A single-session growth mindset intervention for adolescent anxiety and depression: 9-month outcomes of a randomized trial

Jessica Schleider and John Weisz

Harvard University – Psychology, Cambridge, MA, USA

Background: Single-session interventions (SSIs) show promise in the prevention and treatment of youth psychopathology, carrying potential to improve the scalability and accessibility of youth psychological services. However, existing SSIs have conferred greater benefits for youths with anxiety, compared to depression or comorbid problems, and their effects have generally waned over time – particularly for follow-ups exceeding 3 months. **Method:** To help address these discrepancies, we tested whether a novel SSI teaching growth mindset of personality (the belief that personality is malleable) could reduce depression and anxiety and strengthen perceived control in high-risk adolescents ($N = 96$, ages 12–15). At baseline, youths were randomized to receive a 30-min, computer-guided growth mindset intervention or a supportive-therapy control. Youths and parents reported youth anxiety and depressive symptoms, and youths reported their levels of perceived control, at baseline and across a 9-month follow-up period. **Results:** Compared to the control program, the mindset intervention led to significantly greater improvements in parent-reported youth depression ($d = .60$) and anxiety ($d = .28$), youth-reported youth depression ($d = .32$), and youth-reported perceived behavioral control ($d = .29$) by 9-month follow-up. Intervention effects were nonsignificant for youth-reported anxiety, although 9-month effect sizes reached the small-to-medium range ($d = .33$). Intervention group youths also experienced more rapid improvements in parent-reported depression, youth-reported depression, and perceived behavioral control across the follow-up period, compared to control group youths. **Conclusions:** Findings suggest a promising, scalable SSI for reducing internalizing distress in high-risk adolescents. Clinical Trial Registration Number: NCT03132298. **Keywords:** Intervention; depression; anxiety; mindset.

Introduction

Over 200 psychosocial interventions have been identified as 'effective' or 'promising' in reducing youth psychological problems (National Registry of Evidence-Based Programs and Practices, http://www.nrepp.samhsa.gov/). However, up to 80% of youths with mental health needs go without services (Costello, He, Sampson, Kessler, & Merikangas, 2014). Even among youths who do access care, many drop out prematurely (Harpaz-Rotem, Leslie, & Rosenheck, 2004), and fewer than 20% receive empirically supported interventions (Bernstein, Chorpita, Daleiden, Ebesutani, & Rosenblatt, 2015). There are several possible reasons for these discrepancies. Existing youth psychotherapies can be costly and time-intensive (16.54 sessions on average; Weisz et al., in press). Further, only 63% of US counties have a mental health facility offering youth-focused outpatient treatment (Cummings, Wen, & Druss, 2013), limiting access for large swaths of the population. Therefore, there is a need for brief, scalable interventions for youth psychopathology – particularly interventions deliverable beyond brick-and-mortar clinics and via nontraditional means (e.g. computer-based programs) to maximize potential for accessibility.

Some evidence suggests that single-session interventions (SSIs) for youth psychopathology may help address this need. SSIs have shown promising effects for diverse youth problems, including specific phobias (Davis, Ollendick, & Öst, 2012), conduct disorder (Mejia, Calam, & Sanders, 2015), and general distress in multiproblem youths (Perkins, 2006). In a meta-analysis examining 50 randomized-controlled trials (Schleider & Weisz, 2017), SSIs for youth psychological problems demonstrated a significant beneficial effect ($g = .32$), across various levels of youth problem severity and diagnostic status. This result highlights the potential of SSIs for youths with diagnosable and subclinical psychopathology. Further, significant effects emerged even for self-administered (e.g. computer-based) interventions ($g = .32$), suggesting particular potential to reduce costs and broaden service accessibility. Although SSIs' overall effects are slightly smaller than those observed for multisession youth psychotherapy (Weisz et al., 2017), their relative efficiency and scalability could magnify their benefits for youth psychological health on a broad scale.

However, further investigation is needed to determine SSIs' promise and limitations. For instance, SSIs have been most effective in reducing youth anxiety and conduct problems, whereas SSIs targeting youth depression have shown nonsignificant overall effects (Schleider & Weisz, 2017). However, only six of 50 trials in Schleider and Weisz'

meta-analysis targeted depression, ensuring a poorly powered significance test. It remains possible that novel, theoretically precise SSIs could ameliorate youth depression. The effects of SSIs on co-occurring psychological problems are also unclear, as only one of the 50 trials in this meta-analysis explicitly targeted multiple youth problem types. Additionally, SSIs' overall effects have waned over time, with mean effects dropping markedly (to $g = .07$) at 3-month follow-up and beyond. SSI trials have also relied largely on youth self-report outcome measures, and two thirds have used weak comparison conditions (i.e. no-treatment and waitlist controls; Schleider & Weisz, 2017). More rigorous, longer term trials of SSIs targeting depression and associated problems are key next-steps, and a new approach to SSI design may warrant attention as well.

With these needs in mind, we used multi-informant measurement, an active control intervention, and extended follow-up assessment to test a brief computer-administered SSI: one that differed conceptually from the most frequently used intervention approaches. Unlike interventions that focus directly on depressive and anxiety symptoms (e.g. through behavioral activation or graduated exposure), we focused on implicit, self-relevant beliefs thought to underlie internalizing symptoms. We used an SSI designed to teach *growth mindset* of personality, or the belief that personal traits are malleable – as opposed to *fixed mindset*, the belief that personality is unchangeable (Dweck, 2008). Compared to growth mindsets, fixed mindsets of personal traits correlate with and predict higher depression and anxiety in youths, particularly adolescents (Romero, Master, Paunesku, Dweck, & Gross, 2014; Schleider, Abel, & Weisz, 2015; Schleider & Weisz, 2016a). Indeed, personality mindsets are thought to represent 'keystone' beliefs for adolescents: beliefs that powerfully shape responses to the distinctive challenges that adolescents face (Paunesku et al., 2015). Adolescence is characterized by massive social transition, including unstable friendships and social standing (Bukowski & Newcomb, 1984; Chan & Poulin, 2007). By fostering the belief that personal traits are malleable – including shyness, sadness, and likeability – growth personality mindset interventions provide a framework for coping with the very stressors that grow so common and dysregulating during adolescence. Thus, a theoretically precise growth personality mindset intervention may, by addressing implicit beliefs underlying internalizing symptoms, be especially effective in ameliorating those symptoms.

