Effectiveness of a school-based mindfulness program for transdiagnostic prevention in young adolescents

Catherine Johnson [a, *], Christine Burke [b], Sally Brinkman [c, d], Tracey Wade [a]

[a] School of Psychology, Flinders University, Bedford Park, South Australia, Australia
[b] Institute of Positive Psychology and Education, Australian Catholic University, Strathfield, New South Wales, Australia
[c] Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia
[d] School of Population Health, University of Adelaide, Adelaide, South Australia, Australia

ABSTRACT

Anxiety, depression and eating disorders show peak emergence during adolescence and share common risk factors. School-based prevention programs provide a unique opportunity to access a broad spectrum of the population during a key developmental window, but to date, no program targets all three conditions concurrently. Mindfulness has shown promising early results across each of these psychopathologies in a small number of controlled trials in schools, and therefore this study investigated its use in a randomised controlled design targeting anxiety, depression and eating disorder risk factors together for the first time. Students (*M* age 13.63; *SD* = .43) from a broad band of socioeconomic demographics received the eight lesson, once weekly.b ("Dot be") mindfulness in schools curriculum (*N* = 132) or normal lessons (*N* = 176). Anxiety, depression, weight/shape concerns and wellbeing were the primary outcome factors. Although acceptability measures were high, no significant improvements were found on any outcome at post-intervention or 3-month follow-up. Adjusted mean differences between groups at post-intervention were .03 (95% CI: −.06 to −.11) for depression, .01 (−.07 to −.09) for anxiety, .02 (−.05 to −.08) for weight/shape concerns, and .06 (−.08 to −.21) for wellbeing. Anxiety was higher in the mindfulness than the control group at follow-up for males, and those of both genders with low baseline levels of weight/shape concerns or depression. Factors that may be important to address for effective dissemination of mindfulness-based interventions in schools are discussed. Further research is required to identify active ingredients and optimal dose in mindfulness-based interventions in school settings.

© 2016 Elsevier Ltd. All rights reserved.

Anxiety and depression typically emerge in mid-late adolescence (Neil & Christensen, 2009; Teesson et al., 2014; Zisook et al., 2007) and although eating disorders can emerge earlier, a peak also occurs at this time (Doyle, Smyth, & Grange, 2012) with high levels of comorbidity (Pearlstein, 2002). Twelve month prevalence rates for anxiety and depression in young Australians are 15% and 6% respectively (Australian Bureau of Statistics, 2007). These conditions tend to become chronic and episodic, spreading to impact academic achievement, employment, social relationships and physical health (Neil & Christensen, 2009). Eating disorders in Australia, affecting approximately ten percent of adolescents (Fairweather-Schmidt & Wade, 2014), are severe, chronic conditions that are usually associated with other serious physical and psychological pathologies, and result in lowered quality of life (Agras, 2001). However, even subclinical disordered eating, affecting over 20% of young women in one Australian study, is associated with significant reductions in quality of life (Wade, Wilksch, & Lee, 2012). Evidence is accumulating for transdiagnostic risk factors across these three disorders, including difficulties in emotional regulation (Aldao, Nolen-Hoeksema, & Schweizer, 2010), rumination (McEvoy, Watson, Watkins, & Nathan, 2013; Nolen-Hoeksema & Watkins, 2011) and maladaptive perfectionism (Egan, Wade, & Shafran, 2011) with its key element of harsh self-criticism (Dunkley, Zuroff, & Blankstein, 2003). Hence a combined intervention approach might be possible.

School-based prevention programs offer a means of targeting a broad portion of the population at or before peak emergence of these conditions (Calear & Christensen, 2010; Nehmy, 2010). A strong case exists for "universal" programs which are offered to all

* Corresponding author. School of Psychology, Flinders University, GPO Box 2100, Adelaide, South Australia, 5001, Australia.
E-mail address: catherine.johnson@flinders.edu.au (C. Johnson).

students, thus avoiding the disadvantages of programs that select out at-risk individuals e.g., lack of failsafe screening, potential stigmatisation and the loss of opportunity for immunising all youth (Nehmy, 2010). To date, no prevention program successfully targets anxiety, depression and eating disorders simultaneously, which would be an advantage in terms of cost effectiveness and reducing demands on school curricula.

Mindfulness presents as one promising strategy, defined as "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgementally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p. 145). Kabat-Zinn brought ideas stemming from Buddhist origins into a scientific and secular context with his eight week program for adults (Mindfulness Based Stress Reduction, MBSR; Kabat-Zinn, 1990). Segal, Williams, and Teasdale (2002) built on this framework, incorporating cognitive behaviour therapy (CBT) elements to develop Mindfulness Based Cognitive Therapy (MBCT) for people with recurrent depression (McCown, Reibel, & Micozzi, 2010). Mindfulness addresses the transdiagnostic risk factors of interest by fostering the capacity to notice and allow strong unpleasant emotions (e.g., Arch & Craske, 2006; Leahey, Crowther, & Irwin, 2008), to step back from thoughts and recognise them as transient mental events that may not be factual (e.g., Bieling et al., 2012; Teasdale et al., 2002) and to cultivate a friendly, compassionate and non-judgemental stance towards oneself (e.g., Kuyken et al., 2010; Shapiro, Brown, & Biegel, 2007).

Over thirty years of research on mindfulness-based interventions (MBSR and MBCT) in adults shows robust support for treatment of anxiety and depression (especially of a recurrent nature) with moderate effect sizes (Baer, 2003; Grossman, Niemann, Schmidt, & Walach, 2004; Khoury et al., 2013). More recently, benefits are emerging for eating disorders, particularly binge and emotional eating (Katterman, Kleinman, Hood, Nackers, & Corsica, 2014). However the current state of research in youth is a much newer field overrepresented at this nascent stage by uncontrolled trials (Britton et al., 2014; Burke, 2010; Felver, Celis-de Hoyos, Tezanos, & Singh, 2015; Meiklejohn et al., 2012; Tan, 2015; Waters, Barsky, Ridd, & Allen, 2014; Zack, Saekow, Kelly, & Radke, 2014).

It has been suggested that adolescents may receive particular benefit from school based mindfulness programs given the confluence between adequate cognitive development and the increase in academic and social stressors (Broderick & Metz, 2009; Kuyken et al., 2013). To date there have been eight controlled studies of mindfulness interventions derived from MBCT or MBSR in secondary schools. Improvements have been reported across a range of outcomes including negative affect (Bluth et al., 2015; Broderick & Metz, 2009; Kuyken et al., 2013; Raes, Griffith, Van der Gucht, & Williams, 2014; Sibinga et al., 2013), stress (Kuyken et al., 2013; Metz et al., 2013), optimism/wellbeing (Kuyken et al., 2013), rumination (Sibinga et al., 2013), emotional regulation, calmness and somatization (Broderick & Metz, 2009; Metz et al., 2013), and eating disorder risk factors/symptoms (Atkinson & Wade, 2015).

Four of these eight studies are of note, three being randomised controlled trials (Atkinson & Wade, 2015; Raes et al., 2014; Sibinga et al., 2013) and three including follow-up (3 months, Kuyken et al., 2013; and 6 months, Raes et al., 2014; Atkinson & Wade, 2015). Two of these studies found significant improvements for depression, both showing between-group effect sizes of $d = .3$ at post-intervention and follow-up (Kuyken et al., 2013; Raes et al., 2014) and with both a treatment and prevention effect demonstrated by Raes and colleagues. A broadening of results at follow-up to include reduced stress ($d = .25$) and increased wellbeing ($d = .3$) was also shown by Kuyken et al., (2013) suggesting mindfulness skills may strengthen over time, in contrast to the gradually decreasing long term effects of many school prevention programs (Stockings et al., 2015; Weare & Nind, 2011). Although no improvements in negative affect were found in either of the following studies, Sibinga et al. (2013) showed reduced anxiety and rumination compared to controls at the end of the intervention, with medium between-group effect sizes ($d = .64$ and .79 respectively), and Atkinson and Wade (2015) demonstrated improvements in a broad range of eating disorder variables, with medium between-group effect sizes ranging from .47 to .67 at 6-month follow-up. The limitations of these studies include the lack of randomisation (Kuyken et al., 2013), small sample size and large attrition rates (Sibinga et al., 2013), use of an eating disorder specific programme (Atkinson & Wade, 2015), and limited outcome variables (Raes et al., 2014). However, findings across these four studies suggest that mindfulness programs are worthy of replication and continued exploration under more rigorous experimental conditions.

Mindfulness-based interventions (MBSR and MBCT) traditionally place an emphasis on the importance of daily home practice to maximise benefits, although empirical support for this is conflicting. Some researchers have demonstrated a positive association between formal practice and outcome in adults (e.g., Crane et al., 2014; Perich, Manicavasagar, Mitchell, & Ball, 2013) and youth (Huppert & Johnson, 2010; Kuyken et al., 2013) but other adult studies have shown no benefit without a trauma background (Williams et al., 2014) and no relationship between informal practice and outcomes (Crane et al., 2014). Given the conscript audience in school-based mindfulness interventions, and the competing demands for homework time across subjects, the benefits of home practice are particularly important to investigate further in youth.

