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Systematic Review on Depression and Anxiety in Young People in High Income Countries During the Coronavirus Pandemic

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***SYSTEMATIC REVIEW ON DEPRESSION AND
ANXIETY IN YOUNG PEOPLE IN HIGH INCOME
COUNTRIES DURING THE CORONAVIRUS
PANDEMIC***

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Background

According to the World Health Organization (WHO), the Coronavirus Disease 2019 (COVID-19) was initially recognized December 31, 2019 in China when a cluster of pneumonia cases was identified in Wuhan. These were the first cases of the novel COVID-19 virus outbreak, which was declared a pandemic on March 11, 2020.¹ For this study, pandemic was defined as “an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people.”² Since the onset of the pandemic, and its related shutdowns to slow the spread of disease, the toll on mental health has been a concern of public health officials and the health care community. The WHO reports that, despite increasing need, nearly every countries’ mental health services have been disrupted or canceled due to COVID-19.³ Among high-income countries, 80% report implementing telemedicine to treat mental health issues. Although the vast majority of countries provisioned for mental health support in their COVID-19 response plans, only about one-fifth of those countries’ plans have been fully funded.³

The pandemic’s potential mental health consequences and the lack of services to meet the rise in mental health needs was of particular concern for young people in high-income countries since mental health issues were already prevalent among this population. The Child Mind Institute reported in its 2017 Child Mental Health Report that 32% of adolescents have anxiety.⁴ The Child Mind Institute also reported that almost 12% of adolescents have major depressive disorder or dysthymia. Adolescent females were twice as likely to have an anxiety disorder than adolescent boys and about 16% of adolescent females had depression while only 8% of adolescent boys had depression. Prior to the onset of the pandemic, anxiety and depression had been gradually rising in this population adding another 500,000 (measured in 12-month prevalence of major depressive episodes) cases of major depressive episodes in adolescents between 2005 and 2014.⁵ This systematic review therefore focused on the impact of the 2020 COVID-19 pandemic on changes in anxiety and depression among young people.

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Key Questions

This systematic review addressed key questions regarding the rate or prevalence of depression and anxiety in young people in high-income settings similar to the United States.

Key Questions

1. *How had the 2020 Coronavirus pandemic changed the levels of anxiety among adolescents and young people in high-income settings such as the United States?*
2. *How had the 2020 Coronavirus pandemic changed the levels of depression among adolescents and young people in high-income settings such as the United States?*

Methods

A literature search using PubMed was conducted in January 2021. Eligibility criteria were used to identify studies addressing Key Questions, and were defined by populations, interventions, comparators, outcomes, timing, and setting as detailed in **Table 1**. The reviewer assessed each study using the inclusion/exclusion criteria as shown in **Table 1**. The primary population of the systematic review was young people, defined by the WHO as people who were 10-24 years of age.⁶ Studies with some overlapping age ranges were included as long as there was a subgroup analysis of people within the age range of 10-24 years of age. Studies based on populations that were exclusively 18 and older were not included because of the adult focus of the study. For this systematic review articles published between 5/1/2020 and 12/31/2020 were included.

Literature Search Strategies

PubMed was chosen as the electronic database. Search dates were from 5/1/2020 to 12/31/2020. Search terms were: anxiety or anxious AND depression or depressive AND adolescent or youth or young

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people AND COVID-19 or coronavirus or pandemic or SARS-CoV-2. Only peer reviewed, published articles were included in this review.

Data Extraction

Data extraction was done independently by one reviewer using pre-defined categories. Extracted data included, but were not exclusive to, study design, population descriptions, time period of data collection, exposure risk factors for anxiety and depression, depression outcomes, anxiety outcomes, quality assessment, strengths, limitations, and key conclusions.

Results

A PubMed search using search parameters described above yielded 337 records. A total of 241 articles were excluded after reviewing titles and abstracts for subject matter and relevance. The prior mentioned predefined inclusion and exclusion criteria were used to further sort the remaining 96 full text articles, yielding 5 studies that were included in this systematic review. These five studies met the inclusion criteria for age group and setting and had pre- and post-COVID-19 pandemic estimates of depression and anxiety. Of the five included studies, four were longitudinal and one was a retrospective cohort study. See **Figure 1** for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram.

