

SYSTEMATIC REVIEW

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Gender disparity in prevalence of mental health issues in Kerala: a systematic review and meta-analysis

Kizhessery Rahna^{1,5*†}, Muhammad Aaqib Shamim^{2†}, Haseena Chekrain Valappil^{1†}, Jahnavi Subramanian¹, Gopal Ashish Sharma³ and Bijaya K. Padhi⁴

Abstract

Background Kerala is a state in south India, appreciated for its education, better health indicators and quality of life. However, there is a proportionately high prevalence of mental health illnesses and suicides reported in the state. It is unclear if there is any disparity in the gender categories in this. With this systematic review, we aim to systematically study the gender disparity in the prevalence of mental health (MH) issues among adolescents, younger and older adults in Kerala.

Methods A search strategy was built and several databases like Pubmed, Cochrane, Scopus, EMBASE, EBSCOhost, Web of Science, and ProQuest were used alongside grey literature to identify relevant articles. The study was conducted according to the PRISMA guidelines following a prespecified protocol. After relevant data extraction, the estimates were pooled using random effects model due to the high heterogeneity assessed by tau-squared, Cochran Q, and prediction interval. Subgroup analyses, and meta-regression were used to reduce heterogeneity. We also identified the influence and heterogeneity contributed by individual studies using influence plots, Baujat plot, clustering, and performed several sensitivity analyses.

Results Twenty articles were included in the review and meta-analysis. The pooled odds ratio of mental health illnesses amongst females compared to males in Kerala was 1.31 (95% CI: 1.0 – 1.73) and falls within a prediction interval of 0.38 to 4.53. The individual studies showed high heterogeneity ($I^2 = 92%$, $p = p < 0.01$) and hence, subgroup analysis was done for several prespecified subgroups based on etiology, geography, demography, study settings, and age groups. Heterogeneity was significantly reduced by subgrouping based on etiology, study setting and age ($p, 0.001$, $p < 0.001$, $p = 0.001$). In etiologic subgrouping the highest pooled odds was in comorbidities associated MH issues (2.54) and least in non-specific (0.97). In age subgrouping, the highest pooled odds was in elderly (2.53) and least in adolescents (0.63). The odds was highest in health care facility (2.21) and least in educational institution (0.78) based studies. Meta-regression based on the size of the study failed to reduce heterogeneity.

Interpretations A gender disparity was evident in the prevalence of mental health issues, with a higher Odds in females especially among the elderly and adults. A Gender transformative approach in legislative, health systems and policy frameworks will be the answer to this.

Keywords Mental health, Kerala, Elderly, Adult, Adolescent, Gender disparities, Inequalities, Geographic patterns

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Introduction

Health for all and gender equality

“Health for all” theme of World Health Organization (WHO) highlights the significance of ensuring that everyone has equal access to basic healthcare services [1]. Individuals’ and communities’ experiences with health might be very diverse [2]. Health equity is the state whereby all individuals have the chance of attaining their optimal level of health and no one is prevented from achieving this goal due to their socioeconomic status or any other situation that is deemed undesirable by society. Presently, there is an unfair global distribution of the burden of illness and poor health as well as the advantages of wellbeing and good health [3]. Health equity is accomplished when each person can reach their maximum level of health and wellbeing [4]. WHO, in its policy brief on Health and Gender equality, Sustainable Development Goal (SDG-5), gender equality is projected as a crucial determinant for achieving SDG Goal 3 (Health and Well Being) [5]. Although gender equality, is a stand-alone SDG goal, it also plays a significant part in advancing all other objectives and aims for health and well-being [6].

Burden of mental health issues

India, being a country with existing gender inequality [7], with evidence of gender disparities in health expenditure, gender and health are interdependent [8–11]. A vital component of human well-being is mental health (MH) [12]. More than just the absence of disease, MH is an integral component of both our collective and individual health and well-being [13]. However, with over one billion individuals struggling with a mental illness or addiction problem around the world, achieving this level of MH is a persistent challenge for a large portion of the world’s population [12]. Leading causes of disability and important contributors to early mortality both include mental disorders. This burden of sickness and mortality is increasing across the board in terms of sociodemographic development [12, 14]. Mental diseases were the seventh most prevalent cause of Disability-adjusted life years (DALY) and the second most common cause of years lived with disability (YLDs) in 1990 and 2019. This presents a significant challenge for healthcare systems, particularly in developing nations [14].

Burden of mental health illness in Indian and Kerala context

In India, one of the main causes of non-fatal disease burden is mental illness [15]. According to a report in 2017, Indians had a mental condition that could have ranged from mild to severe. Between 1990 and 2017, the share of mental illnesses in India’s overall disease burden nearly doubled [16]. Kerala, a state in southern India, has been

recognized for more than 30 years as an example of “excellent health at low cost” and how to achieve greater health equity [17]. Kerala, one of India’s most decentralized states, has improved access to healthcare services and enhanced outreach programmes based on “wellness” due to contributions from local governments [18], .

Existing system for mental health in Kerala and challenges

The Kerala model of development is praised for its investments in social infrastructure, such as education and healthcare, which led to the better health outcomes like a high life expectancy and the low infant mortality and birth rates [19]. Several programmes aiming to promote MH and assure care for MH issues by increasing awareness on MH issues in general care, equitable and balanced distribution of resources, as well as promoting community participation is in place including community mental health programme, school mental health programmes and palliative care for elderly [20, 21].

Although Kerala was among the first in the country to establish a Mental Health Policy in 2003, which was revised in 2013, as per the report of the National Mental Health Survey, 2015–16, the total prevalence of any mental disorders was found to be 11.36% in Kerala which is greater than the national prevalence of 10.6%, despite the state having the higher percentage of mental health workforce [22–24].

Inequalities in mental health are closely related to and ingrained in the wider economic and social milieu. The effects of mental health disparities include persistent needless suffering and early deaths, a rise in stigma and discrimination, a shortage of investment in the workforce and infrastructure supporting the field, and inadequate or nonexistent care for those who are afflicted [25].

According to the report of National Crime Record Bureau 2019, the rate of suicide in Kerala is 26.9 which is much higher than the national average of 12.0 [26]. Over time, the state has seen an increase in the prevalence of mental health issues and has a heavier burden when compared to national statistics [26].

Social determinants of mental health and the need for awareness

The magnanimity of the problem is out of proportion to the public sector’s capacity for addressing it [22]. Social inequalities were shown to have varied effects on mental health for men and women [27–29].

Understanding determinants for mental health issues is important to address inequity related to mental health as the reason for mental health issues varies across socioeconomic divides [30, 31]. An enhanced knowledge regarding the gender disparities in mental health could provide a firmer scientific basis for monitoring patterns, planning

health programmes, understanding risk groups, and formulating policy decisions.

Given the above context, the purpose of the present study is to review and analyse the difference in the burden of mental health issues between females and males among adolescents and adults in Kerala state.

Methodology

We developed a pre-defined study protocol for this systematic review and registered it at PROSPERO (CRD42023416043).

Databases

Our search was centered on the PI(E)CO criteria (Table S1a) based on the research question, “What is the gender disparity in odds for mental health issues among adolescents and adults in Kerala?” [32].

An instrumental and thorough literature search was done including keywords for all mental health issues namely, “depression”, “mental health”, “mental disorder”, “stress”, “sleep”, post-traumatic stress disorder”, “ADHD” “psychologic”, “OCD” in combination with “Kerala”, and all the ‘district names’ as well as important place

names, to identify relevant studies. We used a standard search procedure to reduce the chance of observer bias [33]. The search strategy was developed by KR, and peer-reviewed by MAS according to PRESS guidelines [34]. An extensive literature search in PubMed, Scopus, EMBASE, EBSCOhost, Cochrane, Web of Science and ProQuest was performed to avoid missing relevant studies and to improve the identification of studies. We assessed all articles published by 12th September 2023. Two reviewers (MAS and KR) independently screened the search results by title and abstract to reduce irrelevant articles as well as selection and reporting bias. Adjusted search syntax and results obtained from each database included in supplementary files (Table S2).

