

The association between academic achievement goals and adolescent depressive symptoms: a prospective cohort study in Australia



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Summary

Background Students define academic competence across two axes: developing skills and understanding (mastery) versus comparisons with peers (performance), and achieving goals (approach) versus avoiding failure (avoidance). We aimed to examine the longitudinal association between achievement goals and adolescent depressive symptoms.

Methods We analysed data from the Kindergarten (recruited at age 4–5 years; born between March, 1999, and February, 2000; recruited from March, 2004 to November, 2004) and Baby (recruited at age 0–1 years; born between March, 2003, and February, 2004; recruited from March, 2004 to January, 2005) cohorts of the Longitudinal Study of Australian Children. Participants were identified through the Medicare enrolment database and sampled using a randomised selection stratified by postcode to represent the Australian population. Achievement goals were measured at age 12–13 years with the Achievement Goal Questionnaire (ranges from 1 to 7 on each of the four subscales), and depressive symptoms with the Short Mood and Feelings Questionnaire (score ranges from 0 to 26, with higher scores indicating more severe symptoms) at ages 14–15 years (both cohorts) and 16–17 years (Kindergarten cohort only). Analyses were linear multilevel and traditional regressions, with confounder adjustment, for participants with available data on the exposures, confounders, and outcome.

Findings We included 3200 participants (1585 female and 1615 male) from the Kindergarten cohort and 2671 participants (1310 female and 1361 male) from the Baby cohort. A 1-point increase in mastery-approach goals was associated with decreased depressive symptom severity score (Kindergarten, -0.33 [95% CI -0.52 to -0.15]; Baby, -0.29 [-0.54 to -0.03]), while a 1-point increase in mastery-avoidance goals was associated with increased depressive symptom severity score (Kindergarten, 0.35 [95% CI 0.21 to 0.48]; Baby, 0.44 [0.25 to 0.64]). A 1-point increase in performance-avoidance goals was associated with increased depressive symptom severity score in the Kindergarten cohort but not the Baby cohort (Kindergarten, 0.26 [95% CI 0.11 to 0.41]; Baby, -0.04 [-0.27 to 0.19]). We found little evidence of an association between depressive symptom severity and performance-approach goals.

Interpretation Depressive symptoms in adolescents were associated with their achievement goals, which could be targetable risk factors for future trials to investigate whether school-based interventions that aim to enhance factors consistent with mastery goals (ie, learning skills and understanding the subject, rather than assessing competence in comparison to peers) could prevent depression in adolescents.

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Introduction

Depression is among the top contributors to the global burden of disease,¹ and incidence increases sharply during adolescence.² Evidence suggests that rates of adolescent depression and co-occurring issues such as deliberate self-harm are rising across many countries, including Australia,³ with approximately 15% of Australian Year 8 secondary school students (age 13–14 years) meeting clinical thresholds for depression.⁴

Schools are a potential setting for preventive interventions that would increase equity of access. Most school-based interventions to prevent mental health problems use psychological approaches aimed at students as individuals (for example, mindfulness, cognitive behavioural therapy, or psychoeducation).⁵

These approaches have generally been ineffective at reducing depressive symptoms.⁶ An alternative is to modify the school environment. Whole-school interventions aim to change the school culture, climate, and values.^{6,7} There is evidence from randomised trials that adolescent depressive symptoms can be reduced through whole-school interventions targeting health promotion and socio-emotional skills.^{8,9} However, many whole-school interventions are unsuccessful, and a better understanding of which risk factors to target is needed.¹⁰

Achievement goals have been widely studied within schools and may represent a modifiable risk factor for adolescent depressive symptoms. Achievement goal orientations can be defined as cognitive representations that guide behaviour to an end state, therefore reflecting

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Research in context

Evidence before this study

The onset of depression commonly occurs in adolescence, with evidence suggesting that the rate of adolescent depression is rising in many countries. Despite the importance of prevention, very few strategies are successful. Modifications to the school environment might lead to improvements in adolescent mental health; however, there is little awareness over which factors to target. Achievement goals, which reflect differences in adolescents' motivation to learn and how they measure their own success, have been linked to adolescents' cognitions, ways of coping, stress, anxiety, and self-esteem. According to the goal-orientation model of depression vulnerability, achievement goals represent a potential risk factor for adolescent depression. Evidence has shown that students' achievement goal orientations are influenced by the school environment and that they are modifiable through targeted intervention. If there is a causal relationship, shifting adolescents' achievement goals could reduce depressive symptoms; however, there is a lack of high-quality evidence. We searched MEDLINE and PsycInfo from database inception to Aug 1, 2023, for studies published in English describing the association between achievement goals and depression in adolescents. We used the search terms "achievement goal*" AND "adolescen*" OR "student*" AND "depression", alongside searches in Google Scholar. We found only one longitudinal study, which used an unrepresentative convenience sample and did not adjust for confounders.

