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Latent class analysis of anxiety and depressive symptoms of the Youth Self-Report in a general population sample of young adolescents

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Abstract

This study examined whether distinct groups of young adolescents with mainly anxiety or mainly depression could be identified in a general population sample. Latent class analysis was used on self-report ratings of DSM-IV symptoms of anxiety and depressive disorders, because it was hypothesized that these ratings provide a bigger chance to identify distinct groups than parent ratings of symptoms that are poorly associated with DSM-IV. Results from exploratory and confirmatory latent class analysis showed that only very small numbers of young adolescents had mainly anxiety or mainly depressive symptoms. Instead, a five-group model fitted the data best. These five groups contained young adolescents who either had a high, intermediate, or low probability to have comorbid symptoms of anxiety and depression. It was concluded that symptoms of DSM-IV anxiety and depressive disorders co-occur in young adolescents, and that latent class analysis on items that capture also severe symptoms like suicidal thoughts are needed to derive groups with specific comorbidity patterns in a general population sample.

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Keywords: Anxiety; Depression; Early adolescence; General population; Latent class analysis

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Introduction

This study investigated the association between anxiety and depression in early adolescence. Effective treatment methods for anxiety and depression for this age groups mainly consist of cognitive behavior therapy programs (e.g., Cartwright-Hatton, Roberts, Chitsabesan, Fothergill, & Harrington, 2004; Curry, 2001). However, most programs are aimed at anxiety or depression, which reflects the assumption that anxiety and depressive disorders represent two different diagnostic entities. Given the need for developing more effective treatment methods for anxiety and depression in children, it is important to investigate the validity of the basic inclusion criteria for such treatments. Therefore, it is important to know which comorbidity patterns of anxiety and depressive disorders exist. If it would really be the case that depression can occur without an anxiety disorder being present, or vice versa, this would underscore the need for treatments that are specific for each disorder. However, if depression and anxiety occur simultaneously in most cases, a differential treatment approach would not be necessary. This would enhance the pace of treatment development and research regarding efficacy of interventions.

Most studies showed that anxiety disorders and depressive disorders co-occur in children and adolescents (Cohen et al., 1993; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Lewinsohn, Zinbarg, Seeley, Lewinsohn, & Sack, 1997; Verhulst, van der Ende, Ferdinand, & Kasius, 1997). The meta-analysis by Angold, Costello and Erkanli (1999) for instance, indicated that anxiety disorders and depressive disorders in children and adolescents are more strongly related to each other than to other psychiatric disorders. It has even been suggested that anxiety disorders and depressive disorders are two different manifestations of the same underlying liability (Clark & Watson, 1991). This might explain the fact that anxiety disorders in childhood are a risk factor for depressive disorders (Wittchen, Beesdo, Bittner, & Goodwin, 2003).

The studies that assessed comorbidity between anxiety and depression (e.g., Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Lewinsohn, Zinbarg, Seeley, Lewinsohn, & Sack, 1997) usually applied a categorical approach, based on the criteria of the Diagnostic and Statistical Manual of mental disorders (DSM-IV; American Psychiatric Association, 2000). In these studies, anxiety and depressive disorders were judged absent or present, by applying the clinical cutoff for a DSM-IV diagnosis. Although comorbidity levels were found in these studies, considerable numbers of individuals also fulfilled criteria of a single diagnosis of anxiety disorder or depressive disorder. However, by applying a categorical approach, comorbidity rates between anxiety and depressive disorders may have been underestimated, because individuals who almost, but not entirely, fulfilled criteria for a diagnosis did not receive this diagnosis. In other words, a child with a depressive disorder and with subthreshold symptoms of an anxiety disorder was considered as a non-comorbid case, which inflated rates of single, non-comorbid, diagnoses.

To investigate whether there are homogeneous groups of children with anxiety symptoms, with depressive symptoms, or with symptoms of both anxiety and depression, latent class analysis (LCA) can be used. LCA yields the possibility to define these groups, or classes, by the probability that specific symptoms are present. Furthermore, LCA indicates which groups of children should be formed to make optimal distinctions between children with different types or frequencies of symptoms. Thus, LCA might yield a class of children in the general population who have a high probability to be endorsed positive on depressive symptoms, but negative on anxiety symptoms. However, it is also possible that LCA does not yield classes of children with a high likelihood of

having symptoms of depression but not of anxiety. This would indicate that the concept of ‘pure’ depression is not useful to distinguish children with different types of symptoms.

