

Toward precision therapeutics: general and specific factors differentiate symptom change in depressed adolescents

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Background: The longitudinal course of multiple symptom domains in adolescents treated for major depression is not known. Revealing the temporal course of general and specific psychopathology factors, including potential differences between psychotherapies, may aid therapeutic decision-making. **Methods:** Participants were adolescents with major depressive disorder (aged 11–17; 75% female; $N = 465$) who were part of the IMPACT trial, a randomized controlled trial comparing cognitive behavioral therapy, short-term psychoanalytic psychotherapy, and brief psychosocial intervention. Self-reported symptoms at baseline and 6, 12, 36, 52, and 86 weeks postrandomization were analyzed with bifactor modeling. **Results:** General psychopathology factor scores decreased across treatment and one-year follow-up. Specific melancholic features and depressive cognitions factors decreased from baseline to 6 weeks. Conduct problems decreased across treatment and follow-up. Anxiety increased by 6 weeks and then reverted to baseline levels. Obsessions-compulsions did not change. Changes in general and specific factors were not significantly different between the three psychotherapies during treatment. During follow-up, however, conduct problems decreased more in brief psychosocial intervention versus cognitive behavioral therapy (1.02, 95% Bayes credible interval 0.25, 1.96), but not versus short-term psychoanalytic psychotherapy. **Conclusions:** The clinical response signature in this trial is best revealed by rapid reductions in depression symptoms and general psychopathology. Protracted improvements in general psychopathology and conduct problems subsequently occur. Psychosocial treatments for adolescent depression have comparable effects on general and specific psychopathology, although a psychoeducational, goal-focused approach may be indicated for youth with comorbid conduct problems.

Keywords: Bifactor models; depression; psychotherapy; adolescent; psychopathology.

Introduction

There is increasing empirical support for a general psychopathology factor that accounts for shared variance in diverse symptoms of mental illness (Caspi et al., 2014; Caspi & Moffitt, 2018; Castellanos-Ryan et al., 2016; Laceulle, Vollebergh, & Ormel, 2015). Evidence for this general factor runs counter to most current clinical practices, which often focus on categorical diagnosis and associated narrow-band questionnaires, and presumes disorder-specific interventions (Caspi & Moffitt, 2018; Hopwood et al., 2019; Messer & Wampold, 2006; Rodriguez-Seijas, Eaton, & Krueger, 2015). However, treatments often reduce symptoms in comorbid domains not explicitly targeted (Hilton et al., 2013; Weisz, McCarty, & Valeri, 2006), suggesting that interventions may decrease psychiatric symptoms overall, rather than those within a single category of psychopathology (Constantinou et al., 2019;

Hopwood et al., 2019). We examined change in general and specific psychopathology factors among adolescents participating in psychosocial treatments for major depression in the IMPACT trial (Goodyer et al., 2017b, 2011). Use of the general psychopathology factor as an outcome variable has potential to provide new insights into symptom patterns over time and whether these patterns vary for different psychotherapies.

General psychopathology factor

The concept of a general factor of psychopathology was popularized by Caspi et al. (2014), building on evidence of overall internalizing and externalizing dimensions of psychopathology (Achenbach & Edelbrock, 1978; Lahey, Van Hulle, Singh, Waldman, & Rathouz, 2011). The general, 'p', factor is dimensional and empirically derived using bifactor modeling and captures shared variance in symptoms across the spectrum of psychopathology (Kotov et al., 2017; Krueger et al., 2018). Specific factors with variance unique to each symptom domain, not

Conflict of interest statement: See Acknowledgements for full disclosures.

accounted for by the general factor, are also identified.

The p factor appears to reflect an overall liability to psychopathology, which may be explained by underlying emotion dysregulation, negative emotionality, and unwanted irrational thoughts (Carver, Johnson, & Timpano, 2017; Caspi et al., 2014; Caspi & Moffitt, 2018). Analyses in clinic and community samples support the reliability and validity of the general psychopathology factor (Carragher et al., 2016; Haltigan et al., 2018; Patalay et al., 2015; Waldman, Poore, van Hulle, Rathouz, & Lahey, 2016). Research on the general factor as a treatment outcome measure is now needed to understand treatment effectiveness in the context of empirically driven, dimensional models of psychopathology (Caspi & Moffitt, 2018; Hopwood et al., 2019).