Added value of this study

Using longitudinal data from two nationally representative Australian cohorts, we examined the association between

four achievement goal orientations (measured with the Achievement Goal Questionnaire) with subsequent depressive symptoms (Short Mood and Feelings Questionnaire) in school-attending adolescents. In the Kindergarten cohort (recruited at age 4–5 years), we found that lower mastery-approach goals and higher mastery-avoidance goals were associated with increased depressive symptoms at follow-up. Higher performance-avoidance goals were associated with increased depressive symptoms, while there was no evidence of an association between performance-approach goals and future depressive symptoms. In the Baby cohort (recruited at age 0–1 year) lower mastery-approach goals and higher mastery-avoidance goals were associated with increased depressive symptoms at follow-up. There was no evidence of an association between performance-approach goals and performance-avoidance goals with future depressive symptoms.

Implications of all the available evidence

Our findings suggest that adolescents' cognitions around learning and success are associated with future mental health outcomes. Our study is the first to investigate this association using longitudinal data from a nationally representative cohort of adolescents, and further replication is needed. Our study is preliminary; however, it provides support for future trials to investigate whether school-based interventions that aim to enhance factors consistent with mastery goals (ie, learning skills and understanding the subject, rather than assessing competence in comparison to peers) could prevent depression in adolescents.

differences in individuals' motivation to achieve outcomes. Two key dimensions differentiate achievement goals.¹¹ The first is how someone defines competence and success for themselves. Mastery goals are when students define their success as developing understanding or skills. By contrast, performance goals are when success is defined by out-performing peers. The second dimension refers to valence, meaning whether someone's achievement goals are focused on attaining success or avoiding failure. Mastery-approach goals refer to the motivation to develop competence, task, or subject understanding, and to learn as much as possible. Mastery-avoidance goals refer to the motivation to avoid incompetence and are characterised by concerns about being unable to learn or understand subject material.¹² Performance-approach goals refer to the motivation to out-perform peers, whereas performance-avoidance refers to the motivation to avoid appearing incompetent and performing worse than peers.

There is a distinction between achievement goals and commitment to academic achievement. The latter refers to how important students value doing well at school and how important they perceive education in general. Some

school climate interventions are successful in reducing adolescent depressive symptoms. However, results from mediation analyses suggested that changes in students' academic commitment following the intervention were not associated with future depressive symptoms.¹³ By contrast, achievement goals refer to how students define their academic competency and success in relation to whether they value learning content or out-performing peers.

According to the goal-orientation model of depression vulnerability, achievement orientations might be linked with vulnerability to depression.^{14,15} The model proposes that high levels of performance-orientated goals lead to external standards for success based on social comparisons, with self-worth dependent on whether one has displayed competence compared with others. Accordingly, performance-orientated adolescents seek to do better than their peers and are more likely to interpret failure as evidence of personal inadequacy. If there are threats to one's self-worth—for example, if a task is too challenging or an exam has been failed—this leads to increased stress and anxiety, including beyond the immediate event, therefore resulting in increased

depression risk. Conversely, mastery-orientation encourages adolescents to view challenges and setbacks as opportunities for learning and growth, with self-worth not contingent on performance, competence, or social comparisons. This leads to adaptive ways of coping with stress or failure and reduces vulnerability to depression.

Achievement goal orientations are modifiable using interventions aimed at the school environment.^{16–18} Students' achievement goal orientations are thought to be influenced by whether schools emphasise learning and personal growth (mastery goals) or competition and social comparison (performance goals).¹⁷ Interventions have been aimed at school policies, teaching practices, and organisational structures to create environments that promote mastery goals and de-emphasise performance goals.¹⁷ Randomised trials have found that achievement goal interventions are associated with improvements in factors associated with depressive symptoms, such as anxiety, physical activity, and confidence and competence.¹⁹

To our knowledge, only one study has investigated the longitudinal association between achievement goals and depressive symptoms. Adolescents with lower mastery goals and higher performance goals at age 13–14 years were more likely to experience consistently high depressive symptoms throughout follow-up (from ages 13–14 years to 18–19 years).²⁰ However, the study did not control for confounders and used an unrepresentative sample of students ($n=2696$) from schools in Helsinki, Finland. Consequently, there is limited understanding as to whether achievement goal orientations are a potential risk factor of adolescent depression.

We investigated whether adolescents' achievement goal orientations were associated with subsequent depressive symptoms, using a nationally representative cohort (the Longitudinal Study of Australian Children; LSAC). We tested whether achievement goals at age 12–13 years were associated with future depressive symptoms between ages 14–17 years and psychological distress at age 18–19 years. We hypothesised that mastery-approach goals would be associated with lower levels of subsequent depressive symptoms and psychological distress, whereas mastery-avoidance, performance-avoidance, and performance-approach goals would be associated with higher levels of future depressive symptoms and psychological distress.

Methods

Study design and participants

LSAC includes two cohorts: the Kindergarten cohort, born between March, 1999, and February, 2000, and recruited at age 4–5 years (recruited from March 2004 to November 2004); and the Baby cohort, born between March, 2003, and February, 2004 and recruited at age 0–1 years recruited from March 2004 to January 2005.²¹ Both studies began in 2004. A total of 4983 children (Kindergarten cohort) and 5107 babies (Baby cohort) were recruited to the first wave, using a random selection

of households from a random selection of 330 postcodes. Sampling was stratified to ensure proportionality to the population of children in these areas. Potential participants had to be enrolled in the Medicare database held by the Health Insurance Commission (which includes 98% of Australian births by 12 months). There were no further eligibility criteria. Only one child was recruited from each household. LSAC received ethics approval from the Australian Institute of Family Studies Human Research Ethics Committee. Informed consent was given by adolescents' primary parent or caregiver at study enrolment and at each future wave up until adolescents reached 18–19 years, and additionally by adolescents from age 14–15 years for the Kindergarten cohort and age 10–11 years onwards for the Baby cohort.

