

Effects of paternal alcoholism on the psycho-behavioral outcomes of children: systematic review and meta-analysis

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Abstract

Introduction: Documented literature includes mixed interpretations of the impact of paternal alcoholism on psycho-behavioral well-being in children. A systematic review and a meta-analysis would facilitate the accurate establishment of this association. **Aim:** To evaluate the effects of paternal alcoholism on the psycho-behavioral well-being of children by a systematic review with a meta-analysis and a narrative review component **Methods:** This PROPERO registered review (CRD42018114754) was conducted by reviewing searching literature in MEDLINE, EMBASE and PsycINFO databases. Twenty nine articles out of 16398 were selected for data extraction after three selection rounds. Thirteen were included in the meta-analyses for four numerical outcomes and two categorical outcomes. Meta-analysis outcomes included; internalizing behavior, externalizing behavior, depression and anxiety. Heterogeneity, risk of biases and the quality of evidence were assessed. Sensitivity analysis was done by re-analyzing with random-model assumption following the fixed model assumption. Furthermore re-analysis with standardized mean difference was done following the analysis with mean difference. Rev Man (version 5.3) software and “GRADEproGDT” online applications were used. Summary of Findings Tables were prepared. A narrative review was done with studies and sub-groups not included in the meta-analysis, under five identified themes: depression and mood disorders; self-perceived mental health problems and personality; aggression; ADHD and other problems. **Results:** With meta-analysis, all four numerical outcomes for demonstrated significant mean differences (MD) with higher values in the group with paternal alcoholism. “Low” level was assigned as the GRADE certainty. For the anxiety when it is regarded as a categorical outcome, the resulting relative effect was significant (OR=2.18, 95% CI= 2.03 to 2.33) with “Moderate” certainty. In sensitivity analysis, associations of similar directions were observed. Narrative review reflected other negative psycho-behavioral consequences of children associated with paternal alcoholism, falling under the five identified themes. **Conclusions:** Robust findings were observed for the positive associations of paternal alcoholism with the selected psycho-behavioral pathologies of children in the meta-analysis. The narrative review further demonstrated negative implications of paternal alcoholism on five identified thematic areas.

Introduction

It is estimated that around 43% of the people 15 years and above, were “current drinkers” in 2016 with a considerable variation worldwide. Nearly a quarter of alcohol consumption in the world and more than half in South East Asia was categorized as “unrecorded”(1). Alcohol-use is within the top ten risk factors (seventh in 2016) of death and DALYs(2). Out of the substance use disorders, alcohol use has been the most common (3). Strategies to prevent alcoholism have been emphasized globally owing to the recent epidemic of chronic Non Communicable Diseases (NCDs) to which excess alcohol consumption contributes. The achievement of Sustainable Development Goals is regarded as only possible if interventions are implemented to address the alcohol burden(1,3).

In addition to its direct health related effects, alcoholism has legal, economic and social implications. Having an alcoholic in the household is assumed to influence the children in diverse ways. In a study

done among Korean students, it was revealed that childhood exposure to an alcoholic or substance abuser has a 2.37 (1.41-3.98) times likelihood of being diagnosed with “definite depression” and 2.11 (1.18-3.76) times chance of potentially developing alcoholism (4). In a Chilean study it was revealed that the consumption of alcohol in the household leads to an increase in the child witnessing physical violence and verbal violence as well as economic problems resulting in the inability of families to provide the optimum care for the child(5). A Norwegian study reported alcohol abuse by parents as an independent risk factor for the school related attention and conduct problems,(6). Higher prevalence of corporal punishment was reported among the heavy alcoholics towards three year old children in United States(7). Additionally, parental drinking patterns influence the intake of alcohol by the children(8–12).

Though many of the studies have explored “parental alcoholism”, in the majority of the families, problem-drinking was more likely to be associated with the father than with the mother(13). The specific influence of paternal drinking on children has been explored in literature. Social competence of the children is affected by the paternal alcoholism(14). Paternal alcoholism is further associated with negative parental behaviors and attachments(15,16). Among youth with depression, those with positive family history of paternal alcoholism were even found to be with changes in electroencephalograms (17). In addition, marital satisfaction has been found to be decreased with paternal alcoholism(18). Even in lower-middle income settings like Sri Lanka, the available limited literature implies the negative consequences of paternal alcoholism(19). This leads to a vicious cycle leading to a decreased bond between the father and the children, yielding more negative psycho-behavioral effects on children. Bad parental-relationships were associated with suicidal ideation in a study done among French adults(20).

