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Profiles of psychosocial and clinical functioning in adolescence and risk for later depression and other outcomes

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Abstract

Background. Most studies examining predictors of the onset of depression focus on variable centered regression methods that focus on the effects of multiple predictors. In contrast, person-centered approaches develop profiles of factors and these profiles can be examined as predictors of onset. Here, we developed profiles of adolescent psychosocial and clinical functioning among adolescents without a history of major depression.

Methods. Data come from a subsample of participants from the Oregon Adolescent Depression Project who completed self-report measures of functioning in adolescence and completed diagnostic and self-report measures at follow-up assessments up to approximately 15 years after baseline.

Results. We identified four profiles of psychosocial and clinical functioning: Thriving; Average Functioning; Externalizing Vulnerability and Family Stress and Internalizing Vulnerability at the baseline assessment of participants without a history of depression at the initial assessment in mid-adolescence. Classes differed in the likelihood of onset and course of depressive disorders, experience of later anxiety and substance use disorders, and psychosocial functioning in adulthood. Moreover, the predictive utility of these classes was maintained when controlling for multiple other established risk factors for depressive disorders.

Conclusions. This work highlights the utility of examining multiple factors simultaneously to understand risk for depression.

Major depressive disorder (MDD) is among the most common forms of psychopathology (Kessler *et al.*, 2005) and accounts for a large proportion of lost productivity in youth and adults (World Health Organization, 2002; Lynch and Clarke, 2006). MDD is etiologically heterogeneous (Goodman and Gotlib, 2002; Kendler *et al.*, 2002) which results in significant challenges in identifying mechanisms leading to the development of, and conversely, preventing, the onset of the disorder. However, the predominant approach for examining the prediction of MDD onset has focused on the influence of specific variables using multiple regression (Klein *et al.*, 2013) or structural equation (Kendler *et al.*, 2002) models. These have frequently been termed variable centered approaches (Muthén and Muthén, 2000).

Work relying on variable centered methods has identified some well-replicated predictors of MDD onset. Female sex is strongly associated with MDD, particularly after the commencement of puberty (Hankin *et al.*, 1998; Cyranowski *et al.*, 2000; Hyde *et al.*, 2008). Maternal history of depression is also associated with MDD onset (Klein *et al.*, 2005; Goodman *et al.*, 2011). Beyond these factors, a number of studies have reported associations between MDD and negative cognitive style, stress, subthreshold internalizing problems, externalizing symptoms and disorders, peer and family support and family conflict (e.g. Kendler *et al.*, 2003; Vrshek-Schallhorn *et al.*, 2015). However, variable centered studies assume that associations hold across all individuals in a given population, ignoring the likely possibility that there are subpopulations of individuals with different etiological pathways toward depression.

In contrast, person-centered approaches do not presume that risk processes are consistent across all individuals in a population (Muthén and Muthén, 2000). In a person-centered framework, subgroups of individuals may develop psychopathology through qualitatively different processes (Hankin, 2012; Russell *et al.*, 2014). Person-centered methods, such as latent profile analysis (LPA), can identify relatively homogenous subgroups of individuals (i.e. classes) that differ based on profiles of multiple within-person characteristics (Hallquist and Wright, 2014). This is similar to cluster analytic methods, but LPA provides additional indices of model fit and is able to quantify precision of assignment to classes and differences between classes on outcomes. In one of the few examples of using LPA to predict future depression, St Clair *et al.* (2015) identified different classes of childhood adversity, including maltreatment and abuse, normative variation in parenting styles, family dissolution, family stress and parental history of psychopathology and examined their relationships with emerging symptoms of depression in adolescents. The authors found that classes characterized by greater dysfunction

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were associated with higher levels of depression and that some of these associations differed by sex. However, this study was limited to predictors related to familial processes.

The present study examines profiles of adolescent psychosocial and clinical characteristics and later outcomes of psychopathology. We chose to focus on adolescent psychosocial and clinical constructs and use fixed demographic risk factors (i.e. sex), family history and outcomes as validators. Indices of psychosocial functioning include a wide array of risk factors previously examined as variable centered predictors of depressive disorders, including major and minor stressors (Hammen, 2006), cognitive style (Alloy *et al*., 2000), self-esteem (Sowislo and Orth, 2013), future aspirations (Hirsch *et al*., 2007), peer and family support (Stice *et al*., 2004) and internalizing and externalizing psychopathology (Klein *et al*., 2009; Groenman *et al*., 2017). Although our analyses are largely exploratory, we hypothesized that classes with higher levels of constructs previously shown to be linked with depression (e.g. negative cognitive styles, poorer social support, greater experience of stress) would be associated with greater risk for the onset of depressive disorders. We also examined associations between class profiles and depressive morbidity, including a number of depressive episodes experienced and a total length of illness. We expected that classes characterized by higher levels of internalizing vulnerability factors, such as negative cognitive style and stress in adolescence, will have a poorer course of depression.