Data collection was primarily conducted every 2 years, with a further two waves conducted during the COVID-19 pandemic. Data were collected from the child, parents, carers, and teachers. Data collection was done through face-to-face interviews in the adolescents' home, phone interviews, or mail-out questionnaires. Further details regarding the LSAC cohorts have been previously described.²¹

Our analyses consisted of adolescents who were registered to attend school at age 12–13 years, with those home-schooled or not registered excluded. We used data collected before the COVID-19 pandemic, given the effect that the pandemic had on adolescent mental health, which might have interfered with potential associations between achievement goals and depressive symptoms. The study follows the STROBE reporting guidelines (appendix pp 12–14).

See Online for appendix

Procedures

Adolescents reported the primary outcome of depressive symptoms using the Short Mood and Feelings Questionnaire (SMFQ).²² The 13-item SMFQ assesses depressive symptom severity in the previous 2 weeks. Scores range from 0 to 26, with higher scores indicating more severe depressive symptoms. We used threshold scores of eight or higher to indicate probable depression.²² For the primary outcome, we used depressive symptom severity score as a repeated measures outcome at ages 14–15 years and 16–17 years for the Kindergarten cohort and at age 14–15 years for the Baby cohort.

As a secondary outcome, we measured psychological distress at age 18–19 years in the Kindergarten cohort using the 10-item Kessler Psychological Distress Scale (K10)²³ to investigate whether achievement goal orientations are associated with mental health outcomes in late adolescence, as the SMFQ was not administered at this timepoint. Scores on the K10 range from 10 to 50, with higher scores indicating more severe distress.

Our exposure was four different achievement goals, measured using the 12-item self-reported Achievement Goal Questionnaire (AGQ),¹¹ based on the two-by-two formulation of achievement goal theory. The AGQ was

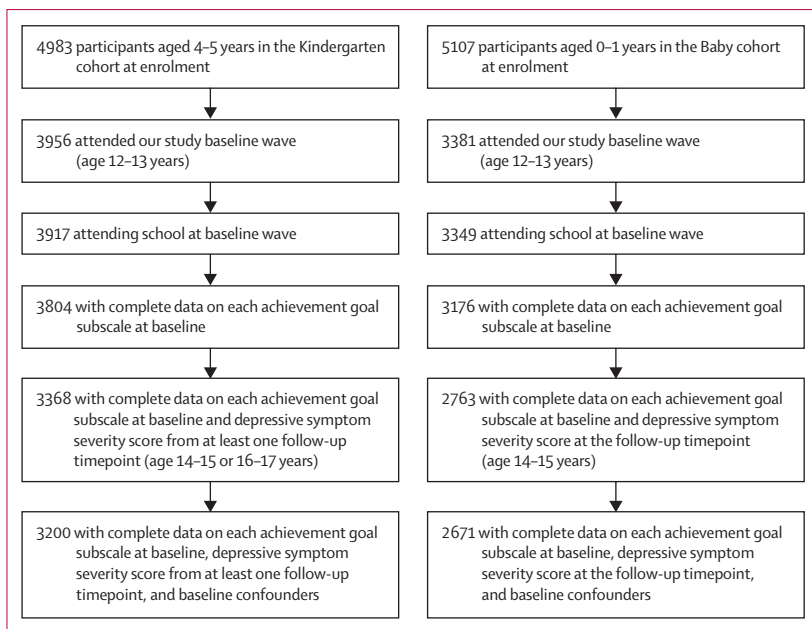


Figure: Study flowchart

	Kindergarten cohort (n=3200)	Baby cohort (n=2671)
Sex		
Female	1585 (49.5%)	1310 (49.0%)
Male	1615 (50.5%)	1361 (51.0%)
Two-parent household		
Yes	2752 (86.0%)	2300 (86.1%)
No	448 (14.0%)	371 (13.9%)
SMFQ score at age 12–13 years (range: 0–26)		
Score at threshold or above (≥8)	540 (16.9%)	520 (19.5%)
Score below threshold (<8)	2660 (83.1%)	2151 (80.5%)
Maternal K6 score at age 12–13 years (range: 6–30)		
Score at threshold or above (≥19)	92 (2.9%)	66 (2.5%)
Score below threshold (<19)	3108 (97.1%)	2605 (97.5%)
Aboriginal or Torres Strait Islander*		
Yes	65 (2.0%)	58 (2.2%)
No	3133 (97.9%)	2613 (97.8%)
Attending government schools		
Yes	1607 (50.2%)	1307 (48.9%)
No	1593 (49.8%)	1364 (51.1%)

Data are n (%). SMFQ=Short Mood and Feelings Questionnaire. K6=6-item Kessler Psychological Distress Scale. * Two adolescents in the Kindergarten cohort had missing data.

Table 1: Baseline characteristics

completed at age 12–13 years in each cohort, and at age 16–17 years in the Kindergarten cohort (appendix p 2). Primary analyses used the AGQ at age 12–13 years.