Research supports this possibility. In community (i.e. psychologically healthy) adolescent samples, single-session growth personality mindset interventions have prevented self-reported increases in depressive symptoms (Miu & Yeager, 2015) and strengthened cognitive (i.e. reduced threat appraisals) and physiological (i.e. faster neuroendocrine and sympathetic nervous system recovery)

responses to laboratory-based social stressors (Yeager, Lee, & Jamieson, 2016). Further, as described in a previous report on our program's immediate effects (Schleider & Weisz, 2016b), high-risk youths receiving a single-session growth mindset intervention reported greater postintervention improvements in perceived behavioral and emotional control; they also recovered over three times as rapidly from a laboratory-based social stressor as youths receiving a comparison program, based on electrodermal activity recovery slopes. This study reports outcomes of that trial at 9 months – the study's primary endpoint – using parent- and youth-report data to examine change in internalizing symptoms across the follow-up period, as well as intervention effects on symptom reductions from baseline to 9-month follow-up. We hypothesized that the mindset SSI, compared to a comparison program, would predict larger and more rapid improvements in youth depressive and anxiety symptoms across the 9-month period.

In addition to examining intervention effects on internalizing symptoms (primary study outcomes), we also explored effects on two facets of adolescents' capacity for effective coping with setbacks (secondary study outcomes): perceived control over one's *behaviors* and *emotions* (henceforth perceived *primary* and *secondary* control) following setbacks. Youths who view their responses to adversities as within their control are more likely to use adaptive, problem-focused coping strategies following multiple types of stressors, whereas those viewing events as uncontrollable are more likely to ruminate and disengage (Cheng & Cheung, 2005; Roussi, Miller, & Shoda, 2000). We hypothesized that the mindset SSI, compared to a comparison program, would predict larger, more rapid improvements in youths' perceived primary and secondary control across the follow-up period. That is, we predicted learning that personal attributes are malleable would improve youths' perceived ability to *adapt their actions* to problem-solve setbacks, and to *adjust their feelings* to shape the personal psychological impact of uncontrollable situations.

Method
Recruitment and resulting sample

All procedures were approved by the university Institutional Review Board. Parents provided written informed consent (and youths, assent) before study participation. The study was registered retrospectively (after the submission of this manuscript) with *clinicaltrials.gov* (see Appendix S1 for details and Appendix S2 for the CONSORT checklist), although procedures were publicly available via the NIH RePORTER prior to study enrollment. Study hypotheses and methods are also detailed in the 'Specific Aims' and 'Research Strategy' sections of the original Ruth L. Kirschstein Predoctoral National Research Service Award proposal for this study, submitted to the National Institute of Mental Health in December 2014 and included here as Appendix S3.

A study testing a 'brief skill-building program' for youths who 'worry or feel sad more than other kids' was advertised at local schools, afterschool programs, and clinics. Interested parents contacted the research team to complete a phone screen. Youths were eligible if they were ages 12–15 and met any of three criteria, based on parental reports: (a) T-score of ≥60 (84th percentile) on any disorder subscale of the Revised Child Anxiety and Depression Scale-Parent (RCADS-P, Ebesutani, Bernstein, Nakamura, Chorpita, & Weisz, 2010)[1]; (b) school-based accommodations for anxiety- or depression-related symptoms (an Individualized Education Plan/IEP or 504 plan); (c) anxiety and/or depression treatment sought for the youth within the previous 3 years. Exclusion criteria were psychosis, intellectual disability, pervasive developmental/autism spectrum disorder, and suicidal ideation leading to hospitalization or attempts within the past year. Because the target population for this study included both high-risk youths and those with clinically elevated symptoms, inclusion criteria were intentionally broad. All study recruitment took place between August and December of 2015.

Of 187 families completing phone screens, 96 enrolled (Figure 1). No significant differences emerged in mean age or gender distribution between study-eligible youths (mean age = 13.33; 55.21% girls) and study-ineligible youths (mean age = 13.09; 51.94% girls). Retention rates at 3, 6, and 9 months were 88.54%, 80.21%, and 73.96%, with nonsignificant attrition differences by intervention group across time-points.[2]

Procedures

During the 2.5-hr laboratory session, youths and parents completed separate baseline questionnaires. Within the same session, youths then completed the intervention or control program, postintervention questionnaires, and a social stress induction (detailed in Schleider & Weisz, 2016b). Youths completed the computerized questionnaires and intervention independently, via the Qualtrics platform. A Qualtrics-embedded randomizer assigned participants to either intervention condition immediately after they completed the baseline questionnaires; thus, both participants and researchers were unaware of condition assignment. The researchers were made aware of condition assignment after each family's 9-month follow-up assessment was complete, at which point the mindset intervention was offered to youths who had not previously received it.
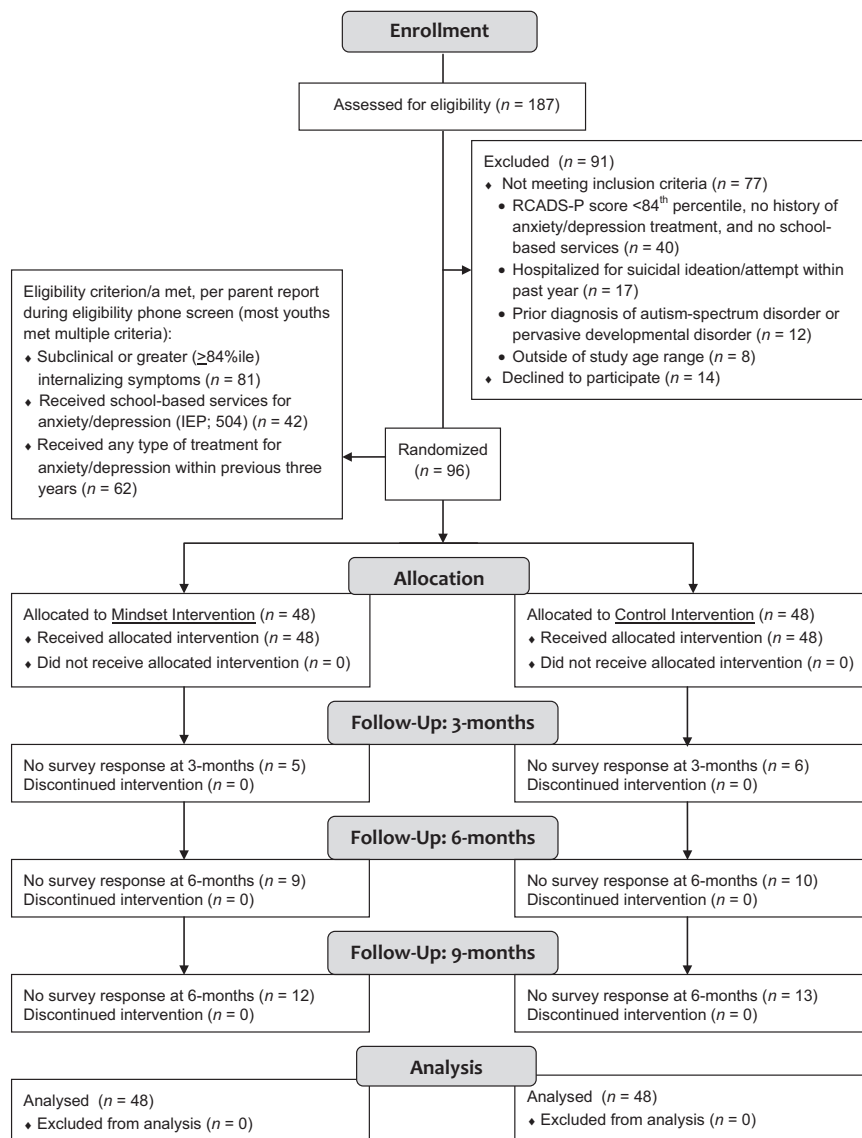

