

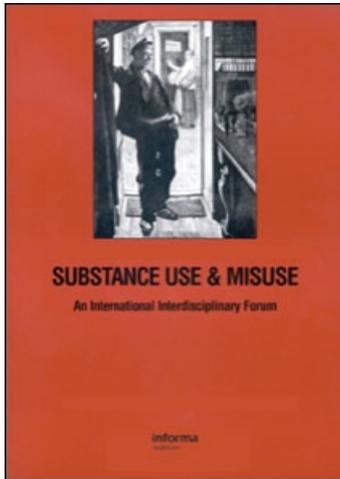
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Screening for Substance Abuse Among Adolescents Validity of the CAGE-AID in Youth Mental Health Care

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Measurements Instruments Scales Tests: CAGE-AID

Screening for Substance Abuse Among Adolescents Validity of the CAGE-AID in Youth Mental Health Care

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Objective: To examine the diagnostic accuracy of the four-item self-report and parent-report versions of the CAGE-AID as a screen for substance-use disorders (SUD) among adolescents in mental health care. *Method:* Patients were 190 Dutch treatment-seeking adolescents (12–18 years old, mean age 15.5 years, 53% boys) and their parents who completed the CAGE-AID questionnaire during intake. DSM-IV clinical diagnoses were used as gold standard in receiver operating characteristic analyses to determine psychometric properties. *Results:* Psychometric properties for both the self-report and the parent-report versions showed the CAGE-AID's excellent diagnostic accuracy in predicting SUD. *Conclusions:* The CAGE-AID seems to be a brief and valid instrument for detecting SUD among adolescents in mental health care. However, denial may play a role in both the CAGE-AID and the clinical interviews. More research is needed to further establish the CAGE-AID's usefulness in other settings. The study's limitations have been noted.

Keywords substance use and misuse; mental health sample; CAGE-AID; adolescents; screening

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Introduction

Adolescence is a critical time for the development of substance-use disorders (SUD) (Clark, Jones Wood, and Cornelius, 2006). Although only a small proportion of the youngsters who experiment with substance use in adolescence develop SUD, longitudinal studies show that early onset of substance use is a strong predictor of later dependence and persistent dysfunction (Rohde *et al.*, 2007).

This early-onset substance use and abuse¹ is often preceded by mental disorders (Boden, Fergusson, and Horwood, 2007; Huizink, Ferdinand, van der, and Verhulst, 2006; Wittchen *et al.*, 2007). Indeed, substance use and misuse in youth mental health care referrals is quite common, with current prevalence estimates varying from 11% to 23% (Aarons, Brown, Hough, Garland, and Wood, 2001; King, Gaines, Lambert, Summerfelt, and Bickman, 2000; Kramer, Robbins, Phillips, Miller, and Burns, 2003; Wilens, Biederman, Abrantes, and Spencer, 1997). These high rates of comorbid substance use and misuse and mental disorders constitutes a challenge for the health care system and society as a whole, since the clinical consequences of comorbidity are substantial (Costello, Erkanli, Federman, and Angold, 1999). Treatment programs have to address a complex web of interrelated problems: comorbid youth generally experience higher levels of impairment, behavioral problems, and criminal justice involvement, and treatment costs are also much higher (King *et al.*, 2000; Kramer *et al.*, 2003; Wilens *et al.*, 1997).

Early and adequate detection of youth with comorbid SUD may allow for intervention before either substance use, mental health or associated problems escalate to more severe levels. Unfortunately, substance-use problems are often diagnosed too late or are simply not detected at all (King *et al.*, 2000). Consequently, appropriate treatment is not provided or applied too late. Lack of training in how to manage positive screens and insufficient time for screening are the greatest barriers to detect adolescents with SUD (Hook Van *et al.*, 2007).

Numerous efforts have been made to develop comprehensive self-report instruments to detect substance use and misuse among adolescents (for extensive review see Winters (2004). These efforts have included many well-defined instruments, but many of these instruments focus solely on one substance and exclude others. Other instruments are very comprehensive, but too extensive and lengthy to be used as screeners (Shaffer *et al.*, 1996). Moreover, many instruments are developed for adolescents in substance-user treatment or paediatric settings rather than for mental health settings and validity in an adolescent psychiatric population has not been established. Since most of the commonly used psychopathology-screening questionnaires, e.g., CBCL, YSR (Achenbach, 1990), and SDQ (Goodman, Meltzer, and Bailey, 2003) do not include a substance-use-related module, there is a need for a brief, reliable, and valid instrument appropriate for screening SUD at intake in youth mental health care.

