Developmental, Dimensional and Diagnostic Interview

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Synonyms

3di

Abbreviations

ADI-R Autism Diagnostic Interview – Revised  
ADOS Autism Diagnostic Observation Schedule  
PDD Pervasive Developmental Disorders  
ASD Autism Spectrum Disorder  
DSM-5 Diagnostic and Statistical Manual of the American Psychiatric Association, 5th Revision  
ICD-10 International Classification of Disease (World Health Organization) 10th Revision  
RDC Research Diagnostic Criteria (ICD-10)

Description

The Developmental, Dimensional and Diagnostic Interview (3di) is a standardized interview unique in its construction. It is neither fully structured nor semi-structured, but a hybrid between the two systems, using the strengths of both approaches. Highly structured interviews can achieve excellent reliability, but validity and patient acceptability suffer. Semi-structured interviews, which rely strongly on interviewer judgment for scoring, can achieve good discriminant validity and acceptability, but achieving good reliability requires intensive initial training, and ‘rater drift’ can occur over time without regular retraining. The 3di is a computerized interview, currently configured to run on any Microsoft Windows format. Computerization of the interview procedure has made it possible to cluster questions according to main domains of function or adjustment, such as medical history, language, non-verbal communication, play and friendships, as well as subdomains, such as sharing possessions, spontaneous affection and imaginative social play. We have avoided structures that are strictly diagnostic in format. As parents become increasingly sophisticated informants about symptomatology associated with particular diagnoses, especially autistic disorders or ADHD, there is a risk of respondent bias. Breaking down complex questions and scattering their components throughout the interview is an effective way of dealing with this problem.

The interview was developed primarily to assist clinicians to make highly reliable diagnoses, with minimal training. Extensive research has demonstrated its content, concurrent, discriminant, and criterion validity for ASD. In the latest version of the interview, the 3di-5, the original emulation of ADI-R algorithm-based symptom analysis has been supplemented by an emulation of DSM-5 symptom subscales. Computerization allows not only the generation of symptom analysis that is completely consistent with the data entered, but also the production of an automated written report on the subject of the interview. Optional
modules permit the assessment of all common child comorbidities, together with algorithms that generate output on the diagnostic significance of those comorbidities according to the ICD-10 RDC. Computerization also facilitates research with the instrument. Using a simple interface, it is possible to download all data from the 3di into the statistical package SPSS, including both the answers to individual questions and subscale scores, as well as diagnostic analysis. This allows the generation of a database of unprecedented symptomatic detail.

**Interview construction:**

The interview comprises over 200 items concerning demography, family background, developmental history, and motor skills. There are nearly 300 questions directly or indirectly concerned with disorders on the autistic spectrum and a further 300 questions that relate to current mental states, relevant to other diagnoses. A structured computer-generated report (approximately 1,500 words) containing detailed quantified symptom profiles is immediately available on completion. All data are automatically readable into SPSS for later analysis (approximately 1,300 variables). The software used to construct the interview has a number of novel features, including the use of an ‘interviewer explorer’ tree, rather like the file explorer that is provided with Microsoft Windows, and colored tabs that indicate whether a question has been answered or not. There is also a route explorer that displays questions on a preselected route through the interview. This innovation allows the efficient pre-entry of material such as demographic details of the family, and other factual matters, as well as allowing specific routes to be selected in order to identify comorbidity. These features have been patented in the UK (patents GB2412832 (A) 2005-10-05: GB2412832 (B) 2006-04-05).

There is a comorbidities tool in the latest release of the 3di-5, which allows outcomes, based largely on the DSM-5 criteria, to be generated for all common child diagnoses. If full pre-entry has been achieved, it will be possible without further questioning – upon completion of the interview – to generate comorbidity probabilities for Attention Deficit Disorder, Conduct Disorder and Tic disorders as well as the Pervasive Developmental Disorders. Additional modules allow the measurement of Anxiety disorders, Depression, Dysthymia, and Bipolar Affective disorder, Eating disorders, Post-traumatic Stress Disorder, and Schizotypal disorders.