The AGQ has four 3-item subscales, which represent distinct internally consistent achievement goals: mastery-approach, mastery-avoidance, performance-approach,

and performance-avoidance. Example items are listed in the appendix (p 3). We used the mean score of each subscale's items, meaning the subscales had a range from one to seven, in line with the procedure used by the scale developers.¹¹ Higher scores indicated higher levels of each achievement goal. Assuming completion of all items, participants therefore had available scores for the four different subscales.

Confounders were selected on the basis of existing studies and theoretical assumptions. All confounders included are routinely associated with adolescent depressive symptoms and achievement goals. Confounders were measured at baseline and included sex assigned at birth (from Medicare records), maternal psychological distress (measured by the 6-item Kessler Psychological Distress Scale),²³ whether the adolescent was living in a single-parent household, and socioeconomic position (appendix p 4). Socioeconomic position was measured as a composite z-score incorporating parents' educational attainment, annual income, and occupational status, and was internally standardised for the recruited cohorts. We adjusted for baseline depressive symptom severity score measured with the SMFQ.

Linked data were obtained from the National Assessment Program–Literacy and Numeracy (NAPLAN). NAPLAN contains national assessment scores on students' numeric and literacy ability. As scores were not available in each domain for all participants, we created an average score across each assessment (reading, writing and spelling, grammar and punctuation, and numeracy) to indicate academic achievement. We used data for grade 7, when students were aged 12–13 years.

Statistical analyses

Our analytic samples for each cohort consisted of adolescents with complete data on each achievement goal subscale, confounders (except for grade 7 NAPLAN scores), and at least one depressive symptom severity outcome score. Sample weights were used in all analyses, except in our secondary analyses using mixed-effects logistic regression, due to issues with non-convergence.

The primary analysis in the Kindergarten cohort was linear multilevel regression models with depressive symptom severity score at follow-up clustered within participants, and a random intercept for participant. In the Baby cohort, analyses were traditional linear regression models as there was one follow-up time-point. We first investigated univariable associations between each AGQ sub-scale and depressive symptom severity score. Next, we added all AGQ subscales (as Pearson correlations between them were lower than 0.7; appendix p 4). For multilevel regression models, we added a variable indicating follow-up timepoint. We then added baseline depressive symptom severity score and finally added all other aforementioned confounders, except for grade 7 NAPLAN scores. In the Kindergarten cohort, we investigated whether associations between AGQ

subscales and depressive symptom severity scores differed according to follow-up, using an interaction between each AGQ sub-scale and time.

As a prespecified secondary analysis, we investigated associations with K10 scores as the outcome in the Kindergarten cohort, to test whether associations replicated at an older age (18–19 years) and with a different outcome. We investigated associations of AGQ scores at age 12–13 years and 16–17 years with the K10 at age 18–19 years using linear regression models and a similar model building procedure to the primary analysis.

As a further secondary analysis, we used an interaction term between each AGQ subscale and adolescents' sex in the final models of the primary analyses, as well as stratifying by sex.

We ran several sensitivity analyses. First, we included scores from NAPLAN assessments as a confounder in our primary analyses. As a proportion of grade 7 NAPLAN assessments took place after the baseline timepoint for the Kindergarten and Baby cohort samples, we did not control for this variable in the primary analysis, and it instead was controlled for in a secondary analysis. Second, we modelled depression as a binary outcome (SMFQ score of 8 or higher)²² using the aforementioned modelling procedure in logistic regression models. We estimated population-attributable fractions within the fully-adjusted logistic regression models for cohorts and subscales where there was evidence in the primary analyses of an association with future depressive symptom severity score. Population-attributable fractions estimate the proportion of depression cases that could be prevented if all adolescents had scores below or above the original median score on each specific AGQ subscale (appendix p 4). Third, we conducted multiple imputation to replace missing data (appendix p 5). Analyses were done with Stata 17.

Role of the funding source

The funder of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report.

Results

We analysed data from 3200 adolescents (80·8% of 3956 participants that attended the baseline wave for this analysis at age 12–13 years) in the Kindergarten cohort and 2671 in the Baby cohort (79·0% of 3381 participants that attended the baseline wave; figure). 1585 (49·5%) of 3200 participants in the Kindergarten cohort were female and 1615 (50·5%) were male, and 1310 (49·0%) of 2671 participants in the Baby cohort were female and 1361 (51·0%) were male (table 1). Approximately half of the Kindergarten cohort were attending government schools at ages 12–13 years (1607 [50·2%] of 3200), with the other half attending non-government schools (1593 [49·8%]; table 1). This was similar for the Baby cohort, with 1307 (48·9%) of 2671 attending government schools and 1364 (51·1%) attending non-government

