REVIEW

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Systematic Review and Meta-Analysis: Adolescent Depression and Long-Term Psychosocial Outcomes

Zahra M. Clayborne, BSc(Hons), Melanie Varin, BSc, Ian Colman, PhD

Objective: Experiencing depression in adolescence can disrupt important developmental processes, which can have longstanding effects on socioeconomic status and relationships. The objective of this article was to systematically review the evidence examining associations between adolescent depression and adult psychosocial outcomes.

Method: Five databases (MEDLINE, Embase, PsycINFO, CINAHL, and ERIC) were searched for articles published from 1980 through March 2017. Eligible articles were peer reviewed, published in English, had prospective cohort study designs, and contrasted adult psychosocial outcomes in those with versus without adolescent depression. Outcomes with sufficient data were pooled using random-effects meta-analyses, with summary measures reported as odds ratios (ORs). A protocol for this review was registered on PROSPERO (CRD42017059662).

Results: Of the 4,988 references screened for inclusion, 31 articles comprising 136 analyses were included for review. Twenty-four cohorts were represented. Seventy-seven analyses across 10 outcomes were meta-analyzed, with remaining analyses summarized narratively. Meta-analyses suggested that adolescent depression was associated with outcomes including, but not limited to, failure to complete secondary school (OR 1.76, 95% CI 1.29–2.39), unemployment (OR 1.66, 95% CI 1.29–2.14), and pregnancy/parenthood (OR 1.38, 95% CI 1.06–1.81).

Conclusion: This review demonstrates that adolescent depression is associated with a myriad of adult psychosocial outcomes. Many are linked and can lead to the propagation of difficulties across the lifespan. These findings can have important implications for encouraging the provision of targeted mental health care early in development to improve life chances.

Key words: depression, longitudinal, epidemiology, outcomes

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Depression is highly prevalent in adolescence, with conservative estimates suggesting up to 12.5% of 12- to 17-year-olds experience symptoms of a major depressive episode in a 12-month period.[1] Longitudinal research estimates that a large proportion of those who experience depressive episodes in adolescence will go on to experience at least 1 recurrent episode in adulthood.[2] Globally, depressive disorders contribute to a substantial degree of disease burden, and prioritizing the prevention and treatment of depression represents a major public health priority.

Adolescence is an important developmental period marked by the building and understanding of healthy relationships, exploring one's interests, developing important skills for life and the workplace, and ultimately transitioning to further education and/or the labor force.[3,4] Experiencing depression during this period can disrupt these processes, which ultimately can affect an individual's long-term socioeconomic standing and peer, familial, and romantic relationships. Several studies demonstrate that experiencing depression in early life is associated with a myriad of poor outcomes in addition to depression recurrence; these range from increased risk of obesity and type 2 diabetes to increased risk of comorbid mental health disorders, including anxiety and substance use disorders.[5-7] An emerging body of evidence also links early-life depression to a number of poor psychosocial outcomes, including lower educational attainment, unemployment, and lower perceived social support.[7,8] Through a preventive and an economic lens, understanding the impact adolescent depression can have on psychosocial outcomes in the long term is important.

To date, there has been no systematic exploration of the associations between adolescent depression and a number of psychosocial outcomes, including marriage, pregnancy and parenthood, and social support. The objective of this systematic review was to synthesize evidence to date examining the associations between adolescent depression and long-term psychosocial outcomes including, but not limited to, educational

attainment, income, employment, pregnancy/parenthood, marital and relationship status, social support, and loneliness.

METHOD

Methodology and reporting for this systematic review are consistent with the PRISMA statement.[9] A PRISMA checklist is provided in Supplement 1, available online. A protocol for this review was developed *a priori* and registered on PROSPERO (CRD42017059662).

Search Strategy and Selection Criteria

We conducted a comprehensive literature search in 5 electronic databases: MEDLINE, Embase, PsycINFO, CINAHL, and ERIC. All database searches were completed in March 2017. An example of the search strategy used in MEDLINE is provided in Supplement 2 (available online), and similar strategies were used for the remaining databases. We also scanned reference lists and citing of eligible articles to supplement database searches.

