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Meta Analysis

Prevalence of depression among school going adolescents in India: a systematic review and meta-analysis of cross-sectional studies

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ABSTRACT

The objective of this systematic review was to estimate the pooled prevalence of depression among schoolgoing adolescents in India by using Beck's Depression Inventory (BDI 1 or BDI 2). A systematic literature search was conducted in PubMed, Ovid MEDLINE, Ovid EMBASE, CINAHL, Cochrane Library, PsycINFO and Google Scholar to identify cross-sectional school-based studies published during 1990-2020. Studies with pre-identified mental illness were excluded. Heterogeneity between studies were examined and estimates were pooled using a random-effects model. Subgroup and sensitivity analysis were performed. Publication bias was evaluated using funnel plot and Egger's test. We included 13 studies in the meta-analysis. The random effect meta-analysis revealed that the pooled prevalence of depression among school going adolescents was 53% (95% CI: 41% - 65%). By gender, the prevalence was 50% (95 % CI: 38%–62%) in males and 57% (95% CI: 46% - 69%) in females. The subgroup analysis revealed that the pooled prevalence increased with the education levels (High school: 42%; High school and pre-university: 55%; and Pre-university: 67%). In this review we found that more than half of the school going adolescents in India suffered from depression that ranged from mild to severe. These results draw attention to re-look at the mental health policy and newer public health approaches to address depression. Further, strengthening school-based mental health services, along with the community and center-based care is crucial to prevent and effective management of depression among adolescents.

Keywords: Adolescent, Cross sectional, Depression, India, Meta-analysis, Systematic review

INTRODUCTION

Mental health disorders have emerged as major health problem; accounting for 11.1% of total disease burden in Low and Middle-Income countries (LMICs).[1] It is the second leading cause of disease burden (in terms of Years lived with disability).[2] Among all the mental health disorders, depression affects 300 million of population world-wide and has become the pre-eminent cause of disease burden among adolescents (10-19 years of age).[3-5] The world-wide prevalence of depression in adolescence ranges from 15-20%.[6] Almost 50% of mental health conditions begin at the age of 14 years.[7] In India one in four adolescents aged 13-15 years have experienced depression with overall prevalence ranging from 15 to 40%.[8,9] Depression in adolescents is often an under detected condition in LMICs and adolescents are more likely to remain untreated posing a major challenge to

health systems.[1,8] Research suggest that more than 70% of the global children with depression do not receive an appropriate diagnosis and treatment, which may be due to the inadequacy of an ideal screening test or assessment tools for depression assessments or due to the reluctance in seeking professional help.[10] This is also related to inadequate capacity of health systems.[1]

Depression in adolescent is mostly associated with impaired school performance, lack of supportive school environment, school dropout, unhealthy relationships, toxic family environment, substance abuse, sexual abuse, internet addiction, risky sexual behaviors and economic difficulties.[11,12] Genetic factors, biological changes associated with puberty, cognitive and socio-cultural factors are few predisposing factors for the occurrence of the depression.[13] Depression is usually characterized by lack of interest or pleasure, mood changes, psychomotor agitation or retardation, fatigue, loss of energy, inability to concentrate, loss of appetite/increased appetite, weight loss, worthlessness or guilt and recurrent thoughts of self-harm/suicide.[10] Mostly the transition from childhood to adulthood results in emotional instability and individuals often face difficulty in establishing their self-identity and self-esteem, which further make them vulnerable to depressive disorders at this age.[14]

The Indian National Mental Health Program and National Mental Health Policy aims to reduce morbidity of mental illness including depression by improving access to prevention and treatment through strengthening care at primary and secondary healthcare levels.