	Mastery-approach	Mastery-avoidance	Performance-approach	Performance-avoidance
Kindergarten cohort				
Total sample	5·56 (1·24)	3·41 (1·59)	4·64 (1·58)	4·74 (1·50)
Sex				
Female	5·61 (1·19)	3·43 (1·60)	4·43 (1·62)	4·61 (1·49)
Male	5·52 (1·27)	3·40 (1·57)	4·84 (1·50)	4·87 (1·50)
Two-parent household				
Yes	5·60 (1·21)	3·38 (1·58)	4·66 (1·58)	4·77 (1·51)
No	5·39 (1·37)	3·58 (1·62)	4·54 (1·56)	4·60 (1·47)
SMFQ score at age 12–13 years (range: 0–26)				
Score at threshold or above (≥ 8)	5·16 (1·36)	4·19 (1·57)	4·44 (1·59)	4·69 (1·51)
Score below threshold (<8)	5·65 (1·19)	3·25 (1·54)	4·69 (1·57)	4·75 (1·50)
Maternal K6 score at age 12–13 years (range: 6–30)				
Score at threshold or above (≥ 19)	5·24 (1·56)	3·85 (1·49)	4·46 (1·60)	4·86 (1·47)
Score below threshold (<19)	5·58 (1·23)	3·40 (1·59)	4·65 (1·58)	4·74 (1·50)
Aboriginal or Torres Strait Islander				
Yes	5·18 (1·59)	3·80 (1·56)	4·35 (1·59)	4·42 (1·52)
No	5·58 (1·23)	3·40 (1·59)	4·65 (1·57)	4·75 (1·50)
Attending government schools				
Yes	5·49 (1·29)	3·46 (1·57)	4·64 (1·58)	4·75 (1·50)
No	5·64 (1·18)	3·36 (1·60)	4·64 (1·57)	4·73 (1·50)
Baby cohort				
Total sample	5·51 (1·26)	3·48 (1·58)	4·66 (1·59)	4·71 (1·53)
Sex				
Female	5·58 (1·23)	3·54 (1·59)	4·48 (1·65)	4·65 (1·56)
Male	5·44 (1·28)	3·43 (1·57)	4·83 (1·50)	4·77 (1·50)
Two-parent household				
Yes	5·55 (1·23)	3·46 (1·58)	4·68 (1·60)	4·72 (1·55)
No	5·26 (1·39)	3·65 (1·56)	4·54 (1·49)	4·65 (1·44)
SMFQ score at age 12–13 years (range: 0–26)				
Score at threshold or above (≥ 8)	5·15 (1·41)	4·06 (1·65)	4·60 (1·62)	4·83 (1·52)
Score below threshold (<8)	5·60 (1·21)	3·34 (1·53)	4·67 (1·58)	4·69 (1·53)
Maternal K6 score at age 12–13 years (range: 6–30)				
Score at threshold or above (≥ 19)	5·40 (1·38)	3·82 (1·74)	4·74 (1·55)	4·98 (1·64)
Score below threshold (<19)	5·51 (1·26)	3·47 (1·58)	4·66 (1·59)	4·71 (1·53)
Aboriginal or Torres Strait Islander				
Yes	5·23 (1·36)	3·59 (1·39)	4·57 (1·59)	4·64 (1·40)
No	5·52 (1·26)	3·48 (1·58)	4·66 (1·59)	4·72 (1·53)
Attending government schools				
Yes	5·44 (1·28)	3·53 (1·55)	4·68 (1·56)	4·74 (1·52)
No	5·58 (1·24)	3·43 (1·61)	4·64 (1·61)	4·69 (1·5)

Data are mean (SD). Each subscale of the Achievement Goal Questionnaire ranges from 1 to 7. SMFQ=Short Mood and Feelings Questionnaire. K6=6-item Kessler Psychological Distress Scale.

Table 2: Mean scores of the Achievement Goal Questionnaire subscales at age 12–13 years

schools. 65 (2·0%) participants from the Kindergarten cohort and 58 (2·2%) from the Baby cohort were Aboriginal or Torres Strait Islander adolescents.

Mean AGQ subscale scores at age 12–13 years according to baseline characteristics are shown in table 2. Of the AGQ subscales, mean scores were highest for mastery-approach and lowest for mastery-avoidance in each cohort.

	Mastery-approach		Mastery-avoidance		Performance-approach		Performance-avoidance	
	Change in depression symptom severity score (95% CI)	p value	Change in depression symptom severity score (95% CI)	p value	Change in depression symptom severity (95% CI)	p value	Change in depression symptom severity (95% CI)	p value
Model 1*	-0.43 (-0.59 to -0.26)	<0.0001	0.67 (0.54 to 0.80)	<0.0001	-0.16 (-0.29 to -0.02)	0.021	0.15 (0.01 to 0.28)	0.031
Model 2†	-0.49 (-0.68 to -0.30)	<0.0001	0.67 (0.53 to 0.81)	<0.0001	-0.16 (-0.32 to 0.005)	0.057	0.18 (0.02 to 0.34)	0.030
Model 3‡	-0.49 (-0.68 to -0.30)	<0.0001	0.67 (0.54 to 0.81)	<0.0001	-0.16 (-0.32 to 0.004)	0.056	0.18 (0.01 to 0.34)	0.033
Model 4§	-0.23 (-0.43 to -0.06)	0.011	0.39 (0.25 to 0.53)	<0.0001	-0.16 (-0.32 to -0.004)	0.045	0.21 (0.05 to 0.36)	0.010
Model 5¶	-0.33 (-0.52 to -0.15)	0.0002	0.35 (0.21 to 0.48)	<0.0001	-0.06 (-0.21 to 0.10)	0.47	0.26 (0.11 to 0.41)	0.001

AGQ=Achievement Goal Questionnaire. *Univariable model with only a singular AGQ subscale added to the model. †Model 1 plus all other AGQ subscales. ‡Model 2 plus time variable. §Model 3 adjusted for baseline depressive symptom severity score. ¶Model 4 adjusted for all remaining confounders: mother's baseline depressive symptom severity score, sex, socioeconomic position, and number of parents in household. Interactions between AGQ subscales and time were added to model 5; results for interaction terms are reported in the text.