Figure 1 CONSORT diagram

Intervention

The 20-to-30-min intervention followed formats used in previous growth mindset interventions (e.g. Miu & Yeager, 2015) and is described elsewhere (Schleider & Weisz, 2016b). The self-administered, computer-based program's content was designed to maximize relevance for youths experiencing internalizing distress. The intervention included five elements:

1. An introduction to the concept of neuroplasticity (describing how and why behaviors are controlled by thoughts and feelings in their brains, which have constant potential for change);
2. Testimonials from older youths describing their beliefs that people can change, given the brain's inherent malleability;
3. Additional vignettes by older youths, describing times when they used 'growth mindsets' to persevere/cope following peer rejection, hopelessness, and feared embarrassment;
4. A worksheet describing strategies for applying these principles to participants' own lives;
5. An exercise wherein participants write notes to younger children, using newly gleaned information about the malleability of personal traits to help them to cope with setbacks ('self-persuasion'; Aronson, 1999).

Control intervention

The 20-to-30-min control program was a computer-based session of supportive therapy (ST), designed to encourage youths to identify and express feelings. The program was thought to be face valid for youths as an intervention designed to help them but without containing growth mindset content. ST has been shown to be less effective than cognitive-behavioral interventions in reducing youth internalizing distress (Stice, Burton, Bearman, & Rohde, 2007). Here, ST was designed to control for nonspecific intervention elements, including completing a computer-based program, and to encourage youths to share emotions with close others. Specific ST activities included:

1. A brief introduction to the functions of human emotions (e.g. alerting us to our needs, facilitating communication);
2. Testimonials from older youths describing times when they benefited from sharing their emotions with friends and family;
3. A worksheet describing challenges kids might face in sharing emotions with others (e.g. embarrassment);
4. An exercise asking youths to write about how they would feel after positive and negative hypothetical situations.

Self-report measures (see Appendix S1 for details on study measures' psychometric properties, as well as reliability coefficients for study measures at all time-points.)

Depressive symptoms

Depressive symptoms were assessed at baseline and all follow-ups (except immediate postintervention, as we did not expect decreases in youth internalizing symptoms within the 2.5 laboratory session) using the Children's Depression Inventory (CDI; Kovacs, 2001), a 27-item self-report questionnaire. Items are scored from 0 to 2; higher scores indicate greater symptom severity.

Anxiety symptoms

Anxiety symptoms were assessed at baseline and all follow-ups (except postintervention) using the Screen for Child Anxiety and Related Disorders-Child version (SCARED-C; Birmaher et al., 1999): a 41-item self-report measure. Youths rate (0–2)

the degree to which statements describing anxiety symptoms are true about them. Higher summed SCARED-C Total Scores indicate greater anxiety severity.

Perceived primary (behavioral) control

Perceived primary control was assessed at baseline, postintervention, and all follow-ups using the Perceived Control Scale for Children (PCSC; Weisz, Weiss, Wasserman, & Rintoul, 1987; Weisz, Southam-Gerow, & McCarty, 2001), a 24-item scale measuring perceived ability to exert *primary control* (to influence objective events or conditions through personal effort). Youths rated agreement with statements about their perceived primary control following social and academic challenges.

Perceived secondary (emotional) control

Perceived primary control was assessed at baseline, postintervention, and all follow-ups using the Secondary Control Scale for Children (SCSC; Weisz, Francis, & Bearman, 2010), a 20-item scale measuring perceived capacity for *secondary control* (to influence the personal psychological impact of objective conditions on oneself, by adjusting oneself to fit those conditions). Respondents rate agreement with items reflecting perceived secondary control of varied types, such as 'finding a silver lining' in distressing situations.

Personality mindsets

The Implicit Personality Theory Questionnaire assesses youths' beliefs about the malleability of personality (IPT-Q; Yeager, Miu, Powers, & Dweck, 2013). Here, changes in mindsets from baseline to postintervention served as a manipulation check for the SSI's capacity to strengthen growth personality mindsets. Using a 1–6 scale, participants rate their agreement with three statements addressing the malleability of personality (e.g. 'Your personality is something about you that you cannot change very much'). Higher total summed scores indicate stronger fixed mindsets, and lower scores, stronger growth mindsets.

Equivalence of experimental conditions

To assess the conditions' similarity on dimensions independent of experimental messages, youths rated (5-point scale) how much they understood the program, tried their hardest on activities, and found the program interesting.

Parent-report measures

Youth depressive symptoms. Parents rated youth depressive symptoms at baseline and all follow-ups (except postintervention) using the Children's Depression Inventory-Parent (CDI-P). CDI-Parent items parallel CDI-Child items, with pronouns changed accordingly.

Youth anxiety symptoms. Parents rated youth anxiety symptoms at baseline and all follow-ups (except postintervention) using the Screen for Child Anxiety and Related Disorders-Parent (SCARED-P). SCARED-Parent items match SCARED-Child items, with pronouns changed accordingly.

Follow-up surveys

In online surveys, youths and parents completed the questionnaires listed above at 3, 6, and 9 months postintervention. Participants who did not respond to online surveys were contacted to complete questionnaires by phone. Families who

completed follow-up surveys did so within 21 days of receiving them.

Power analyses

Target sample size was determined a priori using G*Power 3.1 to calculate the required sample to achieve sufficient power (1-β) to detect mean group differences of small (.2), medium (.5), and large effects (.8) using two-tailed tests with $\alpha = .05$. Sample sizes calculated were 1,492, 168, and 62, respectively. Although power to detect a small effect is ideal, logistical constraints necessitated a more conservative goal. Thus, the target sample of 96 – and the reduced samples resulting from attrition ($n = 85$, $n = 77$, and $n = 71$ at each follow-up) – reflected power to detect medium-to-large effects.