We included articles that examined adolescents 10 to 19 years old at time of ascertainment of depressive status, which is in line with the definition of adolescence put forth by the World Health Organization.[10] Depression was defined as meeting standard diagnostic criteria for a major depressive disorder, in accordance with the third or later editions of the *DSM* or the 9th or 10th edition of the *International Statistical Classification of Diseases and Related Health Problems*. We also included articles that examined depression (characterized as depressive disorder, major depressive disorder, major depression, or experiencing clinically significant depressive symptoms) using self-report scales or diagnostic interviews. Comparators included participants 10 to 19 years of age who did not meet criteria for a major depressive disorder (ie, subthreshold and below). Included articles were published in peer-reviewed, English-language journals, with prospective cohort study designs. There were no restrictions for setting in this review; however, we restricted articles to those published from January 1, 1980 through March 1, 2017, because the former threshold corresponds with the year of publication of the *DSM-III,*[11] which introduced the diagnosis of "major depressive disorder" consistent with current definitions used in research and clinical practice.

Articles were included if they measured psychosocial outcomes in adulthood ($\geq$18 years old), with a minimum of 12 months from exposure to outcome assessment. We identified a number of outcomes *a priori*, and articles were eligible for inclusion if they examined at least 1 of the predefined outcomes of interest. During the review process, we also identified a number of additional outcomes that were included for review. Articles were included if they measured the association between depression in adolescence and at least 1 of the following outcomes: secondary school completion (or failure to complete), postsecondary entry and/or completion, total years of education, current employment status (ie, employed versus unemployed), income, receipt of unemployment or welfare benefits, pregnancy/parenthood, marital or relationship status, single parenthood or unintended pregnancy/parenthood, perceived social support, and loneliness. Outcomes identified in this review or *a priori* that were not meta-analyzed are summarized narratively. A list of excluded articles, and reasons for exclusion, is provided in Table S1 (available online).