The questions in the 3di must be asked in the way in which they are written, and this is designed to sound as natural as possible. It is most efficiently administered from a laptop computer, by the interviewer, using a Microsoft Windows interface. Detailed online guidance is available about coding decisions. Unlimited amounts of ancillary textual information can be entered (using Microsoft Word), which appears in the report. The clinician may record probes with the respondent’s replies and make coding decisions post hoc. Clarification of the meaning of parental responses is largely unnecessary; algorithms have been devised that reliably weight and sum responses within domains, thus relieving the interviewer of the need to make complex judgments. The interview tailors itself to the gender of the subject and the names of child and parents, thereby simplifying the interviewing process. For those familiar with the 3di, an interview should sound like a conversation with the informant. Because of the contemporaneous note-taking facility, a competent typist will have a detailed summary of specific issues relevant to the diagnostic formulation available immediately after the interview, all of which are automatically incorporated into the final report.

Training is semi-automated, and the interview is available as a download to trainees. Reliability is checked ‘live’ during courses, which can be 1-2 days duration depending on the
experience and preference of the trainees. Training courses are held worldwide, and the interview has been translated into 9 languages, with a further 4 languages underway.

The 3di is constructed of modules, some of which are mandatory when inquiring about autism spectrum conditions. Others, concerned with comorbidity, are optional. Algorithms speed the interview by eliminating illogicalities, such as questions about spoken language in a nonverbal child. There are no arbitrary skip rules. If a given diagnosis is suspected, it is possible to select routes through the interview that comprise only the essential questions and modules that are relevant to that diagnosis. The software guides the interviewer through the abbreviated interview, but it is possible to ask additional questions at any point.

Because coding decisions are simple and limited, it is possible easily to check with the respondent which option is the appropriate one. Some are deliberately skew, (e.g., “often, rarely, never”). Skew ratings magnify differences between populations and increase discriminant validity. Responses are generally coded on 3-point scales: 0 = no such behavior; 1 = minimal evidence of such behavior; 2 = definite or persistent evidence of such behavior. Questions are not routinely asked twice, once for current behavior and again for whether the behavior “ever” occurred (e.g., at a specific period of development). This procedure extends the time needed to complete the interview and in our experience does not increase validity but introduces a risk of respondent bias. The 3di uses “ever” questions judiciously, in the same way as the DISCO (Wing et al, 2002).

To minimize the time spent in a face-to-face assessment, a pre-interview package of questionnaires has been designed that are completed by parents in advance of their appointment and entered onto the computer from record forms. With this option, a child with suspected autism can be assessed by an abbreviated but validated interview (the Short 3di – Santosh et al, 2009) in no more than 45 minutes. The full autism interview, which is recommended for complex cases, especially those with, can usually be conducted in 90-120 minutes, with pre-entry. One component of the 3di, which allows the evaluation of higher-level language skill is the Children’s Communication Checklist (Bishop, 1998). This generates a Table of social communication or pragmatic language skills that are commonly impaired in autistic disorders, in domains such as the appropriate use of context, coherence, appropriate initiations and others, together with a Pragmatic Composite Score. As the emphasis in autism research focuses all the more on children without language delay, and formally good language skills, the reliable measure of pragmatic language competence becomes all the more important.

Interviewers can decline to answer sections on grounds of the child’s chronological or mental age, but there are no mandatory age restrictions (e.g., in the realm of friendships). The 3di was developed primarily to assess autistic traits among children with normal-range abilities, but it may also be used for those with moderate or severe mental retardation, and has design features to facilitate their assessment. Algorithms automatically adjust scoring to allow for age or a nonverbal subject.

The interview can be used with an informant for individuals with ASD from early childhood into adulthood. If employed with a case of suspected ASD for those in late adolescence and beyond, rephrasing of some questions will be required. It would be appropriate to ask about a time when that individual was of an age when the domain of content applied (for example, questions about social play). However, it is important to note that the design of the interview questions has been so carefully considered that the same questions can usually be asked without any significant modification about suspected ASD from 3 years upwards. We
have examined the stability of scores on each of the three main domains of autistic symptomatology measured by the ADI-R algorithm, from 4-14 years of age (with samples of approximately 200 children at each year). We found no evidence for a trend toward higher scores in those in the lowest ages. There was no significant difference in mean scores throughout that period.