Wadsworth, Hudziak, Heath, and Achenbach (2001) performed LCA on parent-reported symptoms of children’s anxiety and depression. They found in a general population sample and in a referred sample three different classes of individuals aged 4–18 years with respectively, high, moderate, and low levels of symptoms of both anxiety and depression. Classes with high depression levels and low anxiety levels or vice versa were not identified. This might question the validity of the concept of anxiety and depressive disorders as separate diagnostic constructs. However, this study relied on parent reports, whereas it is known that agreement between parent- and self-report ratings of anxiety and depression is generally poor (Cantwell, Lewinsohn, Rohde, & Seeley, 1997; Gould, Bird, & Jaramillo, 1993; Verhulst & van der Ende, 1991). In addition, self-report ratings yield higher levels of anxiety and depressive symptoms than parent ratings (Essau & Petermann, 2001; Stanger & Lewis, 1993). Hence, use of self-reports may yield different results.

The present study identified groups of young adolescents with specific patterns of anxiety and depressive symptoms. Exploratory and confirmatory LCA were performed on self-report data on DSM-IV symptoms of anxiety and depressive disorders that were obtained from 10- to 12-year-olds from a general population.

Method

Sample and procedure

Tracking Adolescents’ Individual Lives Survey (TRAILS)

The TRAILS is a prospective cohort study of Dutch young adolescents aged 10 to 12 years, who are followed biennially until the age 24. The present study used data from the first assessment wave of TRAILS, which ran from March 2001 to July 2002. The TRAILS target sample consisted of young adolescents from 5 municipalities in the North of the Netherlands, including both urban and rural areas. A detailed description of the TRAILS sampling procedures is presented in De Winter, Oldehinkel, Veenstra, Brunnekreef, and Verhulst (2005). Briefly, of all young adolescents approached for enrolment ($N = 3145$), 6.7% were excluded, because they were not capable to participate because of mental retardation or a serious physical illness or handicap, or when a Dutch-speaking parent or parent surrogate was not available. Of the remaining 2935 young adolescents, 76.0% were enrolled in the study ($N = 2230$, mean age 11.09 years (SD 0.55), 50.8% girls). Responders and non-responders differed on various socio-demographic indicators, but not with respect to the proportion of single parent families, nor on the prevalence of teacher-rated problem behavior. Furthermore, no differences between responders and non-responders were found regarding associations between socio-demographic variables and mental health outcomes (see De Winter, Oldehinkel, Veenstra, Brunnekreef, & Verhulst, 2005).

Measures

Youth Self-Report (YSR)

The YSR (Achenbach, 1991) is a self-report questionnaire that covers behavior and emotional problems of children aged 11 to 18 years in the past 6 months. It contains 113 problem items that

are scored on a 3-point scale (0 = not true, 1 = somewhat or sometimes true, 2 = very or often true). The good reliability and validity of the American version of the YSR were replicated for the Dutch translation (Verhulst, van der Ende, & Koot, 1997). Scores on the YSR scale anxious/depressed are associated with anxiety and depressive disorders. However, the correspondence between this scale and specific DSM anxiety and depressive disorders is low (Edelbrock & Costello, 1988; Gould, Bird, & Jaramillo, 1993; Kasius, Ferdinand, van den Berg, & Verhulst, 1997). In addition, it has been suggested that anxiety and depression become less strongly correlated when they are defined by symptoms that are based on DSM criteria of anxiety and depressive disorders (Gurley, Cohen, Pine, & Brook, 1996; Hiller, Zaudig, & von Bose, 1989). Therefore, instead of using the anxious/depressed scale, the relatively new DSM-IV scales of the YSR (Achenbach, Dumenci, & Rescorla, 2001, 2003) were used. The DSM-IV Scale Anxiety Problems consists of 6 items that reflect symptoms of DSM-IV generalized anxiety disorder, separation anxiety disorder, and specific phobia. The DSM-IV Scale Affective Problems consists of 13 items, and reflects symptoms of DSM-IV dysthymia and major depressive disorder. The DSM-IV Scales Affective Problems, and to a lesser extent Anxiety Problems, has moderate to good correspondence with their DSM-IV counterparts in a previous study (van Lang, Ferdinand, Oldehinkel, Ormel, & Verhulst, 2005). Table 1 lists the items of the DSM-IV scales, compared to those of the anxious/depressed scale. Confirmatory factor analysis showed reasonable goodness-of-fit indices for both DSM-IV scales in the TRAILS sample (goodness of fit index (GFI) = .90, root mean square error of approximation (RMSEA) = .05, and standardized root mean square residual (SRMR) = .07). The internal consistency of the scales were $\alpha = .62$ for the DSM-IV scale anxiety problems, and $\alpha = .72$ for the DSM-IV scale affective problems.