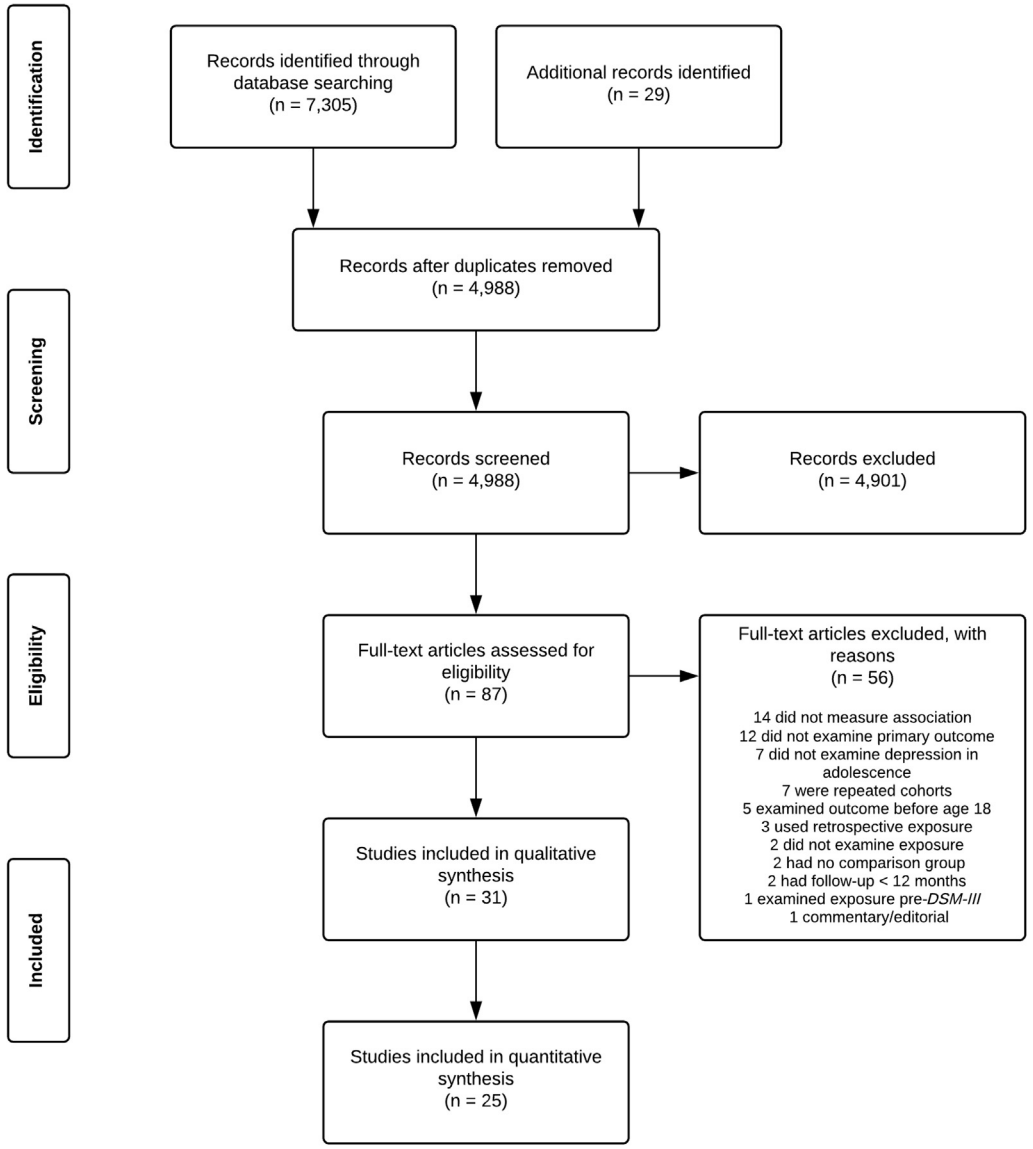
Two independent reviewers screened titles and abstracts of obtained citations to ascertain potential eligibility and remaining citations underwent full-text review. Differences at each stage were resolved by consensus. When multiple eligible articles examining the same cohort of individuals were found, the article using the most recent follow-up data was retained for review. The selection process is presented in Figure 1.

Data Extraction and Analysis

Two independent reviewers first examined the methodologic quality of eligible articles using the Newcastle-Ottawa Scale (NOS),[12] a quality assessment tool used for nonrandomized studies including case-control and cohort studies. The NOS uses a star rating system; stars are assigned for 8 items grouped into 3 categories assessing selection of study groups, comparability, and outcomes. Articles in this review received a maximum of 9 stars: 4 stars for selection, 2 for comparability, and 3 for outcome. Quality ratings also were used to comment on the magnitude of bias present within and across articles. Reliability of quality ratings was assessed by using the κ statistic to measure interobserver agreement.[13]

Data were extracted from eligible articles and entered into a computerized extraction form developed before review. Data items extracted included country, age at exposure and outcome, method of assessment for exposure, cohort examined, follow-up duration, covariates, and measures of association. Article characteristics were summarized in text and in table format (Table S2, available online). Data analysis was performed using Review Manager 5.3 (The Nordic Cochrane Center, Copenhagen, Denmark). Because the outcomes examined were diverse, we completed multiple meta-analyses where appropriate. Eligible articles were sorted by outcome, and a meta-analysis for each outcome was conducted if articles were similar enough to pool (through assessments for clinical and statistical heterogeneity, with the latter set at a threshold of $I^2 < 75\%$)[14] and there were a