Missing data and attrition

There were no subject- or item-level missing data from baseline questionnaires. Figure 1 reports nonresponse rates at all follow-ups. There were no item-level missing data at any follow-up; all who began follow-up surveys completed them in full.

Likelihood of attrition by 9-month follow-up did not differ by condition, baseline youth anxiety/depression, youth gender/ age/race, family income, or parent education. However, attrition was more likely among youths in single-parent homes than those with partnered parents, $\chi^2(1, N = 96) = 2.02$, $p = .004$. Thus, present data are best characterized by the *missing at random* assumption (MAR; Little & Rubin, 1987), whereby incomplete data arise due to observed sample characteristics.[3] MAR data are considered ignorable when appropriate statistical techniques are employed to address potential missingness-related biases (Buhi, Goodson, & Neilands, 2008).

We employed Full Estimation Maximum Likelihood (FIML) to address missing data concerns. FIML is a direct model-based method for estimating parameters under the MAR assumption (Olinsky, Chen, & Harlow, 2003). FIML estimates parameters based on all available data, including cases with incomplete data, and implied missing data values. FIML produces unbiased results across wide-ranging parameter estimates, particularly with small samples ($N < 100$), yielding results similar to those for multiple imputation (Schlomer, Bauman, & Card, 2010).

Analytic plan

To assess intervention effects on youths' perceived control and self- and parent-reported anxiety and depressive symptoms, we ran six linear mixed models (SPSS Mixed) based on the intention-to-treat principle (i.e. including participants regardless of nonresponse at >1 follow-ups). Models were organized to account for their hierarchical structure, with the four assessment points nested within youths. They included a random slope, allowing for individual variation in outcome change rates; a random intercept, allowing for individual variation in baseline symptoms/perceived control; an autoregressive error structure; and FIML estimation. Time (repeated factor), intervention condition, and their interaction were included in all models. Covariates were youth age and gender as well as family structure (single vs. dual-parent home), which predicted attrition. Significant ($p < .05$) condition*time interactions in predicted directions indicated that the intervention condition, versus the control, produced more rapid improvements in outcomes across the study period. Additionally, we calculated effect sizes (ESs) using estimated marginal means; these ESs compared mean gain scores (Cohen's d) reflecting changes in each outcome from baseline to 9-month follow-up for youths receiving the mindset versus control intervention. Statistically significant, positive Cohen's d values indicated greater improvements for intervention group youths versus control group youths.

Results
Sample characteristics

Characteristics of the 96 adolescents and parents are shown in Table 1. Based on cut-off scores of 13 and 25 for the CDI and SCARED-C, respectively (Birmaher et al., 1999; Timbremont, Braet, & Dreessen, 2004), 14.58% of youths self-reported subclinical internalizing problems at baseline, while 85.42% reported clinically elevated symptoms of depression, overall anxiety, or a specific anxiety disorder (based on SCARED-C subscales). Thus, this sample was comparable to those in treatment studies (wherein a majority of youths' problem scores exceed standard cut-offs) and selective/indicated prevention studies (including youths at-risk for or experiencing subclinical problems, with most falling below standard cut-offs). No significant group differences emerged on demographic factors, baseline mindsets, or symptom levels (ps > .10), indicating successful randomization.

Correlations and Descriptive Statistics

Correlations between self- and parent-reported depression and anxiety (all time-points), perceived control (all

Table 1 Sample characteristics

Variable	Mindset intervention ($n = 48$)	Control intervention ($n = 48$)
Youth Age (M, SD)	13.39 (1.58)	13.26 (1.06)
Youth Gender (% female)	54.17%	56.25%
Youth Race/Ethnicity		
African-American	4.17%	6.25%
Asian-American	4.17%	6.25%
Caucasian	75.00%	70.83%
Mixed	8.33%	12.50%
Other	6.25%	4.17%
Hispanic	14.60%	12.50%
Annual income		
>$140,000	33.30%	32.60%
$120,000–140,000	12.50%	17.40%
$100,000–119,999	6.30%	10.90%
$80,000–99,999	8.30%	8.70%
$60,000–79,999	8.30%	6.50%
$40,000–59,999	8.30%	6.50%
$20,000–39,999	10.40%	10.90%
<$19,999	12.50%	6.50%
Single-parent	24.80%	28.80%
% on medication for anxiety/ depression (parent-report)	33.33%	34.80%
% received prior treatment for anxiety/ depression (parent-report)	58.33%	52.10%

time-points), and baseline personality mindsets are presented for the full sample in Table S1. Correlations were generally in expected directions.

Intervention acceptability and length

Participants completed the interventions in 25–30 min, on average. No condition differences emerged in youths' understanding of program content, $t(94) = .35$, $p = .72$, interest in material, $t(94) = -1.14$, $p = .14$, or effort on activities, $t(94) = .90$, $p = .37$.

Manipulation check

Youths receiving the mindset intervention reported greater increases in growth mindsets than control group youths, controlling for baseline mindsets: $F(1, 93) = 21.68$, $\triangle R^2 = .13$, $p < .001$.

Perceived control outcomes

The model predicting perceived primary control trajectories revealed nonsignificant overall effects of time and condition, but a significant time*condition interaction, indicating that youths in the intervention condition experienced more rapid improvements in perceived primary control across the study period than control group youths (Table 2). Further, youths receiving the intervention experienced significantly greater improvements in perceived primary control from baseline to 9-month follow-up ($d = .27$) versus control group youths (Table 3).

The model predicting intervention effects on perceived secondary control revealed nonsignificant overall effects of time, condition, and their interaction. Improvements in perceived secondary control from baseline to 9-month follow-ups did not differ by intervention condition, although the ES was in the small-to-medium range numerically ($d = .24$; Table 3).

