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Research report

General distress, hopelessness—suicidal ideation and worrying in adolescence: Concurrent and predictive validity of a symptom-level bifactor model for clinical diagnoses ☆

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ABSTRACT

Background: Clinical disorders often share common symptoms and aetiological factors. Bifactor models acknowledge the role of an underlying general distress component and more specific sub-domains of psychopathology which specify the unique components of disorders over and above a general factor.
Methods: A bifactor model jointly calibrated data on subjective distress from The Mood and Feelings Questionnaire and the Revised Children's Manifest Anxiety Scale. The bifactor model encompassed a general distress factor, and specific factors for (a) hopelessness—suicidal ideation, (b) generalised worrying and (c) restlessness—fatigue at age 14 which were related to lifetime clinical diagnoses established by interviews at ages 14 (concurrent validity) and current diagnoses at 17 years (predictive validity) in a British population sample of 1159 adolescents.
Results: Diagnostic interviews confirmed the validity of a symptom-level bifactor model. The underlying general distress factor was a powerful but non-specific predictor of affective, anxiety and behaviour disorders. The specific factors for hopelessness—suicidal ideation and generalised worrying contributed to predictive specificity. Hopelessness—suicidal ideation predicted concurrent and future affective disorder; generalised worrying predicted concurrent and future anxiety, specifically concurrent generalised anxiety disorders. Generalised worrying was negatively associated with behaviour disorders.
Limitations: The analyses of gender differences and the prediction of specific disorders was limited due to a low frequency of disorders other than depression.
Conclusions: The bifactor model was able to differentiate concurrent and predict future clinical diagnoses. This can inform the development of targeted as well as non-specific interventions for prevention and treatment of different disorders.

1. Introduction

Psychopathology has traditionally been conceptualised in terms of distinct disorders, which clearly differentiate from one another and from normal functioning. However, evidence shows that psychiatric disorders in adolescence and later in life often co-occur and that distinct clinical diagnoses often share common symptoms and aetiological factors (Brown et al., 2001; Cerda et al., 2008; Kessler et al., 2005; Lahey et al., 2004, 2008, 2011). Caron and Rutter (1991) argued that comorbidity of psychiatric disorders may result from the use of categories of disorders where dimensions are more appropriate. Additionally, comorbidity may reflect overlapping diagnostic criteria, artificial subdivisions of syndromes, or may arise when one disorder represents an early manifestation of another or one disorder is part of another disorder.

Krueger and Markon (2006) propose a dimensional spectrum of psychopathology in which a smaller number of liability constructs underlie multiple disorders. This theoretical proposition has been supported by most multidimensional assessments in developmental studies on children and adolescents whether self, parent or teacher rated, on older or more recent instruments. Prior research has identified two well replicated, higher-order liability

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dimensions of internalising and externalising disorders (Krueger et al., 1998; Krueger and Finger, 2001; Vollebergh et al., 2001; Kendler et al., 2003). Affective and anxiety disorders have been located on the internalising dimension. Furthermore, on the internalising dimension a misery or distress factor that includes mood disorders, generalised anxiety disorder, generalised tensions, and social anxiety can be distinguished from a fear factor including phobias as well as obsessions and compulsions (Lahey et al., 2004; Krueger and Markon, 2006). The externalising dimension includes substance use and conduct disorders.

While a diagnoses- or syndrome-level ("top-down") approach informs and defines diagnostic classification systems, a symptom-level ("bottom-up") approach is more likely to represent the dimensional components *within* existing diagnostic categories. They provide better perspectives on symptom co-occurrence for descriptive epidemiology and enrich aetiological hypotheses by emphasising heterogeneity of symptom dimensions and/or their severity within and across diagnoses (Forbush and Watson, 2013; Kotov et al., 2011; Krueger and Markon, 2011). Studies employing a symptom-level approach often show that bifactor models for reported psychopathology fit the data better than alternative models (Brodbeck et al., 2011; Simms et al., 2008, 2012; Thomas, 2012). Bifactor models (also known as general-specific models) acknowledge the role of an underlying general distress component, which accounts for the communality of psychopathological symptoms. They also allow for more specific sub-domains of psychopathology to be present as independent specific factors (Chen et al., 2006; Reise et al., 2007). These domain-specific factors account for remaining variance, beyond that of the general factor.