FIGURE 1 PRISMA Flowchart of Article Selection Process



sufficient number of analyses available for pooling (ie, a threshold set by the study team *a priori* of $\geq$3 analyses across $\geq$2 articles). A narrative synthesis was conducted when pooling was deemed inappropriate. We used random-effects modeling for all meta-analyses, with analyses weighted using the inverse variance method, and all comparisons were made between those with depression and those without. Summary measures are reported using odds ratios (ORs), presented with 95% CIs. Measures of statistical heterogeneity (I^2 statistic, Cochran Q statistic) were calculated, and forest plots were presented for each meta-analysis. Sensitivity analyses in the presence of moderate heterogeneity ($I^2 > 50\%$ and/or Cochran Q statistic, $p < .05$) were completed on the bases of statistical adjustment and quality when sufficient articles were available to do so. Publication bias was examined by visual inspection of a funnel plot and applying the Egger test for meta-analyses including at least 10 articles, with the Egger test set at a threshold of a p value less than .05 to indicate funnel plot asymmetry.

RESULTS

A PRISMA flowchart summarizing the article selection process is presented in Figure 1. In all, we screened 4,988 articles and ultimately included 31 articles in this review, comprising 24 cohorts and 136 analyses across 40 identified outcomes. Twenty-five articles comprising 77 analyses were included in 10 meta-analyses; remaining analyses were summarized narratively (Table S3, available online). A list of

excluded articles, with reasons for exclusion, is presented in Table S1 (available online).

Characteristics of included articles are presented in Table S2 (available online). The unweighted mean age at exposure ascertainment was 15.57 years (standard deviation [SD] 1.65, range 11–19). At follow-up, the unweighted mean age was 23.81 years (SD 3.66, range 18–35). Average follow-up time was 8.77 years (SD 3.82). Of the 31 articles included in this review, 16 were from the United States, 4 were from Sweden, 4 were from Canada, 3 were from New Zealand, 2 were from Australia, and 1 each was from the Netherlands and Norway. Sample sizes ranged from 63 to 14,271 participants.

Quality ratings are listed in Table S4 (available online). Cumulative star ratings ranged from 5 to 9 of 9 stars; overall, articles included for review were deemed to be of moderate to high quality. The mean star rating was 3.26 of 4 stars for selection, 1.10 of 2 stars for comparability, and 2.26 of 3 stars for outcome. Interobserver agreement was strong ($\kappa = 0.93$).

A summary of the random-effects meta-analyses conducted is presented in Table 1, and corresponding forest plots are presented in Figures S1 to S4 (available online). In all, depression in adolescence was associated with 7 of the 10 adult outcomes that were meta-analyzed in this review; these results are detailed below.

Three meta-analyses summarized associations between adolescent depression and long-term education-related outcomes (Figures S1 and S2, available online). In detail, compared with controls (ie, those without depression), adolescent depression was associated with higher odds of failure to complete secondary school (OR 1.76, 95% CI 1.29–2.39) and lower odds of postsecondary entry (OR 0.75, 0.64–0.88). The relation between adolescent depression and postsecondary completion was not statistically significant (OR 0.87, 95% CI 0.62–1.21). I^2 values ranged from 29% to 71%. Sensitivity analyses were completed for failure to complete secondary school because of moderate heterogeneity ($I^2 = 71\%$). Specifically, removal of articles that did not adjust for covariates (OR 1.42, 95% CI 0.91–2.20) and removal of articles with lower quality scores (ie, <6 stars; OR 1.68, 95% CI 1.12–2.52) attenuated the relation but increased statistical heterogeneity ($I^2 = 82\%$ and 81%, respectively). Visual inspection of funnel plots for failure to complete secondary school (Figure S5, available online) and postsecondary entry (Figure S6, available online) did not seem to clearly indicate publication bias, and the Egger test was not statistically significant for failure to complete secondary school (intercept 0.54, 95% CI −3.90 to 4.99, $t = 0.27$, $p = .79$) and postsecondary entry (intercept −1.51, 95% CI −3.12 to 4.10, $t = -2.06$, $p = .067$)

Four meta-analyses summarized associations between adolescent depression and long-term employment outcomes (Figures S2 and S3, available online). Compared with controls, adolescent depression was associated with higher

TABLE 1 Summary of Random-Effects Meta-Analyses on Adult Psychosocial Outcomes of Adolescent Depression