To facilitate easy integration in any standardized screening procedure, we chose the CAGE-Adapted to Include Drugs (CAGE-AID) scale for its universal use, brevity, and resemblance to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria (Brown and Rounds, 1995). The CAGE-AID is an adapted version of the original CAGE questionnaire that only screens for alcohol use and misuse and dependence (Ewing, 1984). Thus far, reliability and validity of the CAGE-AID have been evaluated in only one adult psychiatric sample (Dyson *et al.*, 1998). In this study, the CAGE-AID showed a sensitivity of 88% and a specificity of 55% for the detection of current SUD. In addition, the CAGE-AID proved to correlate well with other measures of substance use and misuse.

¹The journal's style utilizes the category "substance abuse" as a diagnostic category. Substances are used or misused; living organisms are and can be "abused." Editor's note.

The aim of the present study is to validate the four-item self-report and parent-report versions of the CAGE-AID as a screen for SUD among adolescents in mental health care by (1) assessing the diagnostic accuracy of the self-report and parent-report version of the CAGE-AID, (2) obtaining clinically relevant cut-off scores, and (3) examining parent and child agreement.

Method

Participants

Participants consisted of a convenience sample of 190 adolescents, aged 12 to 18 years, and their primary caretaker (usually their mother), who were referred to a youth mental health care facility in 2004. Youths were seen in several facilities dispersed over The Netherlands (in rural, suburban, and urban settings), all participating in a research network of the Netherlands Institute of Mental Health and Addiction (Trimbos Institute). The CAGE-AID scale was included in a comprehensive screening questionnaire to assess substance-use problems at intake. Adolescents and one of the parents/caretakers were asked to fill out the questionnaire. Potential participants were excluded if they had insufficient knowledge of the Dutch language to read or understand the questions. The medical ethics committee (METIGG) approved the total procedure, and written and informed consent was obtained prior to participation from subjects and one parent or guardian.

The sample consisted of 143 subjects, for whom both self-report and parent-report versions were available; 32 subjects had only self-report data, whereas for 15 subjects only parent-report data were available. Sample characteristics are provided in Table 1.

Instruments

CAGE (Brown and Rounds, 1995) is an acronym for its following four items: (1) "Have you ever felt you ought to Cut down on your drinking or drug use?" (2) "Have people Annoyed you by criticizing your drinking or drug use?" (3) "Have you ever felt bad or Guilty about your drinking or drug use?" (4) "Have you ever had a drink or used drugs first thing in the morning to steady your nerves or get rid of a hangover (Eyeopener)?" The time frame of the CAGE-AID questions was the preceding 6 months. Whereas the original CAGE and CAGE-AID consist of four yes/no items, the current study employed a slightly different format ("not true" (0), "somewhat true" (1), and "certainly true" (2)) to improve sensitivity in detecting potential problems. All items were scored and weighted equally. In the current study, a prescreen item regarding the use of any drug or alcohol in the last 6 months preceded the CAGE-AID. If this question was answered negatively, the CAGE-AID questions could be skipped and were automatically scored as "not true".

Table 1
Selected sample background characteristics ($N = 190$)

Variable	Frequencies or mean (SD)
Age	14.7 (2.1)
Gender (boys)	54.2%
Ethnicity (non-Dutch)	8%
Low (vocational) educational level	39%
One or more comorbid axis I disorders	83%

Procedure

The adolescents and one of their parents/caretakers were asked to complete the CAGE-AID questionnaires upon intake at the mental health center. Clinicians subsequently assessed adolescents with regard to the presence of the DSM-IV criteria of SUD (American Psychiatric Association, 2001). These clinical diagnoses of current SUD were used as the external criterion to validate the CAGE-AID. Clinicians were blind to the screening results of the CAGE-AID. Participants were rewarded with a small gift voucher for filling out the screening questionnaires.

Statistical Analyses

All analyses were conducted with SPSS 14.0. Internal consistency of the CAGE-AID proved to be high for the self-report (Cronbach's $\alpha = .77$) as well as for the parent-report version (Cronbach's $\alpha = .86$).