Previously we applied an integrative data analysis perspective by using a joint factor analyses approach to self-report data from the Mood and Feelings Questionnaire (MFQ) (Angold et al., 1995) and the Revised Manifest Children's Anxiety Scale (RCMAS) (Reynolds and Richmond, 1978). MFQ and RCMAS items were analysed with exploratory factor analyses for categorical data including a Schmid–Leiman decomposition of the second order factor models. Based on these analyses, we compared a three factor model and a bifactor model using confirmatory factor analyses for categorical data. The three factor model identified (a) mood and social-cognitive symptoms of depression, (b) symptoms of worrying, and (c) somatic and information-processing symptoms. These factors can be viewed as distinct yet closely related constructs with inter-factor correlations between .78 and .86. In contrast, the bifactor model operationalised a general distress factor underlying depression and anxiety symptoms, accounting for the communality of these symptoms. Furthermore, domain specific, independent factors were revealed for hopelessness—suicidal ideation, generalised worrying, and restlessness—fatigue. These factors indicated distinct psychopathological constructs, which accounted for unique information over and above the general distress factor. The results clearly identified the bifactor model as the preferred model in our adolescent population sample at age 14. The bifactor model was not compromised by any evidence of item bias with respect to gender differences. Further details of the analysis and interpretation are described elsewhere (Brodbeck et al., 2011).

The general distress factor derived from the MFQ and RCMAS is consistent with an internalising factor comprised of depression, generalised anxiety disorder, and social anxiety (Krueger, 1998; Lahey et al., 2004; Slade and Watson, 2006; Vollebergh et al., 2001) and also in line with neuroticism as a personality trait. The *hopelessness—suicidal ideation* factor was associated with a higher severity on the latent distress continuum than the other factors. The items contained "*Life is not worth living*", "*I thought of killing myself*" and "*My family would be better off without me*". The specific factor for *generalised worrying* contained items such as "*I worried a lot of the time*" and "*I was afraid of a lot of things*." The specific *restlessness—fatigue factor* covered restlessness, sleeping difficulties and tiredness, but did not include other physiological symptoms such as shortness of breath or sweaty hands.

Few studies have used bifactor models for self-reported anxiety and depression data to predict concurrent or future DSM diagnoses in adolescence. One motivation behind the current study is our expectation that both the general distress factor and the specific factors are capable of distinguishing and predicting concurrent and future diagnoses, when these are expressed as binary/dichotomous clinical diagnoses. We sought to establish the criterion-related and predictive validity of the bifactor model's general and specific factors derived from a self-report depression screening and anxiety symptom questionnaire at baseline against interview-based clinical diagnoses of affective, anxiety and behaviour disorders. Firstly, we expected the bifactor model to be validated by lifetime DSM diagnoses of anxiety and depression at age 14. We hypothesised that first the general distress factor would predict affective as well as anxiety diagnoses. Second, we expected that the hopelessness—suicidal ideation factor would be specific to affective and the generalised worrying factor to anxiety disorders. Furthermore, we investigated whether the general distress factor, but not the specific factors, would also predict eating disorders and disorders traditionally located at the externalising dimension of psychopathology. Finally, we tested the predictive validity of the general distress factor and the specific factors for future as well as persistent or recurrent affective, anxiety and behaviour disorders at age 17.

2. Methods

2.1. Participants

The sample comprised 1238 14 year-old adolescents from the ROOTS cohort, a British longitudinal study of the psychological, biological and genetic determinants of adolescent psychopathology (Goodyer et al., 2010). Participants were recruited from Cambridgeshire schools.

Response rate was 33% at baseline ($n=1238$). A total of 55% of the respondents were female and 94% were white with European origins consistent with the demographic nature of the region. Within this sample 14% were classified socio-economically as of hard-pressed or moderate means, 24% were comfortably off, and 62% were categorised as urban prosperity or wealthy achiever. There were no significant gender differences in ethnicity or socio-economic status. The analysis sample included 1159 respondents (93% of the whole sample) who completed at least 85% of the MFQ and RCMAS items at baseline; 1081 had complete data on all items. Details on the MFQ and RCMAS items and instrumentation have been reported elsewhere (Brodbeck et al., 2011).