The District Mental Health Program has incorporated school mental health services by providing life skills education, counseling services through trained teachers for school and college going children.[15] However, the focus has remained mainly on learning and behavior disorders of children without knowing the estimation of different types of mental illness among schoolgoing adolescents.[16]

Most of the scientific studies which report the prevalence of depression in India have varied in their approach, sample size, settings, target population and tools. So, in the absence of targeted national level surveys, there is a greater need to synthesize good quality data from cross-sectional studies to know the disease burden. With this purpose we have undertaken a systematic review to estimate the pooled prevalence of depression among schoolgoing adolescents in India.

METHODS

Protocol and registration

The Systematic review protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) (Registration number: CRD42020193980). We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines through-out our review.

Eligibility criteria

In this review we included cross-sectional studies published from 1990 to 2020 in India that report prevalence of depression among adolescents by using Beck's Depression Inventory (BDI 1 or BDI 2).[17] Furthermore, school-based studies were included because in recent time schools have been attracted as a formal infrastructure to promote mental health services along with the health related activities.[18] Studies without pre-identified mental illness were included and those with known mental illness were excluded.

The BDI tool was preferred over other screening tools because it is widely used in school-based studies and it was found to be a better screening tool.[19] BDI has a 21-item, self-report rating scale that measures characteristic, attitudes and symptoms of depression. The various forms of BDI has been developed which is comprised of several computerized forms, a card form, the 13-item short form and the most recent one is BDI 2. The BDI takes almost ten minutes to complete and participants require a fifth-sixth grade reading level to understand the questions effectively.

Information sources

A systematic review and meta-analysis were conducted using published studies on the prevalence of depression among schoolgoing adolescents in India. We searched for published literature using electronic databases such as PubMed, Ovid MEDLINE, Ovid EMBASE, CINAHL, Cochrane Library, PsycINFO and Google Scholar. The Google Scholar search was limited to the first 70 relevant articles. An additional manual search was also conducted for relevant articles. Search was conducted on 24th June, 2020 and updated on 29th June 2020. We also looked for literature on the national health mission website for national level surveys.

Search

We identified keywords from the review question and identified appropriate synonyms and built a search strategy. During comprehensive literature search the following search terms were included (Adolescent OR School-going OR School going* OR Children OR Pre-University) AND (Depression) AND (Prevalence OR Cross-sectional study OR Cross sectional OR School-based) AND (India). Additionally, we performed a manual search of citations from the relevant published articles. The search was restricted to English language.

Data collection process

Search results from different databases were downloaded in RIS format and uploaded into Rayyan QCRI and

duplicates were removed. It was shared with the research team in a blind mode. Two independent researchers screened the titles and abstracts and included the studies that met the inclusion criteria. About 10% of articles were reviewed by a 3rd reviewer. Following which a call was held with the team members and conflicts were resolved. Further, we reviewed the full text of relevant articles against eligibility criteria and included a finite number of articles for data extraction.

Data extraction form was developed and piloted before we agreed upon the variables. Data extraction form included the following information- study and publication details, study location, type of school, grades, participant characteristics, research design, socio-economic variables, response rate, depression assessment tool and cut-off scores, sample size and prevalence of depression. We also contacted corresponding authors for unavailability of data.

Risk of bias in individual studies

A quality assessment checklist for prevalence studies, adapted from Hoy et al was used to perform the critical appraisal of the included studies.[20] It consists of nine questions that assess the external and internal validity of the study and a 10th item which contains the overall risk of study bias. Each item in the checklist was scored either as "0" or "1" according to "low risk of bias" and "high risk of bias". The total score ranged from '0 to 9' with the overall score categorized as low risk (0-3), moderate risk (4-6) and high risk (7-9) respectively. The methodological quality and eligibility of the identified articles were also assessed by two reviewers and disagreements among reviewers were fixed accordingly followed by a discussion.

Data analysis and synthesis

The extracted data was analyzed in STATA 15. The pooled prevalence was estimated from the proportion of prevalence of depression from individual studies. Due to heterogeneity between studies, meta-analysis was performed with a random effect model using restricted maximum likelihood (REML) estimates. Heterogeneity was assessed by the inconsistency index I and the Q test.[2] Statistical heterogeneity was declared using the Q test P value ≤0.05. Forest plots were used to visualize the prevalence in each study and the combined estimated prevalence with their 95% confidence intervals (95% CI).