Qualitative Assessment

The United States Preventative Services Task Force (USPSTF) guidelines⁷ were used to assess and grade each of the five studies included in this systematic review. USPSTF used a “good”, “fair”, and “poor” system for rating. A “good” study had consistent results from a well-designed study. A “fair” study was limited by number, quality or consistency of results, or the generalizability of the results. A ‘poor’ study had design flaws, insufficient evidence, or gaps in the chain of evidence. These guidelines

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were selected because they were commonly used by researchers and consistent with what many other researchers used to grade studies. Three out of the five studies were rated as “fair” and two out of five were rated as “good.” Stevens et al. (2020) was rated as good quality research that met or exceeded all parameters dictated by the USPSTF. Bignardi et al. (2020) had a 29% response rate during COVID-19 lockdown mental health assessment but was deemed good quality; the study was rated as fair because the research met or exceeded all parameters dictated by the USPSTF. Rogers et al. (2020) had a 67% response rate for both T1 and T2 assessments. All other parameters were met for a “good” rating, but due to the response rate, the study was rated as “fair.” Magson et al. (2020) met or exceeded all parameters dictated by the USPSTF and was rated as “good.” Ferrando et al. (2020) used retrospective data from electronic medical records at Westchester Medical Center Health System (WMC Health), Valhalla, New York for this study, so response rate was not a factor. The limiting factor was the importance of the study. This study was graded as “fair” for reasons of importance to the field and generalizability.

Results from Studies

Huckins et al. (2020) described a population from Dartmouth University in the United States who were part of a larger StudentLife study; a longitudinal multimodal study that followed undergraduate students during their time at Dartmouth focusing on mental health.⁸ This study found a significant increase in self-reported anxiety and depression in week ten of the COVID-19 semester, when the lockdowns were imposed and learning moved online, which did not occur during the non-COVID-19 comparison semesters. The measure for depression was the Patient Health Questionnaire-2 (PHQ-2), which had a range of 0 to 6 with 3 or more indicating need for further diagnostic follow-up for depression.⁹ See **Figure 2** for more details from Huckins et al. (2020) regarding anxiety and depression levels throughout the term. During the COVID-19 term, PHQ-2 scores peaked at higher levels than pre-pandemic (pre-pandemic=1, COVID-19=1.3). The measure used for anxiety was the Generalized Anxiety Disorder-2 questionnaire (GAD-2), which had a score range of 0 to 6 with a 3 or more indicating need for

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further diagnostic follow up for anxiety.¹⁰ GAD scores also peaked higher during the COVID-19 term than pre-pandemic terms (pre-pandemic=1.4, COVID-19=1.75). After week 10, anxiety and depression levels remained elevated when compared to previous terms, however they dropped off at rates comparable to previous terms. Despite increases in both PHQ-2 and GAD scores, neither score met the cutoff for further evaluation but the increase in scores gave a meaningful glimpse into the increased mental health burden during the pandemic.

Bignardi et al. (2020) examined a cohort of 8 to 12-year-olds in the United Kingdom and analyzed the participants' mental health measures with a mixed linear model.¹¹ The results demonstrated a statistically significant increase in depression symptoms and a decrease in anxiety that was not statistically significant. Revised Child Anxiety and Depression Scores (RCADS) short-form subscales for generalized anxiety and depression were used for this study. There was a parent-reported questionnaire and a child-reported questionnaire for each measure prior to COVID-19. There was only a parent-reported questionnaire for each measure during COVID-19. There were 10 screening questions for major depression with a raw score ranging from 0 to 30.¹² The RCADS for anxiety was 6 questions with a raw score ranging from 0 to 18. Raw scores were then standardized, and a higher standardized score signified worse mental health. RCADS depression scores were on average 0.74 (95% CI 0.46 to 1.01) higher during lockdown than before. Bignardi et al. (2020) stated that the confidence intervals suggested a medium-to-large increase in depression was likely. A decrease of 0.06 in RCADS anxiety scores was observed, which was not statistically significant.

Rogers et al. (2020) found small, significant increases in both anxiety and depression among 14–17-year-olds in the United States. They drew data from Project Advancing Health and Education for Adolescent Development (AHEAD) in the United States.¹³ Project AHEAD was a two-wave longitudinal study of adolescent development in the U.S. Adolescents were contacted through the service, Bovitz, a third-party service, which had a nationally representative database of research participants collected via digital advertising. Depression scores were measured before and during COVID-19 using the Children's

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Depression Inventory short version which was a 12-question assessment, and each question was answered with a 0 to 4 scale. The higher scores indicated worse depression symptoms. The authors conducted separate hierarchical linear regression models for depressive and anxiety symptoms to analyze the data and used paired t-tests to show the difference in levels from 2019 to 2020. The mean score for depression showed a small significant increase, going from baseline of 1.75 in October 2019 to 1.84 in April 2020 ($p < .001$). Anxiety was assessed with the GAD before and during COVID-19. The GAD also used a four-point scale with higher scores indicating higher levels of anxiety. The mean score for anxiety was 1.64 in October of 2019 and 1.85 in April 2020, which was a small significant increase in anxiety symptoms ($p < .001$). Both GAD and Children's Depression Inventory scores increased during the pandemic indicating an increased mental health burden. The GAD scores, however, remained below the follow up cutoff level but overall, the increases in both the GAD and the Children's Depression Inventory scores demonstrated increases to anxiety and depression symptoms.