Youth depression outcomes

The model predicting self-reported depressive symptoms revealed nonsignificant effects for time and condition but a significant time*condition interaction (Table 2), indicating that youths in the intervention condition, versus control group youths, reported more rapid declines in depressive symptoms across the follow-up period (Figure 2). Youths receiving the intervention also reported significantly greater declines in depressive symptoms from baseline to 9-month follow-up, compared to control group youths ($d = .32$; Table 3). The percentage of youths

Table 2 Results of mixed linear models predicting intervention effects on 9-month trajectories on all outcome measures, using FIML estimation

	Youth-reported youth anxiety			Youth-reported youth depression		
	B	SE	p	B	SE	P
Intercept	20.74	9.25	.03	1.72	4.64	.71
Age	0.87	1.24	.48	0.035	0.62	.06
Female (vs. male)	4.42	2.67	.10	2.05	1.34	.13
Dual-parent (vs. single-parent) home	−4.13	3.18	.20	−0.97	1.60	.54
Time	−0.13	0.70	.86	0.27	0.34	.43
Condition	1.64	3.63	.65	2.24	1.26	.21
Time*Condition	−1.37	0.97	.16	−1.02	0.47	.03

	Parent-reported youth anxiety			Parent-reported youth depression		
	B	SE	p	B	SE	P
Intercept	25.19	8.25	.003	9.06	3.89	.02
Age	0.13	1.10	.91	−0.46	0.63	.47
Female (vs. male)	−0.16	2.37	.95	0.11	1.35	.94
Dual-parent (vs. single-parent) home	−2.53	2.54	.32	−2.72	1.47	.07
Time	−1.63	0.49	.001	−0.21	0.35	.56
Condition	2.29	3.13	.47	4.52	2.02	.03
Time*Condition	−0.98	0.68	.15	−0.99	−2.02	.047

	Youth-reported perceived primary control			Youth-reported perceived secondary control		
	B	SE	p	B	SE	P
Intercept	19.32	5.51	.001	21.89	6.74	.002
Youth Age	1.28	0.84	.13	−0.33	1.02	.75
Female gender (vs. male gender)	−0.61	1.78	.73	−3.67	2.19	.10
Dual-parent home (vs. single-parent home)	1.22	2.19	.58	1.57	2.63	.55
Time	−0.30	0.44	.56	−0.53	0.61	.38
Condition	−1.47	2.52	.56	−1.10	2.86	.70
Time*Condition	1.24	0.61	.047	0.99	0.84	.25

Table 3 Estimated marginal means and standard errors of the mean (calculated from mixed linear effects models), and effect sizes comparing mean gain scores (Cohen's d) reflecting symptom reduction from baseline to 9-month follow-up change for youths receiving mindset versus control intervention

Outcome variable	Mindset group				Control group				Cohen's d, based on mean gain score [95% CI]
	M (SE) baseline	M (SE) 3 months	M (SE) 6 months	M (SE) 9 months	M (SE) baseline	M (SE) 3 months	M (SE) 6 months	M (SE) 9 months	Baseline to 9 months
Youth depression (youth-report)	12.35 (1.05)	11.54 (1.07)	10.85 (1.16)	10.19 (1.36)	11.76 (1.07)	11.66 (1.14)	12.74 (1.21)	12.47 (1.39)	**.32 [.02, .61]**
Youth depression (parent-report)	13.53 (1.05)	11.41 (0.97)	10.61 (0.94)	9.69 (0.87)	11.27 (0.96)	10.19 (0.95)	9.51 (0.94)	10.84 (1.01)	**.60 [.29, .91]**
Youth anxiety (youth-report)	28.13 (2.05)	24.43 (2.21)	24.25 (2.23)	23.12 (2.43)	30.54 (2.10)	30.47 (2.34)	29.76 (2.33)	30.44 (2.49)	.33 [-.11, .78]
Youth anxiety (parent-report)	25.56 (1.42)	22.31 (1.38)	16.65 (1.27)	18.07 (1.74)	25.24 (1.48)	21.65 (1.74)	18.23 (1.70)	20.99 (1.93)	**.28 [.14, .41]**
Youth perceived primary control	55.60 (1.43)	59.49 (1.42)	57.50 (1.59)	58.81 (1.64)	56.17 (1.46)	55.89 (1.58)	56.56 (1.69)	55.04 (1.65)	**.29 [.01, .58]**
Youth perceived secondary control	33.25 (1.72)	36.99 (1.71)	34.59 (1.79)	34.41 (2.05)	33.32 (1.75)	32.91 (1.83)	33.14 (1.86)	31.37 (2.09)	.24 [-.10, .60]

For symptom-related variables, lower scores indicate better functioning, and for perceived control variables, higher scores indicate better functioning; where applicable, Cohen's d values are corrected (multiplied by −1.0) such that positive values indicate greater improvements for the mindset intervention group as compared to the control intervention group. Significant gains are highlighted in bold.

reporting depressive symptoms above the CDI clinical cut-off decreased by 33.32% in the intervention group, versus 10.85% in the control group, by 9-month follow-up (Table S2).

Likewise, the model predicting parent-reported depression revealed nonsignificant effects for time and condition but a significant time*condition interaction: youths receiving the intervention experienced more rapid declines in parent-reported depressive symptoms than did control group youths across the study period (Figure 2). Further, youths receiving the intervention experienced significantly greater declines in depressive symptoms compared to control group youths, with an ES in the medium-to-large range from baseline to 9-month follow-up (d = .60; Table 3). The percentage of parents reporting depressive symptoms above the CDI-P clinical cut-off decreased by 55.63% in the intervention group, versus 9.66% in the control group, by 9-month follow-up (Table S2).

Youth anxiety outcomes

The model predicting self-reported youth anxiety symptoms revealed nonsignificant effects for time, condition, and their interaction. Anxiety reductions by 9-month follow-up did not differ by condition, although the ES was numerically small-to-medium, favoring the intervention (ds = .33). The percentage of youths reporting anxiety symptoms above the SCARED-C clinical cut-off decreased by 31.01% in the intervention group, versus 17.71% in the control group, by 9-month follow-up (Table S2).

The model predicting parent-reported youth anxiety symptoms revealed a nonsignificant effect for condition, a significant effect for time, and a nonsignificant time*condition interaction effect, indicating that parents reported significant declines in youth anxiety across the study period, regardless of condition. However, youths receiving the intervention experienced significantly greater declines in parent-reported anxiety from baseline to 9-month follow-up, versus control group youths (d = .28). Furthermore, the percentage of parents reporting anxiety symptoms above the SCARED-P clinical cut-off decreased by 71.04% in the intervention group, versus 42.86% in the control group, by 9-month follow-up (Table S2).[4]

Discussion

We tested whether a half-hour, self-administered SSI teaching growth personality mindsets reduced internalizing problems and improved perceived control in high-risk, high-symptom adolescents. Compared to control group youths, youths who received the intervention experienced significantly greater improvements in parent-reported depression (d = .60) and anxiety (d = .28), youth-reported depression (d = .32), and perceived primary control (d = .29) from baseline

to 9-month follow-up. Direct 9-month intervention effects were nonsignificant for youth-reported anxiety and perceived secondary control, although effect sizes were in the small-to-medium range numerically. Additionally, compared to control group youths, youths in the intervention group experienced more rapid improvements in parent- and self-reported depressive symptoms, as well as perceived primary control, across the follow-up period. Rates of change in anxiety symptoms and perceived secondary control did not differ by intervention condition.