Female sex (Hankin *et al*., 1998; Cyranowski *et al*., 2000; Hyde *et al*., 2008), anxiety and substance use disorders (Kim-Cohen *et al*., 2003; Bittner *et al*., 2007) and parental history of psychopathology are also well-established risk factors for depression (Weissman *et al*., 1997; Klein *et al*., 2005; Weissman *et al*., 2016). We utilized these constructs in two ways. First, we examined whether classes differed on these characteristics. Second, as a conservative test, we examined whether class differences in risk for later depression were still present when controlling for these well-established risk factors. Thus, we test whether classes based on psychosocial constructs incrementally predict risk for depression beyond thoroughly established risk factors for depression. Third, we examined the prediction of later anxiety and substance use disorders (SUDs) as a means of evaluating the specificity of the class utility. Finally, in addition to the emphasis on psychopathological outcomes, we also examined class differences on functional outcomes and life satisfaction as a means of evaluating positive developmental outcomes (Rottenberg *et al*., 2018).

Methods

Participants

The present study uses data from the Oregon Adolescent Depression Project (OADP) (Lewinsohn *et al*., 1993), a longitudinal study of a large cohort of high school students who were assessed twice during adolescence, a third time when the average age was 24 and a fourth time when the average age was 30. For this report, we examined baseline factors that predicted the onset of psychopathology throughout all follow-up assessments. Thus, we only included adolescents who completed the age 30 assessment so that the follow-up duration would be consistent for all participants (total $n = 816$), which would avoid biases in examining total morbidity of depressive illness by including adolescents with partial follow-up data. Participants with a lifetime history of psychosis or bipolar spectrum disorders were excluded ($n = 34$). Finally, as the focus of the study was on the prediction of MDD, adolescents with a history of MDD and/or dysthymia at study entry were excluded ($n = 215$). Thus, the final included sample included 567 participants. Participants were randomly selected from nine high schools in western Oregon. A total of 1709 adolescents (ages 14–18; mean age 16.6, S.D. = 1.2) completed the initial (T_1) assessments between 1987 and 1989. The participation rate at T_1 was 61%. All youth provided informed consent before completing research procedures. Retention across assessment waves was good, with modest differences between participants who did and did not fail to complete follow-ups (Lewinsohn *et al*., 1993; Olino *et al*., 2008).

Measures

Proband diagnostic measures

At T_1, T_2 and T_3 probands were interviewed with a version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS; Orvaschel *et al*., 1982), which combined features of the Epidemiologic and Present Episode versions, and included additional items to derive *Diagnostic and Statistical Manual of Mental Disorders*, 3rd edition revised (DSM-III-R; American Psychiatric Association, 1987) diagnoses. Follow-up assessments at T_2 and T_3 were jointly administered with the Longitudinal Interval Follow-Up Evaluation (LIFE; Keller *et al*., 1987). The K-SADS/LIFE procedure provided information regarding the onset and course of disorders since the previous interview. The T_4 interview consisted of a joint administration of the LIFE and the Structured Clinical Interview for DSM-IV (SCID; First *et al*., 1996) to probe for new or continuing episodes since T_3. Diagnoses were based on DSM-III-R criteria for T_1 and T_2 and *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV; American Psychiatric Association, 1994) criteria for T_3 and T_4. Interviews at T_3 and T_4, were conducted by telephone, which generally yields comparable results to face-to-face interviews (Sobin *et al*., 1993; Rohde *et al*., 1997). Most interviewers had advanced degrees in a mental health field and several years of clinical experience.

A subset of interviews from each wave was rated from audio or videotapes by a second interviewer for reliability purposes: $T_1 = 263$, $T_2 = 162$, $T_3 = 190$ and $T_4 = 124$ interviews. Diagnostic agreement among raters was indexed by kappa. To avoid potential inflation, deflation and/or unreliability of the kappa statistic, reliability was calculated only for categories diagnosed 10 or more times by both raters combined. Fleiss (1981) provides guidelines for the interpretation of kappa, whereby values $\geqslant 0.75$ denote excellent agreement beyond chance, those between 0.75 and 0.40 are indicative of good to fair agreement, and coefficients <0.40 reflect poor agreement. Across the four assessment waves, inter-rater diagnostic reliability was good to excellent for all disorders that occurred with sufficient frequency to be evaluated (Farmer *et al*., 2009; Seeley *et al*., 2011)