Magson et al. (2020) showed significant increases in symptoms of both anxiety and depression when compared to pre-pandemic levels. The study drew data from the Risks to Adolescent Wellbeing Project (RAW Project) in Australia.¹⁴ Depression was measured using the Short Mood and Feelings Questionnaire—Child Version (SMFQ), which was a thirteen-item questionnaire used to assess depression in children and adolescent with a score range from 0 to 26.¹⁵ The cut off for the SMFQ was 8 for a significant finding from the questionnaire, which had a sensitivity of 85% and specificity of 60% for Major Depression. The results of the paired samples t-tests showed significant increases in adolescents' symptoms of depression with the mean increasing to 6.04 from 4.31 ($p < 0.001$). There were also significant increases in anxiety with scores increasing to 4.05 from 3.74 ($p < 0.001$). Females showed larger increases in anxiety ($T_1 = 5.55$, $T_2 = 6.52$) than males ($T_1 = 3.63$, $T_2 = 3.64$). Females also showed greater increases in depression ($T_1 = 4.77$, $T_2 = 8.16$) than males ($T_1 = 2.81$, $T_2 = 4.01$). The results of the paired t-tests showed significant increases in symptoms of both anxiety and depression when compared to pre-pandemic levels for males and females combined. It was important to note that the depression scores

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for females during T2 (8.16) were much higher than male scores during T2 (4.01) showing a clear disparity between males and females. The SMFQ was not intended as a diagnostic tool, rather it indicated severity of symptoms.¹⁶ The SMFQ scores appeared to show a meaningful increase in the severity of symptoms of anxiety and depression, especially for females.

Ferrando et al. (2020) conducted a retrospective cohort study which showed insignificant increases in depressive symptoms and Depressive Disorders. Both Anxiety symptoms and Anxiety Disorders showed insignificant decreases. The studied used data from hospitalizations of both adults and children in the suburban New York City area, however, for this systematic review, the author only reported the results for children under 18 years of age.¹⁷ The results were described in two ways: diagnosis of anxiety or depressive disorders or symptoms of anxiety or depression. Depressive Disorders before COVID-19 accounted for 33.7% of admissions, during COVID-19 it increased to 35.4% of admissions ($p=0.75$, not significant). Depression before COVID-19 accounted for 45.0% of hospital admissions and during COVID-19 it increased to 52.3% of admissions ($p=0.35$, not significant). Anxiety Disorders before COVID-19 accounted for 3.5% of hospital admissions and 3.1% during COVID-19 ($p=0.9$, not significant). Anxiety accounted for 30.7% of admissions prior to COVID-19 and actually decreased to 26.2% during COVID-19 ($p=0.45$, not significant). Interestingly, the overall number of children/adolescents presenting for emergency treatment for mental health declined 68%, whereas adults only had a small, non-significant decrease according to Ferrando et al. (2020). This demonstrated that parents were reluctant to bring their children to the hospital early in the pandemic in a COVID-19 hotspot.¹⁸ Of children presenting for emergency mental health evaluation, just over half were admitted to the hospital during the pandemic, whereas only 32% were admitted in the period prior to the pandemic. This was the only study in this systematic review that showed no increase for depression symptoms. This was also the only study in this systematic review that used retrospective data on hospitalizations.

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Near Miss Studies

Overall, the near miss studies reflected the findings of the studies included in this systematic review. Generally, the studies found increased depression levels during the COVID-19 pandemic, with mixed results on anxiety levels. All of the studies indicated that further study and mental health support were needed for young people in the context of the pandemic with special attention given to disparities between men and women. There were four studies classified as near misses, three of which will be discussed in detail.

Kujawa et al. (2020) was excluded from the systematic review for being outside the age range (18-25years) of 10-24 years. This study evaluated young adults in May 2020, and one month later it used the Patient Health Questionnaire (PHQ-9) and the GAD-7.¹⁹ The scores for both surveys were 0 to 3 for each question, and an overall score greater than or equal to 10 was considered to be in the clinical range for anxiety or depression. Kujawa et al. (2020) showed depression was high among young adults (18-25) in May 2020, with 45% of the sample meeting the cutoff for depression. Surprisingly, depression rates decreased in June with only 35% of the sample meeting the criteria. Anxiety decreased from May 2020 to June 2020 as well (May 35%, June 32.4%). Despite the decrease in depression and anxiety rates shown in the study, the rates were much higher than the pre-pandemic levels of 5%-9% that were seen in the general population, thus indicating increased symptoms of anxiety and depression during the pandemic.

Lee et al. (2020) was excluded from the systematic review for being outside the age range with an age range during the pandemic between 22 and 27. The study showed increases in depression and loneliness, but not anxiety.²⁰ Lee et al. (2020) used an established survey population with several years of mental health survey data. Surveys were conducted in January 2020 and April/May 2020 with a study population mean age of 25.1 years. Depression and anxiety were evaluated using the PHQ-4. Scores ranged from 0 to 6 for each measure. Depression had a significant increase with mean scores changing from 1.63 in January to 1.86 in April/May. Anxiety had an insignificant decrease, changing from 2.12 in

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January to 2.05 in April/May. Increased depression scores indicated a change from pre-pandemic levels, but remained below the cutoff for evaluation, however, the increase demonstrated a worsening of depression symptoms.