Subgroup and sensitivity analysis

Subgroup analysis based on the education level categories and sensitivity analyses based on the sample size were performed to address heterogeneity. Publication bias was assessed graphically using funnel plots and tested using Egger's method. A p value ≤0.05 was considered for statistical significance. All statistical analyses were performed with STATA 15.

RESULTS

Study selection

A total of 510 studies were identified through database search and six additional articles were identified through other sources. After removing 151 duplicates, 365 articles were screened for title and abstract. Screening of title and abstract resulted in exclusion of 312 irrelevant articles. Total 53 articles were assessed for full text screening, out of which 40 articles were excluded with reasons (Figure 1) We finalized a total 13 studies that were eligible for full text data extraction.[9,10,14,21-30]

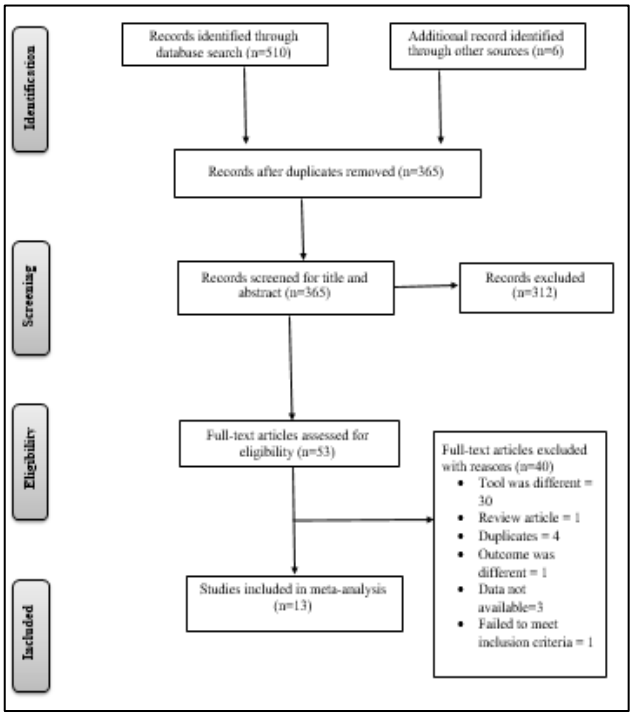

Figure 1: PRISMA flow chart.

Study characteristics

Characteristics of included studies were summarized in Table 1. A total of 13 cross-sectional studies were included for the Meta-analysis. Studies took place in different states of India. Four studies were conducted in Karnataka and one study each in Bihar, Chandigarh, Haryana, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, West Bengal and South India (state not specified).[9,10,14,21-30] In these studies, the participant's age group ranged from 13 to 19 years. Total sample size was 8898, among which 4710 were males and 3430 were girls. Out of 13 studies, nine studies reported the type of school. Four studies took place in public schools (run by the government), two in private and three took place in both government and private schools. Studies had used either BDI 1 or BDI 2 to report depression. Adolescents were studying in different grades ranging from 7th standard to pre-university.

To compare the prevalence across the studies we considered mild, moderate, severe and extremely severe depression categories reported in individual studies.

Prevalence of depression

Thirteen studies were included in the meta-analysis, with a total population of 8898 subjects. Random effects models were used to summarize the prevalence as there was a high level of significant heterogeneity (I^2=99%, p<0.001). The random effect Meta-analysis revealed that the pooled prevalence of depression among Indian adolescents was 53% (95% CI: 41%-65%) (Figure 2) Prevalence was higher in females 57% (95% CI: 46%-69%) than male adolescents 50% (95% CI: 38%–62%) (Figure 3) (Figure 4).

Table 1: Characteristics of included studies (n=13).