The articles searched were reported using the Preferred Reporting Standard of Systematic Reviews and Meta-Analysis (PRISMA) flowchart (Fig. 1).

Selection process

Articles then underwent a full-text screening to identify studies which come under the scope of the review. Any difference in study selection was discussed amongst the reviewers to prepare a final list for the review.

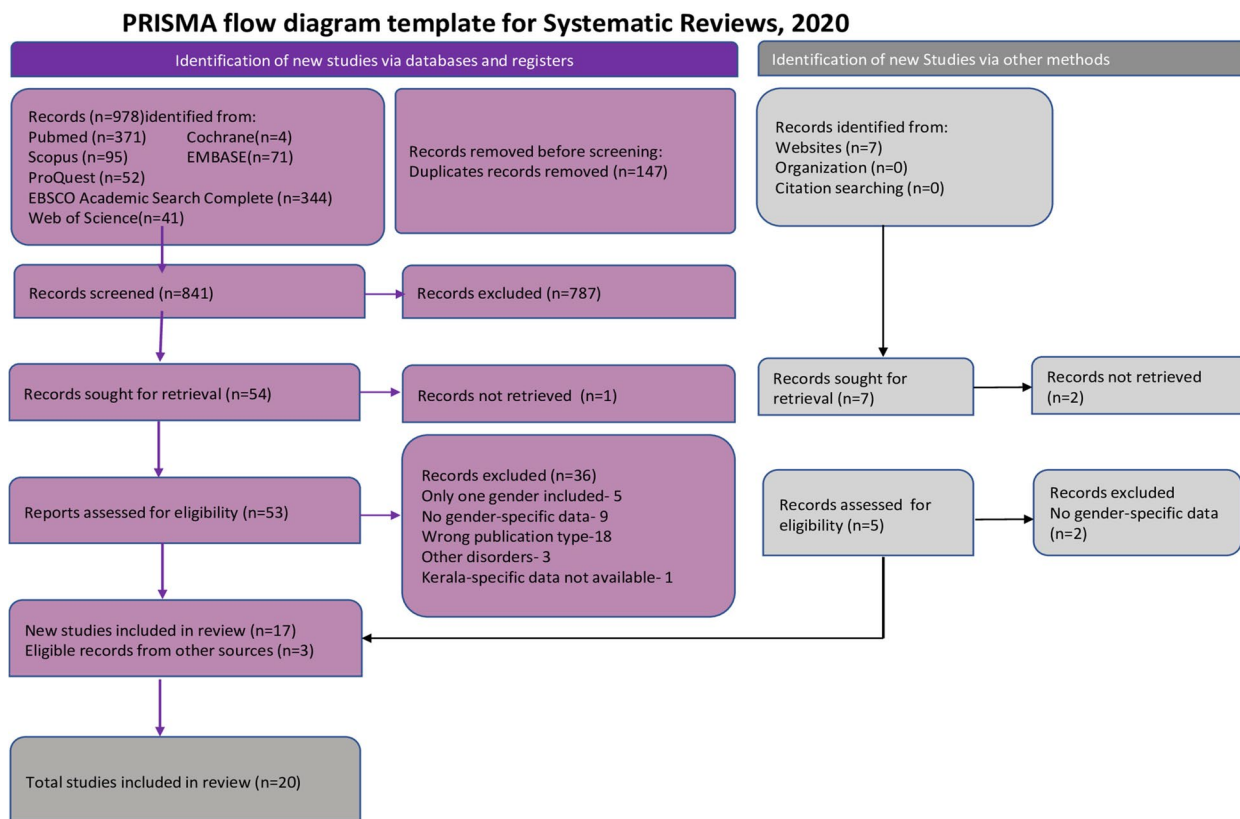


Fig. 1 PRISMA flowchart for included studies in systematic review and meta-analysis with Manuscript Title: Gender disparity in prevalence of mental health issues in Kerala: a systematic review and meta-analysis

Discrepancies were resolved by a third reviewer (HCV). All the decisions were recorded in a Microsoft Excel spreadsheet. Any difference in study selection with respect to the scope of the study was discussed amongst the reviewers before identifying the final list for the review.

Quality assessments

To avoid any bias in quality, quality assessment was done by 2 reviewers (KR and GAS) and in case of discrepancies it was resolved with a third reviewer (MAS). Predefined inclusion criteria minimize bias arising from the selective consideration of evidence [33]. All the decisions were recorded in a Microsoft Excel spreadsheet. Quality assessment tool for observational cohort and cross-sectional studies, recommended by the National Institute of Health was used to identify low-quality studies [35].

Data collection process & data

Data extraction was done independently by two reviewers (MAS and KR). Any differences in data extraction were discussed amongst the reviewers to prepare a final extracted spreadsheet. Discrepancies if any were resolved by a third reviewer (JS). A data extraction sheet was prepared in MS Excel, and the following fields were included: Study authors, year of study, total number of patients as well as total number of males and females in the study, number of male and female cases, age and district, time frame of data collection of study baseline characteristics and other important details. When gender specific number of events was not explicitly mentioned but could be calculated from the given data, it was done.

Inclusion and exclusion criteria

All published and grey literature studies are considered for the review. Eligibility criteria were defined based on the PI(E)CO elements of the review question [36]. All published and grey literature studies until 12th September 2023 were included in the review (For criteria and studies included in the analysis See Table S1a).

Inclusion criteria

The population included was adolescents in the age groups 12–18, adults with ages ranging from 18 to 60 years, and elderly above 60 years. Comparator groups were females and males in the Kerala context. The transgender category was excluded from the review only because the studies comparing male, female and transgender studies satisfying the eligibility criteria were unavailable.

Studies reporting any mental health issues were included in the review. It included issues like depression, psychological distress, mental health, mental disorder, stress, sleep disorder insomnia, post-traumatic stress disorder, ADHD, psychological illness, OCD etc. The tools of data collection were checked and recorded to avoid the disadvantage of uncertainty in the assessment and thus to increase the quality of the body of evidence for the outcome. All studies reporting gender-specific cases or that could potentially be calculated were used in the review.

Psychological distress is defined by American Psychology Association as a set of painful mental and physical symptoms that are associated with normal fluctuations of mood in most people which however may indicate the beginning of major depressive disorder, anxiety disorder, schizophrenia, somatization disorder, or a variety of other clinical conditions [37].

Exclusion criteria

Articles were not included if not satisfying the inclusion criteria.

Table of all inclusion and exclusion criteria (Table S1a).

Statistical analysis

We extracted sex-wise data on the odds of mental health disorders from the eligible studies. Then, we pooled this data from all the studies to arrive at the odds ratio of mental health disorders in females compared to males. We employed an inverse variance model with random study effects. We visualised the results in the form of a forest plot, and a drapery plot. Drapery plot frees us from choosing an arbitrary threshold of significance and plots the results against a range of levels of significance [38].

We assessed heterogeneity using Cochran's Q, tau-squared, and prediction interval [39]. Restricted maximal likelihood estimator computed the confidence interval for tau-squared [40]. Prediction interval is a more practical estimator of heterogeneity in that it gives a range of values into which the result of a similar original study in the future is expected to lie [41, 42]. Heterogeneity and influence of individual studies are also assessed by three standard clustering algorithms [k-means [43], density-based spatial clustering [44], and gaussian mixture models [45]], Baujat plots [46], and influence diagnostics [47].

We explored potential sources of heterogeneity of categorical variables using subgroup analyses, and quantitative variables using meta-regression. Bubble plots are used to visualise the results of meta-regression.

We conducted sensitivity analyses by omitting potential outliers, and overly influential studies, and each study individually.

For the assessment of publication bias and small-study effects, we used a contour-enhanced funnel plot with trim-and-fill analysis [48]. Egger's regression test was performed for quantitative interpretation [49].

All statistical analyses were conducted using meta, metafor, and dmetar packages in R-programming language (v4.3.0). Differences for which $p < 0.05$ (two-sided) were considered statistically significant.