Therefore the first aim of our study was to assess whether the promising effects of mindfulness-based interventions in schools could be replicated in a randomised controlled trial independent of program developers in an Australian context. The second related aim was to investigate a broad range of primary outcome measures, including anxiety, depression, wellbeing, and a risk factor for eating disorders (weight and shape concerns), in order to assess the potential of this intervention as a transdiagnostic prevention program. Secondary measures were two transdiagnostic risk factors that have shown a relationship to mindfulness in non-experimental research in adolescents: emotional dysregulation (Ciarrochi, Kashdan, Leeson, Heaven, & Jordan, 2011; Kerrigan et al., 2011) and self-compassion (a potential antidote to self-critical perfectionism; Bluth & Blanton, 2014). Changes in the mindfulness construct were investigated as well, as recommended by Tan (2015). The third aim was to assess whether any benefits were moderated by increased adherence to home practice. We predicted that all of our outcome measures would show improvement in the mindfulness group compared to the control group at post-intervention and follow-up. It was also predicted that, compared to the control group, the mindfulness intervention would be more effective in improving the primary outcome variables in those with high levels of home mindfulness practice.

1. Method

1.1. Participants

A range of urban coeducational secondary schools in Adelaide, South Australia who were either known to the researchers, had expressed interest in being involved in research or were conveniently located were contacted by email with telephone follow up, and four schools (one private, three public) agreed to participate. One public primary school also expressed interest in taking part and was included in the study. Students in Year 7 (primary school)

and 8 (secondary school) were targeted as representing a crucial developmental point where abstract reasoning capacity has developed sufficiently, but before the escalating pressures of mid-late adolescence, a key time for emergence of common mental health disorders (Calkins, 2010; Zisook et al., 2007).

Power analysis showed that to detect a Cohen's *d* effect size of .3, typical for a universal school-based study (Kuyken et al., 2013; Raes et al., 2014), with a power level of .80, 228 participants were required; 115 in each group (Hedeker, Gibbons, & Waternaux, 1999).

1.2. Design

A cluster (class) based randomised controlled design was used, where classes were randomised to one of two groups, mindfulness or control. Although clustering at school level would have prevented contamination, clustering at the class level within schools allowed for optimal matching across the broadest range of demographic variables. The threat of contamination within schools was considered low due to the class based training and student practice activities being conducted at home. Outcome measures were taken on three occasions, one week pre- and post-intervention, as well as 11 weeks later at the end of the school year. This represents a 3 (time) by 2 (group) repeated measures design.

1.3. Procedure

Research approval was granted by each School Principal, the South Australian Department for Education and Child Development, and the Social and Behavioural Research Ethics Committee of Flinders University, South Australia. Active (opt-in) consent was sought from both students and their parents or guardians for use of questionnaire data only, as the Mindfulness Program was considered standard socio-emotional learning curriculum.

Classes nominated by each school were randomly allocated to either the control or mindfulness groups using the randomisation function available in Excel 2010. This was performed by the principal investigator prior to any contact with participating teachers, and following an a priori rule such that the higher random numbers were assigned to mindfulness classes within each school. Participants filled out questionnaires either online using Qualtrics Survey software, or on paper. Testing was performed in a classroom setting with students requested to observe test conditions (i.e., work individually and silently), with the principal investigator and teacher present to answer any questions. It was not possible for students or the researcher to be blind to the allocated treatment group.

1.4. Intervention

The mindfulness-based intervention chosen was the .b ("Dot be") Mindfulness in Schools curriculum which is based on the adult programs MBCT/MBSR but modified for adolescents in line with principles identified from reviews of effective school-based mental health and wellbeing programs (e.g., explicit teaching of skills and attitudes, shorter practices, interactive and experiential teaching methods, and age appropriate resources such as course manual and guided practices for home; Kuyken et al., 2013). Use of this tightly manualised curriculum enables us to make direct comparison with a non-randomised, controlled UK trial showing promising results in secondary schools (Kuyken et al., 2013) and training is available internationally including Australia. The program consists of nine weekly lessons (for detailed lesson structure see http://mindfulnessinschools.org/what-is-b/nine-lessons/), the length of

which can be modified to suit a school's normal lesson length. This varied from 35 to 60 min in the schools in our study. In order to fit the length of the school term and to allow follow-up a term later, the program was reduced to 8 lessons, with the introductory lesson shortened for inclusion in the first session.

Throughout the course, a range of mindfulness practices were taught: short unguided practices (breath counting, .b: stop and be present, mindfulness of routine daily activities including walking, and watching thought traffic) and two 9-min guided audio files ("FOFBOC: Feet on floor and bum on chair", a seated body scan and breath awareness; and "Beditation", a lying down body scan and relaxation practice). Guided by a homework manual, students were encouraged to practice these at home in a structured way outside of formal lessons. The control group undertook normal curricular lessons, which were mostly pastoral care or community projects. All mindfulness lessons were conducted by the first author (CJ), a mindfulness practitioner with ten years of personal practice, who in addition to .b curriculum certification had undergone adult facilitator training. Before this study commenced, she had also run a small pilot community youth group with the .b programme to establish familiarity with the curriculum.

1.5. Primary outcome measures

1.5.1. Anxiety and depression

Negative affect was measured using the Depression Anxiety Stress Scale – Short form (DASS-21; Lovibond & Lovibond, 1995). Sound psychometric properties have been demonstrated in adults (Brown, Chorpita, Korotitsch, & Barlow, 1997; Henry & Crawford, 2005; Szabo, 2010; Tully, Zajac, & Venning, 2009) and the anxiety and depression factors show good fit in non-clinical adolescents (Szabo, 2010; Tully et al., 2009; Willemsen, Markey, Declercq, & Vanheule, 2011), thus these two seven-item subscales were used in the current study. Each item is scored on a four point scale from 0"never" to 3"almost always", with higher scores reflecting higher depression or anxiety over the past week. Examples of items include "I couldn't seem to experience any positive feeling at all" and "I was worried about situations in which I might panic and make a fool of myself". Cronbach's alpha in this study for depression was .91 and for anxiety was .78.

1.5.2. Weight and shape concerns

The weight and shape subscales form two of the four subscales assessed by the Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994), and are considered to best represent the broad construct of weight concerns that has been found to be one of the strongest risk factors for disordered eating in adolescents (Jacobi & Fittig, 2010; Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004). This questionnaire correlates well with the interview format, which itself has excellent psychometric properties (Berg, Peterson, Frazier, & Crow, 2012; Luce & Crowther, 1999; Mond, Hay, Rodgers, Owen, & Beaumont, 2004). These 12 items use a 7-point rating scale ranging from 0"not at all" to 6"markedly", but in order to simplify for this age group, a 4-point scale was used with the same anchors. Questions relate to the last 28 days and include "How dissatisfied have you felt about your weight?" and "Has your shape influenced how you think about yourself as a person?" Higher scores indicate greater concerns. Internal consistency of the combined score in this study was $\alpha = .96$.

1.5.3. Wellbeing

This construct was measured using the Warwick–Edinburgh Mental Wellbeing Scale (WEMWBS). This 14 item scale has been validated in both university student and community adult populations (Tennant et al., 2007). The WEMWBS was also used by

Kuyken et al. (2013) in their secondary school sample. This 14 item scale surveys the last two weeks, using items such as *"I've been feeling optimistic about the future"* and *"I've been feeling close to other people"*. Items are rated on a five point scale from 1 *"none of the time"* to 5 "*all of the time*", with higher scores signifying higher wellbeing. Internal consistency in the current study was $\alpha = .92$.

1.6. Secondary outcome measures

1.6.1. Mindfulness

The Child and Adolescent Mindfulness Measure (CAMM) was used in this study, and this scale has been validated in 10–17 year olds (Greco, Baer, & Smith, 2011). The CAMM is a 10 item scale, rated from 0 *(never true)* to 4 *(always true)*. Items include statements such as "I keep myself busy so I don't notice my thoughts or feelings", and "At school, I walk from class to class without noticing what I'm doing". All items are reversed to score the questionnaire, with higher scores reflect greater mindfulness. Internal reliability for the current study was $\alpha = .85$.

1.6.2. Emotional dysregulation

This was measured using the Difficulties in Emotional Regulation Scale (DERS; Gratz & Roemer, 2004) which has shown sound psychometric properties in a large community sample of adolescents for the subscales and the overall score (Weinberg & Klonsky, 2009), with the latter being used in the current study. The 36 DERS items are rated from 1 *"almost never"* to 5 *"almost always"* and include items such as *"When I am upset, I feel out of control"* and *"I have difficulty making sense out of my feelings"*. Higher scores indicate greater difficulty in regulating emotions. Cronbach's alpha for the current study was $\alpha = .92$.

1.6.3. Self-compassion

The Self-compassion scale (SCS) is a widely used 26 item questionnaire with sound psychometric properties (Neff, 2003). Six subscales or an overall score can be derived, the latter of which will be used in this study. The SCS has also been used in two adolescent samples with good internal consistency (Bluth & Blanton, 2014; Neff & McGeehee, 2010) which was supported in the current study, $\alpha = .91$. The SCS uses 5-point Likert scales spanning 1 *(almost never)* to 5 *(almost always)* with higher scores indicating greater self-compassion. Items include *"When things are going badly for me, I see the difficulties as part of life that everyone goes through"* and *"When I'm going through a very hard time, I give myself the caring and tenderness I need"*.

