Preventing anxiety and depression in adolescents: A randomised controlled trial of two school based Internet-delivered cognitive behavioural therapy programmes

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ABSTRACT

The aims of the current study were to 1) establish the efficacy of two Internet-based prevention programmes to reduce anxiety and depressive symptoms in adolescents; and 2) investigate the distribution of psychological symptoms in a large sample of Australian adolescents prior to the implementation of the intervention. A cluster randomised controlled trial was conducted with 976 Year 9–10 students from twelve Australian secondary schools in 2009. Four schools were randomly allocated to the Anxiety Internet-based prevention programme (n = 372), five schools to the Depression Internet-based prevention programme (n = 380) and three to their usual health classes (n = 224). The Thiswayup Schools for Anxiety and Depression prevention courses were presented over the Internet and consist of 6–7 evidence-based, curriculum consistent lessons to improve the ability to manage anxiety and depressive symptoms. Participants were assessed at baseline and post-intervention. Data analysis was constrained by both study attrition and data corruption. Thus post-intervention data were only available for 265/976 students. Compared to the control group, students in the depression intervention group showed a significant improvement in anxiety and depressive symptoms at the end of the course, whilst students in the anxiety intervention demonstrated a reduction in symptoms of anxiety. No significant differences were found in psychological distress. The Thiswayup Schools Depression and Anxiety interventions appear to reduce anxiety and depressive symptoms in adolescents using a curriculum based, blended online and offline cognitive behavioural therapy programme that was implemented by classroom teachers. Given the study limitations, particularly the loss of post-intervention data, these findings can only be considered preliminary and need to be replicated in future research.

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1. Introduction

Prevention programmes for internalising disorders (anxiety and depression) should be the top priorities given the prevalence, disability and service use associated with these disorders that have an early age of onset (Andrews et al., 2001). Effective prevention should occur in the developmental epoch preceding and during the age of peak incidence (Gladstone et al., 2011) so that impairment in adulthood can be avoided (Calear and Christensen, 2010; Fisak Jr et al., 2011). Whilst the optimal goal of prevention is to prevent the disorder occurring, to delay the

onset of a disorder or a worsening of symptoms is a cost-effective and worthwhile goal (Garber and Weersing, 2010).

A number of published meta-analyses and systematic reviews have investigated the prevention of internalising disorders within adolescent populations (Horowitz and Garber, 2006; Richardson et al., 2010; Stice et al., 2009). Most of these prevention programmes target depression rather than anxiety (Calear and Christensen, 2010). Few qualified as universal prevention programmes for adolescent anxiety or depression, administered by a teacher in a school setting using cognitive behavioural therapy (CBT). Out of those that did, four programmes were specific for the prevention of depression [Problem Solving for Life (Spence et al., 2005), Resourceful Adolescent Program (Shochet and Ham, 2004), Resourceful Adolescent Program-Kiwi (Merry et al., 2004), Penn Resiliency Program (Chaplin et al., 2006)], and only one for the prevention of anxiety [Aussie Optimism Program (Roberts et al., 2010)]. MoodGYM and FRIENDS were the only programmes that offered

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prevention in both anxiety and depression and only MoodGYM delivered their course online (Barrett et al., 2006; Calear and Christensen, 2010). Small effect sizes are typical in the field. The weighted overall mean effect size for universal school-based anxiety and depression prevention programmes was 0.18 and 0.16, respectively (Fisak et al., 2011; Horowitz and Garber, 2006).

A universal school-based Internet programme for both anxiety and depression would have many advantages. They include high implementation fidelity, scalability, low cost and the ability to monitor user adherence, progress and outcomes through automated data collection and feedback. Yet few Internet programmes have been developed for children and adolescents (Calear and Christensen, 2010). This is surprising given adolescents are familiar and competent using computers (Cuijpers et al., 2008) and are increasingly seeking informal and formal help online (Burns et al., 2010). The efficacy of the Thiswayup Schools courses (formerly CLIMATE Schools) in stress, alcohol and cannabis has been demonstrated (Van Vliet and Andrews, 2009; Newton et al., 2009; Newton et al., 2010; Vogl et al., 2009). We therefore developed and evaluated two web based courses for prevention of anxiety and depression that satisfies the mental health syllabus in high schools in Australia. The current study 1) investigates the efficacy of these courses when compared with usual health education; and 2) reports the distribution of psychological symptoms in a large sample of Australian adolescents prior to the implementation of the intervention.