Debowska et al. (2020) was excluded because the measures were one week apart, and both took place in March and April 2020. Similar to Lee et al. (2020), this study indicated increases in depression in both men and women but decreases in anxiety.²¹ Debowska et al. (2020) assessed anxiety and depression using the Depression Anxiety Stress Scales (DASS), which had 14 depression and 14 anxiety questions with a score range of 0 to 42. Higher scores indicated worse symptoms.²² Measures were taken at five stages over two months between March and April 2020. Scores overall increased over the five stages, peaking at stage four, which was during the strictest lockdowns. Mean depression scores were as follows: stage one=12.17, stage two=13.70, stage three=14.59 stage four=15.07 and stage five=14.25. Women (stage one=12.18) and men (stage one=12.17) had similar scores at stage one, but women peaked higher (women=15.57, men=15.07) at stage four and ended higher at stage five (women=14.53, men=14.25). Mean combined anxiety scores were as follows: stage one=9.52, stage two=8.98, stage three=9.20, stage four=9.61, stage five=8.96. Women had higher anxiety scores (women=10.01, men=7.06) at stage one and peaked at stage four higher than men (women stage 4=10.44, stage 5=9.39; men stage 4=6.58, stage 5=7.00). The mean anxiety scores for both men and women decreased over the five stages, but women experienced higher anxiety levels overall than men did during the study period. This study showed a correlation between strict lockdowns due to the pandemic and increased depression and anxiety symptoms.

Discussion

This systematic review identified studies that assessed changes in anxiety and depression levels among young people following the onset of the COVID-19 pandemic in 2020. The results of this systematic review overwhelmingly found that young people experienced increases in symptoms of

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depression after the onset of the pandemic and its associated lockdowns. Four of the five studies demonstrated significant increases for symptoms of depression. Interestingly, three of the five studies showed increases in anxiety while two showed no significant increase in anxiety.

The three studies that included study populations aged 13 to 22-years-old relied on self-reported data and all three showed increases in levels anxiety and depression.^{11,13,14} Two of the five studies (Ferrando et al. (2020), and Bignardi et al. (2020),^{11,17} indicated a *decrease* in anxiety (albeit not statistically significant); however, these studies relied on parent-reported data or caregivers taking the children to the hospital for emergency mental health evaluations. In other words, both studies relied on data that was *not* self-reported by the young people experiencing the symptoms. The three studies that relied on children self-reporting their symptoms all showed increases in anxiety symptoms.

There was a documented discord between caregiver reported symptoms and child reported symptoms.²³ In the Bignardi et al. (2020) study, caregivers could have missed anxiety symptoms that caused an underreport of children's symptoms after the lockdown. This study also did not have children self-report symptoms of anxiety and depression during COVID-19 period.¹¹ Child reported symptoms were only available for the pre-pandemic assessment. The study relied on caregiver reports to assess changes in levels of anxiety and depression after the onset of the pandemic. This was a significant limitation to this study's conclusions.

The data from Ferrando et al. (2020) was reliant (in part) on caregivers who brought their children in for emergency mental evaluation during a time when many were reluctant to present for care due to fear of COVID-19. Selection bias was an important limitation in the study by Ferrando et al. (2020). In this study, nonemergent depression and anxiety were not included because this study only examined emergent mental health evaluations in children/adolescents presenting to the emergency room. Additionally, depressed symptoms may have been easier to observe than anxiety symptoms and resulted in more emergent visits.

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Of children presenting for emergency mental health evaluations, just over half were admitted to the hospital during the pandemic, whereas only 32% were admitted in the period prior to the pandemic. Children and adolescents who presented for emergent mental health care during the pandemic were less likely to have previous treatment for psychiatric illness than prior to the pandemic.¹⁷ This suggested two things: 1) higher acuity patients were presenting early in the pandemic than prior, and 2) it was likely that pandemic-related factors played a large role in their mental illness. However, there were fewer child/adolescent patients presenting with suicide attempts,¹⁷ which does not support the theory of higher acuity patients presenting during the pandemic.