Outcome	Included Analyses	Participants, n	Odds Ratio	95% CI, Lower Limit	95% CI, Upper Limit	I^2, %	Cochran Q	*p* for Test of Heterogeneity
Did not complete secondary school[a]	17	21,004	1.97	1.73	2.24	71	54.27	<.001
Entered postsecondary education[a]	11	17,724	0.69	0.55	0.88	36	15.57	.11
Completed postsecondary education	4	2,610	0.87	0.62	1.21	29	4.20	.24
Currently employed or in tertiary training, full time[a]	7	2,905	0.70	0.56	0.88	0	5.01	.54
Current or recent unemployment[a]	6	2,743	1.66	1.29	2.14	12	5.68	.34
Long-term or multiple periods of unemployment	3	2,024	1.56	1.15	2.11	0	1.94	.38
Receipt of welfare or unemployment benefits[a]	3	8,842	1.20	0.97	1.48	36	3.15	.21
Earlier marriage or cohabitation[a]	10	3,671	1.14	0.89	1.45	26	12.18	.20
Divorced or separated	5	1,977	1.64	0.83	3.24	46	7.40	.12
Pregnancy or parenthood[a]	11	4,537	1.37	1.14	1.63	46	18.68	.04

Note: [a]*Denotes* a priori *outcome.*

odds of current or recent unemployment (OR 1.66, 95% CI 1.29–2.14) and long-term or multiple periods of unemployment (OR 1.56, 95% CI 1.15–2.11) and with lower odds of being currently employed or in tertiary training (eg, 2-year college, technical institute; OR 0.70, 95% CI 0.56–0.88). The relation between adolescent depression and receipt of unemployment or welfare benefits was not statistically significant (OR 1.20, 95% CI 0.97–1.48). I^2 values ranged from 0% to 36%.

Three meta-analyses summarized associations between adolescent depression and long-term relational outcomes (Figure S4, available online). Compared with controls, adolescent depression was associated with higher odds of pregnancy or parenthood (OR 1.38, 95% CI 1.06–1.81). The relations between adolescent depression and marriage or cohabitation (OR 1.14, 95% CI 0.89–1.45), and divorce/separation (OR 1.64, 95% CI 0.83–3.24) were not statistically significant. I^2 values ranged from 26% to 46%. Sensitivity analyses were completed for pregnancy or parenthood because of moderate statistical heterogeneity ($I^2 = 46\%$). In detail, the removal of articles that did not adjust for covariates (OR 1.50, 95% CI 1.11–2.02) strengthened the relation and substantially lowered the degree of statistical heterogeneity present ($I^2 = 0\%$). Conversely, the removal of articles with quality scores below 6 stars (OR 1.37, 95% CI 1.11–1.68) did not affect the strength of the relation but did lower the degree of statistical heterogeneity present ($I^2 = 0\%$).

In all, 30 of the psychosocial outcomes identified before or during the review process were not meta-analyzed, because of an insufficient number of analyses available for pooling or substantial heterogeneity across eligible articles. A narrative summary of the findings sorted by outcome is presented in Table S3, available online.

For outcomes identified *a priori* , 7 were not meta-analyzed owing to insufficient data for pooling; these included educational attainment, total years of education, income, social support, loneliness, single parenthood, and unintended pregnancy. Two articles examined overall educational attainment and showed a statistically significant, negative association between adolescent depression and overall educational attainment.[15,16] Two articles examined total years of education; 1 article reported a statistically significant association between depression and lower years of education in women but not in men[17] and 1 reported no significant association.[18]

Five articles examined income-related outcomes; 3 reported statistically significant associations between depression and lower hourly pay,[19] lower net weekly income,[20] and lower past-year income.[21] Two articles reported no statistically significant associations between adolescent depression and total yearly household income[18] and low compared with high income.[8]