In order to determine whether the CAGE-AID has the capacity to effectively discriminate clients with SUD from those without SUD, receiver operating characteristic (ROC) analyses were employed. All clients with or without mental disorders other than SUD were grouped together and compared to clients with either primary or secondary SUD. The area under the curve (AUC) statistic can be interpreted as the probability that the CAGE-AID score from a randomly chosen substance-abusing subject is more indicative of SUD than that of a randomly chosen non-substance-abusing subject. An AUC less than 0.7 suggests "low" diagnostic accuracy, from 0.7 to 0.9 "moderate" diagnostic accuracy, and more than 0.9 "high" diagnostic accuracy (Swets and Pickett, 1982).

To determine an optimal cut-off score, the sensitivity, specificity, and overall percentage of correctly classified cases were calculated. In addition, the positive predictive value (PPV, the probability of having a positive diagnosis among those with a positive screening) and the negative predictive value (NPV, the probability of absence of a diagnosis among those with a negative screening result) were calculated. The PPV and NPV will vary depending on the prevalence of a diagnosis in a population. Furthermore, the negative and positive likelihood are presented, expressing the odds of false negatives and false positives. The positive likelihood ratio (LR+) is derived by dividing sensitivity by (1-specificity), whereas the negative likelihood (LR-) is calculated by dividing (1-specificity) by specificity. Finally, the cumulative percentage of total number of screen positives is provided to consider the clinical consequences, especially the burden of unnecessary follow-up assessment, for each specific cut-off point.

The kappa statistic is used to test parent-child agreement. Whereas a kappa of 1 indicates perfect interrater agreement, values more than 0.20 indicate fair agreement, values more than 0.40 moderate agreement, and more than 0.60 substantial agreement (Landis and Koch, 1977).

Results

Prevalence of Clinically Diagnosed Substance-Use Disorders

Eleven subjects (5.8%) fulfilled DSM-IV criteria of SUD; nine boys and two girls. In this psychiatric sample, the number of comorbid axis I diagnoses was high. Eight out of 11 subjects with a substance-use diagnosis had one or more comorbid axis I diagnoses, mainly externalizing disorders (ADHD, CD, and ODD).

CAGE-AID

Most adolescents and their parents did not identify with any of the CAGE-AID questions (a total score of 0 in 81.3% and 85.3% of all cases, respectively). Of all four items, the cut-down item was scored most frequently by both adolescents and their parents (14.4% of each indicated that it was “somewhat” or “certainly true”). The eyopener item was scored least by both adolescents and their parents (7.6% of adolescents and 5.4% of parents indicated that it was “somewhat” or “certainly true”). Correlation between parent-report and self-report versions were consistently high ($p < 0.001$ level) for all single items and total CAGE-AID score.

CAGE-AID Self-Report Version

ROC analyses of the CAGE-AID self-report version showed an AUC of 0.996 (95% CI = 0.989–1.00), indicating that the probability is 99.6% that someone with SUD will have a higher score on the CAGE-AID than someone without SUD.

Table 2 shows the various characteristics for all potential cut-off points of the CAGE-AID self-report version. A satisfactory balance between these characteristics is achieved with a cut-off point of 2. This cut-off leads to a sensitivity of 91% and a high specificity of 98%. With this cut-off, the PPV of the CAGE-AID self-report version is 77%, whereas the NPV is 99%, and an efficiently low (9.9%) of screen positives. Moreover, the likelihood ratio for detecting SUD by using the CAGE-AID self-report version with the cut-off score of 2 is 46 times higher compared to the odds of detecting SUD without using the CAGE-AID self-report. The negative likelihood expresses the odds of overlooking subjects with SUD by the CAGE-AID. With the suggested cut-off score, this happens in one out of 10 cases.

CAGE-AID Parent-Report Version

Receiver Operating Characteristic analysis of the CAGE-AID parent-report version shows an AUC of 0.997 (95% CI = 0.989 to 1.01). Table 3 shows the characteristics for the various

Table 2
Sensitivity and specificity of the CAGE-AID self-report version ($N = 190$)

Scale cut-off score	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	LR+ ^a	LR- ^b	Cumulative (%) screen positives
1	100	97	73	100	33	0	11.5
2	91	98	77	99	46	0.09	9.9
3	82	100	100	98	82	0.18	6.9
4	73	96	100	98	73	0.27	6.1
5	64	100	100	98	64	0.36	5.3
6	45	100	100	95	45	0.55	3.8
7	27	100	100	94	27	0.73	2.3
8	0	100	100	92	0	1.0	0

Note. The row in bold-type indicates the cut-off values that achieve the optimal balance between sensitivity and specificity.