The *retention* rate at the 3-year follow-up was 86% ($n=1074$). Retention was not differentiated by diagnostic status ($\chi^2=.15$, $p=.700$) or socio-economic status ($\chi^2=4.60$, $p=.100$). Retention was clearly associated with gender, with males (14%) more likely to drop out than females (9%) ($\chi^2=6.2$, $p=.013$).

The study was carried out in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines. The study was approved by Cambridgeshire 2 REC, reference number 03/302. All participants and their parents gave written, informed consent after the nature of the study was explained.

2.2. Measures

The *Mood and Feelings Questionnaire* (*MFQ*) is a self-report screening tool for detecting symptoms of depressive disorders in children and adolescents between 6 and 17 years of age (Costello

and Angold, 1988; Angold et al., 1995). The 33 items were designed to cover DSM diagnostic criteria for major depressive disorders.

The *Revised Children's Manifest Anxiety Scale* (RCMAS) measures general anxiety, including physiological anxiety, worry/oversensitivity, and social concerns with 28 items (Reynolds and Richmond, 1978). An additional subscale, which was not included in this study, assessed social desirability.

The *Kiddie-SADS-Present and Lifetime Version* (K-SADS-PL) is a semi-structured diagnostic interview designed to assess psychopathology in children and adolescents according to DSM IV criteria (Kaufman et al., 1997). At baseline, 1205 adolescents were assessed for present and lifetime episodes of psychopathology using the K-SADS-PL (depression, anxiety, eating and disruptive behaviour disorders) to generate DSM-IV axis I diagnoses. Variables for lifetime diagnoses at age 14 (0=absent, 1=present) were created by combining past and present diagnoses at age 14. The K-SADS PL interview was repeated at age 17 (n=1074). We designated High Clinical Index (HCI) or 'probable' case status to those who reported significant symptoms together with clear cut personal impairment (Children Global Assessment Scale score < 51) but who fell just short of the full symptom count for disorder. This was undertaken at both baseline (age 14) and follow-up (age 17). High Clinical Index ratings were aggregated with the respective diagnoses. The K-SADS PL interviews were conducted in confidence face to face with the adolescent in a designated room at the participant's schools. The sessions generally lasted between 50 and 60 min. Interviews were conducted by fully trained researchers and diagnoses reached at consensus meetings with senior clinical staff.

2.3. Data analysis

Factor analyses and regression models were performed using M*plus* (Muthén and Muthén, 1998–2012). For model estimation we used robust Weighted Least Squares (rWLS; estimator=Weighted Least Squares Mean and Variance adjusted (WLSMV)). Unlike Maximum Likelihood (ML) estimation for factor analysis of continuous scores, Muthén's categorical data factor analysis methodology provides asymptotically unbiased, consistent and efficient parameter estimates as well as a correct chi-square test of fit with dichotomous or ordinal observed variables. In all models individuals with partially missing item level data were included, since estimation of missing data patterns is possible under traditional ML and WLSMV.

To test the concurrent validity[1] of the bifactor model based on self-report data with clinical diagnoses at baseline, we computed a series of logistic regression analyses with the bifactor measurement model as predictor and each lifetime diagnosis at age 14 separately as outcome variable (0=absent, 1=present). To analyse the predictive validity of the bifactor model at age 14 for new diagnoses at age 17 compared to never diagnosed, we used logistic regression analyses, comparing never diagnosed adolescents with participants with new diagnoses. To investigate the effects of the bifactor model at baseline on the course of affective, anxiety, and behaviour disorders, we used ordinal regression analyses comparing (a) never diagnosed adolescents (coded as 0), (b) participants with a lifetime diagnosis at age 14, but no current diagnosis at age 17 (coded as 1), and (c) participants with a lifetime diagnosis at age 14 and a continued/recurrent diagnosis at age 17 (coded as 2). As group sizes for new diagnoses at follow-up would be rather small, we only analysed the composite scores of any affective, any anxiety and any behaviour disorders.

[1] We refer to concurrent validity in terms of self-report and interview measures and are aware that the clinical diagnoses recorded at baseline are not necessarily present at age 14.