Two articles examined social support and reported statistically significant associations with adolescent depression, 1 with low social support[8] and the other with increased need for social support.[22] Two articles examined loneliness and reported statistically significant associations between adolescent depression and higher reported loneliness in adulthood.[23,24] For the outcome of single parenthood, 1 article reported a statistically significant, positive association between depression and single parenthood in women but not in men[25]; another article found no significant association with single parenthood in a mixed gender sample.[20] For unintended pregnancy, 2 articles reported no significant association between adolescent depression and unintended pregnancy.[20,26]

DISCUSSION

The findings of this systematic review and meta-analysis demonstrate consistent associations between adolescent depression and a number of psychosocial outcomes in adulthood. Adolescent depression was associated with higher odds of experiencing outcomes including failure to complete secondary school, unemployment, and pregnancy and parenthood, and lower odds of being employed or in tertiary training and entering postsecondary education. Some analyses summarized narratively also demonstrate statistically significant associations between adolescent depression and outcomes including income, social support, and loneliness.

Although the processes linking depression and the psychosocial outcomes included in this review are likely complex, numerous factors have been proposed to explain these relations. First, depression is often associated with significant functional impairment.[27] For adolescents, this can lead to negative effects on one's ability to comprehend and complete schoolwork, which can ultimately influence their educational attainment and, by extension, their employment opportunities.[18] Second, depression can directly affect school attendance, which in turn can affect educational attainment and, relatedly, obstruct the formation and maintenance of relationships owing to less time spent with peers.[28] Third, depression is often marked by social impairment, which can affect the development of stable relationships and social networks and negatively affect one's ability to advance in the workplace later in life.[29,30] Fourth, the potential socioeconomic consequences resulting from depression, including lower educational attainment, unemployment, and welfare receipt, can add stress to intimate relationships owing to financial strain, leading to poorer marital and relational functioning and ultimately separation or divorce.[25,31,32] Fifth, many adolescents who experience a major depressive episode

in adolescence will go on to experience recurrence in adulthood.[2] Experiencing recurrent bouts of depressed mood can be stressful for one's partner, potentially leading to relationship dissolution and/or divorce.[33] Those with depression also might be more likely to select partners who are unsupportive or prone to experiencing depression themselves, which can lead to further relational strain.[25,34,35] Because adolescence is a particularly important developmental period highlighted by academic transition and the development of relationships and critical life skills, depression experienced during this period can make adolescents particularly vulnerable toward experiencing a number of poor psychosocial outcomes compared with their nondepressed peers.

We also found strong evidence across a number of articles suggesting that adolescent depression is associated with higher odds of pregnancy or parenthood. Several factors could account for this association. Those experiencing depression in adolescence might exit school earlier because of disinterest, functional impairment, and/or truancy, which ultimately can lead to marriage, cohabitation, and/or parenthood at younger ages.[36-38] In addition, most articles included in this review examined outcomes in early adulthood, which could account for the higher odds of parenthood among those with adolescent depression. Childbearing gaps between those who experience depression and those who do not might narrow at older ages, particularly if there are differences between groups in educational attainment. Further, it has been hypothesized that earlier parenthood among those experiencing depression might be related to the desire to foster connection and intimacy with others. Those experiencing depressed mood might be particularly susceptible to feelings of isolation, and earlier parenthood could represent attempts to build connections in an effort to modify these feelings.[17,39,40]

This review has several limitations to consider. First, the relations between adolescent depression and the outcomes presented in this review might have been confounded in part by a number of important factors, including baseline or childhood socioeconomic status, gender, ethnicity, genetic vulnerability toward experiencing depression, and family structure. Almost one-third of included articles did not adjust for any covariates, and more than half did not adjust for gender or baseline socioeconomic status. These latter factors are particularly important considerations. For example, adolescent girls with depression might be more prone to poor relational outcomes (eg, divorce/separation, single parenthood) compared with boys,[25,30] and children and adolescents from lower income households are often more likely to experience depression[41] and have lower income and educational attainment in adulthood.[42] To address these limitations, we conducted sensitivity analyses removing articles that did not adjust for gender and socioeconomic status. For failure to complete secondary school, this significantly attenuated the relation, but substantial statistical heterogeneity remained. For pregnancy and parenthood, this strengthened the relation, and statistical heterogeneity was substantially decreased.