^aLR+ = positive likelihood ratio.

^bLR- = negative likelihood.

Table 3
Sensitivity and specificity of the CAGE-AID parent-report version ($N = 190$)

Scale cut-off score	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	LR+ ^a	LR- ^b	Cumulative (%) screen positives
1	100	98	78	100	50	0	8.7
2	100	98	78	100	50	0	8.7
3	100	99	88	100	100	0	7.8
4	71	99	88	98	71	0.29	5.8
5	71	99	88	98	71	0.29	5.8
6	71	100	100	97	71	0.29	4.9
7	57	100	100	94	57	0.43	3.9
8	14	100	100	93	14	0.86	1.0

Note. The row in bold-type indicates the cut-off values that achieve the optimal balance between sensitivity and specificity.

^aLR+ = positive likelihood ratio.

^bLR- = negative likelihood ratio.

cut-off points of the CAGE-AID parent-report version. The optimal balance between these characteristics is achieved with a cut-off point of 3. This cutoff leads to a sensitivity of 100% and specificity of 99%. The PPV of the parent-report CAGE-AID is 88%, whereas the NPV is 100%, with a cumulative percentage of only 7.8% of participants screening positive. The positive likelihood ratio with the cut-off score of 3 heightens the odds of detecting any substance-use disorder 100 times compared to the odds without using the CAGE-AID parent-report version. The negative likelihood (the odds of overlooking SUD) is 0.

Self-Report and Parent-Report Agreement

Using these cut-off scores, the agreement between the CAGE-AID self-report and parent-report versions was substantial (observed agreement = 94.7%; Kappa = 0.74). For those seven out of 11 adolescents clinically diagnosed with SUD, whose parent-version data were available, agreement was perfect. Disagreement occurred for four adolescents who were not suffering from a SUD according to DSM-IV clinical diagnosis, but did have either an above threshold score on the self-report or parent-report versions (three above threshold self-report and below threshold parent-report versions, one below threshold self-report and above threshold parent-report versions).

Discussion

The results provide preliminary evidence that the CAGE-AID self-report and parent-report versions provide an effective instrument to screen for SUD (research question 1) among adolescents referred to mental health care. In ROC analyses both the self-report (AUC = 0.996) and the parent-report versions (AUC = 0.997) demonstrated excellent diagnostic accuracy in predicting substance-use disorder diagnoses.

Subsequently, optimal cut-off scores for clinical use were determined (research question 2). For the self-report version, a cut-off score of 2 yields good accuracy at detecting the presence (sensitivity of 91%) and absence (specificity of 98%) of SUD. This low cut-off score is consistent with the cut-off score found among adult psychiatric referrals (Dyson et al., 1998). However, it should be noted that the latter cut-off was established using

dichotomous answer categories and a maximum score of 4 instead of 8 in current study. For the parent-report version of the CAGE-AID version, a cut-off score of 3 seemed most accurate in detecting SUD (sensitivity of 100% and specificity of 99%). Whereas in both versions the NPV is almost perfect (99% for the self-report version and 100% for the parent-report version), the PPV is also satisfactory (77% for the self-report version and 88% for the parent-report version).

The prevalence of SUD in the current sample (5.8%) is considerably lower than in earlier, mostly North American, studies (King et al., 2000; Kramer et al., 2003). However, most of these studies are conducted in slightly different settings (mainly inpatient facilities) with a generally higher mean age. Studies in outpatient samples report lower prevalence rates and especially so in younger age categories (Aarons et al., 2001; Wilens et al., 1997). All in all, a prevalence in young (12–15 years old) outpatient mental health samples is more likely to amount to about 11% to 12%. The lower prevalence in the current study may be due to the fact that SUD is often overlooked by clinicians (Kramer et al., 2003). Nevertheless, a serious underestimation is unlikely, since undiagnosed cases of SUD would have increased the number of CAGE-AID-false positives and specificity of the CAGE-AID could never remain so high.