1.7. Homework practice

At the two post intervention time points, additional questions were added to the questionnaire package, surveying amount of home practice. At T2 (one week post completion) students were asked *"During the 8 week course, how often did you practice each of the following techniques outside of the lessons?* Students were supplied with a list of techniques learnt during the mindfulness course and asked to rate each on a five point scale as follows: 1 *"never"*, 2 *"once or twice in total"*, 3 *"greater than twice in total but less than once a week"*, 4 *"once or twice each week"* to 5 *"three times or more each week"*. At T3 (end of school year, 11 weeks later) the question was reworded *"Since the mindfulness course at school, how often have you used the following mindfulness techniques?"*

1.8. Course acceptability measures

1.8.1. Student feedback

Participants in the mindfulness intervention group undertook a survey in the last lesson of the course based on a similar measure used by Kuyken et al. (2013). Students were asked to rate the following four questions on a 0–10 point Likert scale with higher scores indicating greater satisfaction/likelihood: *"How would you rate the course in terms of being enjoyable and interesting?", "How much do you think you have learnt during the course?", "In the future, how likely are you to use any of the techniques you have learnt?"* and *"How would you rate the instructor?"*.

1.8.2. Teacher feedback

Teachers in the mindfulness intervention classes as well as school counsellors who attended any lessons also undertook a survey in the last lesson of the course. Staff were asked to rate the same four questions relating to their own experience of the course. In addition, staff were asked *"In your opinion, do you think the course would be more effective if run by the regular class teacher (with some supported mindfulness training) or by an experienced mindfulness trainer (not necessarily a school teacher) coming into the school? Why?"*.

1.8.3. Post hoc qualitative interview

Given the very poor consent rate (25%) for the lowest socio-economic school rendering statistical analysis of this subgroup impossible, and marked difficulties with classroom behaviour in this setting during intervention delivery, a further face to face debriefing meeting was conducted with the school counsellor and classroom teacher following the course. Questions raised by the researcher included whether the content and structure of the .b curriculum lessons were appropriate for these students with high rates of trauma backgrounds, challenging home environments and/or behaviour issues; and how the course might be modified to maximise input for engaged students but still expose disruptive students to the ideas (e.g., smaller groups, different setting to usual classroom, shorter and more frequent lessons).

1.9. Statistical analysis

All analyses were performed using IBM Statistical Package for the Social Sciences, Version 22 (IBM SPSS). One-way ANOVA tests were conducted to examine potential baseline differences between groups completing one, two or three waves of data. Data were not adjusted for the effect of clustering, given that each school contained mindfulness and control groups, and the same instructor delivered all mindfulness classes. Primary and secondary outcome analyses were conducted using Linear Mixed Modelling (LMM), enabling inclusion of cases with missing data via maximum likelihood estimation, with baseline measures entered as covariates. The amount of home practice was investigated as a moderator of outcome at T2 (amount of home practice during the course) and T3 (amount of home practice since the course) for the mindfulness group, using hierarchical multiple regression and controlling for baseline at Step 1, with the overall mean frequency of homework practices during the relevant period entered in Step 2.

2. Results

2.1. Description of participants

Fig. 1 shows the flow of participants through the study. Ten parents (2.4% of eligible students) actively requested that their child not be involved in the study, and of these, the four students in the mindfulness group undertook private study outside of the classroom during these lessons while the six students in the control group did not take part in survey analysis. Consent forms were not returned for a further 97 students (23.4% of eligible students), and
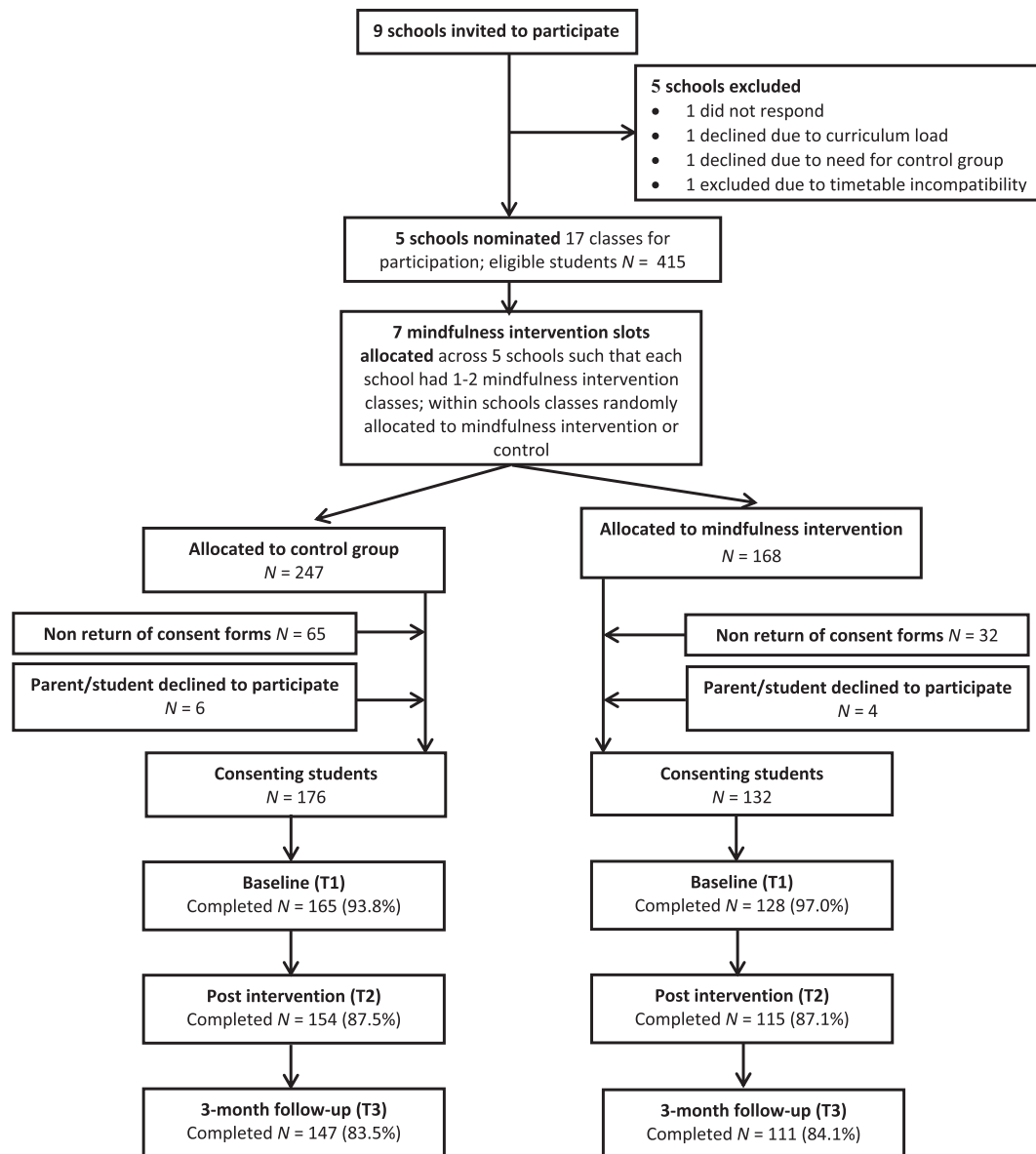
```
                    ┌─────────────────────────────┐
                    │  9 schools invited to participate │
                    └─────────────────────────────┘
                                 │
                                 │              ┌──────────────────────────────────────┐
                                 │              │  5 schools excluded                    │
                                 ├─────────────▶│  • 1 did not respond                   │
                                 │              │  • 1 declined due to curriculum load   │
                                 │              │  • 1 declined due to need for control group │
                                 │              │  • 1 excluded due to timetable incompatibility │
                                 │              └──────────────────────────────────────┘
                                 ▼
                    ┌─────────────────────────────┐
                    │  5 schools nominated 17 classes for │
                    │  participation; eligible students N = 415 │
                    └─────────────────────────────┘
                                 ▼
                    ┌─────────────────────────────┐
                    │  7 mindfulness intervention slots │
                    │  allocated across 5 schools such that each │
                    │  school had 1-2 mindfulness intervention │
                    │  classes; within schools classes randomly │
                    │  allocated to mindfulness intervention or │
                    │  control │
                    └─────────────────────────────┘
```

Fig. 1. Flow of participants through study.

Allocated to control group N = 247

Non return of consent forms N = 65

Parent/student declined to participate N = 6

Consenting students N = 176

Baseline (T1) Completed N = 165 (93.8%)

Post intervention (T2) Completed N = 154 (87.5%)

3-month follow-up (T3) Completed N = 147 (83.5%)

Allocated to mindfulness intervention N = 168

Non return of consent forms N = 32

Parent/student declined to participate N = 4

Consenting students N = 132

Baseline (T1) Completed N = 128 (97.0%)

Post intervention (T2) Completed N = 115 (87.1%)

3-month follow-up (T3) Completed N = 111 (84.1%)

these data were not included in the analysis. Non-return of consent forms was over-represented by the lowest socioeconomic school, rendering 75% of student data unable to be used in this setting.