The PRISMA checklist guided the review conduct and reporting attached in the supplementary section (Table S3).

Ethical approval

Not applicable, being a systematic review of published studies.

All authors in the review had full access to all the data in the study and had the final responsibility for the decision to submit for publication.

Results

The systematic search yielded 978 hits out of which, 147 duplicates were detected and removed. 7 articles were received from preprint servers. 53 full-text articles were retrieved. Eligibility of full-text articles were checked using inclusion and exclusion criteria by full-text screening out of which 20 articles yielded numerical data suitable for meta-analysis [30, 31, 50–67] (Table S1c). Some of the reasons for exclusion in full-text screening were unavailability of gender-specific events of total numbers, multi-state study with state-specific numbers unavailable, wrong outcome, studies conducted only among cases etc. One of the important studies excluded was Joseph et al. [22], as the number of female and male prevalence was given as a ratio i.e. events per 100,000 [22]. Another important study excluded was Ayirolimeethal et al., [68] conducted in 3 district jails in Kerala, as they specifically mentioned that any gender disparity would be due to the sex disparity in jail capacity [68]. An attempt was made to get the total number of females and males in the samples for one eligible study by contacting the author but could not obtain the information [69].

Prisma flowchart is included in the Supplementary files (Fig. 1).

Narrative synthesis of articles

The included studies were assessing burden of mental health issues including Common mental disorders (CMDs), Psychiatric illness, depression, Psychological Distress, OCD, PTSD, ADHD and Hoarding disorder (HD) in Kerala. The tools used to assess and identify the outcome were either clinical evaluation, pre-validated or custom-validated questionnaires. The standard tools in the included studies were Geriatric Depression Scale

(GDS), PTSD Checklist for DSM-5 (PCL-5), Insomnia severity index (ISI), Mini-International Neuropsychiatric Interview (MINI), Clinical assessment guidelines, ADHD rating scale–IV, Composite International Diagnostic Interview (CIDI), CIS-R-19, Kessler Psychological Distress Scale (K10), Hoarding Rating Scale-Interview (HRS-I), pretested semi-structured questionnaire, Montgomery Asberg Depression rating scale (MADRS), Center for Epidemiologic Studies Depression Scale (CES-D), General Health Questionnaire 12 (GHQ-12) and Geriatric depression scale 30 (GDS-30). A slight variation in the criteria was also noticed among studies. For e.g. Raghunath et al., 2019 study gives a higher cut of 9 instead of 5, the cut-off used in other studies using the same tool [31, 57, 58]. Tools and respective diagnostic criteria are given in the Table S1b.

The main characteristics of the included articles were extracted and the studies were sub-grouped based on etiology, geography, demography, study settings, and age groups are summarised in Tables 1, 2 and 3. The studies were conducted in various districts of Kerala between 2015 and 2020. All the studies obtained were cross-sectional studies. 6 of the studies were conducted in community settings, 8 in educational institutions and 6 in healthcare settings. The highest overall prevalence of mental health issues reported among the studies included in this review was 89% [51] while the lowest was 1% [64, 66]. Majority (9 of 20–45%) of the studies were conducted specifically in the central zone of Kerala and the least number of studies (2 of 20–10%) were conducted specifically in the north zone.

The lowest prevalence reported in female and male gender categories was 0.5% and 1% respectively [63, 66]. The highest prevalence among females and males reported in this review was 92% and 87% respectively [51] (Table 2).

Pooled prevalence

The pooled odds ratio of mental health illnesses amongst females compared to males in Kerala is 1.31 (95% CI: 1.00–1.73) (Fig. 2). The odds ratio from individual studies ranged from 0.43 [63] to 7.94 [54]. Drapery plot shows the individual study effects and pooled effect across a p -value function. The results reach significance at a threshold of $p < 0.1$ (Fig. 3). Data used for Meta-synthesis included in the supplementary files (Table S1c).

Heterogeneity estimation and exploration

The estimates of individual studies showed heterogeneity with an I^2 of 92%, and a tau-squared of 0.33. The prediction interval ranged from 0.38 to 4.53 (Fig. 2). To reduce this heterogeneity, we performed subgroup analysis and meta-regression.

Table 1 Baseline characteristics of the included studies (N=20 studies)

Authors	Study design	Population size (N)	Age category	Risk of Bias	Etiology	Study Setting	Demography	Zone	District
As Thilak et al., 2016 [50]	Cross-sectional	250	Elderly	Good	Geriatric	Community	Rural	North	Kannur
Asim et al., 2022 [51]	Cross-sectional	276	Adults and elderly	Good	Trauma from Flood	Community	Mixed or unreported	North	Kozhikode
Dahale et al., 2020 [52]	Cross-sectional	1574	Elderly	Good	Geriatric	Healthcare	Mixed or unreported	All 3 zones	All districts
Gopalan et al., 2016 [53]	Cross-sectional	384	Adults and elderly	Fair	Comorbidity	Healthcare	Urban	South	Trivandrum
Indu et al., 2017 [30]	Cross-sectional	827	Adult	Fair	Non-specific	Healthcare	Mixed or unreported	South	Trivandrum
Jaisoorya & Beena et al., 2020 [61]	Cross-sectional	7150	Adolescent	Fair	Non-specific	Educational	Mixed or unreported	Central	Ernakulam
Jaisoorya & Desai et al., 2019 [62]	Cross-sectional	5145	Adult	Good	Non-specific	Educational	Mixed or unreported	Central	Ernakulam
Jaisoorya & Janardhan et al., 2015 [63]	Cross-sectional	7380	Adolescent	Good	Non-specific	Educational	Mixed or unreported	Central	Ernakulam
Jaisoorya & Janardhan et al., 2017 [64]	Cross-sectional	5784	Adult	Fair	Non-specific	Educational	Mixed or unreported	Central	Ernakulam
Jaisoorya et al., 2017 [65]	Cross-sectional	5374	Adult	Good	Non-specific	Educational	Mixed or unreported	Central	Ernakulam
Jaisoorya, & Thamby et al., 2021 [66]	Cross-sectional	6788	Adults and elderly	Good	Non-specific	Healthcare	Mixed or unreported	All 3 zones	All districts
Maheshwari et al., 2022 [54]	Cross-sectional	50	Adults and elderly	Fair	Comorbidity	Healthcare	Mixed or unreported	Not specified	Not specified
Mathew et al., 2021 [55]	Cross-sectional	670	Adolescent	Fair	Trauma from Flood	Educational	Mixed or unreported	South	Alapppy
Nakulan et al., 2015 [56, 87]	Cross-sectional	220	Elderly	Good	Geriatric	Community	Rural	Central	Thrissur
Neenumol et al., 2022 [57]	Cross-sectional	188	Adults and elderly	Fair	Comorbidity	Healthcare	Urban	Central	Palakkad
Paul et al., 2020 [67]	Cross-sectional	1057	Adolescent	Good	Non-specific	Educational	Urban	Central	Ernakulam
Pillai et al., 2019 [31]	Cross-sectional	855	Adults and elderly	Good	Non-specific	Community	Rural	South	Trivandrum
Raghunathan et al., 2019 [58]	Cross-sectional	364	Adult	Fair	Non-specific	Educational	Urban	South	Trivandrum
Shaji et al., 2017 [59]	Cross-sectional	105,473	Adults and elderly	Good	Non-specific	Community	Mixed or unreported	All 3 zones	Kasaragod, Wayanad, Palakkad, Idukki, Kollam
Thomas et al., 2021 [60]	Cross-sectional	250	Elderly	Good	Geriatric	Community	Rural	Central	Ernakulam

Table 2 Baseline characteristics no of events ($N=20$ studies)