3. Results

Table 1 presents the frequencies of lifetime DSM diagnoses at age 14 assessed with a diagnostic interview and the number of adolescents with a High Clinical Index status, i.e. with significant symptoms together with clear cut personal impairment. In our population-based sample, affective disorders were the most common type of psychopathology experienced by age 14 (8%). Anxiety disorders were also relatively common affecting 6% of the sample. The most frequent anxiety disorder was specific phobia, followed by panic disorder. Social phobias, posttraumatic stress disorders and separation anxieties were relatively rare and were collapsed into the category of any anxiety disorders together with the more frequent anxiety disorders. About 4% of the sample reported any behaviour disorder. Reporting of more than one disorder was common, with a third of those with psychopathology having experienced more than one type of disorder up to the age of 14 (7% of the whole sample).

3.1. Associations of the bifactor model with lifetime affective and anxiety diagnoses at age 14

As reported in Brodbeck et al. (2011), the bifactor model of the joint factor analysis of the MFQ and RCMAS fit the data well (χ^2=3840, df=1724, CFI=.96, TLI=.96, RMSEA=.033, WRMR=1.35). Almost all items had medium to large loadings on the general distress factor (M=.57, SD=.09, range=.35 (blaming others) to .76 (sadness)) as well as on the expected specific factors. The loadings on the specific hopelessness—suicidal ideation factor, which contained 20 items, were highest for items assessing hopelessness and suicidal ideation (all > .49). The loadings on the specific worrying factor (8 items) were highest for items concerning generalised worrying (loadings > .40). The specific somatic factor for restlessness—fatigue contained 13 items with the highest loadings on restlessness (.48), disturbed sleep and tiredness (both loadings .39).

Results of the regression analyses of the bifactor model predicting diagnoses at baseline and follow-up are presented in Table 2. Fig. 1 depicts the significant relationships of the factor scores and the

Table 1
Frequencies of lifetime psychiatric disorders at age 14 (n=1159).

	N	%	DSM[d] N	DSM (%)	HCI[e] N	HCI (%)
Major depression	95	8.2	65	5.6	30	2.6
Specific phobia	26	2.2	23	2	3	.3
Panic disorders (with and without agoraphobia)	19	1.6	0	0	19	1.6
Generalised anxiety disorder	12	1.0	5	.4	7	.6
Obsessive–compulsive disorder	10	.9	5	.4	5	.4
Conduct disorder	16	1.4	7	.6	9	.8
Oppositional defiant disorder	29	2.5	15	1.3	14	1.2
Attention deficit-hyperactivity disorder	11	.9	9	.8	2	.2
Substance and/or alcohol use disorders	9	.8	7	.6	2	.2
Eating disorders	21	1.8	9	.8	12	1
Any affective disorder[a]	98	8.5	67	5.8	31	2.7
Any anxiety disorder[b]	69	6	44	3.8	27	2.3
Any behaviour disorder[c]	45	3.9	22	1.9	23	2.0

[a] Major depression and dysthymia.
[b] Specific phobia, social phobia, post-traumatic stress disorder, generalised anxiety disorder, obsessive–compulsive disorder, panic disorders, separation anxiety, anxiety not otherwise classified.
[c] Oppositional defiant disorder and conduct disorder.
[d] Participants fulfil the DSM criteria for the diagnosis.
[e] High clinical impact; significant, impairing symptoms but just short of the full symptom count for DSM-diagnosis together with clear cut personal impairment (CGAS < 51).

lifetime diagnoses at baseline. As expected, general distress was significantly associated with lifetime affective and anxiety disorders at age 14. Hopelessness—suicidal ideation was associated with affective disorders. A weak negative effect on specific phobias emerged (beta = −.24), which was only marginally significant (p = .052). Generalised worrying was related to the composite score of anxiety disorders. Analysing distinct anxiety disorders, generalised worrying was only associated with GAD, and not specific phobias, panic disorders or obsessive–compulsive disorder (OCD). Counter to our hypotheses, the restlessness—fatigue factor was not related to any diagnosis.

The explained variance of the distinct diagnoses was highest for GAD (almost 60% with a large effect of the general distress and generalised worrying factor), followed by substance use disorders (35% with a moderate to large effect of general distress), major depression (32% with a large effect of general distress) and OCD (29% with a large effect of general distress). The lowest explained variance was found for behaviour disorder diagnoses.