Most of the studies included in the systematic review demonstrated changes in depression and anxiety symptoms in young people during the early COVID-19 period. It was notable that according to two studies^{13,14} the changes were significant *yet* small increases for the ages 13-17, indicating that many young people were coping well early in the pandemic.¹⁴ Both studies were based on self-reported data; one of which had quotas for race/ethnicity, parental education, and the child's sex;¹³ and the other was mostly Caucasian and middle to high socioeconomic status.¹⁴ These two studies were notable for showing small changes in self-reported anxiety and depression, but with small effect leading the researchers to conclude that many young people were coping well.¹⁴

Of the studies included in the systematic review and the near misses, three out of the eight studies show increased depression *and* anxiety, while three showed increases in depression, but *decreases* in anxiety. Two of the studies that found decreases in anxiety were Debowska et al. (2020), and Kujawa et al. (2020), which both took place during the pandemic without a pre-pandemic measure. Kujawa et al. (2020), found higher levels of depression when compared to general pre-pandemic levels, but both depression and anxiety decreased over the study period. Both studies also took place very early in the pandemic, between March and June 2020. This implied the initial pandemic, with its strict lockdowns and general COVID-19 related stress, may have been stressful, but that the stress abated as the pandemic progressed and the lockdowns became less strict. These findings indicated an increased mental health

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burden as demonstrated by worsening symptoms in the majority of the studies. This gave no insight into the long-term mental health ramifications of the pandemic on young people, however.

There were several protective factors for anxiety and depression in young people. Higher maternal education was protective against depression.¹³ Generally, those who identified as male reported less anxiety and depression than females.¹⁷ Less restrictive lockdowns resulted in decreasing depression and anxiety symptoms.²¹ Participants reporting more physical activity, less consumption of COVID-19 related news, and visiting more locations were less likely to have higher anxiety and depression scores.⁸ Social connectedness was a significant moderator for depression with those who reported high social connectedness reported less symptoms of anxiety and depression.¹⁴

There were several risk factors for increased anxiety and depression. Risk factors for depression included changes in friend support, increases in negative affect, family conflict during COVID-19, and decreased friend support.¹³ Reporting depression pre-COVID-19 was a predictor of depression post-COVID-19 onset.¹³ Studies also indicated that sedentary time was a risk factor, increasing with symptoms of anxiety and depression. Increased COVID-19–related news consumption coupled with less physical activity and fewer locations visited correlated with increased anxiety and depression symptoms.⁸ In one study, stricter adherence to lockdown protocols did not impact depression or anxiety symptoms, but it did result in diminished life satisfaction.¹⁴ Isolation resulting from the lockdowns clearly had an impact on deteriorating mental health. In future lockdowns, there should be efforts to ensure adequate social contact to mitigate mental health complaints.

Limitations

All of the studies discussed were published in 2020, therefore, data on the long-term effects of COVID-19 on mental health of young people did not yet exist. The studies by Ferrando et al. (2020), and Bignardi et al. (2020), relied on non-self-reported data, which were less than optimal for assessing mental health. Three out of the five studies had small sample sizes (Rogers et al. 2020, Ferrando et al. 2020,

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Bignardi et al. 2020). Two of the studies had a narrow age range of about 4 years (Huckins et al 2020, Bignardi et al. 2020). Huckins et al. (2020), used smart phone data and the accuracy of which may have been compromised if the phones were not on the participant. Two of the studies (Bignardi et al. 2020, Ferrando et al. 2020) had limited geographic areas. A limitation in the systematic review protocol was the lack of inclusion of studies measuring changes in only anxiety or only depression. See **Table 2** for further information on limitations.

Implications

This systematic review suggested several implications. Young people's mental health was negatively impacted by the COVID-19 pandemic. More resources need to be allocated to support the mental health needs of young people. Short term studies were necessary to understand where needs existed early in the pandemic, however, long-term data will be necessary to ensure future needs are met for mental health treatment. More resources need to be put into preventative mental health care as well as into mitigating potential the effects from the pandemic on mental health of young people.

Conclusions

This systematic review demonstrated that there were changes in the levels of anxiety and depression in young people during the COVID-19 pandemic. These findings indicated that more resources need to be put into the mental health of young people in high-income countries. Four of the five studies in the systematic review revealed significant increases in depression, and three showed significant increases in anxiety. Yet, some studies suggest that many young people coped well with the stressors of the pandemic. It would be beneficial to investigate the disparity between male and female depression and anxiety under similar conditions. More studies are needed on the relationship between the COVID-19 pandemic, lockdowns, and the mental health in young people.

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Table 1. Inclusion and Exclusion Criteria

Category	Inclusion	Exclusion
Population	<ul style="list-style-type: none"> • Adolescents, young adults, youth or young people • Study population or study strata contained within the ages 10-24 years (WHO definition of adolescents and young people) 	<ul style="list-style-type: none"> • Study population or study strata overlaps or is entirely outside the ages 10-24 • Age 18 and over with exclusively adult focus
Comparison	<ul style="list-style-type: none"> • Compare early (March, April, May) in the pandemic to later in the pandemic (after May) • Compare month, quarter, season, or year during the pandemic to pre-pandemic 	<ul style="list-style-type: none"> • No comparison group, just a single estimate presented in the study • Comparison to a published estimate from a separate study
Outcome	<ul style="list-style-type: none"> • At least two estimates of outcome and time period described for each • KQ1: Estimates change in anxiety, anxious symptoms • KQ2: Estimates change in depression, depressive symptoms • Change: increase or decrease in reported anxiety or depression symptoms 	<ul style="list-style-type: none"> • No estimates of anxiety or depression • Study just estimates suicidal thoughts, ideation, or acts • No numbers given, just qualitative results
Setting	<ul style="list-style-type: none"> • Settings comparable to U.S. practice (countries considered 'very high' on the 2018 HDI) 	<ul style="list-style-type: none"> • Countries not rated 'very high' on the 2018 HDI
Study Design	<ul style="list-style-type: none"> • Randomized controlled trials • Observational studies with more than 50 participants • Qualitative studies relevant to KQ • Systematic reviews of these study designs 	<ul style="list-style-type: none"> • All other study designs (case series, case report) • Commentaries, letters, editorials, protocol papers
Study Quality	<ul style="list-style-type: none"> • Good- and fair-quality studies (USPSTF quality criteria²⁴) 	<ul style="list-style-type: none"> • Studies rated poor-quality