Parental psychopathology

First-degree family members of OADP participants were interviewed using the Structured Clinical Interview for DSM-IV, non-patient version (SCID-NP; First *et al*., 1996) at the time of the T_3 assessment. In addition, family history data were collected from the original OADP participants and at least one other family member using a modified version of the Family Informant Schedule and Criteria (FISC; Mannuzza and Fyer, 1990), supplemented with items necessary to derive DSM-IV diagnoses. Interviews were conducted without the knowledge of the

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offspring's diagnoses. All family member participants provided written informed consent before completing research procedures. Of the 568 probands included in this report, diagnostic information was available for 478 mothers (84.1%) and 471 (82.9%) fathers. Direct interviews were available for 365 mothers and 231 fathers (76.4% and 49.0%, respectively, of mothers and fathers with diagnostic information).

As multiple data sources were available for most parents, we derived lifetime best-estimate DSM-IV diagnoses from all available information (Leckman *et al.*, 1982). Two diagnosticians, from a team of four senior clinicians, independently derived best-estimate diagnoses without knowledge of offspring diagnoses. Disagreements were resolved by consensus. Interrater reliability of the independently derived best-estimate diagnoses prior to the resolution of discrepancies was excellent for MDD ($\kappa = 0.91$), any anxiety disorder ($\kappa = 0.94$), AUD ($\kappa = 0.97$) and SUD ($\kappa = 0.96$).

Psychosocial constructs

An extensive battery of psychosocial measures was administered to all participants at T_1 (Lewinsohn *et al.*, 1994; Lewinsohn *et al.*, 2003). Variables were constructed such that higher scores indicated greater impairment or severity. A full description of these self-report measures is presented in the online Supplementary Materials. The target constructs included as indicators of latent profiles were depression, other internalizing problems, externalizing problems, hypomania, minor hassles, major stressors, self-consciousness, negative cognitions, attributional style, self-esteem, social competence, emotional reliance, coping skills, future aspirations in academic, occupational and family domains, family support, peer support and conflict with parents.

At the T_4 assessment, participants completed single-item self-report measures of their highest grade completed and annual household income with nine income ranges. Participants also completed measures of social adjustment and life satisfaction. Fifty-four items from the Social Adjustment Scale, spanning multiple family, social and occupational domains, (Weissman and Bothwell, 1976) were used to assess social adjustment during the two weeks preceding the T_4 interview. Higher scores indicated poorer adjustment. This measure had a coefficient alpha of 0.70 in the current sample and yields similar results to those obtained by the interview format of the instrument (Weissman *et al.*, 1978). Fifteen items related to general feelings of happiness and contentment (Andrews and Withey, 1976; Campbell *et al.*, 1976) were used to assess life satisfaction at T_4. Higher scores indicated poorer life satisfaction. This measure had a coefficient alpha of 0.87 in the current sample.

Data analysis

Latent profile analysis (LPA) models were estimated using Mplus 8.2 (Muthén and Muthén, 1998–2018). Missing data at the T_1 assessment were considered missing at random and accommodated using FIML estimation methods. Empirical comparisons of models were based on the Akaike Information Criteria (AIC), corrected AIC (AICC), Bayesian Information Criteria (BIC), sample-size adjusted BIC (aBIC), the Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT) and the bootstrap likelihood ratio test (BLRT). Lower information criteria values indicate better fit. The LMR-LRT is a comparison of fit between the k and $k-1$ class solutions. A significant difference indicates that the k class solution provides a significantly better fit than the $k-1$ class solution. Simulation work (Nylund *et al.*, 2007) found that the BIC performed best of the information criteria. Thus, this criterion is weighted most strongly in empirical comparisons within model sets. All models were estimated with a sufficient number of random starts to yield a replicated log-likelihood value. The BLRT indicated that all differences between k and $k-1$ classes were significant. As this was not informative, we do not present these results (Table 1).

Class comparisons on outcomes were implemented using the manual three-step approach recommended by Asparouhov and Muthén (2014). We relied on this approach to compare classes as we were interested in class differences on outcomes when including covariates in the model. This approach estimates class differences on outcomes with a pseudo-class draw using posterior probabilities. When there was evidence that there was an omnibus difference in outcomes, we examined pairwise comparisons on outcomes across classes. This method provided a consistent means to examine unadjusted class differences in outcomes, as well as class differences when including covariates.