No	Author	Samples in the study		Females		Males		Prevalence		
		Total (N)	Events	Events	Total	Events	Total	Overall	female	male
1.	As Thilak et al., 2016 [50]	250	181	95	121	86	129	72%	79%	67%
2.	Asim et al., 2022 [51]	276	247	116	126	131	150	89%	92%	87%
3.	Dahale et al., 2020 [52]	1574	637	403	774	234	800	40%	52%	29%
4.	Gopalan et al., 2016 [53]	384	160	113	244	47	140	42%	46%	34%
5.	Indu et al., 2017 [30]	827	225	170	491	55	336	27%	35%	16%
6.	Jaisoorya & Beena et al., 2020 [61]	7150	538	192	3519	346	3631	8%	5%	10%
7.	Jaisoorya & Desai et al., 2019 [62]	5145	143	76	3395	67	1750	3%	2%	4%
8.	Jaisoorya & Janardhan et al., 2015 [63]	7380	61	18	3640	43	3740	1%	0%	1%
9.	Jaisoorya & Janardhan et al., 2017 [64]	5784	164	103	3174	61	1752	3%	3%	3%
10.	Jaisoorya et al., 2017 [65]	5374	1864	1256	3441	608	1933	35%	37%	31%
11.	Jaisoorya, & Thamby et al., 2021 [66]	6788	69	47	4444	22	2344	1%	1%	1%
12.	Maheshwari et al., 2022 [54]	50	25	13	16	12	34	50%	81%	35%
13.	Mathew et al., 2021 [55]	670	234	111	362	123	308	35%	31%	40%
14.	Nakulan et al., 2015 [56, 87]	220	86	60	127	26	93	39%	47%	28%
15.	Neenumol et al., 2022 [57]	188	38	15	45	23	143	20%	33%	16%
16.	Paul et al., 2020 [67]	1057	150	60	438	90	619	14%	14%	15%
17.	Pillai et al., 2019 [31]	855	115	70	556	45	299	13%	13%	15%
18.	Raghunathan et al., 2019 [58]	364	98	83	292	15	72	27%	28%	21%
19.	Shaji et al., 2017 [59]	105,473	9493	5391	52,556	4102	52,917	9%	10%	8%
20.	Thomas et al., 2021 [60]	250	131	99	161	32	89	52%	61%	36%

We performed several prespecified subgroup analyses. Subgrouping for study settings, age groups, and etiology significantly reduced heterogeneity ($p < 0.001$ for all three). Subgrouping for geography ($p = 0.31$) and demography (0.47) are not significant (Table 4).

We conducted meta-regression based upon the sample size of individual studies. This was not significant ($\beta = 0, p = 0.80$) (Fig. 4a). This is not significant for year of publication too ($\beta = 0.04, p = 0.58$) (Fig. 4b).

Influence assessment

We used Baujat plot, influence plots and clustering to identify studies with a high influence. The Baujat plot shows two studies [59, 61] to exert a high influence on the overall result or contribute considerably to the overall heterogeneity (Fig. 5). Clustering did not identify any study as a potential outlier (Figures S1a-d). Influence plots also did not flag any study (Figure S1e).

Results of critical appraisal

Out of 20 articles all articles were rated fair or good quality [30] (Table 1a). Detailed scores of the critical appraisal are listed in Table S4.

Sensitivity analysis

We performed several sensitivity analyses. Omitting the highly influential studies made the pooled effect statistically significant (slightly touched point of no difference earlier). The pooled estimate changed from 1.31 (95% CI: 1.00–1.73) to 1.32 (95% CI: 0.99–1.77) with an I^2 of 85% (earlier 92%) (Figure S2). None of the studies were of low-quality, and hence no sensitivity analysis was done for the quality of studies.

We also performed leave-one-out meta-analyses omitting each individual study one-by-one. The results were pretty stable (Figure S3).

Publication bias and small-study effects

We constructed a contour-enhanced funnel plot. We used the trim and fill method for imputation of potential missing studies (Fig. 6). There is no evidence of publication bias or small study effects. We quantified it using Egger's regression ($p = 0.74$) and it showed similar inference.

Discussion

Our systematic review examined the gender difference in mental health issues in Kerala, with data from 20 studies with 150,059 people from all geographical zones in

Table 3 Meta-data analysed

Author: YOP	Total(N)	Events total	Event females	Total females	Events Males	Total males	Demography	Zone	Age category	Etiology	Study Setting	ROB
As Thilak et. al., 2016 [50]	250	181	95	121	86	129	Rural	North	Elderly	Geriatric	Community	Good
Asim et. al., 2022 [51]	276	247	116	126	131	150	Mixed or unreported	North	Adults and elderly	Trauma from Flood	Community	Good
Dahale et. al., 2020 [52]	1574	637	403	774	234	800	Mixed or unreported	All 3 zones	Elderly	Geriatric	Healthcare	Good
Gopalan et. al., 2016 [53]	384	160	113	244	47	140	Urban	South	Adults and elderly	Comorbidity	Healthcare	Fair
Indu et. al., 2017 [30]	827	225	170	491	55	336	Mixed or unreported	South	Adult	Non-specific	Healthcare	Fair
Jaisoorya & Beena et. al., 2020 [61]	7150	538	192	3519	346	3631	Mixed or unreported	Central	Adolescent	Non-specific	Educational	Fair
Jaisoorya & Desai et. al., 2019 [62]	5145	143	76	3395	67	1750	Mixed or unreported	Central	Adult	Non-specific	Educational	Good
Jaisoorya & Janardhan et. al., 2015 [63]	7380	61	18	3640	43	3740	Mixed or unreported	Central	Adolescent	Non-specific	Educational	Good
Jaisoorya & Janardhan et. al., 2017 [64]	5784	164	103	3174	61	1752	Mixed or unreported	Central	Adult	Non-specific	Educational	Fair
Jaisoorya et. al., 2017 [65]	5374	1864	1256	3441	608	1933	Mixed or unreported	Central	Adult	Non-specific	Educational	Good
Jaisoorya & Thamby et. al., 2021 [66]	6788	69	47	4444	22	2344	Mixed or unreported	All 3 zones	Adults and elderly	Non-specific	Healthcare	Good
Maheshwari et. al., 2022 [54]	50	25	13	16	12	34	Mixed or unreported	Not specified	Adults and elderly	Comorbidity	Healthcare	Fair
Mathew et. al., 2021 [55]	670	234	111	362	123	308	Mixed or unreported	South	Adolescent	Trauma from Flood	Educational	Fair
Nakulan et. al., 2015 [56, 87]	220	86	60	127	26	93	Rural	Central	Elderly	Geriatric	Community	Good
Neenumol et. al., 2022 [57]	188	38	15	45	23	143	Urban	Central	Adults and elderly	Comorbidity	Healthcare	Fair
Paul et. al., 2020 [67]	1057	150	60	438	90	619	Urban	Central	Adolescent	Non-specific	Educational	Good
Pillai et. al., 2019 [31]	855	115	70	556	45	299	Rural	South	Adults and elderly	Non-specific	Community	Good
Raghunathan et. al., 2019 [58]	364	98	83	292	15	72	Urban	South	Adult	Non-specific	Educational	Fair

Table 3 (continued)

Author, YOP	Total(N)	Events total	Event females	Total females	Events Males	Total males	Demography	Zone	Age category	Etiology	Study Setting	ROB
Shaji et. al., 2017 [59]	105473	9493	5391	52556	4102	52917	Mixed or unreported	All 3 zones	Adults and elderly	Non-specific	Community	Good
Thomas et. al., 2021 [60]	250	131	99	161	32	89	Rural	Central	Elderly	Geriatric	Community	Good