2. Materials and Methods

2.1. Participants

Informed consent was obtained from parents of 976 students and twelve school principals from twelve independent high schools in Australia. Schools were recruited from major cities (75%) and inner regional areas of New South Wales, Australia with students from Years 9 to 10, aged between 14 and 16 years, 70% were female. Due to the loss of baseline data (see below) these demographic characteristics were imputed from the location and demographic composition of the school.

2.2. Design

The study was designed as a three arm cluster randomised controlled trial (RCT) and convenience sampling was used to select the schools in New South Wales, Australia. A total of 976 students from twelve schools provided informed consent and completed baseline questionnaires. Four schools (n = 372) were randomly allocated to the 'Overcoming Anxiety' intervention condition, five schools (n = 380) were randomly allocated to the 'Combating Depression' intervention condition, and three schools (n = 224) were randomly allocated to the teaching as usual control condition. Self-report data were obtained from students on two separate occasions: at baseline and at the end of the intervention. Students from the control schools completed the same pattern of assessments but received their usual health classes in place of the online programme. All aspects of this trial were approved by the University of New South Wales Human Ethics Committee and the trial is registered with the Australian Clinical Trials Registry (ACTRN12612000414819).

2.3. Intervention

The Thiswayup Schools: Combating Depression and Overcoming Anxiety courses were developed as universal prevention courses based on CBT principles. The depression course contains 7 lessons whilst the anxiety course contains 6 lessons. Each lesson aims to teach students to identify symptoms of depression or anxiety and teaches them how to deal with these effectively. The programmes incorporate several important cognitive-behavioural components that are based on skill acquisition; psycho-education, management of thoughts, emotions and behaviours specific to each disorder. The courses were delivered once a week over a total of six/seven weeks. The lessons ran for 40 min, students log into the course and individually undertake the 15–20 minute self-directed lesson in which students follow a cartoon based storyline of teenagers with anxiety or depression solve real life problems. In the second component of each lesson, teachers hand out class work sheets to stimulate a discussion to reinforce the information learnt from the cartoon storyline. Teachers in the intervention groups required no training, apart from the manual. Work completed by the control and intervention groups was done in regular personal development and health classes under the supervision of their regular teacher. The current online lessons can be viewed at www.thiswayup.org.au/schools.

2.4. Measures

2.4.1. Anxiety symptomatology

The Generalised Anxiety Disorder seven item scale (GAD-7) was used to measure anxiety symptoms (internal consistency $\alpha = 0.89$) (Daig et al., 2009). The scores of all seven items range from with higher scores indexing higher severity of GAD (range 0–21).

2.4.2. Depression symptomatology

A short form of the Patient Health Questionnaire-9 (Kroenke et al., 2001) was used to measure depressive symptoms (the PHQ-5). This comprised the five items that index the five psychological symptoms of major depression (depressed mood, lack of interest, worthlessness, poor concentration, and thoughts of death) (Andrews et al., 2007; Zimmerman et al., 2006), with each item ranging from 0 (not at all) to 3 (nearly every day). Higher scores on the PHQ-5 index higher severity of depression (range = 0–15).

2.4.3. Psychological distress scale

The six-item short form of the Kessler psychological distress scale [K6; correlation with K10 r = 0.97 (Kessler et al., 2003), internal consistency $\alpha = 0.89$ (Kessler et al., 2002)] was used to measure levels of non-specific psychological distress on a scale of 0–24. The score of each item ranged from 0 (none of the time) to 4 (all of the time) with higher scores indexing higher levels of psychological distress.