IMPACT trial

The IMPACT trial was a multisite, randomized pragmatic superiority effectiveness trial comparing three structured psychosocial therapies for adolescents with a primary diagnosis of major depressive disorder (Goodyer et al., 2017b, 2011): cognitive behavioral therapy (CBT), focused on behavioral activation and identifying and modifying information processing biases; short-term psychoanalytic psychotherapy (STPP), focused on giving meaning to the varieties of the client's emotional experiences and addressing difficulties in the context of the developmental tasks of adolescence (Cregeen, Hughes, Midgley, Rhode, & Rustin, 2017); and brief psychosocial intervention (BPI), a goal-oriented therapy focused on psychoeducation about depression and increasing positive activities (Goodyer et al., 2017a).

CBT, STPP, and BPI were associated with similar decreases in depression and psychosocial impairment at the end of the treatment (36 weeks) and one-year follow-up in the IMPACT trial (Goodyer et al., 2017b). In contrast, secondary outcomes of anxiety, obsessions/compulsions, and antisocial behaviors were significantly lower at the end of the treatment, in favor of the psychological therapies (CBT + STPP) compared to BPI, but no such difference was sustained at the conclusion of the study. This suggests BPI may have similar effects as the other therapies on depression symptoms, but psychological therapies such as CBT and STPP may have more immediate benefits for comorbid symptoms. The inclusion of nondepressive symptoms may make the general factor more sensitive to change and relevant to patients' experience. Here we speculate that the psychological therapies may be more effective (or efficient) at reducing a general factor score more rapidly than BPI.

The results of the IMPACT trial suggested that a dimensional, transdiagnostic analysis may enhance understanding of differences in treatment response. Narrow-band (i.e., total scores within a symptom domain) measures of depression, anxiety,

obsessions/compulsions, and conduct problems showed similar decreases across treatment and follow-up, suggesting a common course of nondepressive and depressive symptoms (Goodyer et al., 2017b). The self-report depression and anxiety scales used in the IMPACT trial have also previously shown a good fit for a latent bifactor model in community adolescents ($n = 1,159$), with a general factor and specific melancholic, cognitive, and anxiety factors (Brodtbeck et al., 2014). A general psychopathology factor may therefore explain the transdiagnostic decline in symptoms in the IMPACT trial. Further, examining the longitudinal course of general and specific factors may provide novel information on change during treatment and follow-up not seen using narrow-band instruments. Here we speculate that specific factors have prognostic validity and are not merely carrying redundant variance.

Present study

Use of the general psychopathology factor as an outcome in clinical trials is limited and has not focused on youth with major depression (Constantinou et al., 2019; Wade, Fox, Zeanah, & Nelson, 2018). The present study examines change in general and specific psychopathology factors among adolescents with a primary diagnosis of major depression receiving one of three psychosocial interventions: CBT, STPP, and a reference standardized care as usual treatment, BPI. Considering prior findings from the IMPACT trial (Goodyer et al., 2017b) and analyses of the general factor in other clinical trials (Constantinou et al., 2019; Wade et al., 2018), we hypothesize that:

1. Symptom reductions will be reflected in decreases in the general factor across treatment and follow-up.
2. Specific factors will show different patterns of change compared to the general factor, with greater reductions early in treatment and minimal subsequent change over follow-up.
3. The established psychological therapies (CBT, STPP) will be associated with greater reductions compared with BPI in all factors during the treatment phase but not during follow-up.

Methods

We analyzed data from the IMPACT trial (Goodyer et al., 2017b, 2017a, 2011) collected at baseline and nominal 6, 12, 36, 52, and 86 weeks postrandomization (for full protocol, see Goodyer et al., 2011). Participating adolescents were randomly assigned, between June 2010 and January 2013, to receive CBT ($n = 154$), STPP ($n = 156$), or BPI ($n = 155$; for CONSORT diagram, see Goodyer et al., 2017a, 2017b); see Table S1 for baseline characteristics by treatment group). There were no significant differences in selective serotonin reuptake inhibitor (SSRI) prescribing between treatments and no effect of SSRI prescribing on the primary outcome of self-reported depressive

symptoms (Goodyer et al., 2017b). Mean treatment length was 24.9 weeks (CBT), 27.9 weeks (STPP), and 27.5 weeks (BPI). Participants attended a median of nine therapy sessions (range = 0–43; BPI median = 6, IQR, 4–11; CBT median = 9, IQR 5–14; STPP median = 11, IQR 5–23).

Study population

Participants were recruited from 15 specialized outpatient mental health clinics in three urban or rural regions in England. All participants had an existing DSM-IV diagnosis of moderate to severe major depressive disorder (Goodyer et al., 2017b, 2011). A total of 465 adolescents aged 11–17 ($M = 15$ years; 75% female; 85% self-reported their ethnicity as White) were included in the present study (470 randomized; 5 withdrew consent). Comorbidity was relatively common, with 48% of participants meeting DSM-IV criteria for one or more comorbid disorders.