Participating schools represented a broad range of socioeconomic status as measured on the Index of Community Socio-Educational Advantage (ACARA, 2011), whereby 1000 represents the mean, with a standard deviation of 100. The participating schools ranged from 951 to 1160, with a mean index of 1047 ($SD = 85.77$). Schools were categorised for this study as low SES (within one SD below mean; two participating schools), medium SES (within one SD above mean; two participating schools) or high SES (greater than one SD above mean; one participating school).

Of the 308 students who participated, the mean age was 13.63 ($SD = .43$) and 47.7% were female. At a participant level, 16.2% of students were in the low SES band, 39% were in the medium category, and 44.8% were in the high SES category. At baseline, 21.6% of the sample scored in the clinical range for depression (moderate or above on DASS-21) and 22.2% for anxiety.

2.2. Preliminary analyses

Data for anxiety, depression, emotional dysregulation and weight/shape concerns was positively skewed. Following square root transformations Z scores for these variables improved to acceptable parameters for normality. After transformation there were between one and six outliers at baseline for the following variables: depression, anxiety, self-compassion and emotional dysregulation. These were retained in the analyses.

Comparable percentages of students were missing at each time point, and one-way ANOVA analyses showed no significant differences on baseline characteristics between those participants who were present for one, two or three waves of data collection. It is noted that for mindfulness, one of the secondary outcomes, this approached significance, $F(2,271) = 3.0$, $p = .051$, such that those who missed two waves of data collection trended towards showing lower levels of mindfulness than those who were missed one or no waves. However, numbers of students missing two waves of data were small ($N = 13$; 4.2%).

Attendance over the 8-lesson course was high ($M = 7.09$; $SD = 1.56$), with 87% attending at least six of the eight lessons. Due to the very low consent rates at the SES schools, this data is more representative of middle-high SES bands.

2.3. Repeated measures analyses

Descriptive statistics (means and standard deviations) for the mindfulness intervention and control groups across each of the three time points are shown in Table 1, including within-group effect sizes from baseline. Table 2 presents results from the mixed models analysis after adjusting for baseline scores, demonstrating only a main effect of time for anxiety, with no main effects of group or group–time interactions for any primary or secondary outcome variable. Between group effect sizes were small at both time points for all outcome variables, ranging from .01 to .28.

Given the absence of significant differences, LMM was also used to investigate gender, depression, anxiety and weight/shape concerns as moderators. For depression and anxiety, "high" classifications were based on scoring moderate or above (≥ 7 or ≥ 6 respectively). For weight/shape concerns, a median split was used. Results of these analyses are shown in Table 3. All significant moderator by group by time interactions were found at three-month follow-up, where anxiety was higher in the mindfulness group compared to controls for males (Cohen's $d = .22$), and also for those with low baseline weight/shape concerns ($d = .30$) or low baseline depression ($d = .27$). A previous study showing higher levels of mindfulness on the CAMM in adolescent males aged 12–15 years (Kuby, McLean, & Allen, 2015) suggested testing for gender differences in this measure might be instructive in interpreting these results. A subsequent independent t-test demonstrated that in our sample, males ($M = 2.63$, $SD = .76$) were higher at baseline on mindfulness than females ($M = 2.23$, $SD = .73$), $t(272) = 4.36$, $p < .001$, $d = .54$.

2.4. Home practice analyses

Mean frequencies for each type of home practice both during the course (measured post intervention) and since the course (measured at follow-up) are shown in Table 4. Across all techniques, on average, students undertook self-directed mindfulness practice less than once a week at both time-points. Overall, 26.25% of students undertook homework once a week or more during the course, and this had reduced to 12.72% at follow-up. Longer practices requiring audio files were done less frequently at both time points, and at follow up, and frequencies for all practices had reduced compared to immediately post intervention.

Amount of home practice was investigated as a moderator. As can be seen in Table 5, frequency of homework did not account for significant variance in any of the primary dependent variables after accounting for baseline scores.

2.5. Course acceptability

Students in the mindfulness group completed course acceptability questionnaires during the last lesson ($n = 129$). On 0–10 Likert scales, mean scores were as follows: enjoyment and interest 6.67 (median 7, range 0–10); amount learnt 6.73 (median 7, range 0–10) and likelihood of using techniques in the future 6.14 (median 7, range 0–10). These scores are comparable to those reported by Kuyken et al. (2013). Instructor rating by students for the current course was 8.49 (median 9, range 0–10).

Seven classroom teachers and two school counsellors who also attended lessons completed course questionnaires pertaining to their personal experience of the course, with mean scores as follows: enjoyment and interest 9.44 (median 10, range 8–10); amount learnt 8.56 (median 9, range 5–10); likelihood of using techniques in the future 8.88 (median 10, range 8–10) and instructor rating 9.67 (median 10, range 8–10). Teachers were also asked to comment on whether an external facilitator or an embedded school teacher should deliver the course. Of the seven

Table 1
Descriptive statistics including within-group effect sizes for mindfulness and control groups at baseline (T1), post-intervention (T2) and follow-up (T3).

		Mindfulness				Control			
		Mean	SD	Within-group ES		Mean	SD	Within-group ES	
Depression	T1	.53	0.49	T1 vs T2	.02	.64	0.70	T1 vs T2	.12
	T2	.52	0.50	T2 vs T3	.04	.56	0.65	T2 vs T3	.16
	T3	.54	0.52	T1 vs T3	.02	.46	0.56	T1 vs T3	.28
Anxiety	T1	.52	0.39	T1 vs T2	.22	.50	0.51	T1 vs T2	.11
	T2	.61	0.42	T2 vs T3	.07	.56	0.56	T2 vs T3	.19
	T3	.58	0.45	T1 vs T3	.14	.46	0.51	T1 vs T3	.08
Weight/Shape Concerns	T1	.79	0.77	T1 vs T2	.09	.91	0.86	T1 vs T2	.09
	T2	.86	0.83	T2 vs T3	.05	.83	0.88	T2 vs T3	.00
	T3	.82	0.83	T1 vs T3	.04	.83	0.81	T1 vs T3	.10
Wellbeing	T1	3.57	0.66	T1 vs T2	.12	3.55	0.74	T1 vs T2	.09
	T2	3.65	0.66	T2 vs T3	.04	3.62	0.79	T2 vs T3	.08
	T3	3.62	0.70	T1 vs T3	.07	3.65	0.80	T1 vs T3	.13
Emotional Regulation	T1	2.51	0.55	T1 vs T2	.40	2.52	0.64	T1 vs T2	.50
	T2	2.28	0.60	T2 vs T3	.02	2.18	0.72	T2 vs T3	.04
	T3	2.29	0.62	T1 vs T3	.38	2.15	0.73	T1 vs T3	.54
Self-compassion	T1	3.09	0.65	T1 vs T2	.05	3.04	0.70	T1 vs T2	.17
	T2	3.12	0.57	T2 vs T3	.11	3.16	0.74	T2 vs T3	.07
	T3	3.18	0.53	T1 vs T3	.15	3.21	0.69	T1 vs T3	.24
Mindfulness	T1	2.47	0.73	T1 vs T2	.07	2.41	0.81	T1 vs T2	.12
	T2	2.42	0.78	T2 vs T3	.03	2.51	0.83	T2 vs T3	.15
	T3	2.44	0.75	T1 vs T3	.04	2.63	0.82	T1 vs T3	.27

Note. ES = effect size (Cohen's *d*); At T1, $N = 128$ (mindfulness) $N = 165$ (control); T2, $N = 115$ (mindfulness) $N = 154$ (control); T3, $N = 111$ (mindfulness) $N = 147$ (control); Measures: Depression/Anxiety = DASS-21; Weight/shape concerns = Weight/shape subscales of the Eating Disorder Examination-Questionnaire; Wellbeing = Warwick Edinburgh Mental Wellbeing Scale; Emotional Dysregulation = Disorders of Emotional Regulation Scale; Self-compassion = Self Compassion Scale; Mindfulness = Child and Adolescent Mindfulness Scale.

Table 2
Mixed model analyses with between-group effect sizes ($N = 308$).

	Treatment group	Time	Treatment group × time	Post intervention (T2)		3-month follow-up (T3)	
				Adjusted mean difference (95% CI)	Between-group ES	Adjusted mean difference (95% CI)	Between-group ES
Primary outcome measures							
Depression	$F(274.12) = 2.60$	$F(243.71) = 3.29$	$F(243.70) = 1.97$	.03 (−.06 to .11)	.01	.09 (.003 to .19)	.23
Anxiety	$F(267.81) = 1.94$	$F(240.22) = 6.89$**	$F(240.23) = 2.54$	.01 (−.07 to .09)	.03	.08 (−.001 to .17)	.23
Weight/Shape concerns	$F(256.01) = .26$	$F(232.76) = .64$	$F(232.77) = 2.26$	.02 (−.05 to .08)	.05	.05 (−.03 to .13)	.13
Wellbeing	$F(267.02) = .33$	$F(236.90) = .05$	$F(236.88) = .37$	.06 (−.08 to .21)	.09	.01 (−.14 to .16)	.02
Secondary outcome measures							
Emotional Dysregulation	$F(264.81) = 1.54$	$F(224.79) = .56$	$F(224.79) = .04$	.02 (−.02 to .06)	.11	.03 (−.02 to .07)	.12
Self-compassion	$F(256.18) = .003$	$F(221.40) = 3.42$	$F(221.40) = .13$	.02 (−.11 to .14)	.03	.009 (−.12 to .13)	.02
Mindfulness	$F(251.85) = 3.39$	$F(226.59) = 1.93$	$F(226.64) = 2.78$	.05 (−.13 to .23)	.06	.23 (.04−.42)	.28

Note. ES = Effect Size (Cohen's d); *$p < .05$ **$p < .01$; MF = Mindfulness intervention group; C = Control group; Measures: Depression/Anxiety = DASS-21; Weight/shape concerns = Weight/shape subscales of the Eating Disorder Examination-Questionnaire; Wellbeing = Warwick Edinburgh Mental Wellbeing Scale; Emotional Dysregulation = Disorders of Emotional Regulation Scale; Self-compassion = Self Compassion Scale; Mindfulness = Child and Adolescent Mindfulness Scale.