Results

For complete reporting, we include a full correlation matrix among our key study variables in online Supplementary Materials. All variables were standardized in the full T_1 sample ($n = 1709$) so that variability in variable values is comparable and can be interpreted with respect to the sample means. We conducted Little's Test of Missing Completely at Random for the indicator variables in the LPA and found that this was supported ($\chi^2(34) = 29.49$, $p = 0.91$).

Latent class model estimation

We included 19 indicator variables in our LPA and estimated up to nine classes. All information criteria demonstrated reductions in values when estimating models with increasing numbers of classes. The LMR-LRT was non-significant for all model comparisons. Thus, statistical indices provided little guidance for a preferred model. Model selection was informed by patterns of variability across class solutions. There was an increasing differentiation of classes in all solutions. This class differentiation was substantial through the four class solution. Beyond the four class solution, there was a subdivision of classes within one of the classes, raising questions about the meaningfulness of the subsequent classes. Specifically, the classes became trivially small, suggesting their limited utility and robustness. Thus, we identified the four class solution as our preferred solution. Class means and standard errors for indicators are presented in online Supplementary Materials and a figure depicting class characteristics is presented in Fig. 1.

Class 1 (31.5%) included participants scoring, on average, 0.57 standard deviations below the mean (S.D. = 0.26) on class indicators. Thus, individuals in this class were functioning very well on most measures. This class is referred to as the 'Thriving Functioning' class. Class 2 (45.7%) was the largest class and included participants scoring, on average, 0.08 standard deviations below the mean (S.D. = 0.10) on class indicators. Thus, individuals in this class were functioning within the average range on most measures. This class is referred to as the 'Average Functioning' class. Class 3 (4.9%) was the smallest class and included participants scoring, on average, 0.47 standard deviations above the mean (S.D. = 0.64) on class indicators. Their mean level of externalizing problems was very high and they

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Table 1. Model fit statistics

Classes	LL	AIC	AICC	BIC	aBIC	Parameters	Entropy
2	−13 748.87	27 613.74	27 627.21	27 865.48	27 681.35	58	0.89
3	−13 557.50	27 271.01	27 296.26	27 609.56	27 361.94	78	0.83
4	−13 406.01	27 008.03	27 049.49	27 433.38	27 122.28	98	0.86
5	−13 308.80	26 853.60	26 916.29	27 365.76	26 991.17	118	0.82
6	−13 237.96	26 751.91	26 841.55	27 350.88	26 912.80	138	0.83
7	−13 167.41	26 650.82	26 773.97	27 336.60	26 835.02	158	0.84
8	−13 118.61	26 593.22	26 757.46	27 365.81	26 800.74	178	0.85
9	−13 069.32	26 534.65	26 748.79	27 394.04	26 765.48	198	0.85

also had scores greater than 0.70 S.D.s above the mean on major stressors, (lower) academic aspirations, poorer family support and more family conflict. Thus, this class is referred to as the 'Externalizing Vulnerability and Family Stress' class. Finally, Class 4 (17.8%) included participants scoring, on average, 0.48 standard deviations above the mean (S.D. = 0.36) on class indicators. Individuals in this class had scores greater than 0.70 S.D.s above the mean on depressive symptomatology, internalizing problems, minor stressors, (reversed) self-esteem and negative cognitive style. Thus, this class is referred to as the 'Internalizing Vulnerability' class.

Class comparisons

We first examined participant sex, parental educational attainment (i.e. whether at least one biological parent earned a 4 year college degree), adolescent anxiety and SUDs at study entry and maternal and paternal history of psychopathology as class correlates. In these analyses (Table 2), we found that there were class differences in sex, parental education, adolescent anxiety and SUD and paternal history of MDD and SUD. Group differences in maternal psychopathology and paternal anxiety disorder were not significant. We found a greater proportion of males in the Externalizing Vulnerability and Family Stress class relative to the other three classes. A higher proportion of youth in the Thriving class had a parent with a college degree than any other class. The proportion of participants with a parent with a college degree in the Average functioning class was higher than that in the Externalizing Vulnerability and Family Stress class. Youth in the Internalizing Vulnerability class had the greatest proportion of anxiety disorders at study entry, which was significantly greater than that in the Thriving and Average Functioning classes. Youth in the Externalizing Vulnerability and Family Stress class had a higher proportion of SUDs than any other class. We also found that paternal history of MDD was higher in the Average Functioning, Externalizing Vulnerability and Family Stress and Internalizing Vulnerability classes than the Thriving class. Finally, paternal SUD was significantly higher in the Internalizing Vulnerability class relative to the Thriving and Average Functioning classes. The Externalizing Vulnerability and Family Stress class did not differ from any of the other classes on paternal SUD.