**Reliability and Validity studies with the 3di:**

Reliability studies have been conducted both in the development phase of the instrument, and also ‘live’ measures of reliability have been obtained in the course of training courses. In our original reliability studies (Skuse et al, 2004) we found that all the dimensional scores in algorithms used to generate diagnoses within DSM-IV-TR defined PDD yielding Intraclass Correlation Coefficients (ICC) for both inter-rater and test-retest reliabilities in excess of 0.86, which is excellent. We found similarly high reliability scores for interviews conducted with the parents of children who had other neurodevelopmental disorders. These values are at least as high, or exceed the ICCs reported for the DISCO (Leekam et al, 2002; Wing et al, 2002) and the ADI-R (Lord et al, 1994).

We have also evaluated the reliability of the instrument during live training sessions, when each group of trainees rates a videorecording of an interview with the parent of an autistic child, in its entirety. Reliability is evaluated on the basis of ADI-R algorithm scores. For a consecutive training group of 208 psychiatrists, paediatricians and other professionals, representing approximately 20 training courses, the following scores were obtained. For the Reciprocal Social Interaction subscale, the reference score (from the interviewer) was 15.0 and the mean for the group was 14.9 (SD 1.24). For language and communication skills, the reference score was 14, and the mean for the group was 14.0 (SD 0.98). Finally, for repetitive and stereotyped behaviors the reference line was 3.7 and the group mean was 3.9 (SD 0.95).

The original criterion validity study (Skuse et al, 2004) was based on the assessment of 29 children with both the 3di and the ADI, who had been interviewed on both instruments by different interviewers, a mean of 2.4 years apart. According to ADI-R algorithm criteria, 17 met all criteria for autism. The results were almost identical, whether the first interview had been the ADI or the 3di. In 19 (65%) of the interviews, there was complete agreement on whether the threshold for case status had been achieved on each of the three domains of the autistic triad of impairment, according to ADI-R algorithm. In 9 of the remaining 10 cases, the instruments disagreed on threshold scores for a single domain. In a further instance, disagreement was on two domains. The agreement on threshold for reciprocal social interaction was 86% (correlation between instruments 0.64, p < .01), for communication 100% (0.64, p < 0.01), and repetitive and stereotyped behaviors 76% (0.53, p < 0.01). We would not expect complete agreement, in part because criterion validity was potentially compromised by inter-rater and test-retest variability, and in part because the ADI-R algorithm was based largely on historical information whereas the 3di seeks contemporaneous information in virtually all domains.

Concurrent validity of the 3di with the Autism Diagnostic Observation Schedule (Lord et al, 2000) has been evaluated in both preschool and school-age children. Because the interview generates scores for social reciprocity and social communication skills (the two main domains scored in the ADOS too) based on current rather than past behaviour, the agreement between the two instruments is remarkably close. Formal analysis of this aspect of validity is pending.
Research studies with the 3di:

The 3di has been widely used in research studies of a wide variety. The detailed phenotyping generated by the interview has encouraged investigations of conceptual issues, such as whether ADHD traits are separable from the autistic profile (Ames and White, 2011); the validity of the specification of PDD-NOS (Mandy et al, 2011); and more recently the construct validity of DSM-5 (Mandy et al, 2012, Mandy et al, 2013). Several studies have examined higher-order cognitive deficits in autistic individuals selected according to 3di criteria, both in the UK (e.g. White and Saldana, 2011; White et al, 2009; Alloway et al, 2010) and in translation (e.g. Schlooz and Hulstijn, 2012). Because the instrument seeks information about a wide range of associated symptoms, including sensory sensitivities, sleep and motor skills, it has encouraged researchers to employ it in studies of sensory processing (e.g. De La Marche et al 2012; Stagg et al, 2013; Alloway, 2012). There have been a number of studies based on the 3di that have studied children’s language development in the context of ASD (e.g. Verhoeven et al, 2012; Williams et al, 2013). The capacity of the instrument to measure comorbidity, has led to investigations of reactive attachment disorder (Minnis et al, 2009), ADHD (Alloway et al, 2009), conduct disorder (Oliver et al, 2011) and oppositional behavior (Mandy et al, 2013). Trait measurement is quintessentially dimensional in character, and so the 3di is ideal for studies of the broader phenotype (e.g. De la Marche et al, 2012), and sex differences in the phenotype (Mandy et al, 2012).