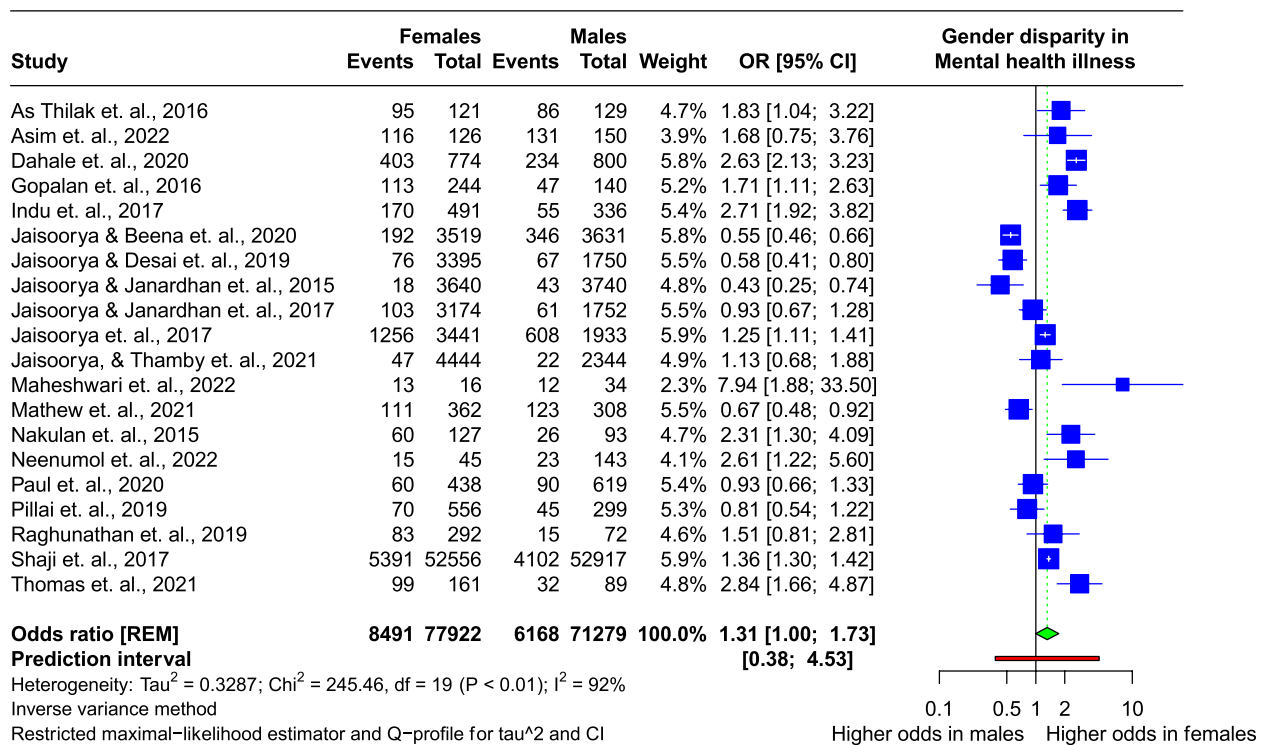


Fig. 2 Forest plot summarising the individual studies and pooled estimate of odds for mental health issues in females with respect to males

Kerala. Mental health disparities between males and females have been documented in various parts of the world, including India [70]. There are limited research specifically talking about the disparity in mental health issues in Kerala, even though there are some studies and articles that provide insights into the mental health status of males and females in the region [71]. We included Common mental disorders (CMDs), Psychiatric illness, depression, Psychological Distress, Obsessive-compulsive disorder (OCD), Post-traumatic stress disorder (PTSD), Attention-deficit/hyperactivity disorder (ADHD) and Hoarding disorder (HD) in this review. The studies included broad ranges of age and conducted among general population or subjects attending health-care facilities(not for MH issues) or students in educational institutes. Thus this review gives a comprehensive and generalizable picture of MH issues and disparity in MH issues in Kerala. The current systematic review also tries to understand possible factors associated with gender disparity in mental health issues in Kerala, including age, etiology, geography, co-morbid illness, study setting and demography.

Main findings

Our study findings show that there is a higher odds of mental health issues among females compared to males. The Odds for mental health illnesses reported by

individual studies range from 0.289 [68] to 7.94 [54]. In our review, 13 out of 20 articles included in our analysis point in the direction of higher odds in females compared to males [30, 50–54, 56–58, 66, 69, 72, 73]. On the other hand, studies by Mathew et al. [55], Jaisooriya & Beena et al. [61], Jaisooriya & Desai et al. [62], Pillai et al. [55], Jaisooriya & Janardhan et al. [63] and Paul et al. [67] report a lower odds ratio suggesting that females are less likely to have mental health issues than males according to their findings [30, 31, 50, 56, 59, 60, 65, 67]. While 2 studies reported that there is no disparity at all [64, 66]. One possible explanation for these discrepancies is that each study had a different sampling frame, which could affect the outcome. Additionally, the studies included different illnesses as well as criteria for the same mental illness, thereby possibly contributing to the difference observed in the point estimate.

Females in the geriatric age group were found to be at two times higher risk of developing mental health issues than other age groups [50, 52, 56, 60]. The overall prevalence and gender disparities and mental health illness are notably higher among conditions like cancer, coronary artery disease and dialysis patients [53, 54, 57]. Out of the 9 studies reporting an association between chronic illness and mental health issues, 7 reported higher odds in females than males [50–54, 57, 60]. Only Mathew et al. [55] and Paul et al. [67] study reported otherwise, which

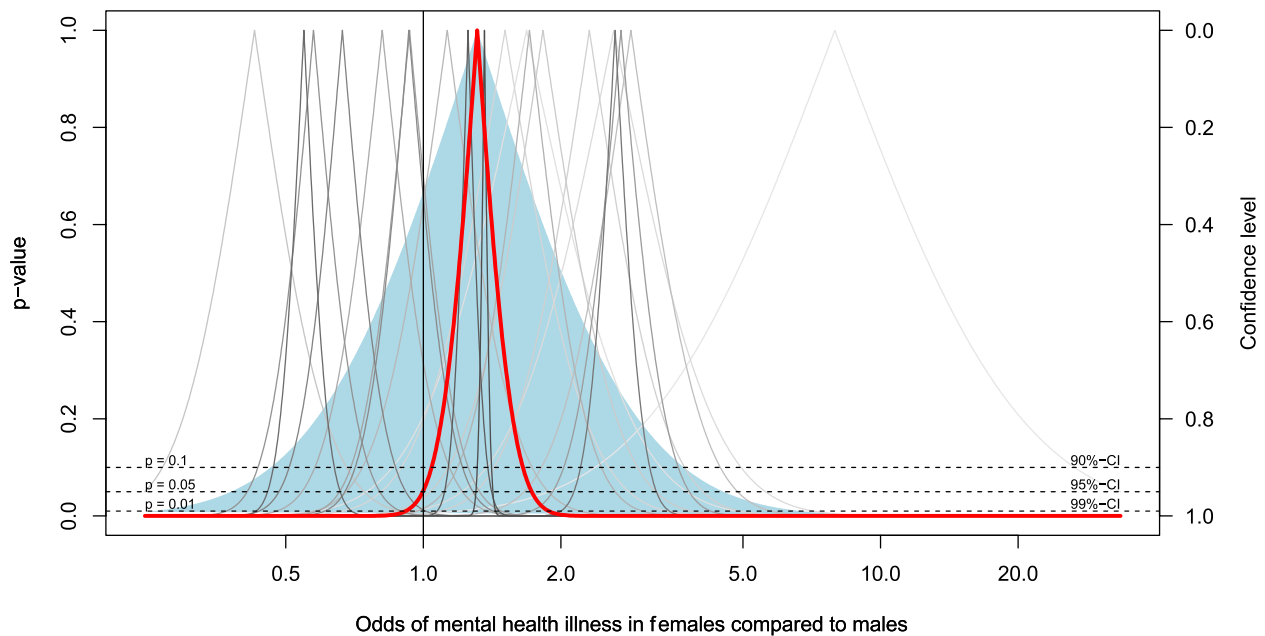
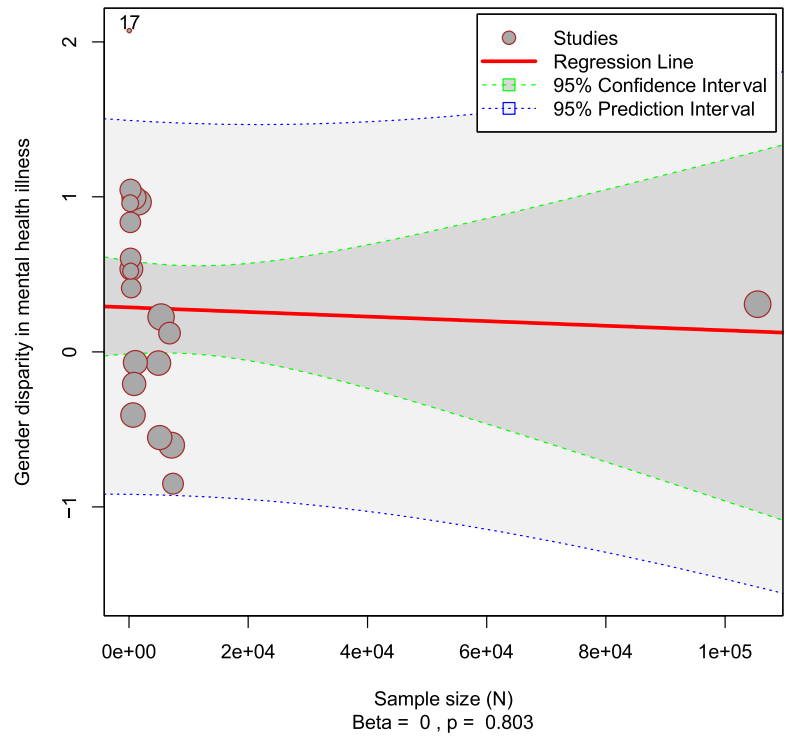