3.2. Associations of the bifactor model with lifetime behaviour disorders, substance use disorders, and eating disorders at baseline

General distress was not only associated with affective and anxiety diagnoses but also behaviour disorders, substance use disorders, and eating disorders. Moderate to large effects emerged for eating disorders and substance use disorders. Weaker effects were found for conduct disorders (CD), oppositional defiant disorders (ODD) and a composite score of any behaviour disorder. Attention Deficit-Hyperactivity Disorder (ADHD) was not related to any of the factor scores. One specific feature of conduct disorders, ODD and behaviour disorders in general was a negative association with generalised worrying (see Table 2).

3.3. Predictive validity of the bifactor model at age 14 for the diagnostic status at age 17

Firstly, we analysed the predictive validity of the bifactor model at baseline for new diagnoses 3 years later. As there were only two adolescents with new behaviour disorders at age 17, we restricted our analyses to the composite scores of new affective and new anxiety disorders (see Table 2). The general distress factor at age 14 significantly predicted new affective and anxiety disorders 3 years later. The specific hopelessness—suicidal ideation factor predicted new affective diagnoses. The predictive validity of the generalised worrying factor for new anxiety diagnoses was not confirmed.

Secondly, we investigated the predictive validity of the bifactor model for the persistence of psychiatric diagnoses, comparing never diagnosed adolescents, participants with diagnoses only up to age 14 and adolescents with persistent or recurrent diagnoses at baseline and the 3-year follow-up. Table 3 reports means and standard deviations of the factors in the never diagnosed group and the groups with lifetime diagnoses at age 14, with current diagnoses at 17 but not 14, and with lifetime diagnoses at age 14 and continued or recurrent diagnoses at age 17. The general distress factor measured at baseline was lowest for never diagnosed adolescents. It showed increased values with the duration of affective and anxiety disorders, i.e. a lifetime diagnosis at age 14 compared to a lifetime diagnosis at age 14 plus a continued/recurrent diagnosis at age 17. The same pattern emerged for the hopelessness—suicidal ideation factor and affective disorders, the generalised worrying factor and anxiety disorders, and in reverse direction for generalised worrying and behaviour disorders.

The general distress factor predicted continued diagnoses of affective and anxiety disorders up at age 14 and 17 (Table 2). As expected, hopelessness—suicidal ideation predicted the presence of affective disorders and generalised worrying the persistence of

Table 2
Results of the regression analyses of the bifactor model at baseline predicting lifetime DSM diagnoses at age 14, new, and continued/recurrent diagnoses at age 17 (standardised estimates).

	General distress			Hopelessness—suicidal ideation			Generalised worrying			Restlessness—fatigue			R^2 (%)
	Estimate	S.E.	p	Estimate	S.E.	p	Estimate	S.E.	p	Estimate	S.E.	p	
Bifactor model predicting lifetime diagnoses at age 14													
Major depression	.54	.04	.000	.15	.07	.024	−.02	.07	.801	−.03	.07	.662	31.8
Specific phobia	.26	.08	.001	−.24	.12	.052	.19	.12	.100	.13	.10	.177	18.0
Panic disorders (with and without agoraphobia)	.43	.09	.000	−.02	.11	.888	.10	.14	.503	.05	.14	.713	19.4
Generalised anxiety disorder	.51	.09	.000	−.14	.13	.303	.55	.15	.000	−.09	.11	.424	59.1
Obsessive–compulsive disorder	.52	.11	.000	.00	.12	.972	.12	.17	.495	.07	.07	.366	29.2
Conduct disorder	.23	.10	.016	.02	.14	.875	−.26	.11	.019	.06	.09	.502	12.2
Oppositional defiant disorder	.18	.08	.035	.14	.09	.125	−.23	.10	.026	.03	.11	.804	10.3
ADHD	−.03	.09	.746	.17	.17	.307	−.13	.09	.128	.16	.13	.209	7.3
Substance and/or alcohol use disorders	.48	.09	.000	.29	.17	.090	−.10	.09	.412	.19	.11	.073	35.4
Eating disorders	.42	.08	.000	−.05	.09	.572	.06	.15	.687	−.17	.10	.079	20.9
Age 14 any affective disorder[a]	.55	.04	.000	.17	.07	.011	−.03	.06	.648	−.02	.06	.703	33.5
Age 14 any anxiety disorder[b]	.38	.06	.000	−.03	.08	.655	.28	.08	.001	.07	.07	.344	22.7
Age 14 any behaviour disorder[c]	.22	.07	.001	.11	.09	.218	−.27	.09	.002	.04	.09	.672	13.5
Bifactor model predicting new diagnoses at age 17													
Age 17 any new affective disorder[d]	.34	.06	.000	.22	.10	.024	.13	.11	.244	.13	.10	.202	19.8
Age 17 any new anxiety disorder[d]	.15	.06	.021	.03	.10	.794	.00	.10	.993	−.05	.10	.519	2.7
Bifactor model predicting continued/recurrent diagnosis at age 17													
Age 14 and 17 any affective disorder	.56	.04	.000	.16	.07	.020	−.06	.04	.393	.16	.07	.397	35.0
Age 14 and 17 any anxiety disorder	.41	.08	.000	−.05	.07	.546	.32	.10	.001	.05	.07	.412	21.8
Age 14 and 17 any behaviour disorder	.22	.07	.001	.11	.09	.194	−.26	.06	.001	.04	.10	.547	13.4