Next, we examined relationships between class membership and later psychopathological outcomes (Table 3). Initial models examined unadjusted class differences and follow-up analyses examined class differences when controlling for better-established risk factors, including sex, adolescent anxiety and substance use disorders, and maternal and paternal depressive, anxiety and substance use disorders.

First, we estimated class differences in time until the first onset of major depressive episode using survival models and presented the proportion of individuals within each class experiencing MDD. We found that individuals in the Internalizing Vulnerability class were significantly more likely to develop MDD than individuals in all other classes, none of which differed from one another. In addition, individuals in the Internalizing Vulnerability class had more episodes of MDD than individuals in the Externalizing Vulnerability and Family Stress and Thriving classes. Moreover, individuals in the Externalizing Vulnerability and Family Stress class had significantly *fewer* episodes than individuals in the Average Functioning class. We also found that individuals in the Internalizing Vulnerability class had longer total MDD durations than individuals in the Externalizing Vulnerability and Family Stress class. There were no other significant group differences.

Classes were compared on the prediction of later anxiety disorders and SUDs by examining proportions of disorders post-T_1, regardless of whether onsets were first episodes or recurrences. The Internalizing Vulnerability class was more likely to develop an anxiety disorder than any other classes. In addition, individuals in the Internalizing Vulnerability and Externalizing Vulnerability and Family Stress classes were more likely to develop SUDs than the Average Functioning and Thriving classes.

Finally, we compared educational attainment, household income, life satisfaction and social adjustment across classes. Classes differed in average levels of education attained – individuals in the Externalizing Vulnerability and Family Stress had the lowest levels of education, individuals in the Average Functioning and Internalizing Vulnerability classes had an intermediate level, and individuals in the Thriving class achieved the highest level. Classes also differed in average levels of household income, with individuals in the Externalizing Vulnerability and Family Stress reporting the lowest household income, individuals in the Internalizing Vulnerability having an intermediate level, and individuals in the Thriving class having the highest levels. Household income of the Average Functioning class did not differ from that of the Thriving or Internalizing Vulnerability classes.

Levels of life satisfaction for individuals in the Average Functioning, Externalizing Vulnerability and Family Stress, and Internalizing Vulnerability classes were significantly lower than that for individuals in the Thriving class. In addition, individuals in the Internalizing Vulnerability class had lower levels of life satisfaction than that in the Average Functioning class. The Externalizing

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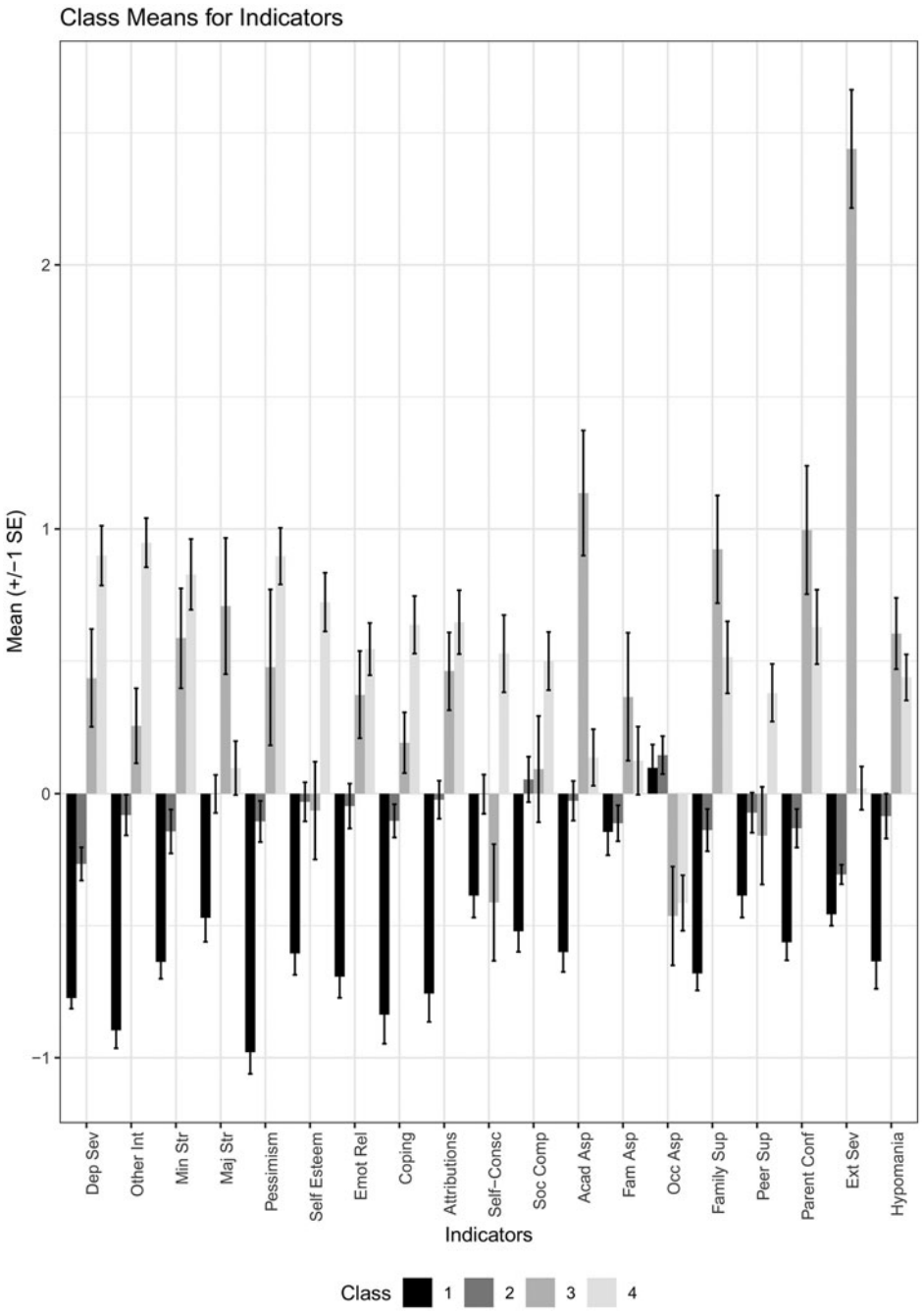