The mindset intervention predicted small-to-medium improvements in parent- and youth-reported anxiety and depressive symptoms at 9-month follow-up. Absolute symptom changes were modest (representing group differences of 3–6 points/symptoms on study measures). Even so, these are the first findings

we know of suggesting that a 30-min, self-administered program may help reduce depression, and to a lesser degree, anxiety, in high-symptom and high-risk youths. Indeed, the intervention reduced rates of clinically elevated depression and anxiety at higher rates than did an active, clinically plausible comparison program, corroborating its clinical utility (Table S2). Findings are especially promising in comparison to previous SSIs for youth mental health problems: 9-month ESs ranged from $d = .28–.60$, effecting significant change across symptom- and coping-related outcomes. Effects of existing SSIs have generally diminished to nonsignificance after 12 weeks (to mean $g = .07$; Schleider & Weisz, 2017). Additionally, the mindset SSI significantly reduced youth depressive symptoms ($ds = .32, .60$ per youth- and parent-reports), outperforming existing youth-focused SSIs targeting depression, which have shown nonsignificant effects overall (mean = .21; Schleider & Weisz, 2017). The intervention's focus on 'keystone beliefs' of high developmental relevance to adolescents may help explain the relative strength and duration of effects.

Furthermore, the mindset SSI's computer-based format makes it highly cost-effective and scalable (e.g. it might be delivered to all new students entering a middle school, or to adolescent patients in pediatricians' offices before annual check-ups). Further, even intervention effects of small-to-medium magnitude can have lasting impact on long-term psychological health – particularly if administered at key developmental junctures (e.g. early adolescence; Glasgow, Lichtenstein, & Marcus, 2003). If effective in larger replication trials in school, community, or primary care settings, this intervention might carry potential for efficient clinical impact, magnifying public health benefit.

Many youths will nonetheless require clinical attention beyond SSIs. In these cases, perhaps this intervention might augment longer term treatments' effects. Teaching youths that personal change is possible, and boosting their perceived behavioral control over events and outcomes, may strengthen 'buy-in', motivation, and engagement in change-focused therapies like CBT. Implementing theoretically precise, brief programs early in treatment may be particularly useful in youth-focused community and outpatient mental healthcare, given high treatment dropout rates in these settings (DeBar, Clarke, O'Connor, & Nichols, 2001; Harpaz-Rotem et al., 2004). Larger trials of the present intervention, both as a stand-alone and adjunctive program, are needed to clarify its capacity to reduce youth internalizing distress.

Notably, the mindset SSI significantly reduced youths' perceived primary but not secondary control. This discrepancy might reflect the intervention's primary message: personal attributes are malleable if we systematically – and with appropriate supports – act to change them. Essentially, it reinforces beliefs
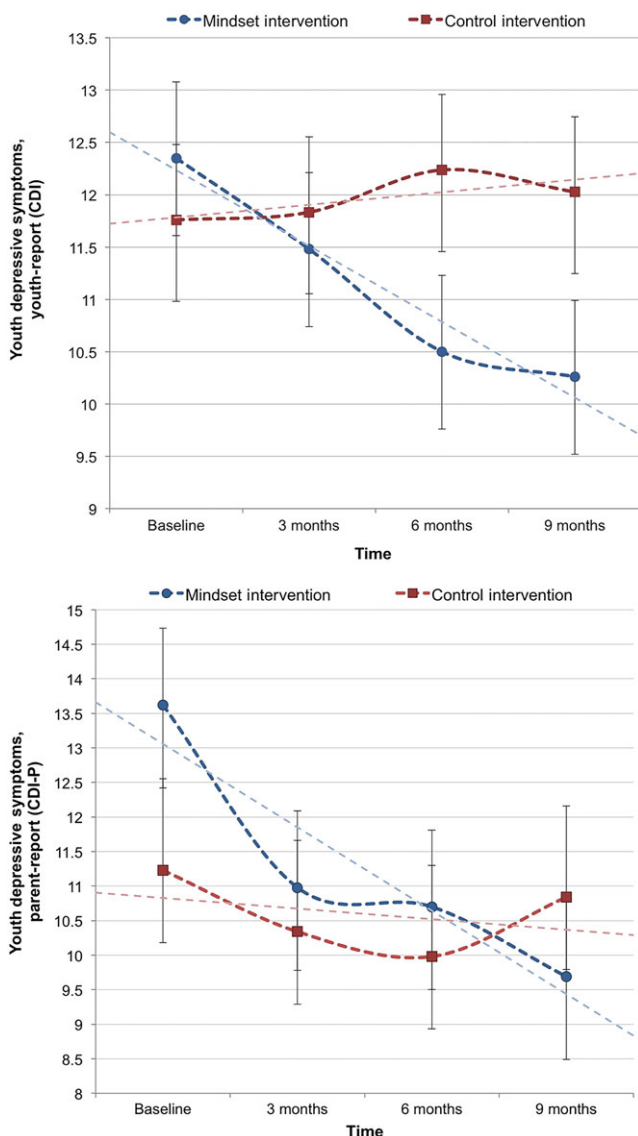

Figure 2 Mindset intervention effects on self-reported youth depressive symptoms (top) and parent-reported youth depressive symptoms (bottom). Fitted estimates based on mixed linear models, FIML estimation, ±1 *SE* [Colour figure can be viewed at wileyonlinelibrary.com]

in *behavioral* control over the kinds of people we are and can become. Thus, it follows that the intervention would shift primary, rather than secondary, perceived control in youths.

Additionally, 9-month intervention effects were somewhat inconsistent across informants. Parent-youth reporting discrepancies are common, especially in intervention outcomes for youth internalizing disorders (Weisz et al., 2017). Parents have tended to report greater post-treatment reductions in youth anxiety than children, and children, greater reductions in depression than parents (Weisz et al., 2017). Present discrepancies in anxiety outcomes fit with prior trends, whereas discrepancies in depression outcomes may have resulted partly from cross-informant differences in baseline symptoms. Baseline youth depression was nonsignificantly higher based on parent- versus youth-report, which may have created more room for improvement in parent-reported depression. Future trials may clarify whether these discrepancies reflect a consistent trend versus sample-specific symptom levels.