Ethical considerations

All participating youth and parents provided informed consent to participate in the IMPACT trial. All study procedures were approved by the Cambridgeshire 2 Research Ethics Committee.

Measures

Adolescent self-reports, completed at six time points, were used: (a) the Mood and Feelings Questionnaire (Costello & Angold, 1988), a 33-item measure of depression symptoms; (b) the Revised Children's Manifest Anxiety Scale (Reynolds & Paget, 1981; Reynolds & Richmond, 1978), a 28-item anxiety questionnaire; (c) the short Leyton Obsessional Inventory (Bamber, Tamplin, Park, Kyte, & Goodyer, 2002), an 11-item measure of obsessions and compulsions; and (d) an 11-item antisocial behavior checklist derived from DSM-IV criteria for conduct disorder (Goodyer et al., 2011). All items were rated on a 4-point scale (never, sometimes, mostly, or almost always). Responses of mostly and almost always were collapsed (Goodyer et al., 2017b). Mean self- and parent ratings on the Health of the Nation Outcome Scales for Children and Adolescents (HoNOSCA; Gowers et al., 1999; Gowers, Levine, Bailey-Rogers, Shore, & Burhouse, 2002) at each time point were used to measure overall symptom burden and impairment.

Statistical analysis

Analyses were carried out using Mplus 8.2 (Muthén & Muthén, 2017) with Bayesian methods equivalent to full information maximum likelihood (Muthén & Muthén, 2017) to handle missing data. Results were considered significant if the 95% Bayes credibility interval did not include zero. We used exploratory factor analysis of baseline self-reported psychopathology items to identify their factor structure (see Appendix S1, Tables S2 and S3), which we then used in a multilevel confirmatory factor analysis (CFA) using data from all time points comparing: unidimensional, correlated factors, and orthogonal bifactor (with specific factors uncorrelated; see Figure 1 & Appendix S1) models. We calculated model-based reliability coefficients for general and specific factors from the orthogonal bifactor model (see Appendix S1; Dueber, 2017). Using data from all time points, we regressed parent- and self-reported HoNOSCA mean scores on factors from the orthogonal bifactor model to examine their convergent validity. We regressed the factors on dummy-coded time points (Wright, Hopwood, Skodol, & Morey, 2016) to examine change over time and compared scores between adjacent time points (see Appendix S1). We used treatment-specific variables in a

multilevel CFA to compare change in general and specific factors in CBT, STPP, and BPI (see Appendix S1).

Results

Multilevel CFA

Both the orthogonal bifactor model (Figure 1), including a general factor and five specific factors (melancholic features, depressive cognitions, anxiety, obsessions-compulsions, and conduct problems), and the correlated factor model fit well, although the orthogonal bifactor model's fit was superior (see Table 1, Appendix S1 and Table S4).

In the orthogonal bifactor model, the general factor, along with the conduct problems and obsessions-compulsions specific factors, demonstrated adequate reliability, whereas evidence was mixed for the depressive cognitions factor, and reliability scores were somewhat lower for the melancholic features and anxiety specific factors (see Appendix S1). Higher general factor and specific conduct problems and melancholic features factor scores were associated with greater symptom burden and impairment across time. Higher depressive cognitions factor scores were associated with more self- but not parent-reported symptom burden and impairment. Anxiety and obsessions-compulsions factor scores were inversely related to symptom burden and impairment (see Table 2 and Table S5 for further analyses).

Change over time

General factor scores decreased significantly between time points from baseline to 52 weeks (see Figure 2 and Table S6). Specific melancholic features, depressive cognitions, and conduct problems factors decreased significantly from baseline to 6 weeks but did not otherwise change significantly between adjacent time points. In supplementary analyses, conduct problems further decreased across treatment and follow-up, despite nonsignificant differences between adjacent time points (see Table S7 and Appendix S1). In contrast, the anxiety factor increased significantly from baseline to 6 weeks and then decreased significantly between 12 and 36 weeks. Anxiety scores at 6 and 12 weeks were significantly higher than baseline but did not differ from baseline at subsequent time points. There was no change in obsessions-compulsions factor scores. In preliminary analyses, there were no differences in change over time by participant sex or geographic region (see Tables S8 and S9).