Fig. 1. For full description of class indicators, see the online supplement. Dep Sev, depression severity; Other Int, other internalizing problems; Min Str, stressors: daily hassles; Maj Str, stress: major stressors; Pessimism, negative cognitions; Emot Rel, emotional reliance; Attributions, attributional style; Self-Consc, self consciousness; Acad Asp, academic aspirations; Fam Asp, family aspirations; Occ Asp, occupational aspirations; Family Sup, family support; Peer Sup, peer support; Parent Conf, parental conflict; Ext Sev, externalizing problems severity.

Vulnerability and Family Stress class did not differ from individuals in the Average Functioning or Internalizing Vulnerability classes on life satisfaction. Finally, individuals in the Thriving and Average Functioning class had significantly better overall social adjustment than individuals in the Externalizing Vulnerability and Family Stress and the Internalizing Vulnerability classes.

Despite adjusting for sex, adolescents' anxiety disorders and SUDs, and parental history of MDD, anxiety, and SUDs, class differences were generally consistent with the unadjusted results (online Supplementary Table 1) and differences in findings follow. However, in these adjusted analyses, there were no significant class differences in household income. We also found that individuals in the Thriving Class had a shorter duration of MDD than those in the Internalizing Vulnerability class. Individuals in the Thriving and Average Functioning classes had significantly better overall social adjustment than individuals in the Internalizing Vulnerability class. Social adjustment of individuals in the Externalizing Vulnerability and Family Stress class did not differ from that of those in any other classes.

Discussion

There are numerous established risk factors for MDD. Previous studies have focused on variable-centered approaches to risk

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Table 2. Class comparisons on proband sex, parental education and psychopathology by the first assessment and parent psychopathology

	Class 1 (%)	Class 2 (%)	Class 3 (%)	Class 4 (%)	χ^2
Male sex	47.20%[a]	46.06%[a]	86.32%[b]	50.15%[a]	15.25**
Parental education	58.29%[a]	43.22%[b]	20.70%[c]	39.98%[b,c]	15.51**
Proband T_1 disorders					
ANX	2.33%[a]	4.19%[a]	2.26%[a,b]	9.84%[b]	9.61*
SUD	1.64%[a]	3.26%[a]	26.35%[b]	5.02%[a]	23.45***
Maternal MDD	24.23%	21.65%	22.95%	25.12%	0.44
Maternal ANX	11.16%	15.68%	23.08%	15.54%	2.32
Maternal SUD	13.67%	14.37%	22.90%	18.83%	1.85
Paternal MDD	3.15%[a]	16.36%[b]	14.21%[b]	12.24%[b]	14.37**
Paternal ANX	4.22%	5.79%	2.78%	7.11%	1.18
Paternal SUD	32.34%[a]	36.42%[a]	36.91%[a,b]	56.05%[b]	10.56**