Another important property of the CAGE-AID is the low cumulative percentage of positive screens, both in the parent- and self-report versions. The cumulative percentage of positive screens should resemble the prevalence of the disorder as close as possible, as clinicians use screening results to make decisions about the use of scarce or expensive referrals to specialist care. In addition, it means that clients could be unjustly labelled as substance users or misusers. Although these concerns are valid, the high degree of impairment associated with comorbid substance use and misuse in psychiatric referrals, justifies the need for extra attention to potential cases (Wilens et al., 1997; Weiner, Abraham, and Lyons, 2001). Thus, as long as a positive screen is considered as an indicator for further evaluation, and by no means a definitive diagnosis, the potential drawbacks for clients with false positive scores are minimal.

Finally, the level of agreement between parent- and child-report versions of the CAGE-AID is substantial (research question 3). Earlier research suggests that self-report on SUD is generally more accurate than parent-report (Fisher et al., 2006). Although, in the current study no such effect was found, the additional value of parent-report version is small. Therefore it might be considered whether peer-report version could perhaps prove to be a much more effective source of information (Andrews, Tildesley, Hops, and Li, 2002).

Clinical Implications

The current study shows that the CAGE-AID can validly screen for SUD among adolescents in mental health care settings. By using the CAGE-AID questionnaire, clinicians can use their precious time at intake more efficiently. Moreover, the four items of the CAGE-AID can easily be integrated in the standardized screening procedures in youth mental health care.

²Treatment can be briefly and usefully defined as a planned, goal directed change process of necessary quality, appropriateness, and conditions (endogenous and exogenous), which is “bounded” (culture, place, time, etc.) and can be categorized into professional-based, tradition-based, mutual-help based (AA, NA, etc.) and self-help (“natural recovery”) models. There are no unique models or techniques used with substance users, of whatever types, which aren’t also used with non-substance users. In the West, with the relatively new ideology of “harm reduction” and the even newer Quality of Life (QOL) treatment-driven model there are now a new set of goals in addition to those derived from/associated with the older tradition of abstinence driven models. Editor’s note.

The high NPV ensures that potential substance users are not overlooked and a positive CAGE-AID screen increases the odds of the presence of a SUD by 46 (self-report) to 100 (parent-report) times, while efficiency (low cumulative percentage) is maintained. This type of screening for SUD in adolescents and in youth mental health care is important, as these comorbid adolescents are often more severely impaired, have poorer treatment outcome, and higher health care utilization and subsequent costs (Grella, Hser, Joshi, and Rounds-Bryant, 2001; King et al., 2000). Moreover, adolescents seeking mental health treatment, in whom SUD remains undetected, are less likely to receive substance-user treatment² and have more involvement with the criminal justice system at 6 months follow-up (Kramer et al., 2003). Referral trajectories seem at random and many sectors of public care (such as paediatric, juvenile justice, and mental health care) are not well equipped to provide adequate care for (comorbid) substance-abusing adolescents (Aarons et al., 2001; Hook Van et al., 2007).

Study's Limitations

Some limitations of the present study should be noted. First, assessment of SUD relied on clinical diagnoses. Although clinicians adhered to DSM-IV criteria, individual differences may exist.

Secondly, the prevalence of SUD in the current study (5.8%) is lower than in comparable samples in other studies (around 11%) (Aarons et al., 2001; Wilens et al., 1997). A possible explanation could be that the sample was not a completely random. Facilities participated voluntarily and do not necessarily represent the entire Dutch youth mental health care system. However, most of the reported characteristics of the CAGE-AID, such as the AUC, sensitivity, and specificity, are unaffected by prevalent rates.

Thirdly, the utility of an instrument varies greatly depending on the context and population in which it is applied. Our results showed that the CAGE-AID screens very accurately among adolescents referred to youth mental health care, but these findings cannot be generalized to other populations. For example, the CAGE has been proven to be less sensitive for screening for alcohol use and misuse and dependence among adolescent medical patients and adolescents in primary care (Knight, Goodman, Pulerwitz, and DuRant, 2000; Knight, Sherritt, Harris, Gates, and Chang, 2003). Moreover, because of the limited size of our SUD sample, the current study has not been able to examine possible gender or age effects. Some gender effects have been reported concerning the CAGE; it was less sensitive for alcohol use and misuse in young women compared to young men (O'Hare and Tran, 1997). Future research should attempt to replicate the findings of the present study in a more gender and age diverse sample. In conclusion, our findings show that employing the CAGE-AID offers clinicians a general, but accurate point of departure for cases that need more detailed diagnostic attention. The short CAGE-AID is as effective as extensive clinical assessment. However, denial may play a role in both the CAGE-AID and the clinical interview. And although there is evidence for the validity of the self-report method for the assessment of adolescent substance use (Winters, Stinchfield, Henly, and Schwartz, 1990), the use of a selective two-stage screening process, employing biological indicators such as urinalysis, is always recommended when in doubt about the presence or (excessive) use of substances (Kilpatrick, Howlett, Sedgwick, and Ghodse, 2000).