Table 3
Mixed model analyses for moderation: Estimated marginal means for moderator (4) by treatment group (2) by time (2).

Moderator	Outcome variable (moderator × treatment group × time)	Post intervention M (SE)				3-month follow-up M (SE)			
		Male		Female		Male		Female	
		MF ($N = 70$)	C ($N = 91$)	MF ($N = 62$)	C ($N = 85$)	MF	C	MF	C
Gender	Wellbeing $F(236.34) = .15$	3.74 (.08)	3.69 (.07)	3.56 (.08)	3.48 (.07)	3.70 (.08)	3.70 (.07)	3.52 (.08)	3.51 (.07)
	Depression $F(243.43) = 1.59$	.58 (.05)	.57 (.04)	.67 (.05)	.62 (.04)	.57 (.05)	.48 (.04)	.67 (.05)	.56 (.04)
	Anxiety $F(240.10) = 3.55$**	.69 (.04)	.64 (.04)	.65 (.04)	.67 (.04)	**.62 (.04)**	**.51 (.04)**	.68 (.05)	.61 (.04)
	Weight/Shape concerns $F(235.87) = 1.63$	.72 (.04)	.72 (.04)	.82 (.04)	.79 (.04)	.65 (.04)	.79 (.04)	.79 (.04)	.75 (.04)
		Low Depression		High Depression		Low Depression		High Depression	
		MF ($N = 110$)	C ($N = 135$)	MF ($N = 22$)	C ($N = 41$)	MF	C	MF	C
Depression	Wellbeing $F(238.87) = .53$	3.69 (.06)	3.59 (.06)	3.49 (.14)	3.59 (.11)	3.67 (.06)	3.58 (.06)	3.35 (.14)	3.71 (.11)
	Weight/Shape concerns $F(234.14) = 2.29$	.77 (.03)	.72 (.03)	.77 (.07)	.86 (.05)	.69 (.03)	.76 (.03)	.84 (.07)	.79 (.06)
	Anxiety $F(239.67) = 3.54$**	.66 (.03)	.62 (.03)	.74 (.07)	.74 (.06)	**.61 (.03)**	**.51 (.03)**	.83 (.08)	.71 (.06)
		Low Anxiety		High Anxiety		Low Anxiety		High Anxiety	
		MF ($N = 104$)	C ($N = 139$)	MF ($N = 28$)	C ($N = 37$)	MF	C	MF	C
Anxiety	Wellbeing $F(236.09) = .54$	3.68 (.06)	3.66 (.06)	3.57 (.12)	3.36 (.11)	3.67 (.06)	3.64 (.06)	3.44 (.12)	3.48 (.12)
	Weight/Shape concerns $F(232.59) = 2.04$	.77 (.03)	.73 (.03)	.77 (.06)	.85 (.06)	.69 (.03)	.76 (.03)	.82 (.06)	.79 (.06)
	Depression $F(243.20) = 2.34$	.61 (.04)	.55 (.03)	.67 (.07)	.76 (.07)	.56 (.04)	.48 (.03)	.77 (.07)	.69 (.07)
		Low WSC		High WSC		Low WSC		High WSC	
		MF ($N = 65$)	C ($N = 73$)	MF ($N = 67$)	C ($N = 103$)	MF	C	MF	C
WSC	Wellbeing $F(235.47) = .51$	3.73 (.08)	3.70 (.07)	3.58 (.08)	3.50 (.07)	3.75 (.08)	3.66 (.08)	3.49 (.08)	3.56 (.07)
	Anxiety $F(240.06) = 2.84$*	.67 (.04)	.61 (.04)	.67 (.04)	.70 (.04)	**.64 (.04)**	**.49 (.04)**	.65 (.04)	.62 (.04)
	Depression $F(243.42) = 1.66$	.58 (.05)	.55 (.04)	.66 (.05)	.63 (.04)	.58 (.05)	.45 (.05)	.65 (.05)	.58 (.04)

Note. M = adjusted mean after controlling for baseline value of dependent variable; SE = standard error; MF = Mindfulness intervention group; C = Control group; Depression/Anxiety = DASS-21; WSC (Weight/shape concerns) = Weight/shape subscales of the Eating Disorder Examination-Questionnaire; Wellbeing = Warwick Edinburgh Mental Wellbeing Scale; **$p < .01$ *$p < .05$ with significant pairwise comparison in bold.

respondents, three preferred an external facilitator, citing increased student engagement with a novel presenter, and the need for extensive teacher training to deliver such a specialised topic. Four respondents nominated a co-teaching role as ideal, benefiting from the combination of an expert in mindfulness working with the teacher taking care of classroom behaviour. One of these teachers suggested that teachers could progress to become self-sufficient with delivery in this model. The final two respondents felt both approaches had merit, with external facilitators lacking detailed knowledge of student background, but embedded teachers needing to be engaged and well trained to deliver the program adequately.

A *post hoc* qualitative interview with the school teacher and counsellor from the lowest SES school was conducted following the intervention, prompted by the poor consent rates and behaviour problems at this school. Importantly, school staff felt that the content and structure of this course was appropriate for this cohort, and that it worked well to give students the freedom to "tune out" by inviting them to put their heads down on the desk to rest at any time, but at the same time allowing them to be exposed to alternative strategies for dealing with unpleasant emotions and thoughts. Staff felt this course compared favourably to other programs that had been trialled in the school, as it contained less theory and did not require expensive equipment to implement, but had good practical strategies for immediate use. Suggestions were made to spend longer in the introductory session to engage students, as immediate defence strategies such as "I've coped in the

Table 4
Frequency of home practice compliance for the mindfulness intervention group ($N = 132$).

	During course		Since course	
	Mean (SD)	Percentage with high compliance[a]	Mean (SD)	Percentage with high compliance[a]
Mindfulness Practice				
Breath counting	2.85 (1.15)	31.2	2.18 (1.13)	16
.b[b]	2.71 (1.26)	31.2	2.04 (1.15)	11.3
Beditation[c]	2.09 (1.22)	17.8	1.82 (1.09)	11.9
FOFBOC[c]	2.13 (1.12)	14.0	1.73 (0.97)	7.6
Everyday activities	2.83 (1.33)	33.9	2.10 (1.29)	17.1
Thought Traffic	2.59 (1.38)	29.4	1.90 (1.17)	12.4
Overall	2.54 (0.93)	26.25	1.98 (0.94)	12.72

Note.
[a] Undertook homework once a week or more.
[b] Stop and be present - brief meditation.
[c] Nine minute audio file guided body scan mediation.

Table 5
Regression Analysis Showing the Extent to which Frequency of Home Practice during the Mindfulness Intervention Predicted Change on the Primary Outcome Measures at Post Intervention and Follow-up ($N = 132$).

	Depression			Anxiety			Weight/Shape concerns			Wellbeing		
	R^2	R^2 change	β	R^2	R^2 change	β	R^2	R^2 change	β	R^2	R^2 change	β
Post-intervention												
Model 1												
Baseline value for dependent variable	.27**		.52**	.18**		.43**	.65**		.81**	.36**		.60**
Model 2												
Baseline value for dependent variable			.51**			.43**			.81**			.58**
Mean frequency of all home practices		.003	−.05		.003	.05		<.001	−.01		.004	.07
Follow-up												
Model 1												
Baseline value for dependent variable	.30**		.55**	.15**		.39**	.63**		.79**	.42**		.65**
Model 2												
Baseline value for dependent variable			.54**			.39**			.79**			.63**
Mean frequency of all home practices		.01	−.07		.003	.05		.001	.03		.02	.08

Note. * significant at $p < .05$; ** significant at $p < .01$; Measures: Depression/Anxiety = DASS-21; Weight/shape concerns = Weight/shape subscales of the Eating Disorder Examination-Questionnaire; Wellbeing = Warwick Edinburgh Mental Wellbeing Scale.

past; I don't need this" were noted by the classroom teacher. A firm team–teaching alliance was also seen as important, with someone always present who knew the students' backgrounds, with expectations of behaviour more firmly outlined in the introductory lesson, and with consistent classroom teacher follow-up if boundaries were crossed. Reinforcement of ideas during pastoral care lessons was cited as an ideal accompaniment to the course. Moving forwards, staff suggested using a different room for future delivery in order to interrupt classroom dynamics, including use of smaller groups to increase interaction and better manage behaviour issues, and running sessions twice a week to reinforce ideas.