Statistical analysis

YSR data of $N = 2029$ young adolescents (91% of the TRAILS sample, 51% girls) were available and used for latent class analysis (LCA). LCA is a statistical technique that is aimed at identifying the smallest number of classes (or groups) of individuals with similar patterns of behaviors that can explain the observed relationship among a set of items. It first identifies homogeneous classes of individuals, according to their item scores. Subsequently, for each individual, the probability of belonging to a specific class is calculated and for individuals who fall in a specific class, the probability of a positive item score is calculated for all items that are entered in the analysis (i.e., symptom endorsement probabilities). The analyses were performed with Mplus Version 3.0 (Muthén & Muthén, 1998–2004). All YSR items were dichotomized in 0 = not true, and 1 = somewhat, or often true. The item ‘harms self’ had the lowest frequency score (4.1%).

First, an exploratory LCA was conducted. To obtain an optimal class-solution with exploratory LCA, each model was estimated by stepwise addition of classes, until the model fitted the data well. The stability of each model was examined by using different sets of starting values to prevent solutions based on a local maximum in iteration processes. When a stable model was identified, values of the Bayesian Information Criterion (BIC; Kass & Wasserman, 1995) of each model were compared, and the model with lowest BIC was preferred. In addition, the significance level of the Vuong–Lo–Mendell–Rubin likelihood ratio test (LRT) of each model had to show a significant improvement in model fit, compared to the fit of the former model (Golden,

Table 1

Anxiety and depression items^a of the YSR/DSM-IV Scales Anxiety Problems and Affective Problems, compared to the YSR anxious/depressed scale

	YSR anxious/ depressed scale	YSR/DSM-IV scale anxiety problems	YSR/DSM-IV scale affective problems
<i>Anxiety items:</i>			
Fears doing bad	+	—	—
Must be perfect	+	—	—
Other are out to get me	+	—	—
Self-conscious	+	—	—
Suspicious	+	—	—
Nervous	+	+	—
Fearful	+	+	—
Worries	+	+	—
Dependent	—	+	—
Fears	—	+	—
Fears school	—	+	—
<i>Depression items:</i>			
Loneliness	+	—	—
Feels unloved	+	—	—
Cries a lot	+	—	+
Feels worthless	+	—	+
Feels too guilty	+	—	+
Feels sad	+	—	+
Enjoys little	—	—	+
Harms self	—	—	+
Does not eat well	—	—	+
Overtired	—	—	+
Sleeps less	—	—	+
Sleeps more	—	—	+
Thinks of suicide	—	—	+
Trouble sleeping	—	—	+
Lacks energy	—	—	+

Note: + means that an item is present in the scale, and — means that an item is not present in the scale.

^aItems are described by its abbreviations.

2000). Finally, gender was entered as a covariate to the best fitting model to allow for possible gender-related differences.

Second, a confirmatory LCA was performed to examine a specific model. It was tested whether young adolescents with high scores on anxiety and low scores on depression, or vice versa, could be identified, adjacent to individuals with high or low scores on both. This confirmatory model with four classes was imposed on the data. The parameters of the class that consisted of individuals with high scores on anxiety and low scores on depression were defined, using the probability scores that were found in the high- and low-symptom groups of the exploratory LCA solution. This means that each anxiety item received the conditional probability value (or logit value) that belonged to the item in the high-symptom group of the

exploratory LCA solution, and each depression item the conditional probability value that belonged to the item in the low-symptom group. The opposite applied for the class that consisted of individuals with low scores on anxiety and high scores on depression. The parameters of the two classes that contained individuals with high or low scores on both anxiety and depression were not fixed.¹

To test whether the confirmatory model fitted the sample data better than the exploratory model, the difference in likelihood ratio statistics G^2 was examined, as suggested by Schuster and Smith (2002). Because the confirmatory model consisted of four classes, the difference in likelihood ratio statistics could only be calculated by subtracting the G^2 of this model from the G^2 of the exploratory LCA solution that consisted of also four classes.

Results

Identification of the exploratory LCA model

The values of BIC and significance levels of LRT of a 2- to a 6-class-solution derived from exploratory LCA are presented in Table 2. It shows that a 5-class solution fitted the data best. When gender was entered in the model, the BIC value changed into 37,899.