Fig. 3 Drapery plot demonstrating the study effects based on p-value functions

Table 4 Subgroup analyses based on age group, etiology, study settings, demography and geography

Sub-group	No. of studies (N=20)	Pooled estimate (95% CI)	I ²	p value
Age category				< 0.001***
Adults and elderly	7	1.48 [1.07–2.05]	64.0%	
Adult	5	1.21 [0.73–2.02]	90.8%	
Elderly	4	2.53[2.12–3.01]	0.0%	
Adolescent	4	0.63 [0.48–0.84]	65.9%	
Study setting				< 0.001***
Educational	8	0.78 [0.59–1.04]	91.1%	
Community	6	1.61 [1.12–2.34]	72.3%	
Healthcare facility	6	2.21 [1.58–3.09]	65.9%	
Etiology				< 0.001***
Non-specific	11	0.98 [0.72–1.33]	93.7%	
Geriatric	4	2.53 [2.12–3.01]	0.0%	
Comorbidity	3	2.54 [1.29–4.98]	55.3%	
Trauma	2	0.98 [0.40–2.40]	77.3%	
Demography				0.47
Mixed or unreported	12	1.15 [0.80–1.71]	95.0%	
Rural only	5	1.73 [0.98–3.04]	82.2%	
Urban only	5	1.47 [0.97–2.24]	63.9%	
Geography				0.81
Central	9	1.07 [0.69–1.67]	92.3%	
South	5	1.30 [0.77–2.19]	90.3%	
North	2	1.78 [1.12–2.83]	0.0%	
All 3 zones or not specified	4	1.93 [1.07–3.49]	93.1%	

(a) Bubble plot demonstrating meta-regression based upon sample size



(b) Bubble plot demonstrating meta-regression based upon a average age

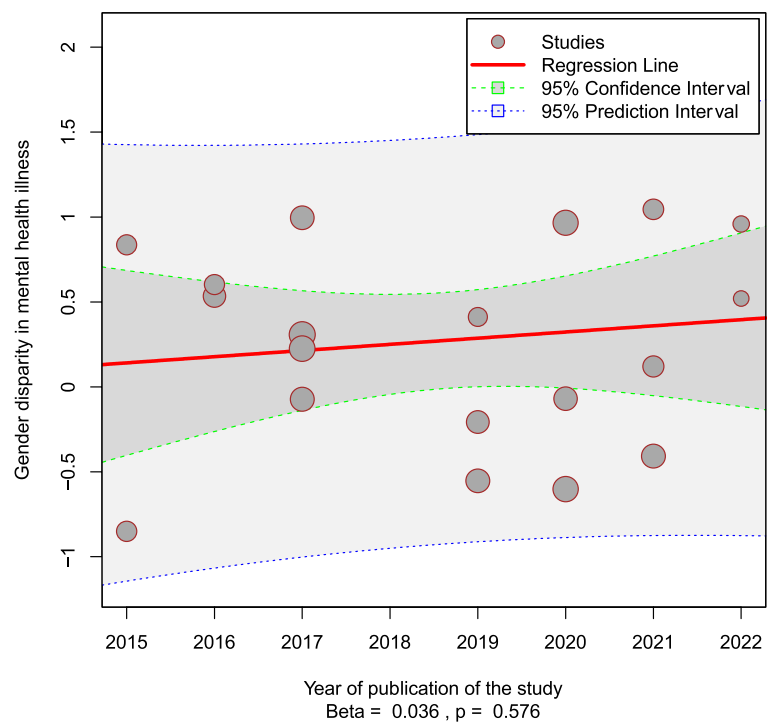


Fig. 4 Bubble plot demonstrating meta-regression based upon the size of the study. Bubble plot demonstrating meta-regression based upon the year of publication of the study

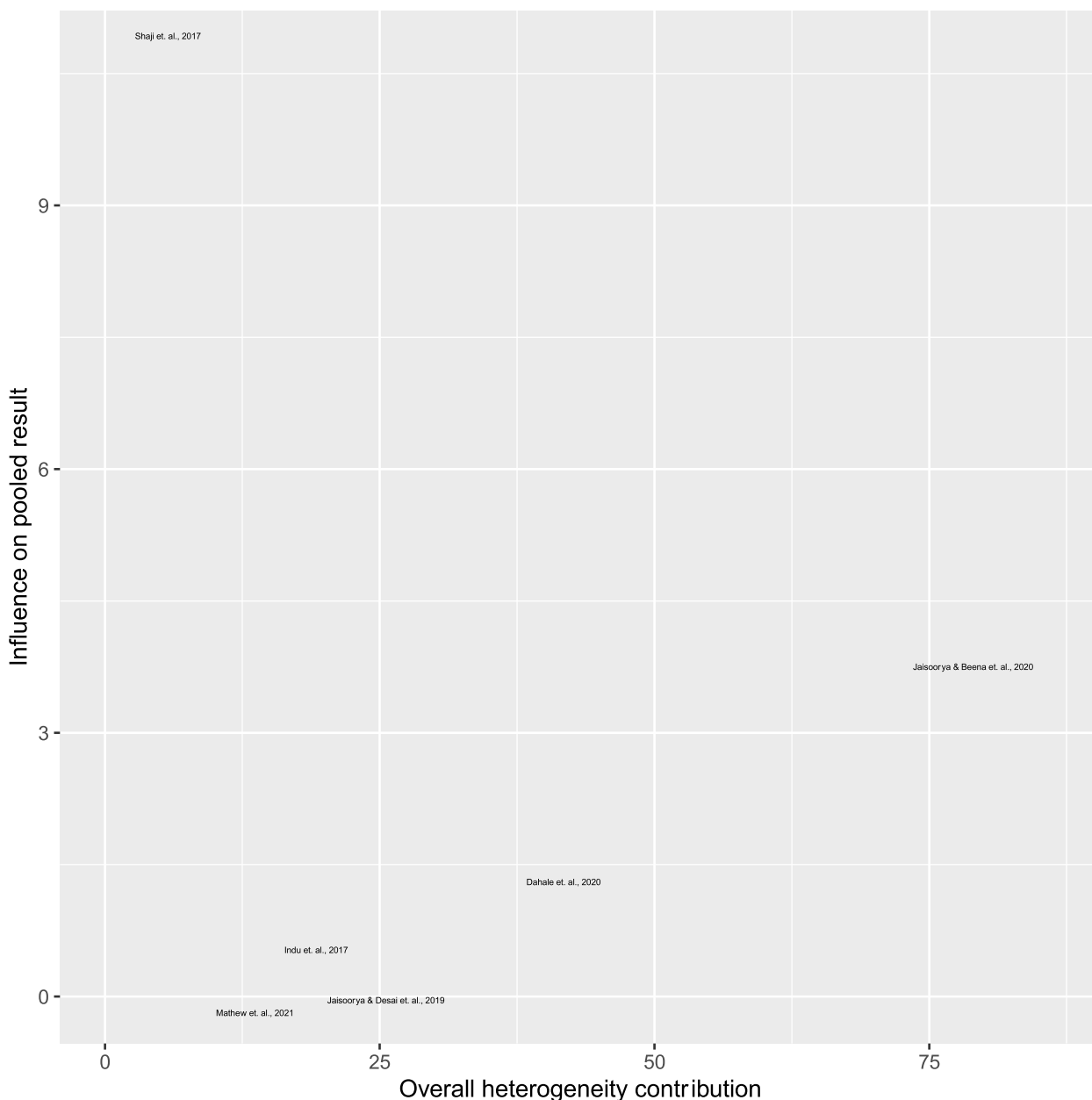


Fig. 5 Baujat plot to identify studies contributing overtly to influence and heterogeneity