Author Name	Year of publication	State	Age in years Range (Mean)	Sample size	Male (N)	Female (N)	Type of school	Grade
Jha et al	2017	Bihar	14-18	1485	893	519	N/A	9 to 12
Sharma et al	2014	Chandigarh	N/A	300	150	150	Govt	11
Malik et al	2015	Haryana	13-17 Mean-15.13	374	254	120	Govt	9 to 10
Jayashree et al	2018	Karnataka	15-18	201	128	73	N/A	High school and Pre-University
Joseph et al	2011	Karnataka	16-19 Mean-17.27	308	205	103	Both	Pre-University students
Nagendra et al	2012	Karnataka	15- 19	3126	1841	1285	Both	High schools, pre-university colleges, Industrial Training Institute (ITI)
Sinha et al	2020	Karnataka	15-18	254	110	144	Govt	9 to 10
Nair et al	2004	Kerala	13-19	898	430	468	N/A	9, 11 and 12
Rama et al	2016	Madhya Pradesh	14-16	136	80	56	Private	9 to 10
Bansal et al	2009	Maharashtra	N/A	125	N/A	N/A	Govt	9
Jayanthi et al	2015	South India	14-17	560	N/A	N/A	Both	9 to 12
Mohanraj et al	2010	Tamil Nadu	14-18 Mean-15.6	964	509	455	Private	10, 11 and 12
Basu et al	2017	West Bengal	13-17	167	110	57	N/A	7 to 9

Subgroup analysis

Subgroup analysis based on the education level categories and sensitivity analyses based on the sample size were performed to address heterogeneity. The subgroup analysis revealed that the pooled prevalence increased with education levels (High school: 42%; High school and pre-university: 55%; and Pre-university: 67%) (Figure 5).

Sensitivity analysis

Sensitivity analysis performed by excluding the studies with sample size less than 200 which did not affect the overall estimate.[9,27,30] The pooled prevalence found to be 57% (95% CI: 44%–69%) (Figure 6).

Risk of bias between studies

All the studies were found to be low risk of bias when assessed by Hoy et al checklist.[20] The most of the studies failed to meet question 2 and question 4 of the checklist. In most of the studies sampling frame was not a close representation of the target population and no clear information was available to evaluate response rate. All the studies had collected data directly from the participants (Table 2).

Y=Yes (Low risk), N= No (High risk)

- Was the study's target population a close representation of the national population in relation to relevant variables, e.g. age, sex, occupation?
- Was the sampling frame a true or close representation of the target population?
- Was some form of random selection used to select the sample, OR, was a census undertaken?
- Was the likelihood of non-response bias minimal?
- Were data collected directly from the subjects (as opposed to a proxy)?
- Was an acceptable case definition used in the study?
- Was the study instrument that measured the parameter of interest (e.g. prevalence of low back pain) shown to have reliability and validity (if necessary)?
- Was the same mode of data collection used for all subjects?
- Were the numerator(s) and denominator(s) for the parameter of interest appropriate?
- Overall scores

Risk of bias levels based on overall scores i.e. 0-3=Low risk, 4-6=Moderate, 7-9=High risk

Publication bias

Publication bias was evaluated using funnel plot and Egger's test. Test revealed that there was no significant publication bias (P=0.50) (Figure 7).