KQ = Key Question, "WHO defines 'Adolescents' as individuals in the 10-19 years age group and 'Youth' as the 15-24-year age group. While 'Young People' covers the age range 10-24 years."

Refinement:

Literature reviews (not systemic reviews) are not included in this SR.

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Studies that include only ages 18-24 will be included, however studies that are 18 and over with an exclusively adult focus will not be included. Studies with younger children that overlap with the ages 10-24 will be included due to focus on children rather than adults.

Pre-pandemic is defined before March 2020.

Countries rated 'very high' on the 2018 HDI²⁵

Andorra	Croatia	Israel	New Zealand	Slovakia
Argentina	Cyprus	Italy	Norway	Slovenia
Australia	Czech Republic	Japan	Oman	Spain
Austria	Denmark	Kazakhstan	Palau	Sweden
Bahamas	Estonia	Kuwait	Poland	Switzerland
Bahrain	Finland	Latvia	Portugal	Turkey
Barbados	France	Liechtenstein	Qatar	UAE
Belarus	Germany	Lithuania	Romania	UK
Belgium	Greece	Luxembourg	Russia	Uruguay
Brunei	Hong Kong	Malaysia	Saudi Arabia	
Bulgaria	Hungary	Malta	Seychelles	
Canada	Iceland	Montenegro	South Korea	
Chile	Ireland	Netherlands	Singapore	