Treatment effects

CBT and STPP, and STPP and BPI, did not differ in their associations with changes in factor scores across time (see Figure 3, and Tables S10 and

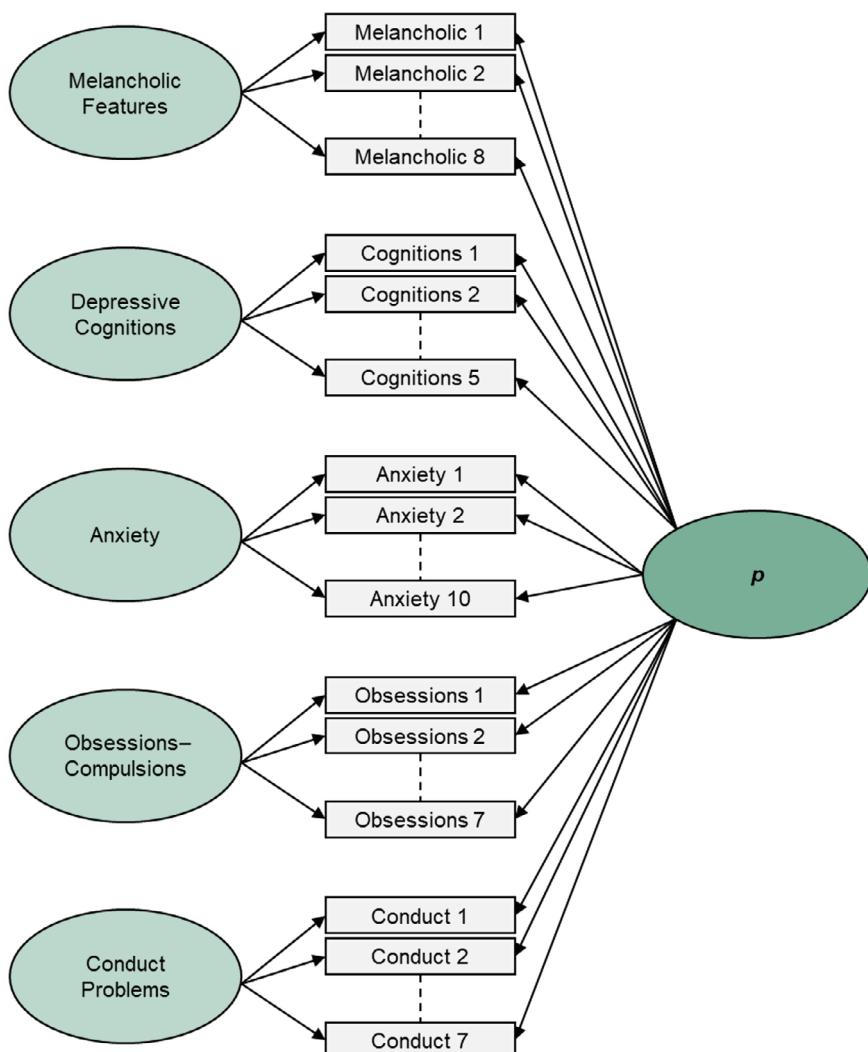


Figure 1 Orthogonal bifactor model

Table 1 Fit statistics for multilevel confirmatory factor analysis across six time points

Model	FP	χ^2	RMSEA	CFI	BIC ^a	Δ BIC ^a
Unidimensional	111	16,723.09	.110	.866	114,936.84	—
Five correlated factors	121	4,636.37	.056	.967	109,178.53	5,758.31
Orthogonal bifactor	148	3,134.42	.045	.979	108,386.26	797.27

BIC, Bayesian information criterion; CFI, comparative fit index; FP, free parameters; RMSEA, root mean squared error of approximation.

^aBIC values were obtained by rerunning the analysis with the maximum likelihood estimator. Change in BIC is calculated from the model in the line above.

S11). However, there was a significantly larger decrease in conduct problems from 36 to 52 weeks (i.e., post-treatment phase) in BPI compared with CBT, although not compared with STPP. No other treatment differences were significant. An analysis comparing BPI versus [CBT + STPP] showed similar results (see Appendix S1 and Table S12).

Discussion

To our knowledge, this study is the first to examine the effects of psychosocial therapy on general and

specific psychopathology factors in adolescents presenting with major depression and comorbid conditions. A latent bifactor model with five specific factors and a general psychopathology factor fitted the data well. Consistent with our first hypothesis, the general *p* factor (containing variance from all 37 psychopathology items) decreased significantly across treatment and one-year follow-up. In contrast, in line with our second hypothesis, specific factors showed less consistent decreases over time. For example, specific melancholic features and depressive cognitions factors decreased only during

Table 2 Multivariate regression of symptom burden and impairment ratings on general and specific factors