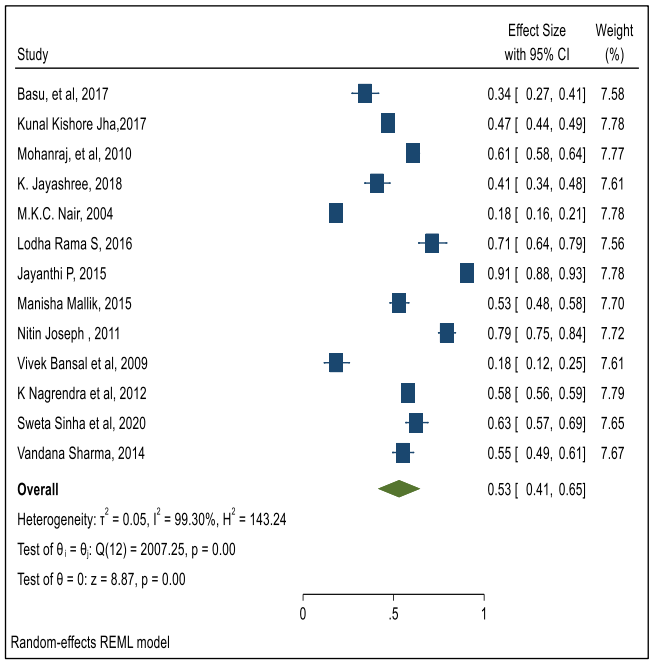

Figure 2: Meta-analysis and forest plot of included studies.

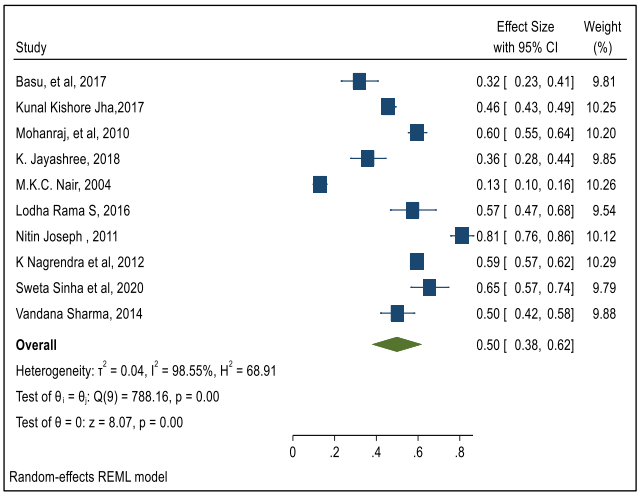

Figure 3: Meta analysis and forest plot of included studies.

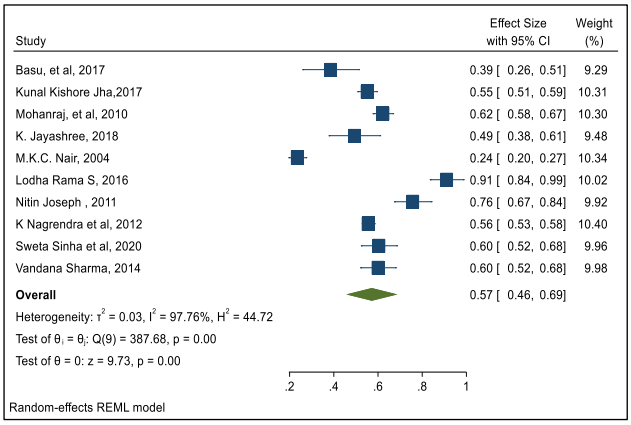

Figure 4: Meta analysis and forest plot (Female).

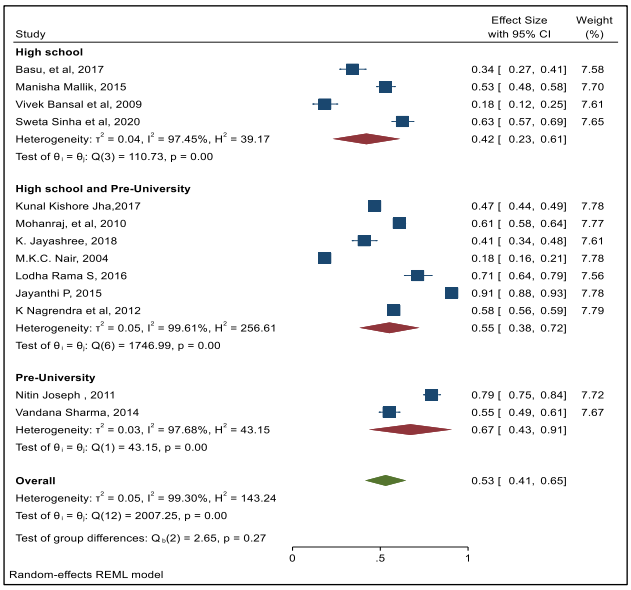

Figure 5: Subgroup analysis based on education level and forest plot.