Fig. 1 shows that class 1 consisted of 15% of the sample, class 2 of 6%, class 3 of 17%, class 4 of 23%, and class 5 of 39%. Compared to class 5, class 1 contained significantly more girls ($z = 3.52$, $p < .05$; boys/girls = 41%/59%), as did class 4 ($z = 3.35$, $p < .05$; boys/girls = 41%/59%). Individuals in class 1 and class 2 had the highest probability to score on the anxiety and depression items. The difference between class 1 and class 2 was a higher likelihood to have anxiety symptoms (i.e., being too fearful or anxious, nervous, having fears for certain animals, situations, or places other than school) in class 1, and to have severe depressive symptoms (i.e., feeling worthless or inferior, sad, enjoying little, and talks about killing self and deliberately harms self or attempts suicide) in class 2. Individuals from class 3 and class 4 had a comparable probability profile, but class 3 had a higher likelihood to score on the depression items about sleeping and eating problems. The percentage of individuals correctly classified were 84% for class 1, 94% for class 2, 87% for class 3, 85% for class 4, and 88% for class 5.

The confirmatory LCA model

Compared to the likelihood ratio statistics G^2 of the exploratory LCA solution with 4 classes, the confirmatory model had a significantly worse fit to the sample data ($\Delta G^2 = 336$, on the basis of $df = 38$, $p < .01$). The confirmatory model revealed that the class with high scores on anxiety and low scores on depression consisted of $N = 5$ individuals (0.2%), with 71% being correctly classified. The class with low scores on anxiety and high scores on depression contained $N = 11$ individuals (0.5%) with 86% being correctly classified.

¹Information about this confirmatory LCA is available on request to the corresponding author.

Table 2

Statistical values of a 2- to a 6-class-solution of the YSR/DSM-IV Scales Anxiety Problems and Affective Problems derived from exploratory LCA

2		3		4		5		6	
BIC	LRT	BIC	LRT	BIC	LRT	BIC	LRT	BIC	LRT
value	<i>p</i> -value	value	<i>p</i> -value	value	<i>p</i> -value	value	<i>p</i> -value	value	<i>p</i> -value
38,278	0.00	37,915	0.00	37,897	0.01	37,893	0.01	37,958	n.s.

Note: n.s. means not significant.

Fig. 1. Symptom endorsement profile of the items of the YSR/DSM-IV Scales Anxiety Problems and Affective Problems.

Discussion

This study examined whether distinct groups of young adolescents with mainly anxiety or mainly depressive symptoms could be identified in a general population of 10- to 12-year-olds. Symptom ratings of anxiety and depression were obtained from self-reports and were based on DSM-IV criteria for anxiety and depressive disorders. It was hypothesized that such ratings yield a bigger chance to identify distinct groups with mainly anxiety or mainly depression than parent reports (e.g., Essau & Petermann, 2001; Gurley, Cohen, Pine, & Brook, 1996), or ratings that are poorly associated with DSM criteria like items of the anxious/depressed scale (e.g., Kasius, Ferdinand, van den Berg, & Verhulst, 1997).

The results showed that the model with five groups obtained from exploratory LCA fitted the sample data best. All five groups contained young adolescents with symptoms of both DSM-IV anxiety disorders and depressive disorders. To test whether individuals with mainly anxiety or mainly depression could be identified in the sample, a confirmatory LCA with 4 classes was also performed. However, the results of this confirmatory LCA showed that only very small numbers of individuals had mainly anxiety or mainly depression, and most (99%) had comorbid symptoms. Moreover, the fit of the confirmatory model was significantly worse than the fit of the exploratory model with 4 classes. Given these results, it can be concluded that there are no distinct groups with mainly anxiety or mainly depression in the general population. Instead, five distinct groups fitted the data best and all consisted of young adolescents who had both anxiety and depression.

Group characteristics

The five identified groups could be compared with the three groups found by [Wadsworth, Hudziak, Heath, and Achenbach \(2001\)](#). They showed that 8–11% of the non-referred subjects fell in the high-symptom group, 46–55% in the low-symptom group and 34–46% in the intermediate group. The high- and low-symptom groups were characterized by respectively a high or low probability to have comorbid symptoms of anxiety and depression, and the intermediate group by a moderate likelihood to have these comorbid symptoms. The present study showed that 39% of the sample fell in the low-symptom group, and that two more groups had specific comorbidity patterns that were not identified by [Wadsworth, Hudziak, Heath, and Achenbach \(2001\)](#).