Variable	Estimate	Posterior SD	<i>p</i>	95% Bayes CI		Significance
				Lower 2.5%	Upper 2.5%	
Self-reported impairment						
General factor	0.675	0.015	<.001	0.644	0.705	*
Melancholic features	0.159	0.028	<.001	0.104	0.213	*
Depressive cognitions	0.091	0.025	<.001	0.042	0.139	*
Anxiety	-0.053	0.024	.015	-0.100	-0.005	*
Obsessions-compulsions	-0.056	0.020	.003	-0.096	-0.016	*
Conduct problems	0.184	0.022	<.001	0.141	0.227	*
Parent-reported impairment						
General factor	0.480	0.027	<.001	0.426	0.531	*
Melancholic features	0.096	0.040	.009	0.017	0.173	*
Depressive cognitions	0.039	0.037	.146	-0.034	0.112	
Anxiety	-0.099	0.038	.005	-0.173	-0.024	*
Obsessions-compulsions	-0.072	0.032	.012	-0.134	-0.010	*
Conduct problems	0.213	0.033	<.001	0.148	0.277	*

Standardized estimates. CI = credibility interval. One-tailed *p* values based on the posterior distribution can be interpreted as the proportion of the posterior distribution that is below zero (or, for negative estimates, above zero).

*95% Bayes credibility interval does not contain 0.

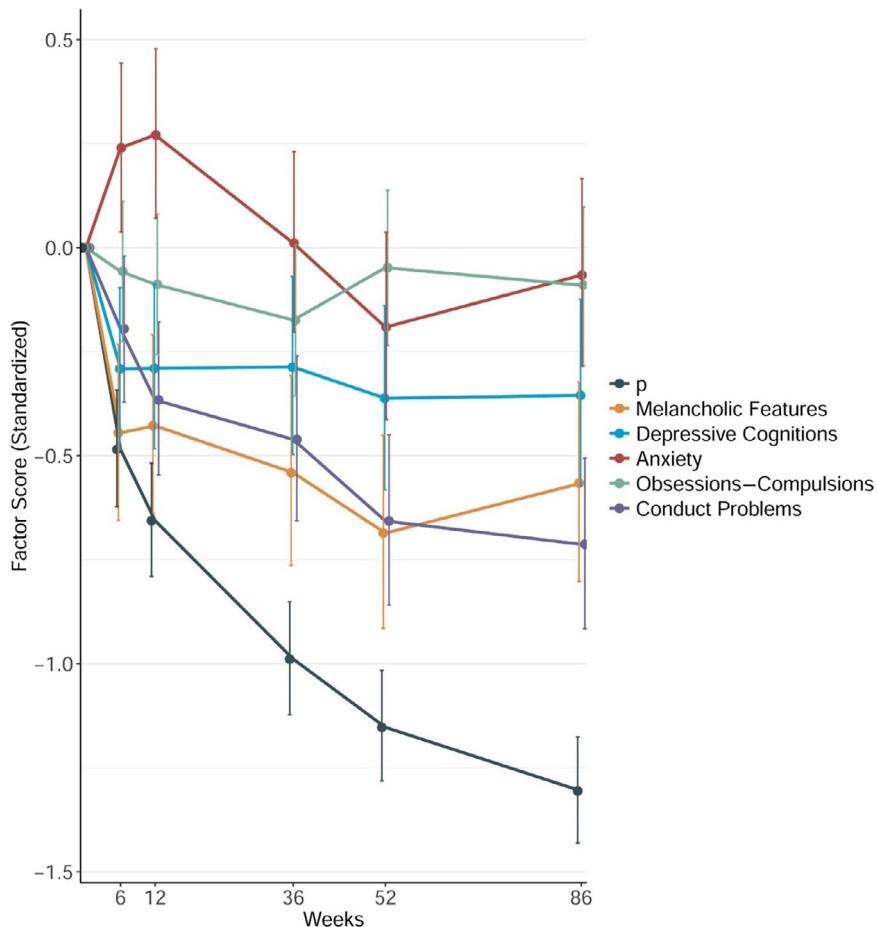


Figure 2 General and specific factor scores across treatment and follow-up. Error bars represent the 95% Bayes credibility interval. Factors are derived from orthogonal bifactor modeling, in which each item loads on the general *p* factor has its remaining variance accounted for by one of the five specific factors

the initial weeks of therapy, whereas anxiety factor scores initially increased and then returned to baseline, and conduct problems factor scores continued to decrease across treatment and follow-up. The course of the general and specific factors

reveals novel insights into change across treatment and follow-up not evident when using the sum scores from each of the narrow-band domain measures reported in the original study (Goodyer et al., 2017b).