3. Discussion

This study investigated an existing 8-week mindfulness curriculum in early adolescents within a randomised controlled design, with a wide range of outcome measures: depression, anxiety, wellbeing, eating disorder risk factors, emotional dysregulation, self-compassion and mindfulness. Unlike earlier promising studies in secondary schools (Atkinson & Wade, 2015; Kuyken et al., 2013; Raes et al., 2014; Sibinga et al., 2013), we found no improvements in any of the outcome variables either immediately post intervention or at three-month follow-up, despite high acceptability of the program amongst students and teachers.

In contrast, self-rated anxiety was higher in the mindfulness group at follow-up across a range of subgroups: males, and those of both genders with low baseline levels of weight/shape concerns or depression. Increases in negative affect post mindfulness-based

intervention have been demonstrated previously in adults (Brooker et al., 2013). These authors suggested that this may be due to increased awareness of emotional states as mindfulness increases, which was supported by improvement in the "observing" subscale of their mindfulness measure (Five Facet Mindfulness Questionnaire, Baer et al., 2008). While we did not see a concomitant increase in mindfulness in our study, we used a short, single factor youth measure (CAMM) which may not have had the capacity to detect this type of change. Males showed higher baseline scores for mindfulness in our adolescent sample, replicating a recent finding by Kuby et al. (2015), and this may have amplified the effect of increasing awareness. It is more difficult to explain the increases in anxiety for those low in depression and weight/shape concerns at baseline. One possibility is a jump in awareness of emotional states in these groups which may become somewhat ruminative in nature. Brooker et al. (2013) hypothesised that as mindfulness continues to develop, one might then start to see a decrease in negative affect. However, at the three month follow-up mark in our study, anxiety levels remained greater in these subgroups. Taken overall, effect sizes for all subgroup interactions were small ($d < .30$) and further investigations of moderators in this age group will be instructive.

Universal studies can be subject to floor or ceiling effects on measures, given the relative health of the sample compared to clinical groups. We were able to compare our low baseline measures for depression on the DASS-21 to two other similar school based studies to explore this possibility. Clinical levels of depression at baseline, using standard clinical cut-offs for the DASS-21,

were similar in our sample (intervention group = 16.7%; control = 23.3%) to Raes et al. in their 2014 study demonstrating improvement (21%; 24%). Further, Nehmy and Wade (2015) reported similarly low mean scores at baseline (.57; .59) to our study (.53; .64), yet were still able to detect improvement (lowering of scores) in their 6-week CBT intervention in schools. Together with the lack of improvement across any of the other six outcome measures, the presence of floor or ceiling effects do not adequately explain our findings.

Given the exponential growth of studies supporting mindfulness in young people, it is sobering to find that under tightly controlled experimental conditions we were unable to replicate the postulated improvements in mental health. One explanation for a lack of effect is that while mindfulness programs for youth are downward derivations of adult curricula, underlying mechanisms of change may differ between these two populations given incomplete neurocognitive development in the maturing brain (Meiklejohn et al., 2012; Tan, 2015). As yet, no model of mindfulness in youth exists to describe the developmental trajectory of its various facets with and without intervention. In the absence of cross-sectional measurement of mindfulness facets in different age groups in youth, and mediational pathway research within age brackets, program developers are, to a degree, "flying blind" in applying a model that may have limited applicability to this group (Burke, 2010; Meiklejohn et al., 2012).

In the effective 8-week adult mindfulness programs, classes are 2.5 h supplemented by 40 min of daily home practice. Questions remain as to how to best dilute youth programs so they are digestible and safe while still achieving an effect. Of the four controlled trials in secondary schools to date, all were once weekly, single module programs, based on the traditional structure of adult interventions. The .b curriculum allows variable lesson length to fit school timetables, and although not reported by Kuyken et al. (2013), this varied in our trial from 35 min to 60 min. By contrast, dosage within weekly lessons was greater in the curricula used by Sibinga et al. (2013) and Raes et al. (2014): 50 min per lesson over 12 weeks, and 100 min over eight weeks, respectively. However, Atkinson and Wade (2015) also allowed variable lesson length in a comparatively short (three week) curriculum that focused on applying aspects of mindfulness to body image. Although there was no change in negative affect, lasting improvement occurred across a broad range of eating disorder variables (weight/shape concerns, dietary restraint, thin ideal and eating disorder symptoms). This suggests that applying mindfulness principles to specific scenarios (e.g., body image in magazines, mirror exercises) might increase its effectiveness in youth, and this is worthy of further investigation across a broader range of applications. Future studies might also formally investigate optimal lesson length, or whether alternative strategies to increase the dose of mindfulness (e.g., short daily classroom practices, extending curriculum length or teaching additional modules over subsequent year levels) achieve more robust replication of positive effects in young people.

An alternative explanation for the lack of effect in our study relates to program adherence. While the .b curriculum is tightly manualised, there were three variations made during delivery in our trial that may have inadvertently had an impact on dosage and effect. First, the nine week course was shortened to 8 weeks by reducing the introductory lesson (designed to engage students in why mindfulness might be of benefit) to a 10 min presentation combined with Lesson 1. In retrospect this may have been a key omission, potentially impacting on home practice commitment, particularly with a conscript audience. Second, course manuals were supplied to students in most schools in e-format in our trial, which meant that students had to either convert the file or print a hard copy in order to complete the home practice log, which

created extra barriers to undertaking homework that was not being checked or graded. Third, this particular curriculum is designed to be delivered by embedded teachers in schools rather than an external facilitator, such as was used in our program. The benefits of class teacher delivery extend beyond increased disseminability to include more regular contact with the class for embodiment of mindful behaviour, drip-feeding of ideas across the curriculum, regular reminders of daily home practice, and the opportunity to conduct extra mindfulness practices between the formal weekly lessons. Taken together, these adherence changes may have reduced the overall dose of mindfulness outside of formal lessons, in particular through home practice compliance. Illustrating this, only 26.25% of our students undertook home practice once a week or more during the course, which contrasts sharply with Huppert and Johnson (2010) who, in an earlier iteration of the .b curriculum, reported nearly 70% of students undertaking self-directed practice more than once a week. Rates of ongoing mindfulness practice at three month follow-up were also lower in our study (12.72% practising once a week or more) compared to Kuyken et al. (2013) who found 21% of students continued practising at least once a week. Although our study did not support a relationship between degree of home practice and outcome, this may reflect the small numbers of participants in the high compliance group, and future school-based studies should continue to carefully evaluate self-directed practice to either clearly demonstrate its benefit to students or conversely, to remove this added demand if results do not support an effect.

Competent delivery of the mindfulness program evaluated in this trial must be examined as another potential issue. In our study, ratings from students and school staff support the .b instructor's competency in engaging students in the classroom, despite the lack of prior teaching experience. However, a separate issue is instructor experience in delivering mindfulness-based interventions. Although the .b instructor exceeded the mindfulness prerequisites for delivering the .b curriculum, she would be considered an early phase adult mindfulness instructor (Mindfulness Training Institute of Australasia, MTIA, 2014). This does raise questions about competencies to teach mindfulness-based interventions to youth, as evidenced in a previous study which found such competency to be critical to obtaining significant improvements (Atkinson & Wade, 2015). Certainly in adults, competencies are becoming more tightly prescribed (Crane et al., 2012) and it could be argued that competency to teach youth should be just as tightly monitored, or even more so, given the vulnerability of this population. However, this would prevent large-scale dissemination, and Felver et al. (2015) suggest the possibility that mindfulness-based interventions for young people, being more simplistic, may require less extensive training than the more comprehensive adult programs. How much training is enough for safe and effective dissemination of mindfulness on a large scale to young people remains an important area for future research.

Given the benefits of school teachers conducting mindfulness-based programs through increased contact with students, it was interesting that from an experiential perspective, staff preference in our trial leant towards an external facilitator or a team teaching approach. Certainly there was an emerging theme that school teacher motivation in developing competence to teach mindfulness (ranked as very important by staff in this trial) would vary. While the novelty of an external presenter may be of benefit in mid to high socioeconomic demographics, the behavioural challenges apparent with the lowest socioeconomic school in our study support the idea that teacher familiarity and trust may be a crucial element in successfully imparting skills with this group (Bluth et al., 2015).

The design of this study addresses several shortcomings

identified in the literature (Britton et al., 2014; Burke, 2010; Felver et al., 2015; Meiklejohn et al., 2012; Tan, 2015; Waters et al., 2014). First, it was a multi-site, randomised controlled design with a moderately large sample size based on a priori power calculations. Second, it included follow-up (three months). Third, it sought to replicate an existing mindfulness-based intervention for youth. Fourth, socioeconomic status was not only reported but a broad range of socioeconomic bands included, although it was unfortunate that poor opt-in consent rates resulted in high data wastage in the lower range schools. Use of the same instructor for all classes in the intervention arm represents a strength (consistency) and a limitation (generalisability of findings). Another limitation is the reliance on self-report measures. It is recommended that future studies aim to include multiple source measures such as parent and teacher reports. Accessing existing school databases for academic and behaviour records may also be worth considering as a relatively simple way to add weight to self-report results.