For instance, two high-symptom groups were found that consisted of young adolescents with a high probability for anxiety symptoms. One of the groups contained young adolescents with comorbid symptoms of mild depression (15%), whereas the other comprised young adolescents with comorbid symptoms of severe depression (6%). The young adolescents with comorbid symptoms of severe depression reported feelings of worthlessness and sadness, and thoughts about suicide or harming self, which are severe features of DSM-IV major depressive disorder ([American Psychiatric Association, 2000](#)).

Two other groups of young adolescents were found with a moderate probability for anxiety symptoms and with some probability for depressive symptoms (23%) or a high probability for specific problems with eating and sleeping (17%). The group that was likely to have problems with eating and sleeping might also have other mental or physical health problems, as [Tanaka et al. \(2002\)](#) showed that sleep problems were closely related to unhealthy lifestyle and mental and physical health problems in junior high school students. However, given the high number in this group, and the small likelihood to have anxiety and depressive symptoms, follow-up data of this group is needed to clarify whether these individuals suffer from psychopathology, or from unstructured or unhealthy lifestyles.

Beside the fact that this study was conducted in a Dutch general population of 10- to 12-year-olds, the use of self-reports and DSM-IV symptoms of anxiety and depressive disorders may have been responsible that more specific comorbidity patterns were found than in the study by [Wadsworth, Hudziak, Heath, and Achenbach \(2001\)](#). The DSM-IV Scale Affective Problems for instance, includes items of thinking of suicide and displaying self-mutilating behaviors, which are

not present in the anxious/depressed scale. These items distinguished young adolescents with high symptom levels of anxiety into two groups that either had comorbid symptoms of mild depression or severe depression. Items about anhedonia (e.g., enjoys little), which is supposed to be a core feature of depression, did not discriminate the groups. Instead, items about suicidal ideation and sleep disturbances distinguished the groups most strongly. Especially suicidal ideation is important in this respect, because suicidal thoughts in adolescents are shown to be associated with other psychiatric problems like aggression or conduct disorders (Dhossche, Ferdinand, van der Ende, Hofstra, & Verhulst, 2002; Miotto et al., 2003). This may indicate that the presence of suicidal thoughts should have a stronger clinical significance in the classification criteria of depression than currently is done. Adolescents with suicide thoughts may benefit from more specified treatment programs like a combination of medication and family therapy (Curry, 2001) than adolescents with symptoms of anxiety and mild depression. Nevertheless, since most adolescents had comorbid symptoms of DSM-IV anxiety and depressive disorders, there may be no strong need for differential treatment approaches for those with anxiety or depression. Both may equally benefit from cognitive behavior therapy programs that focus for instance on the presence of cognitive distortions.

Limitations

The results should be interpreted in the context of two limitations. First, the sample consisted of 10- to 12- year-old adolescents only. It can be argued that these young adolescents might have experienced difficulty to give reliable and valid information about their emotional state. For instance, 10-year-olds are technically not included in the YSR age range. However, the internal consistency of the scales was moderate to good, and both scales were associated with anxiety and depression scales of the Revised Child Anxiety and Depression Scale (RCADS: Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) in the TRAILS sample (van Lang, Ferdinand, Oldehinkel, Ormel, & Verhulst, 2005). This indicates that YSR data of this group can be considered reliable and valid. However, the study should be replicated in children and older adolescents, because the present results only apply to young adolescents who are at the transition from childhood to adolescence.

Second, ratings on the scales were dichotomized in ‘not present’ or ‘sometimes or frequently present’. It is important to notice that items that discriminated most strongly between the groups encompassed symptoms that might have occurred only occasionally. For instance, of the 181 young adolescents (8.9%) that indicated that they had suicide thoughts, 26 (1.3%) thought about suicide often. Follow-up data will show whether the identified groups are robust and have clinical validity. In addition, a clinically referred sample would clarify whether groups with similar comorbidity patterns emerge from analysis on items that encompass frequently occurring symptoms.

Conclusion

The results showed that there were no groups of young adolescents with mainly symptoms of DSM-IV anxiety disorders or DSM-IV depressive disorders in a general population of 10- to 12-year-olds. Groups that were identified were characterized by a high, moderate, or low

probability to have comorbid symptoms of anxiety and depression. As found by a previous study that relied on parent reports and did not use items based on DSM-IV criteria, the present study showed with self-reports and DSM-IV symptoms of anxiety and depressive disorders, anxiety and depression mainly co-occur. In addition, it showed that items about severe depressive symptoms like suicidal thoughts are useful to derive optimal distinctions between adolescents from a general population sample.

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