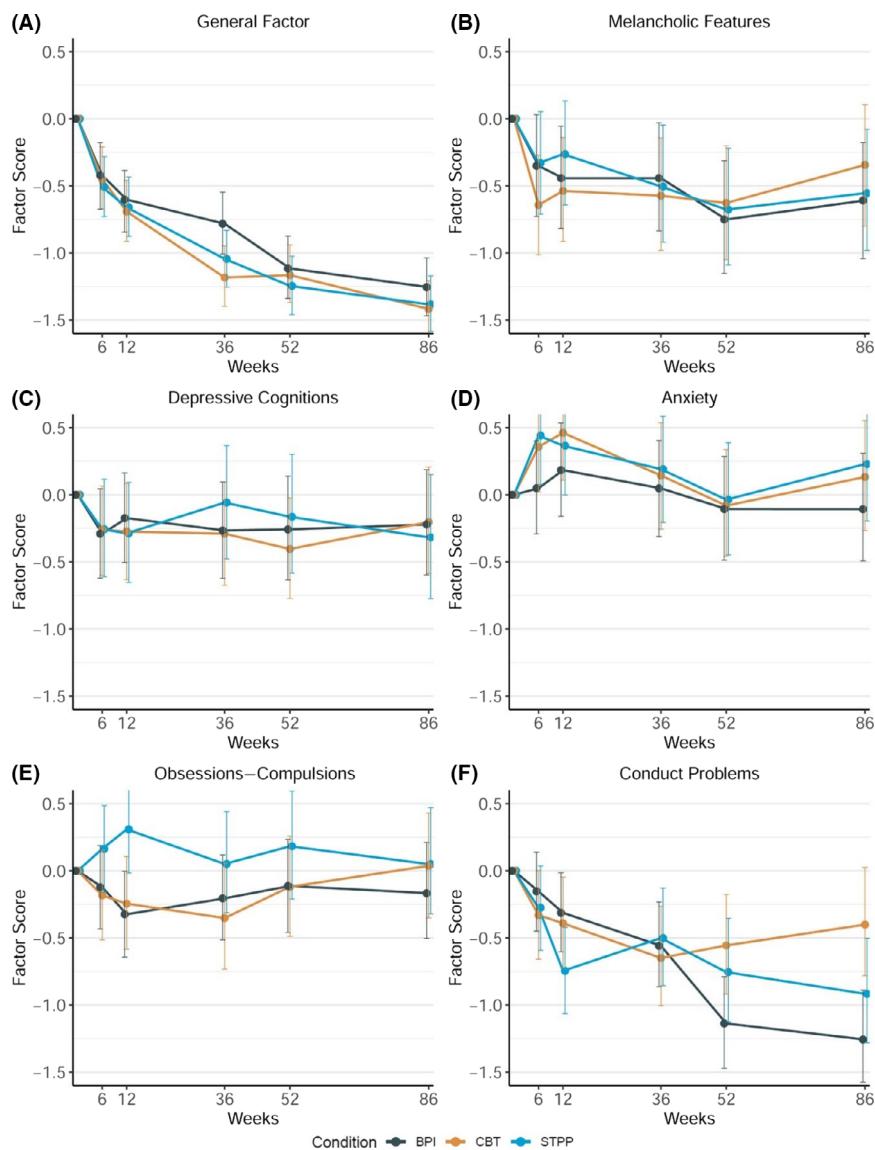


Figure 3 Change in general and specific factor scores by treatment type. BPI, brief psychosocial intervention; CBT, cognitive behavioral therapy; and STPP, short-term psychoanalytical psychotherapy. Error bars represent the 95% Bayes credibility interval. Factors are derived from orthogonal bifactor modeling, in which each item loads on the general p factor has its remaining variance accounted for by one of the five specific factors

The general psychopathology factor and the specific conduct problems factor showed continued decreases across treatment and into follow-up. These continued decreases across time suggest that general psychopathology and specific conduct problems are the two factors that may be most responsive to therapy, including further improvements once therapy has ended. In the main IMPACT trial analysis (Goodyer et al., 2017b), significant decreases in anxiety, depression, obsessions-compulsions, and antisocial behavior were noted. Previous randomized controlled trials of psychotherapy for depression have also demonstrated improvements in comorbid symptom domains, including anxiety, attention-deficit/hyperactivity disorder, and conduct problems (Asarnow et al., 2009; Hilton et al., 2013). Our results suggest that decreases in these various symptom domains can be best understood as overall

decreases in psychopathology, rather than improvements in discrete symptom areas. These broad decreases in psychopathology may be attributed to improvements in transdiagnostic processes believed to underlie the general psychopathology factor, such as negative emotionality, emotion dysregulation, or unwanted irrational thoughts (Asarnow et al., 2009; Carver et al., 2017; Caspi et al., 2014; Caspi & Moffitt, 2018). The present findings parallel those of longitudinal and intervention studies, which have reported a steady decrease in general psychopathology (Constantinou et al., 2019; Wade et al., 2018; Wright et al., 2016). Decreases in specific conduct problems during and following psychosocial treatment have also been reported in institutionalized children placed in foster care (Wade et al., 2018), and in adolescents being treated for conduct problems (Constantinou et al., 2019). The marked decrease in

conduct problems in our model is notable in comparison with results of studies using narrow-band domain measures, which have found inconsistent effects on conduct problems in adolescents being treated for depression (Goodyer et al., 2017b; Weisz et al., 2006).