2.5. Statistical analysis

Statistical analyses were constrained by both study attrition and corrupted data. Less than half of the sample (n = 421 / 976; 43.1%) provided post-intervention data due to study attrition. After completion of the study, the unit moved to a different location and changed information technology provider. In this process, the data files were corrupted and demographic details (including age and sex) were unrecoverable, whilst post-intervention scores for the main outcome variables were also lost. We were able to recover the post-intervention scores for 265 students but we were unable to determine whether individual missing scores in the recovered databases were the result of study attrition or corrupted data. Outcome analyses were therefore conducted on an intention to treat basis using linear mixed-model repeated measures (MMRM) analysis of variance tests (West et al., 2006). Under the assumption that data is missing at random (MAR), mixed models estimate statistical parameters in repeated measures studies with unbalanced data using maximum likelihood estimation, making use of the incomplete data in a way that does not bias the parameter estimates (West et al., 2006). Baseline analyses were conducted on both the full (n = 976) and reduced (n = 265) samples.

2.5.1. Missing data analysis

Initial analyses focused on baseline differences between those students for whom we did and did not have post-treatment data. Chi-

Table 1
Proportion of missing data within each of the twelve schools.

	Missing post-intervention data
School 1 (n = 123)	95 (77.2%)
School 2 (n = 85)	40 (47.1%)
School 3 (n = 69)	51 (73.9%)
School 4 (n = 95)	94 (98.9%)
School 5 (n = 138)	86 (62.3%)
School 6 (n = 85)	48 (56.5%)
School 7 (n = 23)	23 (100.0%)
School 8 (n = 48)	44 (91.7%)
School 9 (n = 86)	78 (90.7%)
School 10 (n = 60)	34 (56.7%)
School 11 (n = 148)	108 (73.0%)
School 12 (n = 16)	10 (62.5%)

square difference tests were used to determine whether loss of data occurred differentially across treatment groups. t-Tests were used to determine whether baseline scores on the GAD-7, PHQ-5 and K6 differed for those students with and without post-treatment data.

2.5.2. Baseline analysis

The distribution of scores for the GAD-7, PHQ-5 and K6 were first examined in the full sample (n = 976). In both the full (n = 976) and reduced (n = 265) samples, baseline equivalence between the three trial arms was also assessed using a series of one-way analysis of variance tests using the GAD-7, PHQ-5 and K6 as dependent variables.

2.5.3. Outcome analysis

Intervention effects were examined using linear MMRM analysis of variance tests with measurement occasion (baseline and post-intervention) as a within-group factor and intervention (anxiety, depression, control) as a three-level between-group factor. Due to the significant loss of data within some schools (see Table 1), it was not possible to take into account the clustered nature of the data, and between-school effects could not be included in the statistical models. These analyses were conducted for all three outcome variables using the MIXED procedure in SPSS Version 22 with a random intercept. Measurement occasion was treated as a categorical variable. This model was examined with several different residual covariance structures. Model fit indices and inspection of the variance–covariance matrix supported the specification of an identity covariance structure for the PHQ-5 and a diagonal covariance structure for the GAD-7 and K6. Using the TEST subcommand, planned contrasts were used to examine between-group effects (anxiety vs. control, depression vs. control, anxiety vs. depression), whilst the COMPARE statement on the EMMEANS subcommand was used to examine within-group effects from baseline to post-intervention.

3. Results

3.1. Missing data analysis

Baseline characteristics of those students with and without post-intervention data are detailed in Table 2. Those with and without post-intervention data did not differ in terms of their treatment condition, but did differ in terms of baseline GAD-7 and K6 scores. When compared to students with missing data, those with post-intervention data available had a lower GAD-7 score [$t(974) = 3.16$, $p < 0.01$] and higher K6 [$t(974) = -2.82$, $p < 0.01$] score at baseline.

3.2. Baseline distribution of the GAD-7, PHQ-5 and K6

In the overall sample (n = 976), the mean baseline GAD-7 score was 4.6 (SD = 4.6; range = 0–21), the mean PHQ-5 score was 2.9 (SD = 3.0; range = 0–15), and the mean K6 score was 18.4 (SD = 5.3; range = 0–24). Overall, 15.6% (n = 152 / 976) reported some level of suicidal ideation according to question five of the PHQ-5 ("thoughts that you were better off dead, or of hurting yourself"). Eighty-one (8.3%) reported suicidal ideation "several days" over the past two weeks, 41 (4.2%) reported suicidal ideation "more than half the days" and 30 (3.1%) reported suicidal ideation "nearly every day".