Table 3: Mean change in depressive symptom severity score across ages 14–15 years and 16–17 years from linear multilevel model, per 1-point increase in achievement goals at age 12–13 years, in the Kindergarten cohort

	Mastery-approach		Mastery-avoidance		Performance-approach		Performance-avoidance	
	Change in depression symptom severity score (95% CI)	p value	Change in depression symptom severity score (95% CI)	p value	Change in depression symptom severity (95% CI)	p value	Change in depression symptom severity (95% CI)	p value
Model 1*	-0.28 (-0.51 to -0.05)	0.018	0.62 (0.44 to 0.81)	<0.0001	0.04 (-0.15 to 0.22)	0.69	0.11 (-0.08 to 0.30)	0.27
Model 2†	-0.40 (-0.66 to -0.15)	0.0020	0.66 (0.47 to 0.86)	<0.0001	0.09 (-0.14 to 0.31)	0.44	-0.05 (-0.28 to 0.19)	0.70
Model 3‡	-0.18 (-0.44 to 0.07)	0.16	0.49 (0.30 to 0.68)	<0.0001	0.07 (-0.15 to 0.29)	0.55	-0.06 (-0.29 to 0.17)	0.60
Model 4§	-0.29 (-0.54 to -0.03)	0.027	0.44 (0.25 to 0.64)	<0.0001	0.18 (-0.03 to 0.40)	0.11	-0.04 (-0.27 to 0.19)	0.65

AGQ=Achievement Goal Questionnaire. *Univariable model with only a singular AGQ subscale added to the model. †Model 1 plus all other AGQ subscales. ‡Model 2 adjusted for baseline depressive symptom severity score. §Model 3 adjusted for all remaining confounders: mother's baseline depressive symptom severity score, sex, socioeconomic position, and number of parents in household.

Table 4: Change in depressive symptom severity score at age 14–15 years, per 1-point increase in achievement goal orientations at age 12–13 years in the Baby cohort

Participants with missing data in both cohorts had lower scores of mastery-approach goals, and higher scores of mastery-avoidance goals at age 12–13 years than did those in the complete case samples (appendix p 5). In the Kindergarten cohort, participants with missing data had higher depressive symptom severity scores at age 12–13 years and at age 16–17 years. Missing data were associated with living in a single-parent household, a lower score on the socioeconomic variable, and higher levels of maternal psychological distress (appendix p 5).

Within the analytical sample, depressive symptom severity score increased over the timepoints for both cohorts (appendix p 5). Depressive symptom severity score at ages 12–13 years (mean difference 0.33 [95% CI 0.04 to 0.62]) and 14–15 years (mean difference 0.90 [0.53 to 1.26]) were slightly higher in the Baby cohort than in the Kindergarten cohort.

Findings were consistent across cohorts for mastery goals. For the Kindergarten cohort, a 1-point increase in mastery-approach was associated with a -0.43 (95% CI -0.59 to -0.26) decrease in depressive symptom severity score on average across follow-ups in the univariable analysis (table 3, model 1). Evidence of this association remained after all adjustments (-0.33 [95% CI -0.52 to -0.15]; table 3, model 5). There was no evidence

that the magnitude of the association varied by timepoint (p value for interaction term, 0.21). A 1-point increase in mastery-avoidance was associated with a 0.67 (95% CI 0.54 to 0.80) increase in depressive symptom severity score on average across follow-ups in the univariable model (table 3, model 1), and strong evidence remained after all adjustments (0.35 [95% CI 0.21 to 0.48]; table 3, model 5). There was little evidence that this association varied by timepoint (p value for interaction term, 0.070).

For the Baby cohort, a 1-point increase in mastery-approach was associated with a -0.28 (95% CI -0.51 to -0.05) decrease in depressive symptom severity score at age 14–15 years in the univariable model (table 4, model 1). Strong evidence of this association remained after all adjustments (-0.29 [95% CI -0.54 to -0.03]; table 4, model 5). A 1-point increase in mastery-avoidance goals was associated with a 0.62 (95% CI 0.44 to 0.81) increase in depressive symptom severity score in the univariable model (table 4, model 1), and strong evidence remained after adjustments (0.44 [0.25 to 0.64]; table 4, model 5).

Findings were consistent for performance-approach but not for performance-avoidance across cohorts. For the Kindergarten cohort, a 1-point increase in performance-approach goals was associated with

a -0.16 (95% CI -0.29 to -0.02) decrease in depressive symptom severity score on average across follow-ups in the univariable model (table 3, model 1). The association attenuated after adjusting for remaining confounders (-0.06 [95% CI -0.21 to 0.10]; table 3, model 5). There was no evidence that the magnitude of the association varied by timepoint ($p=0.31$).