Study limitations suggest directions for future research. First, results suggest the efficacy but not effectiveness of the intervention's impact on youth internalizing distress. Trials with larger samples, and in real-world environments, will clarify the program's utility if completed at home, school, or community-based clinics. Second, eligibility screening relied on parental initiative and reports, potentially restricting our sample to youths whose parents recognized psychological symptoms and were motivated to seek supports for their child. Third, consistent with large-scale RCTs of youth anxiety and depression treatments (e.g. Treatment for Adolescents With Depression Study (TADS) Team et al., 2009; Piacentini et al., 2014), attrition at long-term follow-up exceeded 25%. Here, single-parent families were more likely to drop out, but unmeasured factors might have also affected attrition. Future research may help identify primary drivers of attrition in youth-focused intervention trials. Finally, this sample was relatively high-income and largely Caucasian, potentially limiting generalizability. However, mindset interventions have prevented increases in depression in ethnically diverse youths from both low- and high-income families (Miu & Yeager, 2015). The present intervention might show similarly generalized effects, but this needs to be investigated empirically.

Overall, results suggest that a self-administered SSI teaching growth personality mindsets may reduce longer term internalizing dysfunction in high-risk adolescents. Although symptom reductions were modest and additional trials are needed to ascertain their clinical impact, the intervention's positive effects on depressive and anxiety symptoms, significance of findings across parent- and youth-reported depression, and comparison to an active comparison condition support the robustness of observed effects. Additionally, the findings appear to be the first to suggest the possible longer term utility of growth mindset SSIs for youths experiencing and/or at high-risk for psychopathology. Future studies may examine the effectiveness of this and similar SSIs across diverse settings and samples and their potential to enhance the effectiveness of longer term interventions.

Supporting information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Clinical Trial Registration Information.

Appendix S2. CONSORT Checklist.

Appendix S3. Ruth L. Kirschstein Predoctoral National Research Service Award proposal.

Table S1. Zero-order correlations for primary study outcomes.

Table S2. Percentage of youths in the intervention and control conditions with youth- and parent-reported anxiety and depressive symptoms above clinical cut-offs at baseline and 9-month follow-up.

Acknowledgements

Correspondence

Jessica Schleider, Harvard University Graduate School of Arts and Sciences – Psychology, 33 Kirkland Street, #1032 Cambridge, MA, USA; Email: jschleider@fas.harvard.edu

---

Key points

- Single-session interventions (SSIs) for youth psychopathology have shown promise, but SSIs for depression have had limited success to date. Further, positive effects of existing SSIs have tended to diminish 3 months postintervention.

- A 30-min, computer-based intervention teaching growth mindset of personality (i.e. the belief that personal traits are malleable) reduced internalizing problems and increased perceived behavioral control in high-risk early adolescents across 9 months.
- Intervention effects were especially promising for youth depression: compared to control group youths, those receiving the mindset program experienced greater and more rapid reductions in parent- and self-reported depression across the 9-month follow-up period.
- Pending replication in larger trials, results suggest a potentially promising, scalable SSI for reducing internalizing problems – especially depression – in high-risk and high-symptom early adolescents.

Notes

1. The RCADS-P was used for screening purposes only in the present study. This measure is the only brief, publicly available parent-report questionnaire that generates symptom percentile scores for each DSM-IV anxiety disorder *and* depression (five items per disorder type). To assess the intervention's potentially distinct impacts on anxiety and depressive symptoms, we included more extensive, fine-grained parent- and youth-report questionnaires of both symptom types in the full study assessment battery.

2. Attrition rates in this study were well within the range of those generally observed in randomized trials of child mental health interventions – even when compared very large, multisite clinical trials. For example, in the Child/Adolescent Anxiety Multimodal Study [Piacentini et al. (2014)] the largest placebo-controlled RCT to date comparing cognitive-behavioral and pharmacological therapies for youth anxiety disorders, attrition was 22% at 6-month follow-up (vs. our 6-month attrition rate of 19.79%, and not far below our 9-month attrition rate of 26.04%). In the Treatment of Adolescents with Depression Study (TADS), the largest placebo-controlled RCT to date comparing cognitive-behavioral and pharmacological therapies for adolescent depression, dropout was 34% at 12-month follow-up [Treatment for Adolescents With Depression Study (TADS) Team et al. (2009)].

3. Living in a single-parent home versus a dual-parent home was not significantly associated with the study's primary outcomes (youth anxiety, youth depression, and perceived primary and secondary control) across follow-up points.

4. We also examined whether youths' adjunctive mental health services, which were unrestricted during the study period, were associated with intervention effects on youth anxiety or depression. Post hoc linear mixed effects models indicated that neither medication-based nor psychosocial adjunctive treatments predicted changes in youth anxiety or depression, over and above the effects of the intervention. Changes in adjunctive treatments during the follow-up period were also unassociated with intervention effects on anxiety or depressive symptoms. These analyses, as well as additional information on youths' adjunctive treatments during the study, are detailed in the Appendix S1.

References

Aronson, E. (1999). The power of self-persuasion. *American Psychologist*, *54*, 875–884.

Bernstein, A., Chorpita, B.F., Daleiden, E.L., Ebesutani, C.K., & Rosenblatt, A. (2015). Building an evidence-informed service array: Considering evidence-based programs as well as their practice elements. *Journal of Consulting and Clinical Psychology*, *83*, 1085–1096.

Birmaher, B., Brent, D., Chiappetta, L., Bridge, J., Monga, S., & Baugher, M. (1999). Psychometric properties of the Screen for Child Anxiety Related Emotional Disorders (SCARED): A replication study. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*, 1230–1236.

Buhi, E.R., Goodson, P., & Neilands, T.B. (2008). Out of sight, not out of mind: Strategies for handling missing data. *American Journal of Health Behavior*, *32*, 83–92.

Bukowski, W.M., & Newcomb, A.F. (1984). Stability and determinants of sociometric status and friendship choice: A longitudinal perspective. *Developmental Psychology*, *20*, 941–952.

Chan, A., & Poulin, F. (2007). Monthly changes in the composition of friendship networks in early adolescence. *Merrill-Palmer Quarterly*, *53*, 578–602.

Cheng, C., & Cheung, M.W.L. (2005). Cognitive processes underlying coping flexibility: Differentiation and integration. *Journal of Personality*, *73*, 859–886.

Costello, E.J., He, J.P., Sampson, N.A., Kessler, R.C., & Merikangas, K.R. (2014). Services for adolescents with psychiatric disorders: 12-month data from the National Comorbidity Survey-Adolescent. *Psychiatric Services*, *65*, 359–366.