We hypothesized that specific factors might differ in the amount they change during treatment and follow-up. We note the rapid decrease from baseline to 6 weeks for general psychopathology and some specific factors (melancholic, depressive cognitions, and conduct): This may index a mechanism common to all the therapies, such as feeling understood or instilling a sense of hope. The lack of any further significant change in melancholic and depressive cognitions factors suggests that their subsequent levels may index more trait-like features or components less responsive to psychological intervention. Higher melancholic features and depressive cognitions scores were also associated with greater symptom burden and impairment, in line with evidence that specific internalizing, independent of the general factor, is related to psychosocial impairment severity (Haltigan et al., 2018). Thus, even after structured psychotherapy, adolescents may experience residual symptoms specific to melancholy (e.g., anhedonia, fatigue) and depressive thinking that are associated with ongoing impairment. Further research is needed to determine the longitudinal relevance of persistent melancholy and depressive cognitions to treatment response and relapse. Therapies that better address residual depressive symptoms are also needed.

In contrast, the specific anxiety factor increased from baseline to 6 weeks and then decreased to baseline levels by 36 weeks, marking the end of the treatment phase, consistent with evidence from previous bifactor modeling of an increase in specific anxiety with treatment onset (Constantinou et al., 2019). This pattern may reflect the potential for therapy to initially increase anxiety, followed by eventually becoming more comfortable with the experience. The published results of the IMPACT trial and other trials using narrow-band domain measures have not captured this unique symptom course, instead showing consistent decreases in anxiety across treatment (Goodyer et al., 2017b; Kerns, Read, Klugman, & Kendall, 2013; Young et al., 2012). The specific anxiety factor derived from bifactor modeling, a pure index of anxiety once overall psychopathology has been controlled, may therefore represent a novel and potentially more precise aspect of anxiety symptomatology not measured in previous clinical trials. The specific anxiety factor was related to *lower* levels of symptom burden/impairment in the present study. Of note, this is consistent with some previous evidence of an inverse association between the internalizing factor derived through bifactor modeling and impairment (Caspi et al., 2014; Lahey et al.,

2015). One possible interpretation is that specific anxiety symptoms, net of overall psychopathology, may not require further intervention in adolescents who have received a successful structured course of psychotherapy for depression and may even be adaptive. However, as it is also possible that this finding may be artefactual, further research using a broader set of anxiety items and a more comprehensive measure of function is needed to confirm this suggestion.

Interestingly, there was no statistically significant change in the specific obsessions-compulsions factor over time. We speculate that obsessions and compulsions, at least those indexed by the current specific factor, are unlikely to contribute substantially to treatment response or time to recovery. Indeed, the specific obsessions-compulsions factor was inversely related to symptom burden and impairment as rated by youth and their parents, consistent with previous evidence from bifactor modeling (Laceulle, Chung, Vollebergh, & Ormel, 2019). As with the anxiety specific factor, this negative association may have been due to this factor being adaptive or may have been artefactual, and needs further investigation. Further analyses of treatment outcomes using bifactor modeling, including different psychopathology measures, may increase our understanding of how various therapies are associated with changes in general and specific aspects of psychopathology (Caspi & Moffitt, 2018).

When we examined the pattern of scores across time by therapy type, the results were not consistent with our third hypothesis: Patients receiving established psychological treatments (CBT, STPP) did not show greater reductions in any factor during the treatment phase compared to those receiving BPI. Changes in general and specific factor scores were comparable for the three therapies during the treatment phase. The original IMPACT trial reported no superiority effects for established psychological treatments compared with BPI. The authors speculated that the comparable results of the three therapies may be explained by either: a) similar mechanisms underpinning therapeutic response (other than time itself), often referred to as 'common factors' (Messer & Wampold, 2006; Wampold, 2015); or b) the three therapies having specific mechanisms that operate to bring about the same observed end points but by different therapeutic routes (equifinality; Calderon et al., 2019; Goodyer et al., 2017b; Midgley et al., 2018). Bifactor modeling provides some added value to the second of these suggestions, noting that BPI is associated with an additional decline in conduct factor scores post-treatment compared to CBT. This may index a unique advantage of BPI over CBT (but not STPP) for major depression cases with high baseline conduct symptoms. Perhaps, the greater emphasis on ameliorating peer and family relationships and school functioning, both of which predict less antisocial behavior