For the Kindergarten cohort, a 1-point increase in performance-avoidance goals was associated with a 0.15 (95% CI 0.01 to 0.28) increase on average across follow-ups in depressive symptom severity score in the univariable model (table 3, model 1). This association was unaltered until the final model where the effect estimate increased slightly (0.26 [95% CI 0.11 to 0.41]; table 3, model 5). The magnitude of the association between performance-avoidance and depressive symptom severity score reduced as follow-up progressed (p value for interaction term: 0.026). When analysed in separate fully adjusted models, higher levels of performance-avoidance goals were associated with increased depressive symptom severity scores at both age 14–15 years and 16–17 years (table 5).

For the Baby cohort, there was no evidence of an association between performance-approach goals and depressive symptom severity score at follow-up, in either the unadjusted (0.04 [95% CI -0.15 to 0.22]; table 4, model 1) or fully adjusted models (0.18 [95% CI -0.03 to 0.40]; table 4, model 4). Performance-avoidance goals had no association with future depressive symptom severity score at age 14–15 years in either the unadjusted (0.11 [95% CI -0.08 to 0.30]; table 4, model 4) or fully adjusted models (-0.04 [-0.27 to 0.19]; table 4, model 4).

The association between mastery goals and performance-approach goals with psychological distress measured with the K10 at age 18–19 years in the Kindergarten cohort were similar to the results from the main analyses (appendix pp 6–7). However, there was no evidence of an association between performance-avoidance goals at age 12–13 years (0.14 [95% CI -0.13 to 0.40]) and 16–17 years (-0.10 [-0.40 to 0.19]) with psychological distress at age 18–19 years respectively, whereas a positive association with depressive symptom severity score was found in the main analysis.

Grade 7 NAPLAN scores were available for 93.1% ($n=2979$) of the Kindergarten cohort and 89.3% ($n=2384$) of the Baby cohort. The addition of NAPLAN scores to the final models had minimal effect on the regression coefficients for either cohort (appendix p 8). The results from the multiple imputation and complete case analyses were similar (appendix p 9). However, in the multiple imputation analysis, higher levels of performance-approach goals at age 12–13 years were associated with increased depressive symptom severity score at age 14–15 years in the Baby cohort in the fully adjusted model (appendix p 9).

We found a similar pattern when using a binary depression variable in both cohorts (appendix p 10). No

	Outcome at age 14–15 years (n=3068)		Outcome at 16–17 years (n=2686)	
	Change in depression symptom severity (95% CI)	p value	Change in depression symptom severity (95% CI)	p value
Unadjusted	0.28 (0.12 to 0.44)	0.0008	0.07 (-0.12 to 0.27)	0.48
Adjusted*	0.39 (0.20 to 0.58)	<0.0001	0.25 (0.02 to 0.48)	0.034

*All other Achievement Goal Questionnaire subscales, baseline depressive symptom severity score, mother's baseline depressive symptom severity score, sex, socioeconomic position, and number of parents in household.

Table 5: Change in Short Mood and Feelings Questionnaire depressive symptom severity score by timepoint, per 1-point increase in performance-avoidance goals at age 12–13 years in the Kindergarten cohort

association was found between performance-avoidance goals with depressive symptom severity score in the Kindergarten cohort in the fully adjusted model using a binary depression outcome, contrary to the main analyses (appendix p 10).

According to the population-attributable fractions, the prevalence of adolescent depression in the Kindergarten cohort would be 0.60% to 18.5% lower at age 14–15 years, and 2.9% to 12.9% lower at age 16–17 years in a hypothetical scenario in which all adolescents have mastery-approach scores above the sample median at age 12–13 years (appendix p 11). For the Baby cohort, the population-attributable fractions according to mastery-approach were smaller (between -1.3% and 11.4%). Furthermore, the prevalence of adolescent depression in the Kindergarten cohort would be 7.9% to 19.6% lower at age 14–15 years, and 3.4% to 12.4% lower at age 16–17 years, and for the Baby cohort 5.8% to 17.6% lower at age 14–15 years if all adolescents have mastery-avoidance scores below the sample median at age 12–13 years. Finally, the prevalence of adolescent depression in the Kindergarten cohort would be 4.1% to 14.9% lower at age 14–15 years, and -0.9% to 7.8% lower at age 16–17 years in a scenario in which all adolescents have performance-approach scores below the sample median at age 12–13 years.

Discussion

In two nationally representative cohorts, we found consistent evidence that higher mastery-approach goals were associated with lower levels of subsequent depressive symptoms, and that higher mastery-avoidance goals were associated with higher subsequent depressive symptoms. We also observed this pattern in late adolescence with the outcome of psychological distress.

In the Kindergarten cohort, there was evidence that higher levels of performance-avoidance goals at age 12–13 years were associated with increased depressive symptoms at age 14–15 years and 16–17 years, but there was no association with performance-approach goals. In the Baby cohort, there was no evidence of an association with performance-approach or avoidance. The confidence intervals for each cohort's estimates overlapped, indicating no evidence of a cross-cohort interaction. The follow-up time-period for the Kindergarten cohort

extended to ages 16–17 years, leading to cross-cohort differences in the age of outcome assessment and the analytical approach used, which might explain the discrepancy in effect sizes for performance-avoidance. Cross-cohort differences in results might be partly due to potential cohort differences in their school experience or norms around academic achievement and success. However, this is unlikely to explain a substantial proportion of the differences given the small difference in year of birth, and therefore the likelihood that these experiences were markedly different between the cohorts.

