	31 (63.3%)
Avoidance	38 (80.9%)	38 (79.2%)
Hyperarousal	28 (58.3%)	40 (83.3%)
Impairment	31 (64.6%)	28 (60.9%)
Diagnosis	24 (50.0%)	14 (29.2%)
T2:	n = 45	n = 48
Re-experiencing	30 (66.7%)	30 (62.5%)
Avoidance	30 (66.7%)	10 (20.8%)
Hyperarousal	25 (55.6%)	25 (52.1%)
Impairment	27 (60.0%)	24 (51.1%)
Diagnosis	18 (40.0%)	9 (18.8%)
Phi Coefficient (T1 and T2 diagnoses)	.33*	.51**
Positive predictive value	56.5%	50.0%
Negative predictive value	76.2%	93.8%

PTO for Table note

Table 2 note

[1] Indicates “not applicable”, as these criteria not used within the PTSD-AA diagnostic algorithm.

[2]ASD-CO was assessed at T1, while PTSD-CO was assessed at T2.

* = $p < .05$. ** = $p < .01$.

Positive predictive value = probability that someone with the full diagnosis at T1 would retain the diagnosis at T2. Negative predictive value = probability that someone without that diagnosis at T1 would remain diagnosis free at T2.

Table 3. Frequency of parent- and child-reported DSM-IV ASD and PTSD diagnoses and criteria, by time point and age group

	Parent report			Child report
	2-6 years	7-10 years	All	7-10 years
T1 (2-4 weeks post-MVA):	n=62	n=51[1]	n=113	n=48
ASD Stressor	56 (90.3%)	45 (88.2%)	101 (89.4%)	40 (83.3%)
ASD Dissociation	4 (8.9%)	5 (10.4%)‡	9 (9.7%)	22 (45.8%)‡
ASD Re-experiencing	18 (29.0%)	13 (25.5%)‡	31 (27.4%)	30 (61.2%)‡
ASD Avoidance	14 (23.0%)†	28 (54.9%)†,‡	42 (37.5%)	31 (64.6%)‡
ASD Hyperarousal	30 (49.2%)	35 (68.6%)	65 (58.0%)	34 (70.8%)
ASD Impairment	7 (13.5%)	10 (23.8%)‡	17 (18.1%)	28 (58.3%)‡
ASD Diagnosis	1 (1.6%)	2 (3.9%)‡	3 (2.6%)	11 (22.9%)‡
T1 PTSD Diagnosis[2]	0 (0.0%)	2 (3.9%)‡	3 (2.6%)	11 (22.9%)‡
T2 (6 months post-MVA):	n=60	n=48[1]	n=108	n=45
Re-experiencing	20 (33.3%)	20 (41.7%)	40 (37.0%)	18 (40.0%)
Avoidance	1 (1.7%)	3 (6.3%)	4 (3.7%)	9 (20.5%)
Hyperarousal	19 (31.7%)	21 (43.8%)	40 (37.0%)	15 (34.1%)
Impairment	3 (6.5%)	8 (19.0%)‡	11 (12.5%)	20 (45.5%)‡
PTSD	1 (1.7%)	1 (2.1%)‡	2 (1.9%)	6 (13.3%)‡
Phi Coefficient (T1 ASD and T2 PTSD)	n/a	-.03	-.02	.38*
Positive predictive value	n/a	0%	0%	36.4%
Negative predictive value	98.3%	97.8%	98.1%	93.9%

PTO for table note

Table 3 note:

† Indicates significant age-related difference (for parent-report data) within the same row. ‡ Indicates significant parent-child difference (for 7-10 year olds) within the same row. For these comparisons a Bonferroni corrected alpha (.0125) was used for the individual criteria, while a conventional alpha level (.05) was applied for the diagnoses. [1] One parent did not complete the interviews at T1 and T2 although the child did. [2] DSM-IV PTSD without the duration criterion. n/a = This analysis could not be performed due to a lack of positive cases. * = $p < .05$.

Positive predictive value = probability that someone with the full diagnosis at T1 would retain the diagnosis at T2. Negative predictive value = probability that someone without that diagnosis at T1 would remain diagnosis free at T2.

Table 4. Sensitivity, specificity, positive and negative predictive values, and regression statistics of T1 diagnoses to predict T2 diagnoses

Outcome at 6-months	2-4 week predictor	Regression statistics χ^2	p	Odds ratio	Positive predictive value	Negative predictive value	Sensitivity	Specificity	% correctly identified
2-6 years									
PTSD-AA-PR	PTSD-AA-PR	11.12	.001	53.00	.75	.95	.50	.98	93.3
PTSD-PR	ASD-PR	0.09	.77	.02	n/a [1]	.98	.00	1.00	98.3
7-10 years									
PTSD-AA-CO	PTSD-AA-PR	11.75	.001	20.80	.89	.72	.44	.96	75.5
PTSD-AA-CO	PTSD-AA-CR	0.12	.73	.80	.38	.57	.33	.61	50.0
PTSD-AA-CO	PTSD-AA-CO	4.99	<.03	4.16	.57	.76	.72	.62	65.9
PTSD-CO	ASD-PR	1.05	.31	4.75	.50	.83	.11	.97	81.3
PTSD-CO	ASD-CR	9.84	<.002	12.80	.55	.91	.67	.86	82.6
PTSD-CO	ASD-CO	11.11	<.001	15.00	.50	.94	.78	.81	80.4
All									
PTSD-AA[2]	PTSD-AA[2]	24.50	<.001	12.55	.59	.90	.67	.86	81.7
PTSD[2]	ASD[2]	20.39	,<.001	29.67	.50	..97	.70	.93	90.6

PTO for Table note

Table 4 note

Sensitivity = probability that someone with a given diagnosis at T2 would have previously met criteria for the relevant diagnosis at T1. Specificity = probability that someone without a given diagnosis at T2 would also not have met criteria for the relevant diagnosis at T1. Positive predictive value = probability that someone with a given diagnosis at T1 would go on to have the relevant diagnosis at T2. Negative predictive value = probability that someone without a given diagnosis at T1 would not go on to have the relevant diagnosis at T2.

[1]This analysis could not be performed due to a lack of positive cases as the single positive case at T1 dropped out at T2.

[2] For these analyses on the whole sample, our best estimates of caseness were either parent-report (-PR) or combined-report (-CO), dependent on age.

Table 5. Parent-child agreement (Cohen's κ) for PTSD-AA, ASD and PTSD criteria and diagnoses in 7-10 year olds

	PTSD-AA	ASD/PTSD
T1		
Stressor	n/a[2]	.67***
Dissociation	n/a[2]	.06
Reexperiencing	.31*	.30**
Avoidance	.27	.19
Hyperarousal	.18	.32*
Impairment	.26*	.21
Diagnosis	-.02	.09
T2		
Reexperiencing	-.06	.04
Avoidance	.20	.26*
Hyperarousal	.41**	.39**
Impairment	.28	.13
Diagnosis	-.09	-.04

[1] * = p<.05; ** = p<.01; *** = p<.0001

[2] Indicates "not applicable", as these criteria not used within the PTSD-AA algorithm.

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