Cummings, J.R., Wen, H., & Druss, B.G. (2013). Improving access to mental health services for youth in the United States. *JAMA*, *309*, 553–554.

Davis, T.E., Ollendick, T.H., & Öst, L.G. (2012). *Intensive one-session treatment of specific phobias*. New York: Springer.

DeBar, L.L., Clarke, G.N., O'Connor, E., & Nichols, G.A. (2001). Treated prevalence, incidence, and pharmacotherapy of child and adolescent mood disorders in an HMO. *Mental Health Services Research*, *3*, 73–89.

Dweck, C.S. (2008). Can personality be changed? The role of beliefs in personality and change. *Current Directions in Psychological Science*, *17*, 391–394.

Ebesutani, C., Bernstein, A., Nakamura, B.J., Chorpita, B.F., & Weisz, J.R. (2010). A Psychometric Analysis of the Revised Child Anxiety and Depression Scale-Parent Version in a Clinical Sample. *Journal of Abnormal Child Psychology*, *38*, 249–260.

Glasgow, R.E., Lichtenstein, E., & Marcus, A.C. (2003). Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *American Journal of Public Health*, *93*, 1261–1267.

Harpaz-Rotem, I., Leslie, D., & Rosenheck, R.A. (2004). Treatment retention among children entering a new episode of mental health care. *Psychiatric Services*, *55*, 1022–1028.

Kovacs, M. (2001). *Children's depression inventory manual*. North Tonawanda, NY: Multi Health Systems.

Little, R.J., & Rubin, D.B. (1987). The analysis of social science data with missing values. *Sociological Methods and Research, 18*, 292–326.

Mejia, A., Calam, R., & Sanders, M.R. (2015). A pilot randomized controlled trial of a brief parenting intervention in low-resource settings in Panama. *Prevention Science, 16*, 707–717.

Miu, A., & Yeager, D.S. (2015). Preventing symptoms of depression by teaching adolescents that people can change: Nine-month effects of a brief incremental theory of personality intervention. *Clinical Psychological Science, 3*, 726–743.

Olinsky, A., Chen, S., & Harlow, L. (2003). The comparative efficacy of imputation methods for missing data in structural equation modeling. *European Journal of Operational Research, 151*, 53–79.

Paunesku, D., Walton, G.M., Romero, C., Smith, E.N., Yeager, D.S., & Dweck, C.S. (2015). Mind-set interventions are a scalable treatment for academic underachievement. *Psychological Science, 26*, 784–793.

Perkins, R. (2006). The effectiveness of one session of therapy using a single-session therapy approach for children and adolescents with mental health problems. *Psychology and Psychotherapy: Theory, Research and Practice, 79*, 215–227.

Piacentini, J., Bennett, S., Compton, S.N., Kendall, P.C., Birmaher, B., Albano, A.M., ... & Walkup, J. (2014). 24- and 36-week outcomes for the Child/Adolescent Anxiety Multimodal Study (CAMS). *Journal of the American Academy of Child and Adolescent Psychiatry, 53*, 297–310.

Romero, C., Master, A., Paunesku, D., Dweck, C.S., & Gross, J.J. (2014). Academic and emotional functioning in middle school: The role of implicit theories. *Emotion, 14*, 227–234.

Roussi, P., Miller, S.M., & Shoda, Y. (2000). Discriminative facility in the face of threat: Relationship to psychological distress. *Psychology and Health, 15*, 21–33.

Schleider, J.L., Abel, M.R., & Weisz, J.R. (2015). Implicit theories and mental health problems in youths: A random-effects meta-analysis. *Clinical Psychology Review, 35*, 1–9.

Schleider, J.L., & Weisz, J.R. (2016a). Implicit theories relate to youth psychopathology, but how? A longitudinal test of two predictive models. *Child Psychiatry and Human Development, 47*, 603–617.

Schleider, J.L., & Weisz, J.R. (2016b). Reducing risk for internalizing problems in adolescents: Effects of a single-session intervention teaching that personality can change. *Behaviour Research and Therapy, 87*, 170–181.

Schleider, J.L., & Weisz, J.R. (2017). Little treatments, promising effects? Meta-analysis of single-session interventions for youth psychiatric problems. *Journal of the American Academy of Child and Adolescent Psychiatry, 56*, 107–115.

Schlomer, G.L., Bauman, S., & Card, N.A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology, 57*, 1–10.

Stice, E., Burton, W., Bearman, S., & Rohde, P. (2007). Randomized trial of a brief depression prevention program: An elusive search for a psychosocial placebo control condition. *Behaviour Research and Therapy, 45*, 863–876.

Timbremont, B., Braet, C., & Dreessen, L. (2004). Assessing depression in youth: Relation between the Children's Depression Inventory and a structured interview. *Journal of Clinical Child and Adolescent Psychology, 33*, 149–157.

Treatment for Adolescents with Depression Study (TADS) Team, March, J., Silva, S., Curry, J., Wells, K., Fairbank, J., ... & Bartoi, M. (2009). The Treatment for Adolescents with Depression Study (TADS): Outcomes over 1 year of naturalistic follow-up. *American Journal of Psychiatry, 166*, 1141–1149.

Weisz, J.R., Francis, S.E., & Bearman, S.K. (2010). Assessing secondary control and its association with youth depression symptoms. *Journal of Abnormal Child Psychology, 38*, 883–893.

Weisz, J.R., Kuppens, S., Ng, M.Y., Eckshtain, D., Ugueto, A.M., Vaughn-Coaxum, R., ... & Forwood, S.R. (2017). What five decades of research tells us about the effects of youth psychological therapy: A multilevel meta-analysis and implications for science and practice. *American Psychologist, 72*, 79–117.

Weisz, J.R., Southam-Gerow, M.A., & McCarty, C.A. (2001). Control-related beliefs and depressive symptoms in clinic-referred children and adolescents: Developmental differences and model specificity. *Journal of Abnormal Psychology, 110*, 97–109.

Weisz, J.R., Weiss, B., Wasserman, A.A., & Rintoul, B. (1987). Control-related beliefs and depression among clinic-referred children and adolescents. *Journal of Abnormal Psychology, 96*, 58–63.

Yeager, D.S., Lee, H.Y., & Jamieson, J.P. (2016). How to improve adolescent stress responses: Insights from integrating implicit theories of personality and biopsychosocial models. *Psychological Science, 27*, 1078–1091.

Yeager, D.S., Miu, A.S., Powers, J., & Dweck, C.S. (2013). Implicit theories of personality and attributions of hostile intent: A meta-analysis, an experiment, and a longitudinal intervention. *Child Development, 84*, 1651–1657.