Note: Percentages are model-based estimates taking into account imprecision of class membership. χ^2 statistic is computed based on the adjusted differences between log-likelihood values between the model with constrained thresholds *v.* freely estimated thresholds across classes. Class 1: Thriving Class (31.9%); Class 2: Average Functioning (45.5%); Class 3: Externalizing Vulnerability and Family Stress (4.9%); Class 4: Internalizing Vulnerability (17.7%). Different superscripts indicate significant pairwise differences at $p < 0.05$. MDD, major depressive disorder; ANX, anxiety disorder; SUD, substance use disorder

Table 3. Comparisons of classes on later psychopathology and psychosocial functioning

	Class 1 (%)/M (SE)	Class 2 (%)/M (SE)	Class 3 (%)/M (SE)	Class 4 (%)/M (SE)	χ^2
MDD	31.37%[a]	39.06%[a]	23.25%[a]	61.59%[b]	23.90***
Number MDEs	0.50 (0.08)[a,b]	0.69 (0.07)[a,c]	0.30 (0.10)[b]	0.92 (0.10)[c]	15.20**
MDD duration	29.87 (5.66)a,b	34.00 (4.00)[a,b]	20.49 (5.80)[a]	50.21 (10.17)[b]	9.48*
PT1 ANX	7.73%[a]	10.51%[a]	4.37%[a]	30.64%[b]	25.91***
PT1 SUD	29.55%[a]	32.96%[a]	69.17%[b]	58.30%[b]	28.99***
Highest grade	15.46 (0.16)[a]	14.42 (0.14)[b]	12.85 (0.31)[c]	14.14 (0.21)[b]	52.45***
Household income	7.65 (0.18)[a]	7.56 (0.13)[a,c]	5.99 (0.34)[b]	7.08 (0.22)[c]	16.37**
Life satisfaction	25.3 (0.66)[a]	28.67 (0.58)[b]	31.78 (1.77)[b,c]	32.26 (0.84)[c]	38.85***
Social adjustment	1.58 (0.03)[a]	1.64 (0.02)[a]	1.80 (0.07)[b]	1.87 (0.03)[b]	42.61***

Note: Percentages are model-based estimates taking into account imprecision of class membership. χ^2 statistic is computed based on the adjusted differences between log-likelihood values between the model with constrained thresholds *v.* freely estimated thresholds across classes. Class 1: Thriving Class (31.9%); Class 2: Average Functioning (45.5%); Class 3: Externalizing Vulnerability and Family Stress (4.9%); Class 4: Internalizing Vulnerability (17.7%). MDD, major depressive disorder; ANX, anxiety disorder; SUD, substance use disorder; MDE, major depressive episode; MDD, duration in months; PT1, post-T1 assessment; Highest Grade, highest grade level completed; Household Income, mean of income ranges (1 = no income; 2 ⩽ $5000; 3 = $5000–$9999; 4 = $10 000–14 999; 5 = $15 000–$19 999; 6 = $20 000–$29 999; 7 = $30 000–$39 999; 8 = $40 000–$49 999; 9 = $50 000 or more).

factors of the onset of depression (Kendler *et al.*, 2002; Hankin, 2012; Klein *et al.*, 2013; Russell *et al.*, 2014). These methods presume that risk factors will be similarly predictive for all individuals from a population. However, person-centered approaches (Muthén and Muthén, 2000) circumvent this assumption by permitting tests of qualitatively different pathways to an outcome for subgroups who share profiles of functioning. In the present study, we examined how profiles of psychosocial and clinical functioning in adolescence are associated with future psychopathology and adaptive functioning. We identified four classes, labeled as Thriving, Average, Externalizing Vulnerability with Family Stress and Internalizing Vulnerability. These classes were associated with different patterns of pathological outcomes as well as markers of adaptive functioning in adulthood. Moreover, most class differences persisted when controlling for better-established risk factors for psychopathology.

Two of our identified classes, labeled as Thriving and Average functioning, reflect superior and average levels of psychosocial and clinical functioning. The Average class included the largest proportion of individuals in the sample (45.5%) and had values near the mean on most class indicators. Thus, the label Average captures the statistical characteristics of this class well. The Thriving class was also sizeable (31.9%) and was characterized by highly adaptive functioning across multiple domains, with many class indicators having means well above the sample average. Though these two class profiles were quantitatively distinct with regard to their indicators, they did not differ significantly from one another on any psychopathological outcome examined. This suggests that a wide range of adaptive functioning is associated with buffering against the experience of psychopathology. However, these classes differed in levels of educational attainment, life satisfaction and social adjustment (in our conservative analyses) in adulthood, with the Thriving class having higher levels than the Average functioning class. Schaefer *et al.* (2017) examined differences between individuals from the Dunedin cohort who never experienced mental health problems and those who

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had mental health problems on only 1–2 assessments throughout the study. The authors found that there were no differences in multiple risk factor domains, including family history of psychopathology, but there were differences in life satisfaction and relationship quality. Thus, across parallel conceptualizations of functioning, associations with well-being are similar.