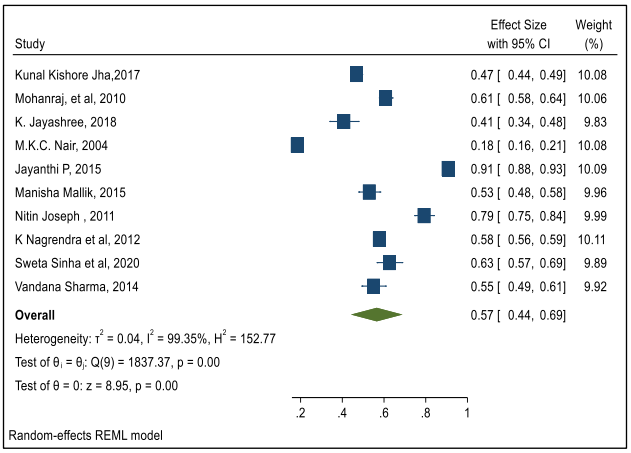

Figure 6: Sensitivity analysis and forest plot.

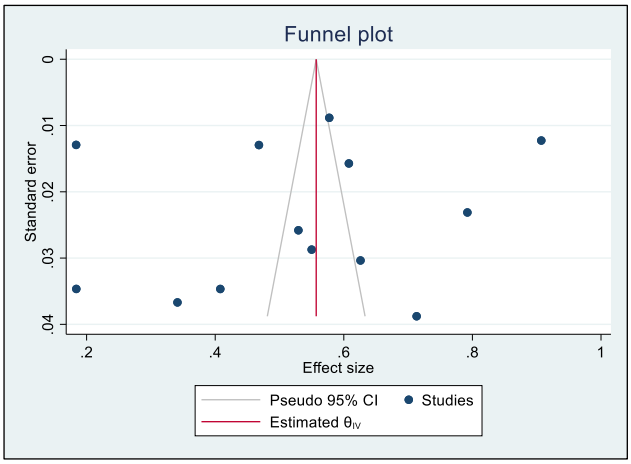

Figure 7: Publication bias.

Table 2: Risk of bias assessment.

Studies	Criteria										Risk bias levels
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	
Basu et al, 2017	Y	N	N	Y	Y	Y	Y	Y	Y	2	Low risk
Kunal Kishore Jha, 2017	Y	N	Y	Y	Y	Y	Y	Y	Y	1	Low risk
Mohanraj et al, 2010	Y	N	Y	Y	Y	Y	Y	Y	Y	1	Low risk
K. Jayashree, 2018	Y	N	N	Y	Y	N	Y	Y	Y	3	Low risk
M.K.C. Nair, 2004	Y	Y	N	N	Y	Y	Y	Y	Y	2	Low risk
Lodha Rama S, 2016	Y	N	Y	N	Y	Y	Y	Y	Y	2	Low risk
Jayanthi P, 2015	Y	Y	N	N	Y	N	Y	Y	Y	3	Low risk
Manisha Mallik, 2015	Y	N	N	N	Y	Y	Y	Y	Y	3	Low risk
Nitin Joseph, 2011	Y	Y	Y	Y	Y	Y	Y	Y	Y	0	Low risk
Vivek Bansal et al, 2009	N	N	Y	N	Y	Y	Y	Y	Y	3	Low risk
K Nagendra et al, 2012	Y	Y	Y	Y	Y	Y	Y	Y	Y	0	Low risk
Sweta Sinha et al, 2020	Y	N	Y	Y	Y	Y	Y	Y	Y	1	Low risk
Vandana Sharma, 2014	N	N	Y	Y	Y	N	Y	Y	Y	3	Low risk