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Table 2: Key Information

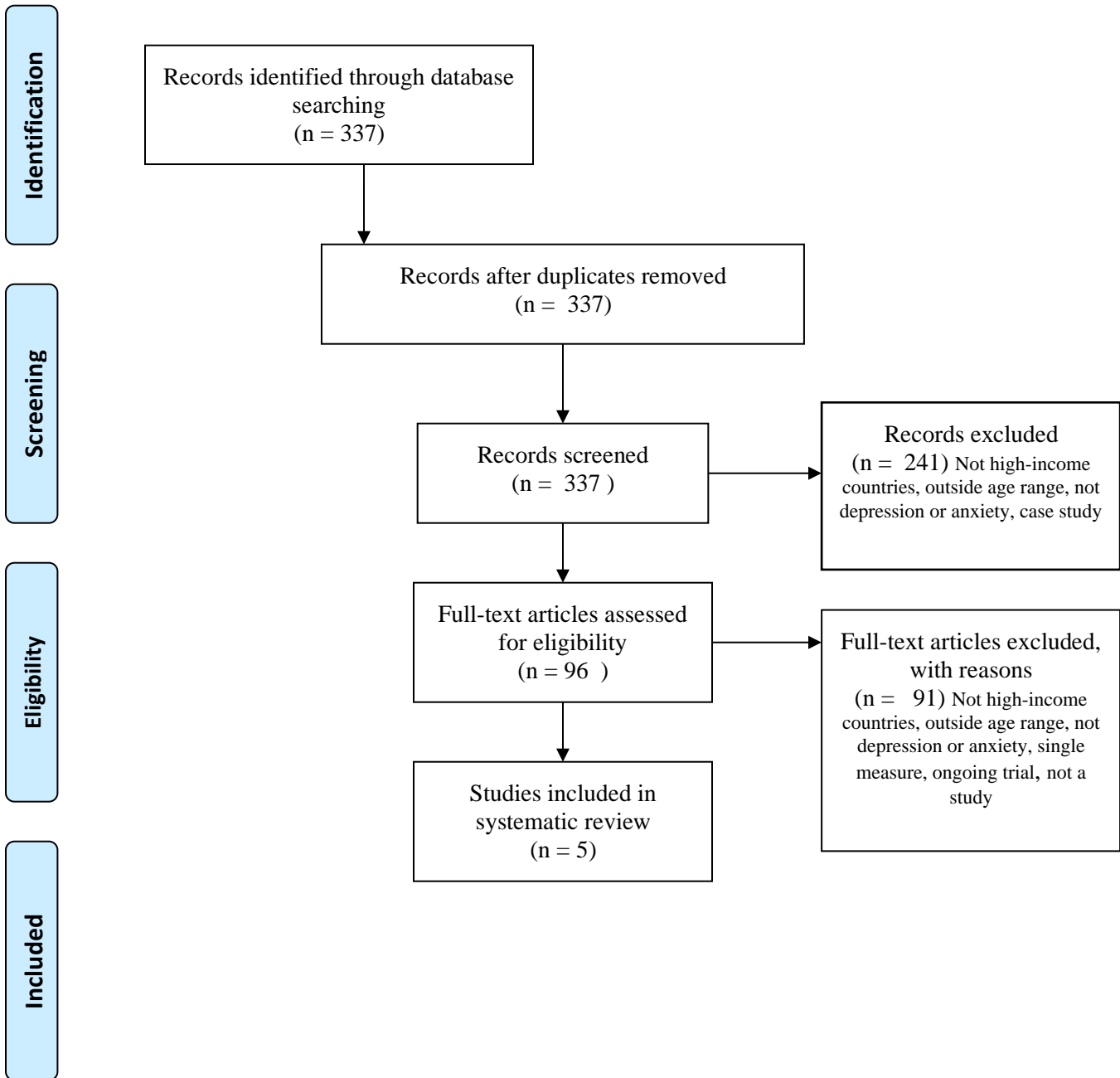
Title	First Author/ year of publication	Study design/ age/analysis	Limitations	Results	USPSTF Rating/ Applicability
Mental Health and Behavior of College Students During the Early Phases of the COVID-19 Pandemic: Longitudinal Smartphone and Ecological Momentary Assessment Study ⁸	Huckins, 2020	Longitudinal, multimodal study, 18 to 22 years	Self-reported data, Study has narrow age range of university students who carry a smartphone that is compatible with the Studentlife app- limited generalizability Smartphone data accuracy may be compromised if phones are not carried constantly Early COVID-19 time period	This study used PHQ-2 and GAD questionnaires and found a significant increase in self-reported anxiety and depression in week ten of the COVID-19 semester 10. After week 10 in the Winter 2020 term, both depression and anxiety remained consistently elevated above the levels in other terms; however, they decreased at similar rates.	Good High applicability
Longitudinal increases in childhood depression symptoms during the COVID-19 lockdown Error! Bookmark not defined.	Bignardi, 2020	longitudinal, convenience sample, cohort, age 8-12	Small sample size reducing statistical power of observations, sample from small area in the UK- questionable generalizability, lack of child reported measures during lockdown, child and adult report child mental health differently Early COVID-19 time period	Standardized RCADS depression scores were on average 0.74 (95% CI 0.46 to 1.01) higher during lockdown than before (see Figure 2). The CIs suggest a medium-to-large increase in depression is likely . Non-significant Decrease of 0.06 in RCADS anxiety scores (B=-0.06, 95% CI -0.34 to 0.23)	Fair High applicability
Adolescents' Perceived Socio-Emotional Impact of COVID-19 and Implications for Mental Health: Results From a U.S.-Based Mixed-Methods Study ¹³	Rogers, 2020	a two-wave longitudinal study, 14 to 17 years	Brief , self-reported responses, probably not comprehensive Early COVID-19 time period	small significant increases in depressive symptoms (< .001; Cohen's d = .19 small effect) small significant increases in anxiety symptoms (p < .001; Cohen's d = .28 small effect)	Fair High applicability

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Risk and Protective Factors for Prospective Changes in Adolescent Mental Health during the COVID-19 Pandemic ¹⁴	Magson, 2020	longitudinal, convenience sample Drawn from larger Risks to Adolescent Wellbeing Project (RAW), 13-16	Does not establish causation, used self-reported data-subject to bias, relatively small, demographically limited sample, only Australians, primarily Caucasian Early COVID-19 time period	the results of the paired samples t-tests showed significant increases in adolescents' symptoms of depression , (p < 0.001) and significant increases in anxiety , (p < 0.001)	Good High applicability
Psychiatric emergencies during the height of the COVID-19 pandemic in the suburban New York City area ¹⁷	Ferrando, 2020	retrospective cohort study, pre COVID-19 average age 13.6, post COVID-19 13.8	Data collected from one hospital- geographically limited Number of child/adolescents seen was small, retrospective, time limited, Early COVID-19 time period, selection bias	Depressive Disorders pre: 68 (33.7%) post: 23 (35.4%) non-significant P=0.75 Depression pre: 91 (45.0%) post: 34 (52.3%) non-significant P=0.35 increase Anxiety Disorders pre: 7 (3.5%) post: 2 (3.1%) non-significant P=0.9 Anxiety Pre: 62 (30.7%) Post: 17 (26.2%) non-significant P=0.45 decrease	Fair Moderate applicability