4. Conclusion

In a tightly controlled experimental design, evaluating the impact of an existing and widely available school-based mindfulness program, no improvements were demonstrated on any outcome measure either immediately post intervention or at three month follow-up. Further research, including investigation of mediators and moderators in experimental designs, is required to identify active ingredients and optimal dose in mindfulness-based programs in school settings.

Acknowledgements

References

ACARA. (2011). *Guide to understanding ICSEA*. Sydney: Australian Curriculum Assessment and Reporting Authority.

Agras, W. (2001). The consequences and costs of the eating disorders. *Psychiatric Clinics of North America, 24*, 371–379.

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: a meta-analytic review. *Clinical Psychology Review, 30*, 217–237.

Arch, J., & Craske, M. (2006). Mechanisms of mindfulness: emotion regulation following a focused breathing induction. *Behaviour Research and Therapy, 44*(12), 1849–1858.

Atkinson, M., & Wade, T. (2015). Mindfulness-based prevention for eating disorders: a school-based cluster randomised controlled pilot study. *International Journal of Eating Disorders, 48*(7), 1024–1037.

Australian Bureau of Statistics. (2007). *National survey of mental health and well-being*. Retrieved from http://www.ausstats.abs.gov.au/.

Baer, R. (2003). Mindfulness training as a clinical intervention: a conceptual and empirical review. *Clinical Psychology: Science and Practice, 10*, 125–143.

Baer, R., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., … Williams, J. M. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment, 15*(3), 329–342. http://dx.doi.org/10.1177/1073191107313003.

Berg, K., Peterson, C., Frazier, P., & Crow, S. (2012). Psychometric evaluation of the eating disorder examination and eating disorder examination-questionnaire: a systematic review of the literature. *International Journal of Eating Disorders, 45*, 428–438.

Bieling, P. J., Hawley, L. L., Bloch, R. T., Corcoran, K. M., Levitan, R. D., Young, L. T., … Segal, Z. V. (2012). Treatment-specific changes in decentering following mindfulness-based cognitive therapy versus antidepressant medication or placebo for prevention of depressive relapse. *Journal of Consulting & Clinical Psychology, 80*(3), 365–372.

Bluth, K., & Blanton, P. (2014). Mindfulness and self-compassion: exploring pathways to adolescent emotional well-being. *Journal of Child and Family Studies, 23*(7), 1298–1309.

Bluth, K., Campo, R., Pruteanu-Malinici, S., Reams, A., Mullarkey, M., & Broderick, P. (2015). A school-based mindfulness pilot study for ethnically diverse at-risk adolescents. *Mindfulness*. http://dx.doi.org/10.1007/s12671-014-0376-1. online 4 Jan 2015.

Britton, W., Lepp, N., Niles, H., Rocha, T., Fisher, N., & Gold, J. (2014). A randomized controlled pilot trial of classroom-based mindfulness meditation compared to an active control condition in sixth-grade children. *Journal of School Psychology, 52*, 263–278.

Broderick, P. C., & Metz, S. (2009). Learning to BREATHE: a pilot trial of a mindfulness curriculum for adolescents. *Advances in School Mental Health Promotion, 2*(1), 35–46. http://dx.doi.org/10.1080/1754730X.2009.9715696.

Brooker, J., Julian, J., Webber, L., Chan, J., Shawyer, F., & Meadows, G. (2013). Evaluation of an occupational mindfulness program for staff employed in the disability sector in Australia. *Mindfulness, 4*(2), 122–136.

Brown, T. A., Chorpita, B. F., Korotitsch, W., & Barlow, D. H. (1997). Psychometric properties of the depression anxiety stress scales (DASS) in clinical samples. *Behaviour Research and Therapy, 35*(1), 79–89. http://dx.doi.org/10.1016/S0005-7967(96)00068-X.

Burke, C. (2010). Mindfulness-based approaches with children and adolescents: a preliminary review of current research in an emergent field. *Journal of Clinical and Family Studies, 19*(2), 133–144.

Calear, A. L., & Christensen, H. (2010). Systematic review of school-based prevention and early intervention programs for depression. *Journal of Adolescence, 33*(3), 429–438. http://dx.doi.org/10.1016/j.adolescence.2009.07.004.

Calkins, S. D. (2010). Psychobiological models of adolescent risk: implications for prevention and intervention. *Developmental Psychobiology, 52*(3), 213–215. http://dx.doi.org/10.1002/dev.20435.

Ciarrochi, J., Kashdan, T. B., Leeson, P., Heaven, P., & Jordan, C. (2011). On being aware and accepting: a one-year longitudinal study into adolescent well-being. *Journal of Adolescence, 34*(4), 695–703. http://dx.doi.org/10.1016/j.adolescence.2010.09.003.

Crane, C., Crane, R. S., Eames, C., Fennell, M. J. V., Silverton, S., Williams, J. M. G., et al. (2014). The effects of amount of home meditation practice in Mindfulness Based Cognitive Therapy on hazard of relapse to depression in the staying well after depression trial. *Behaviour Research and Therapy, 63*, 17–24. http://dx.doi.org/10.1016/j.brat.2014.08.015.

Crane, R., Soulsby, J., Kuyken, W., Williams, J., Eames, C., Bartley, T., … Silverton, S. (2012). *The Bangor, Exeter and Oxford mindfulness-based interventions teaching assessment criteria*. Bangor: Bangor University.

Doyle, P. M., Smyth, A., & Grange, D. L. (2012). Childhood and adulthood: when do eating disorders start and do treatments differ? In J. Alexander, & J. Treasure (Eds.), *A collaborative approach to eating disorders* (pp. 217–224). New York, NY: Routledge/Taylor & Francis Group.

Dunkley, D., Zuroff, D., & Blankstein, K. (2003). Self-critical perfectionism and daily affect: dispositional and situational influences on stress and coping. *Journal of Personality & Social Psychology, 84*(1), 234–252.

Egan, S., Wade, T., & Shafran, R. (2011). Perfectionism as a transdiagnostic process: a clinical review. *Clinical Psychology Review, 31*(2), 203–212.

Fairburn, C., & Beglin, S. (1994). Assessment of eating disorders: interview or self-report questionnaire? *International Journal of Eating Disorders, 16*, 363–370.

Fairweather-Schmidt, K., & Wade, T. (2014). DSM-V Eating disorders and other specified eating and feeding disorders: is there a meaningful differentiation? *International Journal of Eating Disorders, 47*(5), 524–533.

Felver, J. C., Celis-de Hoyos, C. E., Tezanos, K., & Singh, N. N. (2015). A systematic review of mindfulness-based interventions for youth in school settings. *Mindfulness*. http://dx.doi.org/10.1007/s12671-015-0389-4.

Gratz, K., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41–54.

Greco, L., Baer, R., & Smith, G. T. (2011). Assessing mindfulness in children and adolescents: development and validation of the child and adolescent mindfulness measure (CAMM). *Psychological Assessment, 23*(3), 606–614.

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: a meta-analysis. *Journal of Psychosomatic Research, 57*, 35–43.

Hedeker, D., Gibbons, R., & Waternaux, C. (1999). Sample size estimation for longitudinal design with attrition: comparing time-related contrasts between two groups. *Journal of Educational and Behavioral Statistics, 24*(1), 70–93.

Henry, J., & Crawford, J. (2005). The short-form version of the depression anxiety stress scales (DASS-21): construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 44*(2), 227–239.

Huppert, F. A., & Johnson, D. M. (2010). A controlled trial of mindfulness training in schools: the importance of practice for an impact on well-being. *The Journal of Positive Psychology, 5*(4), 264–274. http://dx.doi.org/10.1080/17439761003794148.

Jacobi, C., & Fittig, E. (2010). Psychosocial risk factors for eating disorders. In W. Agras (Ed.), *The Oxford handbook of eating disorders* (pp. 123–136). New York: Oxford University Press.

Jacobi, C., Hayward, C., de Zwaan, M., Kraemer, H., & Agras, W. (2004). Coming to terms with risk factors for eating disorders: application of risk terminology and suggestions for a general taxonomy. *Psychological Bulletin, 130*(1), 19–65.

Kabat-Zinn, J. (1990). *Full catastrophe living*. New York: Dell.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144–156. http://dx.doi.org/10.1093/clipsy.bpg016.

Katterman, S. N., Kleinman, B. M., Hood, M. M., Nackers, L. M., & Corsica, J. A. (2014).

Mindfulness meditation as an intervention for binge eating, emotional eating, and weight loss: a systematic review. *Eating Behaviors, 15*(2), 197–204. http://dx.doi.org/10.1016/j.eatbeh.2014.01.005.

Kerrigan, D., Johnson, K., Stewart, M., Magyari, T., Hutton, N., Ellen, J. M., et al. (2011). Perceptions, experiences, and shifts in perspective occurring among urban youth participating in a mindfulness-based stress reduction program. *Complementary Therapies in Clinical Practice, 17*(2), 96–101. http://dx.doi.org/10.1016/j.ctcp.2010.08.003.

Khoury, B., Lecomte, T., Fortin, G., Masse, M., Therien, P., Bouchard, V., … Hofmann, S. G. (2013). Mindfulness-based therapy: a comprehensive meta-analysis. *Clin Psychol Rev, 33*(6), 763–771. http://dx.doi.org/10.1016/j.cpr.2013.05.005.