DISCUSSION

The systematic review and meta-analysis were conducted to estimate the pooled prevalence among schoolgoing adolescents in India. In this review, the estimated pooled prevalence of depression was found to be 53% (95% CI: 41%-65%). The pooled prevalence reported in our review was within the range of point prevalence reported in a similar review performed on schoolgoing children, ranging from 3% to 68%; most of the individual studies reported prevalence of >40%.[31] A cross-sectional survey of undergraduate medical students in Gujrat, when assessed using Patient Health Questionnaire (PHQ-9) reported overall prevalence of 65% which is comparable with the findings of our review.[32]

There were limited reviews conducted on school-based setting in India however, in South Asian region, China has conducted several reviews on school-based studies. The pooled prevalence found in our review was higher than prevalence reported in Chinese reviews. The average pooled prevalence among college going children was 30.39%, on secondary school students it was reported to be 24.3% (95% CI: 21.3%-27.6%) and in another review among children and adolescent of less than 18 years of age depression was found to be 19.85% (95% CI: 14.75%-24.96%), one more review on primary school students with lesser prevalence of 17.2%.[33-36]

Results of pooled prevalence gives new insights to relook at the prevention strategies through strengthening of school-based mental health services along with the community and center-based care. Our review showed an increased trend of depression as adolescent progress towards higher educational level. Similar trend was also established in a recent meta-analysis conducted in China. An increase in prevalence of 24.5% (95% CI: 17.8%–32.8%) to 40.1% (95% CI: 29.4%–51.9%) from Year 1 in Junior secondary school to year 3 in senior secondary school was reported.[34] These findings emphasize the need to consider age-specific developmental needs and prevention strategies by early (10-13), middle (14-17) and late adolescent period (18-19 years). Gender has appeared as a foremost factor associated with depression.

Prevalence of depression was found higher among females than males which is consistent with the Iranian systematic review where it showed that mean prevalence of depression higher among girls than boys.[37] The high prevalence of depression among females might be associated with the changes during puberty.[38]

We found minimal methodological issues in included studies. All the studies included were having low risk of bias when assessed using Hoy et al checklist which may slightly differ compared to other quality assessment checklists for cross-sectional studies.[20,38] Even though BDI is a widely used and validated tool, the cut-off score and categories differed which was challenging to compare between studies. In our review, prevalence is comprehensive of depression status (from mild to extremely severe), could be an overestimation of the depression.

We followed a sound scientific methodology through-out our review. Our review would contribute to the evidence base for country specific adolescent mental health policies by estimating the burden of depression among adolescents. Given the various tools for the assessment of depression our review focused on the studies that used the BDI tool to measure depression which is a validated and reliable tool; hence more likely to provide a precise measurement of depression.

In the Meta-analysis a significant heterogeneity among studies was reported and we tried to address heterogeneity with a sensitivity and sub-group analysis that needs to be considered when interpreting the results of this review. The extraneous variables such as home environment, family income, parent-child relationship and supporting mechanisms were not assessed since most of the individual studies did not report these variables. Most of the studies were conducted in South India, which lacked the real representation of studies from North-East, North-West regions of India.

CONCLUSION

The study revealed that the schoolgoing adolescents across India frequently experienced depressive symptoms and the levels of depression at this age group ranged from mild to severe. This calls for an urgent need to impart adequate awareness in parents, teachers and peer groups, as well as to sensitize them regarding the intensity of the disease, so that early identification and treatment can be accomplished. Despite the efforts by the government in public health facilities and community level, lack of human resources, infrastructure and stigma associated with the disease has been challenging to provide quality mental health. One of the cost-effective ways to address mental health in adolescents is through strengthening school-based programs with an integrated approach by the health and education departments. School teachers could be the potential candidates to empower with the skills of identifying early symptoms of mental illness, that would later help to draw the attention of the health department.

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