The 3di in translation:

The 3di has now been translated into many languages, an exercise that has been facilitated by the computerization of the interview. We encourage those who are interested in a translation to contact the team via our website (www.ixdx.org). Completed translations include: Cantonese (3di-s only), Dutch, Finnish, Italian, Mandarin (3di-s only), Norwegian, Spanish, Taiwanese (3di-s completed, 3di underway) and Thai (3dis, 3di underway). Other translations (e.g. Arabic, Hindi, Swahili, French) are pending. The instrument works very well in translation. Last year a validation study was published by the Thai translation team (Chuthapisith et al, 2012) which showed the 3di-s had as good sensitivity and specificity in Thailand as in the original UK validation (Santosh et al, 2009). The highly detailed phenotyping that is possible with the 3di allows one to examine subtle differences in the autism phenotype that might be due to cultural factors. A recently published paper on the validity of the DSM-5 criteria in the Finnish translation (Mandy et al, 2013) found that although the DSM-5 model worked well in Finnish ASD participants, it was not suitable for measuring very subtle autistic traits in that population – those we describe as comprising the Broader Autism Phenotype.

The 3di and DSM-5

The 3di was originally devised to be a dimensional measure of autistic traits, back in the 1990s when very few in the field of autism were prepared to countenance this as a valid way of conceptualizing the syndrome. Accordingly, it was designed not only to emulate ADI-R algorithm content, but also to measure symptoms in a far broader context including associated problems such as sensory sensitivities and pragmatic language skills, which were not at that time part of any diagnostic rubric. When the DSM-5 was finally published (APA, 2013) the new diagnostic criteria could readily be emulated by writing new algorithms for 3di questions and subscales. These included nonverbal interaction, peer relationships,
sharing, socioemotional reciprocity, nonverbal communication skills, conversational abilities, unusual preoccupations, routines and rituals, stereotyped and repetitive motor behavior, preoccupation with parts of objects and sensory abnormalities. We used confirmatory factor analysis to assess the construct validity of ASD, especially its bi-dimensional reconceptualization of the autism phenotype. We had in fact shown years before, that social reciprocity and communication skills, as measured by 3di emulation of ADI-R algorithm scores, were tightly correlated across the entire range of the autism spectrum. In our analysis of the DSM-5 criteria (Mandy et al, 2012; Mandy et al, 2013) we found that the two-factor model of autistic symptoms had superior statistical properties to the DSM-IV-TR model. We also showed that it made statistical sense to include stereotyped language usage (a subscale of the Children’s Communication Checklist) within the restricted repetitive behaviour dimension, together with sensory sensitivities. The latest release of the 3di-5 has greatly increased numbers of questions within this latter dimension (especially in the domain of hyper- and hyposensitivity to a range of environmental stimuli), which has improved its metrical properties.

Summary

The 3di is a unique computerized interview that allows ‘deep phenotyping’ of suspected cases of autism spectrum disorder, in children from 3 years of age upwards. It can be administered in the evaluation of adults with minor modification. The interview is designed to be easy to use, quick to learn, and highly reliable. The inter-rater reliability of a computerized interview in which scoring is automated and summary ratings are generated from a host of simple rating decisions is inevitably higher than it would be for paper-based instruments with complex scoring protocols. The instrument is designed to facilitate the evaluation of suspected ASD in a format that is acceptable to both the interviewer and the interviewee. We have trained over 2000 users worldwide, and have found that the majority of those who were already familiar with an alternative system of autism evaluation find the 3di a preferable system because of its user-friendliness and its efficiency.

References:

Alloway TP, Gathercole SE, Elliott J. Examining the link between working memory behaviour and academic attainment in children with ADHD. Dev Med Child Neurol. 2010 Jul;52(7):632-6