3.3. Baseline equivalence

At baseline, there were no significant differences between the three trial arms in terms of anxiety symptoms, depression symptoms or psychological distress in both the whole [n = 976; GAD-7: $_{(2, 973)} = 1.53$, $p = 0.22$; PHQ-5: $F_{(2, 973)} = 2.27$, $p = 0.10$; K6: $F_{(2, 973)} = 0.30$, $p = 0.74$] and reduced samples [n = 265; GAD-7: $F_{(2, 262)} = 1.33$, $p = 0.27$; PHQ-5: $F_{(2, 262)} = 0.48$, $p = 0.62$; K6: $F_{(2, 262)} = 2.17$, $p = 0.12$].

3.4. Symptom related outcomes

The estimated marginal means and results from the MMRM analyses for each of the outcome measures are presented in Table 1. For the depression intervention, there was a significant reduction in both the PHQ-5 (Cohen's $d = 0.14$; CI: -0.16–0.45) and GAD-7 (Cohen's $d = 0.29$; CI: -0.01–0.60) when compared with the control group. For the anxiety intervention, there was a significant reduction in the GAD-7 (Cohen's $d = 0.18$; CI: -0.13–0.49) when compared with the control group. There were no statistically significant differences between the treatment groups in terms of psychological distress (Table 3).

4. Discussion

We investigated the benefits of two teacher-led, curriculum-based online CBT interventions for anxiety and depression in adolescents.

Table 2
Baseline demographic and clinical characteristics of those with and without post-intervention data.

	Whole sample (n = 976)	Data available (n = 265)	Missing data (n = 711)	Data available vs. unavailable
	n (%)	n (%)	n (%)	
Condition				
Control	224 (23.0)	72 (27.2)	152 (21.4)	
Anxiety	372 (38.1)	92 (34.7)	280 (39.4)	$\chi^2(2, N = 976) = 3.99$, $p = 0.14$
Depression	380 (38.9)	101 (38.1)	279 (39.2)	
	Mean (range)	Mean (SD)	Mean (SD)	
PHQ-5	2.9 (3.0)	2.6 (2.6)	3.0 (3.2)	$t(974) = 1.95$, $p = 0.05$
GAD-7	4.6 (4.6)	3.9 (3.6)	4.9 (4.9)	$t(974) = 3.16$, $p < 0.01$
K6	18.4 (5.3)	19.1 (4.6)	18.1 (5.6)	$t(974) = -2.82$, $p < 0.01$

Note. PHQ-5 = Patient Health Questionnaire − 5 item; GAD-7 = The Generalised Anxiety Disorder 7-item scale; K6 = Kessler Distress Scale − 6 item.

Table 3
Estimated marginal means and results from marginal models.

Outcome measure	Condition	Baseline (n = 976)		Post-treatment (n = 265)		Within-group	Between-group		
		n	Mean (SD)	n	Mean (SD)	Baseline vs. post-treatment	Anxiety vs. control	Depression vs. control	Anxiety vs. depression
PHQ-5	Control	224	2.55 (2.96)	72	2.67 (2.47)	$F_{(1, 303.7)} = 0.19$	$F_{(1, 308.1)} = 2.37$	$F_{(1, 306.8)} = 6.35$ [*]	$F_{(1, 312.7)} = 1.04$
	Anxiety	372	2.98 (2.97)	92	2.55 (2.41)	$F_{(1, 313.9)} = 3.36$			
	Depression	380	3.08 (2.96)	101	2.32 (2.42)	$F_{(1, 311.3)} = 11.53$ [**]			
GAD-7	Control	224	4.15 (4.58)	72	4.41 (3.22)	$F_{(1, 319.2)} = 0.42$	$F_{(1, 319.6)} = 4.41$ [*]	$F_{(1, 319.6)} = 9.67$ [**]	$F_{(1, 318.8)} = 1.12$
	Anxiety	372	4.67 (4.57)	92	3.83 (3.17)	$F_{(1, 318.4)} = 6.04$ [*]			
	Depression	380	4.81 (4.58)	101	3.47 (3.19)	$F_{(1, 319.2)} = 16.7$ [**]			
K6	Control	224	18.56 (5.34)	72	17.24 (5.80)	$F_{(1, 275.7)} = 4.01$ [*]	$F_{(1, 275.4)} = 2.13$	$F_{(1, 275.5)} = 1.32$	$F_{(1, 274.7)} = 0.13$
	Anxiety	372	18.43 (5.34)	92	18.38 (5.73)	$F_{(1, 274.5)} = 0.01$			
	Depression	380	18.23 (5.34)	101	18.00 (5.74)	$F_{(1, 275.0)} = 0.35$			