might be due to the age group of the study. The long chronicity of these conditions adds up to prolonged out of pocket expenditures thereby affecting mental health. These conditions often bring not only physical burdens but also significant mental health challenges. Study also shows that woman facing these illnesses often experience a greater psychological distress, possibly due to a complex interplay of social and biological factors. This highlights the importance of addressing the unique mental health needs of patients dealing with both physical and

mental health issues with gender-sensitive policies and interventions. Two separate studies conducted among college students have consistently found higher rates of depression among female students, which could be attributed to factors such as break-ups, marital issues, demands of a challenging curriculum etc [58, 65].

When it comes to specific mental health disorders, gender differences are apparent. Conditions like PTSD, ADHD, and OCD tend to be more prevalent among males. A study highlights the prevalence of psychiatric

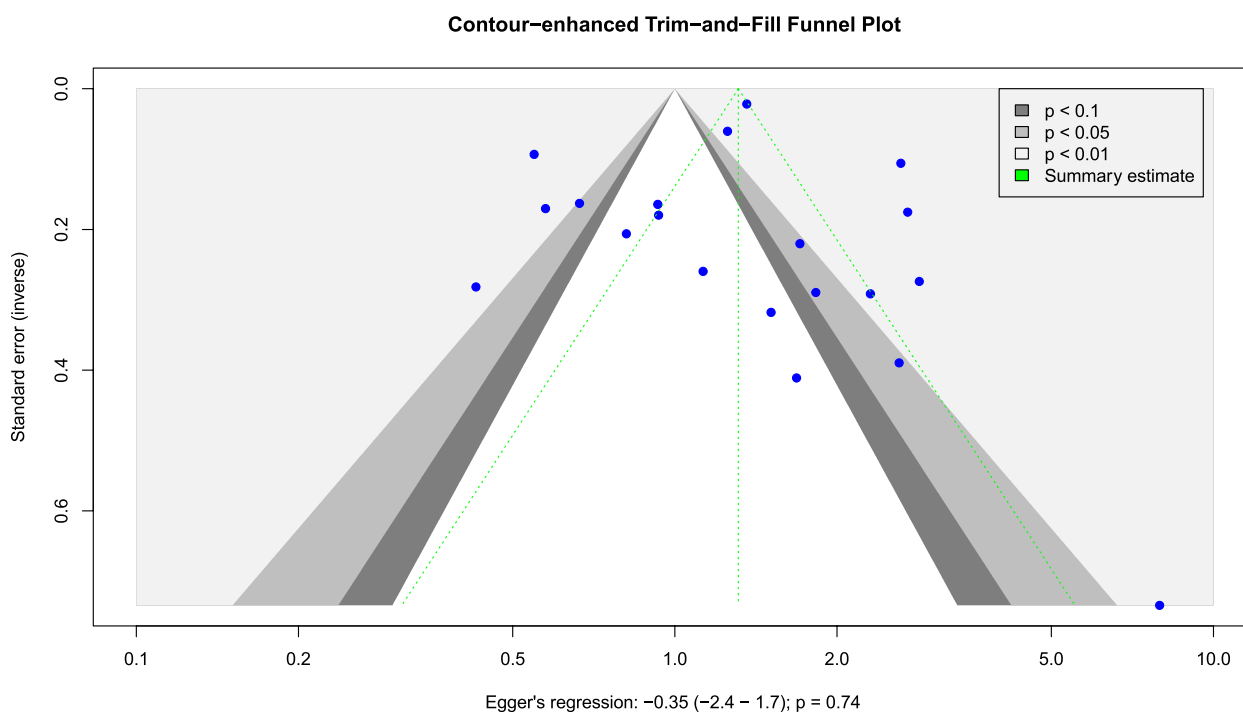


Fig. 6 Contour-enhanced trim-and-fill funnel plot demonstrating publication bias and small-study effects

morbidity among male prisoners in Kerala, with substance dependence playing a significant role in exacerbating this issue [68]. Mental health issues also appear to be more prevalent i.e., 11% and 89%, among the population affected by flood [51, 55]. Asim et al. [51] study assessing both PTSD and depression among flood-affected populations found, that females are at higher risk for mental health issues. However, another study conducted among adolescents, reports that there a higher Odds for PTSD among males in flood-affected population which may be due to the age category included in the study [55].

In subgroup analysis, even though not significant, the analysis was pointing towards a higher gender disparity in the North-zone (1.77) compared to central and south zones with Odds of 1.07 and 1.3 respectively. There is no literature discussing the gender disparity identified between the zones yet a better socio-economic development as well as lower male-female literacy difference in Travancore – Cochin i.e., the south region compared to the north Kerala i.e. the Malabar is reported in some studies [74]. A higher education, which is found to be a protective factor in mental health issues might have contributed to better mental health among females, and thus a possibility of lesser disparity in the South compared to the North cannot be ignored. Further studies

should be done to rule this out, by adjusting the possible confounding variables [29, 51, 57, 74].

Factors associated with mental health

The most common risk factors for mental health issues reported in the SRMA were female gender, increasing age, urban residence, issues in social relations, lower socio-economic status, illiterate, presence of injury or medical illnesses, financial stress, and family history of depression.

Basu et al. and Stephen et al. also observed that women had a higher prevalence of common mental disorders, such as depression and anxiety, compared to men in Kerala. Several studies found that women were more likely to report experiencing stressful life events, such as domestic violence and financial difficulties, which may contribute to the higher rates of mental health issues [75–77].

Age is also an important factor contributing to mental health issues and gender disparity in mental health issues. In our analysis, all 4 elderly studies in Kerala report a high depression rate among elderly females and is adhering to the findings from studies by Rose et al. in north Kerala and Bineetha et al., [78] in central Kerala [73, 78]. The higher odds of mental health issues in females and in the elderly are noticed in other parts of India as well [79, 80]. Paul et al. [67] focused on the mental health of adolescents in Kerala and found that boys had higher

levels of psychological distress compared to girls. The study also found that boys were more likely to experience academic failures, poor peer relationships and substance abuse which may contribute to their higher rates of mental health issues [67]. Another systematic review and a study based in Pune, conducted among 500 adolescents also reports that there is no significant gender difference in the prevalence of mental health issues among females and males [70, 81]. This contrast may be attributed to the studied population, as our review also found that there is either no disparity or higher odds among males among adolescents or the student population.

Several studies discuss the importance of social relations, networks, and support systems, as well as how problems with these connections such as loneliness, breakups, disputes and conflicts can result in mental health problems [31, 50–52, 55, 58, 60, 67]. This adheres with the existing literature [82, 83].

The prevalence of mental health issues reported in this review ranges from 1% to as high as 89%. Aligning with this, a study by Soman et al. reports that the suicide rate in Kerala is the highest among all major states in India, with a rate of 44.7 per 100,000 in males compared to 26.8 per 100,000 in females [28]. 9 studies mention suicide ideation among individuals with mental health issues. According to Soman et al., [28] study, the overall suicide rate was 44.7 per 100,000 for men and 26.8 per 100,000 for women. But according to the same study, suicide accounts for more than 50% of all deaths among young girls aged 15 to 24 years in Kerala. This makes mental health and suicide prevention critical health issues in Kerala.