Yet some studies have demonstrated that there is no difference between the emotional and behavioral problems of the children in relation to the alcohol intake status of their parents(13). Similarly, some literature has demonstrated significant effects of mothers’ intake but not that of the father(21). Furthermore some researches have documented that in general, children of alcoholic parents could “manage quite well”(21). However in some of these studies which have depicted negative associations, several limitations have been highlighted, including small sample sizes.. Hence, a systematically reviewed literature with meta-analysis could help in correctly establishing the effects of paternal influence on psycho-behavioral well-being of children.

Behavioral disorders of children are conventionally classified as internal (inward directing) and external (demonstrated to the external environment). Externalizing behaviors of children include; “lack of compliance with social norms, lower emotional control and associated interpersonal aggressiveness (22). In contrast, internalizing disorders are directed inwards and reflect the child’s psychological and emotional state (23,24). These encompass a diverse group of conditions which include; “depression, withdrawal, and anxiety, as well as feelings of inferiority, self-consciousness, shyness, hypersensitivity, and somatic complaints”(23,24). There is an overlap between externalizing behaviors and internalizing disorders and hence, the term psycho-behavioral would be more appropriate in representing a comprehensive scope of the dynamics and interactions related to these.

This systematic review includes five meta-analyses done on the effects of paternal alcoholism on four defined psycho-behavioral outcomes of children. Additionally this includes a narrative review component covering a broader range of outcomes, for the selected studies or their sub-groups those were not included in the meta-analysis.

Methods

Protocol and registration

The review was done according to the PRISMA (i.e. Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines(25). Registration of the review was done in the PROSPERO-International prospective register of systematic reviews registration (CRD42018114754).

Eligibility criteria

The PICOS sequence of the research question(26) was whether “paternal alcoholism incurs effects compared to its absence, on the psychological and behavioral outcomes of children”. The selection criteria of the studies included; studies having a quantifiable effect measure related to psychological or behavioral well-being of children and including a paternal specific-analysis. Psychological or behavioral well-being outcomes of interest included; depression, anxiety, internalizing behavioral, externalizing behavior, self-perceived mental well-being, personality, aggression, Attention Deficit Hyperactive Disorder (ADHD) and non-compliance. Outcomes on suicidal ideation, parental attachment, alcohol-use of children, and education attainment of children were outside the scope of this review and excluded.

Search strategy

The literature search was done in MEDLINE, EMBASE and PsycINFO databases. Search strategies were finalized with the inputs of a research librarian (Supplementary material- Annex I-III). The period covered in the search approximately included 20 years (i.e. from 1st of January 1998 to 24th of December 2018). Unpublished articles were searched by contacting the expert colleagues in the related fields. Additionally, the reference lists of selected articles were searched for potential articles. After compiling the manuscript, additional searches were done for any new articles.

When the data required for meta-analysis were not available in the manuscript, attempts were made to contact the respective corresponding authors through emails. When findings of selected studies were not completely available for the meta-analysis, those studies or their sub-groups were included in the narrative synthesis.

Selection of studies

Three rounds of selections were done. In the first round, duplicated articles and those not consistent with the general objective of the review were excluded. Abstracts were reviewed in the first round. Full articles were reviewed from the second round onwards. In the second round, articles were reviewed for the

outcome and the study design. Merely qualitative manuscripts and studies with non-matching outcomes for the scope of the review were excluded. In the third round of selection, the characteristics of the exposed/ non-exposed groups were reviewed. Manuscripts with discrepancies of the defined exposure and which did not include a paternal-specific analysis were excluded. The flow diagram of the selection process is illustrated in Figure 1.

Data-extraction

Data extraction was done using a pre-designed template. The extracted variables are summarized in Figure 2. When several follow up measurements were available in a single selected study for meta-analysis, the last wave of data collection was selected for the extraction.

Estimation of bias

A risk of bias table (Table 3) for the selected studies for the meta-analysis was prepared having referred the necessary recommendations for observational studies(55). Subsequently Funnel plots were used for assessing publication bias (56).

Meta-analysis and narrative synthesis

The assessment for statistical heterogeneity of the selected studies was done with chi-square and I-square tests for all the meta-analyses(56,57). The cut-offs of the I-square test for heterogeneity and for the p value of chi-square test were considered as 50% and 0.1 respectively(56,58). Following the heterogeneity assessments, Review Manager (version 5.3) application was used for the meta-analysis(59) with pooling done by Mantel- Haenszel method. Initially fixed-model assumptions were followed. For assessing the robustness of the findings, sensitivity analysis was done by re-performing the meta-analysis with random-method assumption (60,61). Mean Difference (MD) with its confidence interval (CI) was used as the effect measure for continuous measurements. Following this, re-analysis was done with Standardized Mean Difference (SMD) as another step in sensitivity analysis. Odds Ratio (OR) was used for the categorical variables. When studies have provided gender-specific effect measures without a combined measure, they were separately included as sub-groups in the meta-analysis. When the studies that met inclusion criteria did not have data for inclusion in the meta-analysis, they were used for narrative synthesis (62,63). Summary of Findings table was synthesized for the findings of the meta-analysis (64). GRADE criteria were used in assessing the quality. "GRADEproGDT" online application was used in this regard(55,65,66).