[a] Major depression and dysthymia.
[b] Specific phobias, social phobia, agoraphobia, panic disorders, PTSD, GAD, OCD, separation anxiety, anxiety not otherwise classified.
[c] ODD and conduct disorders.
[d] New disorders compared to never diagnosed.

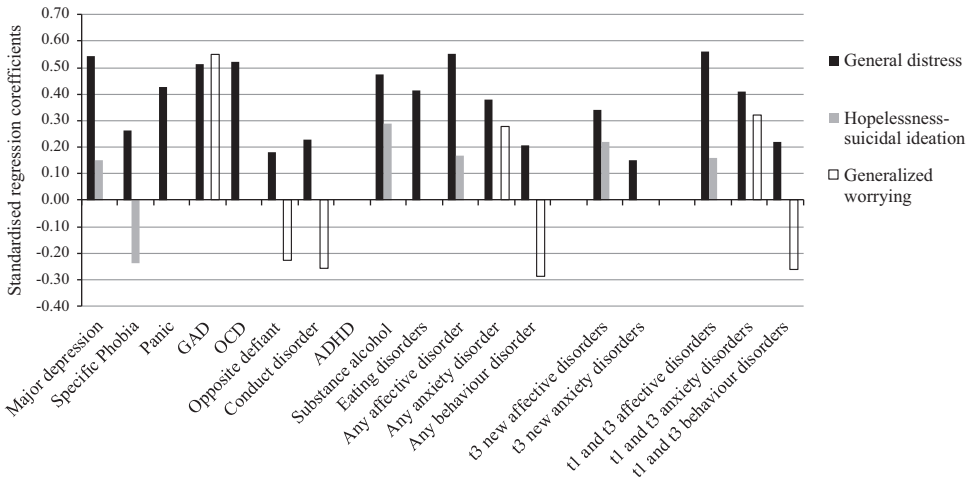

Fig. 1. Significant associations of the bifactor model and lifetime diagnoses at age 14 (t1) and current diagnosis at age 17 (t3).

Table 3
Means and standard deviations of the factor scores for concurrent and future DSM-diagnoses.

	N	General factor		Hopelessness—suicidal ideation		Generalised worrying		Restlessness—fatigue	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Affective disorders[a]									
Never diagnosed	928	−.11	.92	.04	.67	.04	.68	−.02	.70
Lifetime diagnosis at age 14	75	.90	.77	.25	.84	−.05	.71	.01	.67
Diagnosis at age 17 only	32	.68	.71	.33	.81	.17	.84	.21	.88
Diagnoses at age 14 and 17	9	1.48	.59	.38	1.17	.06	.60	−.12	.94
Anxiety disorders[b]									
Never diagnosed	926	−.06	.94	.07	.70	.02	.67	−.01	.70
Lifetime diagnosis at age 14	44	.60	.86	−.04	.66	.35	.82	.15	.73
Diagnosis at age 17 only	54	.23	.97	.16	.68	.04	.73	−.17	.80
Diagnoses at age 14 and 17	19	.82	1.13	.04	.72	.45	.88	.00	.73
Behaviour disorders[c]									
Never diagnosed	992	−.03	.94	.06	.69	.05	.68	−.02	.71
Lifetime diagnosis at age 14	26	.59	.99	.07	.74	−.23	.70	.19	.74
Diagnosis at age 17 only	2	.74	.06	−.23	1.64	.68	1.19	.01	1.64
Diagnosis at age 14 and 17	12	.22	1.23	.28	.78	−.35	.69	−.18	.75