Way forward

Several articles have discussed mental health disparities between males and females in India more broadly, including Kerala. These articles highlight the need for greater awareness and attention to overall Mental health and gender-specific mental health needs in Kerala. There is a need for more research and targeted interventions to address mental health prevalence, vulnerable groups and disparities in the state. The findings of mental health disparities in the elderly population in Kerala highlight a significant concern that requires immediate attention.

Eight studies discussed the importance of social relations, networks, and support systems, as well as how problems with these connections such as loneliness, marriage, breakups, and conflicts can result in mental health problems [31, 50–52, 55, 58, 60, 67]. However none of the 20 studies mentioned or assessed the influence of the internet and social media on these social relations. While the effect of social media and the internet is still under scrutiny, it has undoubtedly transformed social relations.

Studies in this area are especially important as over-usage of social media was found to be associated with depression, and is found to be higher among adolescent girls. This calls for policies for safer and regulated use of these platforms. However, the higher internet penetration also makes it possible to create awareness and health intervention through digital platforms. Artificial intelligence and cyber monitoring can also be utilized for monitoring health behaviour and risk groups [84–86].

There could be various factors contributing to this gender and age disparity in MH issues, such as social isolation, chronic health conditions and the lack of accessibility to mental health care services [50, 60, 87]. With just 0.3 psychiatrists for a 1 lakh population in 2014, Kerala's infrastructure fell behind considering the steadily increasing burden of MH illness in the state [22]. The inadequacy should be addressed on a prompt basis. Kerala, being the state with the highest literacy in the country is still reflecting gender disparities in assessing mental health services. Further research (qualitative or mixed method approach) may be undertaken to address the social determinants leading to the disparity. A Gender transformative approach to address the root causes of gender-based health inequities by integrating legislative, health systems and policy frameworks and social movements rather than conventional gender sensitive-methodologies to reduce gender-based constraints is suggested [88]. The interventions challenges and try to balance the unequal gender norms, roles, and unequal power relations that privilege men over women to bring about long-lasting changes by leveraging individual changes [89].

Strength of the study

The strength of our study is that it includes all the relevant articles which measure gender-specific health equity in the state, making it representative of the Kerala population, which increases the generalizability of the findings. The thorough publication bias assessment also ensures that the studies included in our meta-analysis were not biased towards a particular outcome. Our Analysis also shows that studies with a higher proportion of females and better sample size were significantly associated with greater gender differences in the prevalence of mental health outcomes.

The I^2 statistic is a measure of heterogeneity that indicates the percentage of variability in the effect sizes that is due to true differences between studies rather than chance. A high I^2 value (>50%) suggests substantial heterogeneity, which may have implications for the interpretation of the meta-analysis results. In our study, the I^2 value in F plot is more than 86% indicating a high level of heterogeneity among the studies included in the

meta-analysis. This may be due to differences in the study populations, age, type of illness, etiology, sample size, study methods, geography or other factors like diagnostic criteria and measurement tools, contributing to the variability. However, we have successfully reduced it using subgroup analyses to get meaningful insights.

Limitations and scope for further research

The exclusion of the third gender in all the studies conducted across the state is a significant limitation, as this group often faces unique challenges that could impact mental health outcomes. Future studies should consider including the third gender to obtain a more comprehensive understanding of mental health disparities in Kerala. Studies argue that transgender community marginalization is still on the rise in Kerala's health services resulting from inadequate knowledge among health professionals on sexual variation and associated health issues faced by sexual minorities [90, 91]. Reports on aggression, and exploitation agents while accessing health service is not uncommon in Kerala [90] Owing to stigma, violence, and discrimination even in health service, potentially life-threatening illnesses like HIV, which is highly prevalent in the community, mental health issues like social anxiety frequently affects the transgender population [91].

The studies included in our meta-analysis were conducted across different communities in Kerala, and in different age groups which could contribute to heterogeneity in the results. which could affect the validity of the findings. The concentration of studies in the south zone is also noticeable in the literature. Socioeconomic factors, employment, financial stress, social relations, discrimination, trauma, and education are known confounding variables in mental health research, and our meta-analysis did not account for them adequately [31, 59, 67, 92]. Matching confounding and adjusting for the potentially confounding factors in studies might improve the accuracy of the estimates of disparities [93, 94].

Conclusion and recommendation

Our study findings can be used to highlight the gender disparities in mental health and the importance of addressing mental health issues in females and the elderly population. It may also be important to examine the factors that contribute to these differences, such as social and cultural factors, biological differences, and access to mental health services. Considering these findings it is recommended that the government of Kerala take immediate action to address this gap by increasing funding for mental health services among geriatric age groups, as well as promoting mental health awareness and reducing the stigma surrounding mental illness. It is also important to involve local communities in this effort to ensure

that they are culturally sensitive to the specific needs and challenges faced by the female population. Finally, continuous research and monitoring of mental health disparities will be essential to measure the effectiveness of the ongoing intervention and identify areas of further improvement.

Developing and following equity guidelines for observational research in, such studies aid in understanding the impact of inequities as these studies frequently collect population data [95]. This helps with better assessment of ongoing programmes as well. Continuous assessment and accountability are essential for ensuring the long-term sustainability of a program [96]. Our review underlines the fact that well-deserved equality and social justice for minorities, vulnerable communities, and disadvantaged populations should be ensured at the least in basic healthcare settings and services as envisaged in the WHO policy brief as an accelerator [6].

Abbreviations

ADHD	Attention-deficit/hyperactivity disorder
MH	Mental health OCD: Obsessive-Compulsive Disorder
OR(s)	Odds Ratio(s)
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
PTSD	Post-traumatic stress disorder
WHO	World Health Organization
BKP	Bijaya K Padhi
GAS	Gopal Ashish Sharma
HCV	Haseena Chekrain Valappil
JS	Jahnvi Subramanian
KR	Kizhessery Rahna
MAS	Muhammad Aaqib Shamim

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12939-024-02275-4>.

Supplementary Material 1. Table S1. Inclusion and exclusion criteria. b) Table S1b: Data collection tool c) Studies include in meta-synthesis. Table S2. The adjusted search terms and results [as of 2023.09.03]. Table S3. PRISMA checklist. Table S4. Quality assessment of included cross-sectional studies and cohort studies with the use of National Heart, Lung, and Blood Institute (NHLBI) quality assessment tool.

Supplementary Material 2. Figure S1. a-c) Clustering to identify influence and heterogeneity contributed by studies; d) Influence plot to visualise influence. Figure S2. Sensitivity analysis after omitting potential outliers. Figure S3. Leave-one-out meta-analyses for each study showing the effect on the pooled estimate.

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Authors' contributions

The research question and inclusion-exclusion were designed and refined by the Authors (Kizhessery Rahna and Muhammad Aaqib Shamim). Kizhessery Rahna developed the search strategy and was reviewed by Muhammad Aaqib Shamim. Kizhessery Rahna screened citations, read and selected related articles in this systematic review any discrepancy was discussed with Muhammad Aaqib Shamim and resolved. Acquisition and extraction of data done by

Kizhessery Rahna and Muhammad Aaqib Shamim. Haseena Chekrain Valappil acted as second reviewers and rechecked the screened articles. Drafting the work was done by Kizhessery Rahna, Muhammad Aaqib Shamim, Jahnvi Subramanian and Haseena Chekrain Valappil. Revising it critically for important intellectual content done by Gopal Ashish Sharma and Bijaya K Padhi. Quality assessment was done by Kizhessery Rahna and Gopal Ashish Sharma. Muhammad Aaqib Shamim and Kizhessery Rahna analyzed and interpreted the data regarding the Mental health issues from articles. Final version to be published was read and approved by all authors.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article and accompanying supplementary information files.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

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Competing interests

The authors declare no competing interests.

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