(Dishion, Patterson, Stoolmiller, & Skinner, 1991), or more liaison with carers and agencies, contributed to continued decreases in conduct problems in BPI compared to CBT; although it is notable that STPP, which is not traditionally viewed as a treatment for conduct disorder, also demonstrated a decline in conduct factor scores, possibly due to the fact that it focuses on the emotional difficulties that may underlie conduct problems. If these findings are replicated, this would be the first suggestion that clinicians might be able to personalize treatment for depressed adolescents based on their conduct problem severity.

Limitations

Several limitations of the current study should be noted. First, in terms of the measures used, the items in our analysis were identified through an exploratory factor analysis of baseline data and did not include social anxiety, impulsivity, or executive dysfunction. In addition, given the self-report nature of our data and the depressive cognitions items having a common stem, shared method variance may have increased associations between items. Although representative of a well-fitting factor structure, the items may also not be those most sensitive to intervention. In addition, measures were not always administered precisely at the given number of weeks planned; therefore, our results should not be used to make specific determinations about the number of weeks at which change may be observed. Second, reliabilities were somewhat low for the melancholic features and anxiety specific factors; therefore, it is important not to overinterpret the meaning of these specific factors. Third, around 30% of all participants in each group took a SSRI medication during the trial, and our analysis did not allow for an examination of medication onset effects. Future research, including randomized controlled trials, is needed to examine the effect of SSRIs on general and specific psychopathology factors. Finally, further validity analyses using other criterion measures, including objective and/or biological indicators, are needed. The current study also has many strengths, including a relatively large clinical sample of adolescents, multiple measurement points during treatment and follow-up, random assignment, and the ability to compare three types of structured psychotherapy delivered in routine, free to access, clinical practice.

Conclusion

In a recent editorial evaluating the state of the science regarding the general psychopathology factor, Ronald asked: 'Instead of treating specific symptoms, or disorders, should we treat p?' (Ronald, 2019, p. 499). The present results suggest that perhaps we already are. With the emphasis on

manualized, disorder-specific therapies over the past three decades (Forbes, Rapee, & Krueger, 2019; Roy-Byrne, 2017), further research in other samples will be important to understand the extent to which evidence-based interventions may have broad effects on general psychopathology (Hopwood et al., 2019). Future investigations of change in general and specific psychopathology factors with modular and transdiagnostic therapy approaches are also needed (Bilek & Ehrenreich-May, 2012; Chorpita & Weisz, 2009; Chorpita et al., 2013; Ehrenreich-May et al., 2017). Similarly, investigations of transdiagnostic prevention programs with the potential for broad effects on psychopathology may prove especially useful (Forbes et al., 2019). Additionally, the potential importance of specific factors in bifactor models of symptom change during treatment not observed using traditional, disorder-specific, measurement approaches should not be overlooked as these may aid personalized treatment decision-making.

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Appendix S1. Online supplementary material.

Table S1. Baseline participant demographics and clinical characteristics by treatment condition.

Table S2. Summary of exploratory factor analysis of baseline data ($n = 465$).

Table S3. Items and loadings by factor from final iteration of the exploratory factor analysis.

Table S4. Standardized factor loadings for multilevel orthogonal bifactor model.

Table S5. Multivariate regression of six impairment-specific ratings on general and specific factors.

Table S6. Change in general and specific factor scores across time.

Table S7. Additional comparisons of change in the specific conduct problems factor across time.

Table S8. Comparison of change in factor scores between males and females.

Table S9. Comparison of change in factor scores between three regions.

Table S10. Change in general and specific factor scores across time by treatment type.

Table S11. Comparison of change in factor scores between psychosocial treatments.

Table S12. Comparison of change in factor scores between BPI and CBT + STPP.

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Key points

- Evidence of the reliability and validity of the general psychopathology, 'p', factor, has accumulated in recent years.
- This study provides novel information on how three types of psychotherapy influence general and specific aspects of psychopathology.
- General factor and specific conduct problems factor scores decrease across treatment and follow-up, whereas melancholic and depressive cognitions decrease only in the initial 6 weeks.
- Longitudinal courses of general and specific factors are similar across therapies, although conduct problems decrease more post-therapy after brief psychosocial intervention than cognitive behavioral therapy, but not short-term psychoanalytic psychotherapy.
- Bifactor modeling reveals symptom changes not observed using domain sum scores, including differences that may aid selection of psychotherapy for depressed adolescents.

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