[a] Major depression and dysthymia.
[b] Specific phobias, social phobia, PTSD, GAD, OCD, anxiety not otherwise classified, panic disorders, separation anxiety.
[c] Oppositional defiant disorders and conduct disorders.

anxiety disorders up to age 14 as well as at age 17. For behaviour disorders at age 17, the relationship between persistence of diagnoses and factor scores was only linear for generalised worrying but not general distress. Thus, only lower scores of generalised worrying predicted the persistence of behaviour disorders.

4. Discussion

The present study examined the criterion-related and prospective validity of a symptom-level bifactor model derived from self-reported depressive and anxiety symptoms at age 14 with interview-based diagnoses of internalising and externalising disorders up to age 14 and at age 17. The bifactor model included a general distress factor and specific factors for hopelessness—suicidal ideation, generalised worrying and restlessness—fatigue. Given the number and magnitude of item loadings, the general distress factor which also captures severity of psychopathological distress showed higher measurement accuracy and allowed more precise measurement across a wider range of the population continuum than the specific factors (Brodbeck et al., 2011). However, the specific factors were able to differentiate distinct features of disorders and thus were important for enhancing predictive specificity.

The results show that the *general distress factor* was not only associated with affective and anxiety diagnoses up to age 14 but predicted new and persistent/recurrent affective and anxiety disorders 3 years later. In addition, the general distress factor was also related to externalising disorders i.e. behaviour and substance use disorders as well as eating disorders. Only ADHD was not associated with self-reported general distress. Thus, this factor, derived from depressive and anxiety symptoms, encompassed more that an internalising factor with depression, generalised anxiety disorder, and social anxiety found in other studies (Krueger, 1998; Lahey et al., 2004; Slade and Watson, 2006; Vollebergh et al., 2001). Rather, this factor operates as a general underlying index for unspecific psychological stress related to all psychiatric disorders apart from ADHD. In line with other studies based on bifactor models using different questionnaires among adult populations (Simms et al., 2008; Thomas, 2012), these findings support the view that most psychiatric diagnoses on the internalising as well as the externalising dimension share a

common distress component, which may account for the co-occurrence of symptoms and disorders from distinct diagnostic groups.

Confirming our hypothesis, the domain-specific factors of hopelessness—suicidal ideation and generalised worrying were able to differentiate affective, anxiety and behaviour disorders. The *hopelessness—suicidal ideation factor* at baseline was specifically associated with affective disorders up to age 14, as well as new and persistent or recurrent affective diagnoses at age 17. Unexpectedly, the *specific generalised worrying factor* was able to differentiate anxiety and behaviour disorders, i.e. conduct disorders and ODD. Consistent with our hypotheses, generalised worrying was positively related with the composite score of anxiety disorders at baseline. Generalised worrying also predicted persistent or recurrent but not new anxiety disorders at age 17. In contrast, behaviour disorders at age 14 were characterised by a significant negative association with generalised worrying. Moreover, persistent or recurrent behaviour disorders at age 17 were predicted by lower generalised worrying at baseline. The specific features of these externalising disorders seem to be high distress and a lack of generalised worrying. Counter to our hypotheses, the *restlessness—fatigue factor* was not associated with any psychiatric diagnosis. This suggests that symptoms of restlessness, disturbed sleep, and tiredness which were rather common in our sample of adolescents were not contributing to the formation of psychiatric disorders in this age group. This resonates with the recent report that during adolescence neither weight gain nor increased appetite were associated with clinical depression but more likely represent a developmental growth factor (Cole et al., 2012). However, symptoms associated with restlessness—fatigue might emerge as more important for affective disorders in adulthood once the adolescent growth phase is complete.