Kuby, A., McLean, N., & Allen, K. (2015). Validation of the child and adolescent mindfulness measure (CAMM) with non-clinical adolescents. *Mindfulness, 6,* 1448–1455.

Kuyken, W., Watkins, E., Holden, E., White, K., Taylor, R., Byford, S., … Dalgleish, T. (2010). How does mindfulness-based cognitive therapy work? *Behaviour Research and Therapy, 48,* 1105–1112.

Kuyken, W., Weare, K., Ukoumunne, O., Vicary, R., Motton, N., Burnett, R., … Huppert, F. (2013). Effectiveness of the Mindfulness in Schools Programme: non-randomised controlled feasibility study. *British Journal of Psychiatry, 203,* 126–131.

Leahey, T. M., Crowther, J. H., & Irwin, S. R. (2008). A cognitive-behavioral mindfulness group therapy intervention for the treatment of binge eating in bariatric surgery patients. *Cognitive and Behavioral Practice, 15*(4), 364–375. http://dx.doi.org/10.1016/j.cbpra.2008.01.004.

Lovibond, S., & Lovibond, P. (1995). *Manual for the depression anxiety stress scales* (2nd ed.). Sydney: Psychology Foundation.

Luce, K. H., & Crowther, J. H. (1999). The reliability of the eating disorder examination—Self-report questionnaire version (EDE-Q). *International Journal of Eating Disorders, 25*(3), 349–351. http://dx.doi.org/10.1002/(SICI)1098-108X(199904)25:3<349::AID-EAT15>3.0.CO;2-M.

McCown, D., Reibel, D., & Micozzi, M. (2010). *Teaching mindfulness: a practical guide for clinicians and educators.* New York: Springer.

McEvoy, P., Watson, H., Watkins, E., & Nathan, P. (2013). The relationship between worry, rumination, and comorbidity: evidence for repetitive negative thinking as a transdiagnostic construct. *Journal of Affective Disorders, 151*(1), 313–320.

Meiklejohn, J., Phillips, C., Freedman, M., Griffin, M., Biegel, G., Roach, A., … Saltzman, A. (2012). Integrating mindfulness training into K-12 education: fostering the resilience of teachers and students. *Mindfulness.* http://dx.doi.org/10.1007/s12671-012-0094-5. online first.

Metz, S., Frank, J., Reibel, D., Cantrell, T., Sanders, R., & Broderick, P. (2013). The effectiveness of the learning to BREATHE program on adolescent emotion regulation. *Research in Human Development, 10*(3), 252–272.

Mindfulness Training Institute Australasia (2014). Retrieved from http://www.mtia.org.au/training-pathway-in-brief.

Mond, J., Hay, P., Rodgers, B., Owen, C., & Beaumont, P. (2004). Validity of the eating disorder examination questionnaire (EDE-Q) in screening for eating disorders in community samples. *Behaviour Research and Therapy, 42,* 551–567.

Neff, K. (2003). The development and validation of a scale to measure self-compassion. *Self and Identity, 2,* 223–250.

Neff, K., & McGeehee, P. (2010). Self-compassion and psychological resilience among adolescents and young adults. *Self and Identity, 9,* 225–240.

Nehmy, T. (2010). School-based prevention of depression and anxiety in Australia: current state and future directions. *Clinical Psychologist, 14*(3), 74–83.

Nehmy, T. J., & Wade, T. D. (2015). Reducing the onset of negative affect in adolescents: evaluation of a perfectionism program in a universal prevention setting. *Behaviour Research and Therapy, 67,* 55–63. http://dx.doi.org/10.1016/j.brat.2015.02.007.

Neil, A. L., & Christensen, H. (2009). Efficacy and effectiveness of school-based prevention and early intervention programs for anxiety. *Clinical Psychology Review, 29*(3), 208–215. http://dx.doi.org/10.1016/j.cpr.2009.01.002.

Nolen-Hoeksema, S., & Watkins, E. (2011). A heuristic for developing transdiagnostic models pf psychopathology: explaining multifinality and divergent trajectories. *Perspectives on Psychological Science, 6*(6), 598–609.

Pearlstein, T. (2002). Eating disorders and comorbidity. *Archives of Women's Mental Health, 4,* 67–68.

Perich, T., Manicavasagar, V., Mitchell, P. B., & Ball, J. R. (2013). The association between meditation practice and treatment outcome in mindfulness-based cognitive therapy for bipolar disorder. *Behaviour Research and Therapy, 51*(7), 338–343. http://dx.doi.org/10.1016/j.brat.2013.03.006.

Raes, F., Griffith, J., Van der Gucht, K., & Williams, J. (2014). School-based prevention and reduction of depression in adolescents: a cluster-randomized trial of a mindfulness group program. *Mindfulness, 5*(5), 477–486.

Segal, Z., Williams, J., & Teasdale, J. (2002). *Mindfulness-based cognitive therapy for depression: a new approach to preventing relapse.* New York: Guilford.

Shapiro, S., Brown, K. W., & Biegel, G. M. (2007). Teaching self-care to caregivers: effects of mindfulness-based stress reduction on the mental health of therapists in training. *Training & Education in Professional Psychology, 1*(2), 105–115.

Sibinga, E., Perry-Parish, C., Chung, S., Johnson, S., Smith, M., & Ellen, J. (2013). School-based mindfulness instruction for urban male youth: a small randomized controlled trial. *Preventive Medicine, 57,* 799–801.

Stockings, E., Degenhardt, L., Dobbins, T., Lee, Y., Erskine, H., Whiteford, H., et al. (2015). Preventing depression and anxiety in young people: a review of the joint efficacy of universal, selective and indicated prevention. *Psychological Medicine.* advance online publication.

Szabo, M. (2010). The short version of the depression anxiety stress scales (DASS-21): factor structure in a young adolescent sample. *Journal of Adolescence, 33,* 1–8.

Tan, L. B. (2015). A critical review of adolescent mindfulness-based programmes. *Clinical Child Psychology and Psychiatry.* http://dx.doi.org/10.1177/1359104515577486. advance online publication.

Teasdale, J. D., Moore, R. G., Hayhurst, H., Pope, M., Williams, S., & Segal, Z. V. (2002). Metacognitive awareness and prevention of relapse in depression: empirical evidence. *Journal of Consulting & Clinical Psychology, 70*(2), 275–287.

Teesson, M., Newton, N., Slade, T., Chapman, C., Allsop, S., Hides, L., … Andrews, G. (2014). The CLIMATE schools combined study: a cluster randomised controlled trial of a universal internet-based prevention program for youth substance misuse, depression and anxiety. *Biomed Central Psychiatry, 14*(32). http://dx.doi.org/10.1186/1471-244X-14-32.

Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., … Stewart-Brown, S. (2007). The Warwick-Edinburgh mental well-being scale (WEMWBS): development and UK validation. *Health and Quality of Life Outcomes, 5*(63), 1–13. http://dx.doi.org/10.1186/1477-7525-5-63.

Tully, P. J., Zajac, I. T., & Venning, A. J. (2009). The structure of anxiety and depression in a normative sample of younger and older Australian adolescents. *Journal of Abnormal Child Psychology, 37*(5), 717–726. http://dx.doi.org/10.1007/s10802-009-9306-4.

Wade, T., Wilksch, S., & Lee, C. (2012). A longitudinal investigation of the impact of disordered eating on young women's quality of life. *Health Psychology, 31.*

Waters, L., Barsky, A., Ridd, A., & Allen, K. (2014). Contemplative education: a systematic, evidence-based review of the effect of meditation interventions in schools. *Educational Psychology Review.* http://dx.doi.org/10.1007/s10648-014-9258-2. Published online 4 March 2014.

Weare, K., & Nind, M. (2011). Mental health promotion and problem prevention in schools: what does the evidence say? *Health Promotion International, 26*(Suppl. 1), i29–i69. http://dx.doi.org/10.1093/heapro/dar075.

Weinberg, A., & Klonsky, E. (2009). Measurement of emotion dysregulation in adolescents. *Psychological Assessment, 21*(4), 616–621.

Willemsen, J., Markey, S., Declercq, F., & Vanheule, S. (2011). Negative emotionality in a large community sample of adolescents: the factor structure and measurement invariance of the short version of the depression anxiety stress scales (DASS-21). *Stress and Health, 27*(3), e120–e128. http://dx.doi.org/10.1002/smi.1342.

Williams, J., Crane, C., Barnhofer, T., Brennan, K., Duggan, D., Fennell, M., … Russell, I. (2014). Mindfulness-based cognitive therapy for preventing relapse in recurrent depression: a randomized dismantling trial. *Journal of Consulting and Clinical Psychology, 82*(2), 275–286.

Zack, S., Saekow, J., Kelly, M., & Radke, A. (2014). Mindfulness based interventions for youth. *Journal of Rational-Emotive & Cognitive-Behavior Therapy.* http://dx.doi.org/10.1007/s10942-014-0179-2.

Zisook, S., Lesser, I., Stewart, J., Wisniewski, S., Balasubramani, G., Fava, M., et al. (2007). Effect of age at onset on the course of major depressive disorder. *American Journal of Psychiatry, 164,* 1539–1546.