RÉSUMÉ

L'Objectif de cette étude est: d'Examiner la précision diagnostique de cette échelle CAGE-AID comprenant un questionnaire de quatre questions à remplir par l'adolescent lui-même

et ses parents, pour détecter les abus de substances parmi les jeunes dans le service mentaux. Méthode: 190 patients se présentant pour traitement (12–18 ans moyenne 15,5 ans; pour 82% mâles) et leur parents ayant rempli le CAGE-AID pendant une évaluation clinique dans un service de psychiatrie. Ces adolescents ont tous été examinés par des cliniciens et ont reçu un diagnostic clinique en DSM IV, qui sert de standard en or pour les analyses Receiver Operating Characteristics (ROC). Résultats: le questionnaire rempli par les adolescents et les parents montrent une excellente acuité diagnostique, prédictive pour le diagnostic d'abus de substances. Conclusion: le questionnaire CAGE-AID est un instrument concis mais bien valide permettant la détection d'abus de substances dans une population d'adolescents se présentant en services de psychiatrie. Cependant, c'est importante de tiennent compte de détecter ceux qui ne rapportent pas ou cachent leur problème avec les drogues. Des efforts de recherche sont recommandés pour déterminer l'efficacité de CAGE-AID dans d'autres secteurs de prise en charge pour les jeunes. Mots clefs: abus de substances, CAGE-AID, adolescents, détection

RESUMEN

Objetivo: Examinar el diagnóstico preciso de la versión CAGE-AID incluye un cuestionario de cuatro preguntas a rellenar por el adolescente mismo y sus padres, para detectar el abuso de sustancias (SUD) entre los jóvenes con asistencia sanitaria mental. Método: 190 pacientes adolescentes se presentaron para tratamiento (12–18 años; media de 15.5 años; 82% varones) y sus padres quienes rellenaron el cuestionario CAGE-AID durante la admisión en los servicios psiquiátricos. Los adolescentes fueron más tarde extensamente examinados por médicos, y los diagnósticos clínicos DSM IV se utilizaron como pauta de oro para los análisis ROC (Receiver Operating Characteristics). Resultados: El cuestionario rellenado por los adolescentes y los padres y los adolescentes demostraban un diagnóstico preciso y excelente, en predicción del diagnóstico de abuso de sustancias. Conclusión: La CAGE-AID es un instrumento breve pero bien válido para detectar SUD entre adolescentes con asistencia sanitaria mental. Sin embargo, es importante para considerar detectar abusos defensivos u ocultos de sustancias. Se necesita más investigación para estabilizar la eficacia de la CAGE-AID's en otros sectores.

Palabras claves: Abuso de sustancias, CAGE-AID, adolescentes, evaluación.

THE AUTHORS



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Rutger Jan van der Gaag, M.D., Ph.D., specializes in psychiatry and child psychiatry, especially in developmental disorders (autism, ADHD, conduct disorders, and substance-use disorders). After having been director of training in (child and adolescent) psychiatry from 1995 until 2002 in Veldwijk (nowadays Meerkanten) in Ermelo, he was appointed professor of clinical child and adolescent psychiatry at the Radboud University in Nijmegen. The research at Karakter University Centre for Child and Adolescent Psychiatry at the Radboud University Centre in Nijmegen focuses on developmental psychopathology.



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Corine de Ruiter, Ph.D., University of Amsterdam, is a licensed clinical psychologist and cognitive behaviour therapist. She studied at Barton College, Wilson, North Carolina and completed her clinical training at the University of Oregon, Eugene (OR), USA. She has been a scientist-practitioner throughout her career, and published in the areas of personality disorders, violence risk assessment, treatment evaluation, and psychological assessment. She is currently professor of forensic psychology at Maastricht University, The Netherlands and is senior scientist at the Netherlands Institute of Mental Health and Addiction (Trimbos-Institute).



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