The bifactor model was able to differentiate clinical diagnoses at baseline. Eating disorders were only associated with the general distress factor, explaining 22% of the variance. Substance use disorders were strongly related to general distress and showed a substantial, but not significant relationship with hopelessness—suicidal ideation. The bifactor model explained 35% of the variance in substance use disorders. ADHD was not related to the bifactor model. Affective disorders were characterised by high general distress and hopelessness—suicidal ideation, but were not associated with generalised worrying. An association between affective disorders and generalised worrying might have been expected. However, domains of worrying may differ (Starcevic, 1995). In affective disorders, worrying may be more focused and specifically related to guilt, loss, and exaggerated responsibility whereas in our items we only assessed general worrying.

Distinct patterns appeared within the group of anxiety disorders, accounting for the heterogeneity within this diagnostic group. Fear-based disorders, such as panic disorders or specific phobias which are associated with a specific threat, were only related to general distress, but not generalised worrying. Interestingly, specific phobia was characterised by a negative association with hopelessness—suicidal ideation, which was marginally significant. This is plausible as a fear reaction is related to a fight-or-flight response, which is contrary to passive hopelessness. Generalised anxiety disorders revealed strong associations with general distress, but also with generalised worrying. Moreover, almost 60% of the variance was explained by these factors, which is almost double that of other disorders. This supports worrying as a cardinal factor of GAD (for an overview see Newman and Llera, 2011) and also validates the generalised worrying factor.

Overall, most diagnoses were related to the dimensional construct of general distress together with a pattern of specific factors. The general distress factor may part explain diagnostic concurrent and sequential comorbidity due to emotional and behavioural symptoms (with the exception of those required for ADHD) occurring on the same general dimensional construct. The specific factors represent independent constructs or categories of psychopathology. These dimensional factors would contribute to the syndrome formation because particular symptoms will be expressed if the individual is high on a particular dimension. We predict therefore that variation in diagnostic comorbidity in a sample of patients with major depression would be explained by differences in their scores on these three dimensions. For example individuals who are high scorers on all three constructs would show the greatest degree of diagnostic comorbidity both over time (i.e. changing diagnosis with age) and at the same time (reporting two or more diagnoses concurrently).

In summary, the symptom-level bifactor model based on self-report data was validated by interview-based DSM diagnoses. However, our results also illustrate that current diagnostic boundaries may not optimally reflect the underlying structure of psychopathology in adolescence (Sonuga-Barke, 2013). The underlying general distress component proved to be non-specific to both internalising and externalising disorders with the exception of ADHD. The specific factors hopelessness—suicidal ideation and generalised worrying were able to separate common and distinct features of affective, anxiety and behaviour disorders and contributed to a better distinction between these disorders. Furthermore, the generalised worrying factor discriminated generalised anxiety disorders from more fear based anxiety disorders. These findings highlight the importance of domain-specific factors that provide unique information over and above the general distress factor and reflect the distinctiveness of certain symptomatology within depression and anxiety.

4.1. Limitations

A particular strength of the ROOTS study is the high retention rate after 3 years, which was not affected by prior psychopathology. However, the initial recruitment rate within schools was relatively low. Reasons this could be due to the ethically approved recruitment strategy which required participants to actively “opt in” rather than “opt out” as preferred by the schools. We were aware that some highly dysfunctional families may not have actively opted into the study. Furthermore the relatively low frequency of psychiatric disorders other than MDD limited the analyses of gender differences, co-occurrence of diagnoses, and the course of specific disorders.

5. Conclusions

Our findings illustrate that bifactor modelling and a psychometric epidemiology perspective of calibrating multi-instrument item level data enrich clinical psychiatric research. This approach may improve the understanding of the development of common and domain-specific features of psychiatric disorders. It may also contribute to the current debate over categorical and dimensional psychiatric classification systems (e.g. DSM and ICD) and lead to more accurate future taxonomies of psychopathology. Furthermore, the general distress factor and the specific factors for hopelessness—suicidal ideation and generalised worrying represent promising independent targets for future research on aetiological factors, such as genotypes, early adverse life experiences, or intermediate biology including cognition and biomarkers. In terms of clinical implications, the results may promote the development of intervention models which target shared aspects of depressive, anxiety, and behaviour disorders, but also tailor treatment to address disorder specific features, revealed within the bifactor model.

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The founding sources had no involvement in the design, writing or the decision to submit the paper for publication.

Conflict of interest

All of the authors declare that they have no conflicts of interest in regards to this work.

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