The other two classes had similar overall levels of indicators, but differed qualitatively on which specific indicators were elevated. The Internalizing Vulnerability class had elevations on many internalizing correlates, whereas the Externalizing Vulnerability and Family Conflict class had elevations on those domains. The Externalizing Vulnerability with Family Stress class had a higher proportion of males than all other classes and higher rates of SUDs than the Thriving and Average classes. This is consistent with evidence that males (Grant *et al.*, 2009) and early externalizing problems (Groenman *et al.*, 2017) are risk factors for SUDs. However, relative to the Thriving and Average classes, the Externalizing Vulnerability with Family Stress class did not differ on depressive morbidity or risk for anxiety disorders. Thus, this class had specific risk for SUDs. Moreover, they had *fewer* episodes of depression than the Average group, providing further evidence of qualitative, rather than just severity, differences. Thus, externalizing problems and heightened family conflict appeared to be associated with reduced depressive morbidity.

The Internalizing Vulnerability class had the greatest psychiatric morbidity relative to other classes. It was characterized by elevations on multiple indices of cognitive vulnerability to depression, which have previously been shown to be potent predictors of depressive disorders (Alloy *et al.*, 2000). Moreover, it exhibited a higher risk for anxiety disorders and SUDs than the Thriving and Average classes. This suggests that the collection of elevated indicators in the Internalizing Vulnerability class reflects transdiagnostic risk (Nolen-Hoeksema and Watkins, 2011; Hong and Cheung, 2015). When controlling for additional well-established clinical and demographic risk factors, the Internalizing Vulnerability class continued to have a higher risk for MDD than the Thriving and Average classes, as well as a greater number of MDD episodes and total duration of illness than the Thriving and Externalizing Vulnerability with Family Stress classes. Thus, these profiles continued to provide additional explanatory utility beyond established risk factors.

The Internalizing Vulnerability class was also associated with an increase in paternal, but not maternal, history of depression. This parallels earlier work in this dataset showing paternal depression was associated with lower adolescent social competence (Lewinsohn *et al.*, 2005). The non-significant association for maternal depression raises important questions about the processes that give rise to these classes. Maternal depression is an established risk factor for depression (Klein *et al.*, 2005), but did not discriminate between classes defined by other psychosocial risk factors. Thus, these psychosocial functioning classes do not appear to mediate the relationship between maternal and offspring depression. However, maternal depression is associated with other risk indicators that were not included here (Goodman and Gotlib, 2002), for example personality or temperamental characteristics, and biological processes such as neural response (Olino, 2016).

In the broader work on the aggregation of psychopathology in the population, there is evidence that a majority of incident psychopathology (Farmer *et al.*, 2013) and adverse physical and psychosocial outcomes (Caspi *et al.*, 2017) condensed within a small proportion of the population. Our class indicators focused on both psychosocial and clinical functioning and paralleled the epidemiological results focusing on clinical outcomes. Thus, there is an apparent parallel between vulnerability and clinical outcomes.

The LPA models demonstrated utility relative to traditional regression-based methods. The identified profiles showed constellations of multiple constructs and found that they were associated with different psychopathological outcomes. To identify similar patterns using regression methods, many more models would need to be estimated. Moreover, as we found some non-linear patterns within our classes, particularly with respect to the presence of heightened externalizing problems, these would have required estimating additional interaction effects. This would lead to many tests and increase the likelihood of type-I error.

Our study benefits from a wide array of measures of risk for psychopathology assessed on a large cohort of youth who were carefully assessed for multiple forms of psychopathology for up to 15 years. However, these strengths must be weighed against several limitations. First, we relied solely on self-report measures to examine psychosocial and clinical functioning. Other types of measures and variables (e.g. neuroimaging, behavior, personality traits) may add value in predicting psychopathology. Second, identifying pathways to emergence of psychopathology in a mechanistic fashion requires a longitudinal assessment of risk factors to identify how these change over time (Hankin, 2012; Olino, 2016).

The results of this work suggest that empirically-derived profiles of clinical and psychosocial risk factors have prognostic value for predicting onset and course of depression, as well as adaptive function. Moreover, these associations are independent of, and account for additional variance, over and above better-established clinical and demographic risk factors for depression.

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