The effect sizes were modest; however, small effect sizes are of clinical and public health importance when exposures and outcomes are common, and the population of interest is large.²⁴ The population-attributable fractions indicate (under the assumptions that the associations are causal and there is no residual confounding) that reducing adolescents' mastery-avoidance goals and increasing their mastery-approach goals might lead to a reduction in the prevalence of adolescent depression. Our findings contrast with a previous longitudinal study in which higher levels of both performance-approach and performance-avoidance goals were associated with increased risk of depressive symptoms in Finnish adolescents.²⁰

We used multiple imputation to examine the effect of missing data and in most cases the direction and magnitude of the coefficients did not alter substantially between the complete case samples and multiply imputed datasets. However, in the multiply imputed dataset there was evidence that higher levels of performance-approach goals at age 12–13 years were associated with increased depressive symptoms at age 14–15 years for the Baby cohort, which was not observed in the complete case sample, although the absolute change in the coefficient between the complete case and imputed dataset analyses was small (0·06).

Our study has several limitations. First, we adjusted for a wide range of confounders but are unable to rule out the possibility of residual confounding—for example, due to personality or genetic factors. Accordingly, the effect sizes might over-estimate any association. Second, we used self-reported depressive symptoms and were not able to corroborate findings using other methods of measuring the outcome such as a confirmed diagnosis. However, the SMFQ has shown high discriminatory ability for identifying cases of adolescent depression that meet diagnostic criteria.²⁵ Finally, the sample also consisted of only a small number of Aboriginal or Torres Strait Islander adolescents, and data linked to ethnicity were not available. We were therefore unable to explore whether the association varied across different population groups.

There are several cognitive mechanisms that might explain why mastery goals were associated with depressive symptoms. Dysfunctional attitudes and negative attributions are modifiable belief systems that

have been found to increase the risk of depression.^{26,27} Dysfunctional attitudes involve core beliefs such as “if I fail at my work then I am a failure as a person”. Negative attributions for events are internal (our fault), global (affect all aspects of our world), and stable (will affect our future).²⁸ By appraising failure as an opportunity to learn and grow, mastery-approach orientation might reduce dysfunctional attitudes and negative attributions and decrease vulnerability to depression. Mastery-approach goals could promote growth mindsets: core beliefs that abilities can be developed through practice, which are associated with reduced risk of depressive symptoms.^{14,29,30} Growth mindsets could encourage adaptive ways of coping with stress and failure. Conversely, mastery-avoidance goals could increase the risk of these experiences.

Adolescents' achievement goals are likely to be shaped by the educational curriculum, school climate, and the extent of high-stakes testing (ie, the frequency of exams or tests with important consequences for future educational and occupational opportunities). Teaching and assessments focused on academic performance might lead to an increased likelihood of adolescents having dysfunctional attitudes regarding school or exam failure (or risk of), and decreased likelihood of growth mindsets, thus they are less able to handle stress or failure. Accordingly, the extent that achievement goals might exert risk on adolescent depression can vary across cultures, countries, and schools. Future research, including longitudinal mediation analyses, is required to identify the pathways and processes through which achievement goals could affect depressive symptoms in adolescents. Achievement goals might be associated with other common mental health problems in adolescents, such as anxiety disorders, and further research is required.

Our findings support the hypothesis that mastery-approach goals are associated with lower levels of subsequent depressive symptoms in adolescents. Our study is the first to investigate this association using longitudinal data from a nationally representative cohort of adolescents. Although this is preliminary, the results support evaluating interventions targeting school environments so that they emphasise learning, development, and personal growth (ie, mastery goals). Although some existing whole-school approaches are associated with decreased adolescent depressive symptoms, interventions have not focused on achievement goals. Our study suggests they might be more effective if they incorporate approaches promoting mastery-approach goals, assuming the observed associations are causal. Whole-school interventions could target the attitudes and values of schools and teachers to promote a school climate in which academic mistakes are seen as opportunities for growth and learning is prioritised over academic performance. Classroom environments where teachers use students'

own past performance as comparison points, rather than other students' performance or normative standards, might also foster mastery-approach goals. School-based interventions to promote mastery-approach goals could be evaluated in trials of preventative interventions for depressive symptoms.

Contributors

TS, GL, KL, and GeL designed the study and analysis plan. TS led the data analysis, with support from GeL. TS and GeL led the manuscript write-up, with support from all authors. TS and GeL accessed and verified the data. KL had access to all Longitudinal Study of Australian Children data and GL had no access to the data. All authors accept responsibility for the decision to submit for publication.

Declaration of interests

GL is chair of an NIHR-funded trial steering committee and has received funding for travel and accommodation to attend the European College of Neuropsychopharmacology Congress 2023. KL is a participant on the Murdoch Children's Research Institute Data Governance Instruments working group and declares no other competing interests. All other authors declare no competing interests.

Data sharing

The data used in the study are available from the Australian Data Archive Dataverse.

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For the Australian Data Archive Dataverse see <https://dataverse.ada.edu.au/dataverse.xhtml?alias=lsac>