Note. PHQ-5 = Patient Health Questionnaire − 5 item; GAD-7 = The Generalised Anxiety Disorder 7-item scale; K6 = Kessler Distress Scale − 6 item.
  [*] Statistically significant at $p < 0.05$.
[**] Statistically significant at $p < 0.01$.

Students who received the depression intervention showed significant improvements in depression and anxiety symptoms at post-intervention compared to those who were in the control group. Those in the anxiety intervention group also demonstrated reductions in symptoms of anxiety when compared to the control group. Neither course elicited statistically significant reduction in psychological distress when compared with health education as usual. The principal limitation of the current study is the loss of most of the post-intervention data through both attrition and data corruption. The baseline scores on the depression and anxiety symptom measures differed between those with and without data at post-intervention, but this was not in a consistent manner. Whilst these baseline differences were statistically significant, they were small and unlikely to represent clinically meaningful differences. This loss of data may have affected the results in unknown ways and the lack of statistically significant effects may be due to insufficient statistical power, or treatment ineffectiveness. The significant loss of data within some schools meant that we were unable to take into account the clustered nature of the data, and the analysis was unable to be conducted on the unit of randomisation (i.e., the schools). This loss of post-intervention data, coupled with the fact that this was a predominantly female sample at baseline, raises questions about the generalisability of these findings. The lack of longer term follow-up data is a further limitation, as is the lack of detail regarding usual health education in the control schools.

Despite these limitations, the current study has strengths that make it a worthwhile contribution to the literature. In particular, the current study included baseline data on screening measures (the GAD-7, PHQ-5 and K6) rarely administered in general population adolescent samples. Due to the inclusion of the PHQ-5, the current study also included baseline data on suicidal ideation in a large sample of adolescents. At baseline, 71 of the 976 (7.3%) adolescents reported thoughts that they would be "better off dead or of hurting yourself in some way" more than half the days in the preceding 2 weeks. In adults, the same responses to this particular question have been shown to be a strong predictor of suicidal attempts and death (Simon et al., 2013). With the limitations of the current study in mind, the Thiswayup Schools courses for anxiety and depression compare positively with other school based interventions, where the weighted overall mean effect size ranges from 0.16 to 0.18. These effect sizes are small, but need to be interpreted within the context of the non-clinical nature of community samples, where scores fluctuate within the "normal" healthy range (Lowry-Webster et al., 2001). These effect sizes compare favourably with the average post-test effect size observed for prevention programmes such as substance abuse, HIV, smoking, eating disorders and obesity (Stice et al., 2009).

5. Conclusion

The school environment is a place in which adolescents spend a large proportion of their lives and the school curriculum should include effective learning in mental health. Such psychoeducation is especially important in the light of the frequency of suicidal thoughts in this group. The Thiswayup Schools depression and anxiety courses demonstrated benefit in the targeted symptoms. The study, flawed by attrition and the corruption of data, demonstrates the practicality of using an online teacher-led programme in the context of Australia's existing education services. Given the study limitations, including the loss of post-intervention data, these findings can only be considered preliminary and need to be replicated in future research.

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