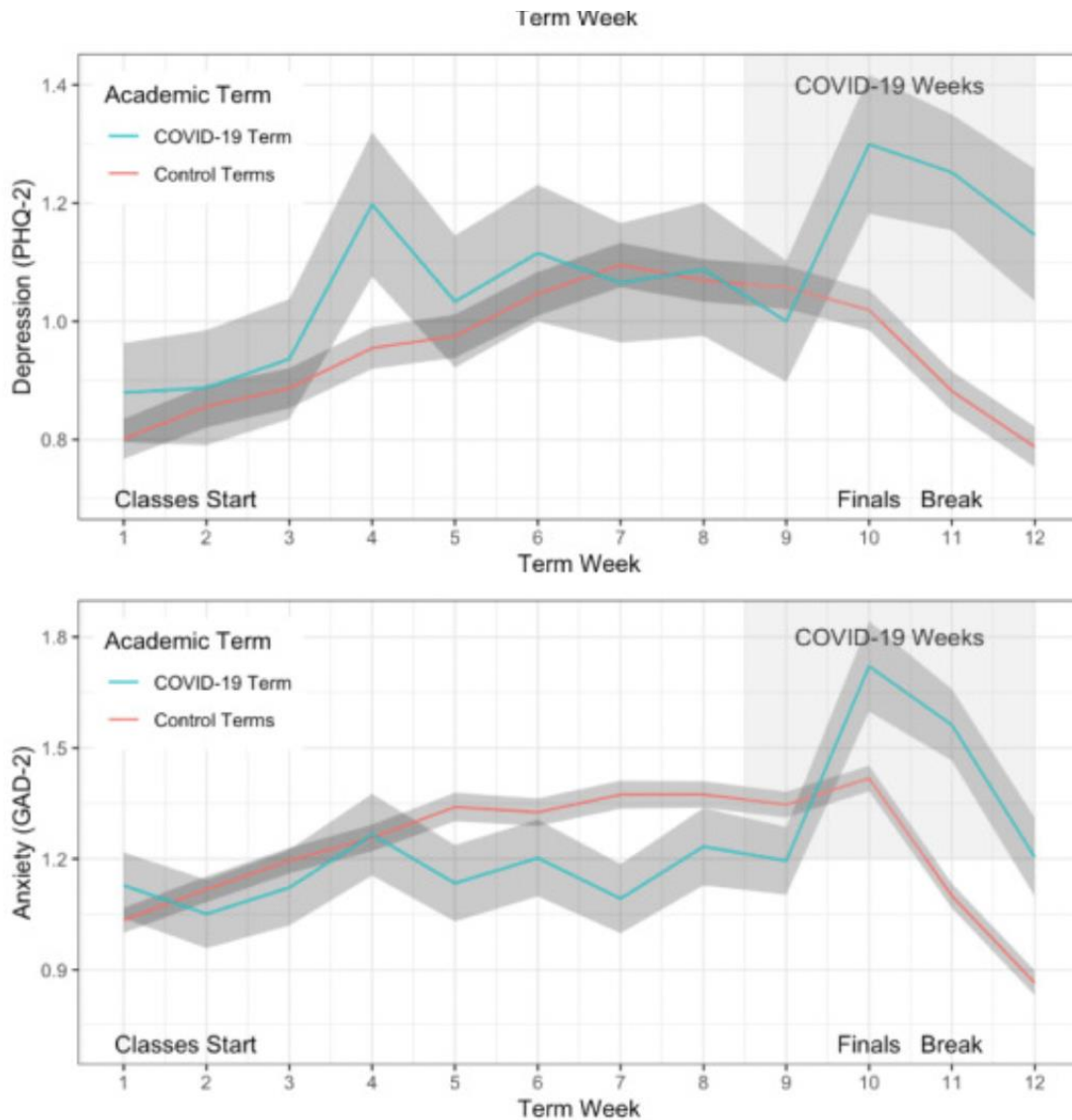
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Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flow Diagram



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Figure 2. Anxiety and Depression Levels During Control Term and Covid-19 Term ⁸



¹ World Health Organization.(2020a). *Archived: WHO Timeline - COVID-19*. Retrieved December 25 from <https://www.who.int/news/item/27-04-2020-who-timeline---COVID-19>

² Last JM, editor. *A dictionary of epidemiology*, 4th edition. New York: Oxford University Press; 2001.

³ World Health Organization. (2020b). *COVID-19 disrupting mental health services in most countries, WHO survey*. Retrieved December 26 from <https://www.who.int/news/item/05-10-2020-COVID-19-disrupting-mental-health-services-in-most-countries-who-survey>

⁴Child Mind Institute. (2017). *Anxiety and Depression in Adolescence*. Retrieved December 25 from <https://childmind.org/report/2017-childrens-mental-health-report/anxiety-depression-adolescence/>

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⁶ World Health Organization. *Adolescent health in the South-East Asia Region*. Retrieved December 21 from <https://www.who.int/southeastasia/health-topics/adolescent-health>

⁷ United States Preventive Task Force. (n.d.). *Grade Definitions*. Retrieved January 2021 from <https://www.uspreventiveservicestaskforce.org/apps/gradedef.jsp>.

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