We also defined, *a priori* , that included articles would be published, peer reviewed, and in the English-language. As a result, we cannot rule out any potential bias that could arise from not including articles published in other languages; for example, articles published in other languages might be more likely to report null or negative findings.[43] Across included articles, there also was a moderate degree of variability with respect to follow-up duration (range 1–16 years), which could have led to some of the statistical heterogeneity we observed for certain outcomes. Because of the broad number of outcomes examined in our review and the small number of analyses included across outcomes, we did not conduct sensitivity analyses to examine the potential influence of shorter follow-up duration.

The potential for reverse causality also cannot be ruled out. In detail, children with cognitive or social impairments might be more prone toward experiencing depression in adolescence, which can lead to experiencing adverse psychosocial outcomes in adulthood. This possibility is supported by a recent genome-wide association meta-analysis by Wray *et al.*,[44] which suggests that genetic variation in educational attainment alters the risk for depression. As a result, interventions targeted at improving learning or social behaviors in childhood might be valuable. In addition, many of the articles included did not address the potential impact of depression recurrence in adulthood, which could confound in part the observed associations. This is a particularly important consideration, because chronic, recurrent depression is common, is often more severe, and is associated with poorer outcomes throughout the lifespan compared with depression that does not recur.[2] Moreover, because most articles in our review examined depression and/or long-term outcomes using self-report items, we cannot rule out the potential risk of bias present across articles using self-report versus diagnostic interviews or administrative data. However, we hypothesize that those with depression and/or poorer long-term outcomes might be less likely to report these issues on the basis of social desirability, which would likely bias our pooled estimates toward the null. Furthermore, most articles that measured depression by self-report used validated measures with strong psychometric properties (eg, Centre for Epidemiologic Studies–Depression scale).[45]

This review is not without strengths. First, limiting our inclusion criteria to articles with prospective cohort designs allowed for better ascertainment of the temporal relation

between adolescent depression and long-term outcomes. Second, most articles included were of moderate to high methodologic quality, particularly in the selection and representativeness of participants, which strengthens the reliability of our findings. Third, despite moderate heterogeneity across included articles, most analyses included in this review demonstrated consistent associations between adolescent depression and long-term outcomes. Fourth, this review is the first to provide a systematic exploration of the associations between adolescent depression and a vast range of psychosocial outcomes, thus providing a much-needed synthesis of the current evidence.

Future work should continue to extend the available literature on long-term outcomes of adolescent depression. This includes consideration of potential confounders or effect modifiers, including gender, socioeconomic status, comorbid conditions, and depression recurrence; examining the impact of childhood learning or social difficulties on psychosocial outcomes and how depression can influence these relationships; study of the impact of depression on psychosocial outcomes in later adulthood; and the exploration of outcomes identified in this review that remain understudied (eg, social support, job quality). As research in this area continues to grow, syntheses involving meta-regression analyses to explore which factors (eg, age, length of follow-up) account for potential heterogeneity also might be valuable. These efforts can lead to improved understanding of the long-term effects of adolescent depression on adult functioning, which can affect policy-related and clinical decisions for the prevention and management of depression experienced early in life.

Despite calls to prioritize mental health care and preventive efforts on a global scale, the economic and societal burdens of depression continue to increase. Understanding the role that depression experienced early in life can ultimately have on an individual's socioeconomic standing and relationships is crucial. Adolescence represents a critical developmental period that can shape an individual's long-term socioeconomic status and ability to form healthy relationships; interruptions in these developmental processes can have negative consequences throughout the lifespan. Findings from this review provide strong evidence that adolescent depression is associated with a myriad of psychosocial outcomes experienced in adulthood.

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Correspondence to Ian Colman, PhD, School of Epidemiology and Public Health, University of Ottawa, Room 308C, 600 Peter Morand Crescent, Ottawa, ON K1G 5Z3, Canada; e-mail: icolman@uottawa.ca

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