Results

At the end of the three rounds of selection, 13 studies were selected for meta-analysis. Table 1 summarizes their characteristics.

The articles selected only for the narrative review have been summarized in Table 2.

The risk of bias estimates of the selected articles for the meta-analyses have been mentioned in Table 3. To impart an impartial judgment, for all studies the “failure of confounding control” was mentioned as “unclear risk”. As all the studies used validated instruments, for “flawed measurements” the bias was estimated to be of “low risk”.

The Summary of Finding tables for the numerical outcomes as well as for the categorical outcomes are shown respectively in Tables 4 and 5. As shown in Table 4, for the numerical outcomes of depression, anxiety, internalizing behavior and externalizing behaviors, significant mean differences were noted. The measurements had been higher for the exposed (i.e. father alcoholic) group.

A significantly higher relative effect (OR=2.18, 95% CI= 2.03-2.33) was noted for the exposed group (i.e. with paternal alcoholism) for the occurrence of childhood anxiety among children when analyzed as a categorical outcome.

The sensitivity analysis was done by re-doing the meta-analysis using SMD and with the random model assumptions. The observed effect measures remained statistically significant demonstrating the robustness of the findings (Table 6).

Even though meta-analysis of three studies(32,33,37) (Singh-2017, Jacob-1999 and Jacob-2000) yielded a pooled Odds Ratio of 1.68 (95 CI=1.28 to 2.20) for depression as a categorical outcome, statistical heterogeneity was noted ($I^2= 74\%$). Hence those findings were described in the narrative review section below.

The Figures 3A to 7A shows the Forrest plots for the mentioned meta-analyses. Immediately below , Figures 3B to 7B demonstrate the Funnel plots drawn for selected studies.

The narrative review based on the articles or outcomes of articles which were not included in the meta-analyses is described below

Depression and mood disorders

When fathers are active-problem drinkers, children were found to have 1.56 times greater likelihood of having depressive symptoms (95% CI= 1.24-1.96). Even when stratified for gender, significantly higher likelihoods were observed for males (OR=1.75, 95% CI=1.14-2.68) and females (OR=1.49, 95% CI= 1.13-1.96)(47). In the study by Jacob & Windle (2000), the RDC-depression percentages were 35.9% and 33.3% respectively for the exposed and control groups(33). Following structural equation modeling, done with data collected among undergraduate students, it was revealed that paternal alcoholism had a “total effect on depressive symptoms” (beta coefficient=0.118, 95% CI= 0.006 to 0.230, $p=0.039$)(54). In a study done in California, a slight increase of depression was noted in the group with paternal alcoholism amidst gender differences(32). A North Indian study revealed a significant association between the

alcohol use of the father and depression in the school children(37). A non-significant independent association with “drinking father” and depression was found by Kelley *et al* (2010)(46).

Similarly, mood disorders were higher among the exposed group (18.6% to 7.0%).(48) The problem drinking of the father was associated with an increased life time risk of mood disorders among children(48). Malone, Lacona & McGue (2002) showed that paternal alcoholism is associated with depression among 17 year old offspring but not at 14 years(41).

Self-perceived mental health problems and personality

In a longitudinal study done in United States, the SF-12 mental health index values were found to be worse for the children of alcoholic fathers even at age 40, compared to those of non-alcoholic fathers (39). In the study by Jacob and Windle (2000), for the five domains (i.e. extraversion, neuroticism, agreeableness, conscientiousness and openness to experience) assessed by NEO-Personality Inventory, the children of alcoholic fathers reported less favorable outcomes compared to children with non-alcoholic fathers(33).

Aggression

Edwards *et al* (2006b) conducted a study to explore aggressive behavior of children who experienced paternal alcoholism. It was found that, by 48 months, 22% of children were in the clinical range for aggression in the father-alcoholic group compared to 5.4% in the non-alcohol group(49).

As concluded by Grekin and others (2005), paternal alcoholism is a predictor of both violent and non-violent delinquency at age 15(52). The study by Finan *et al* (2015) showed that paternal alcoholism was a direct predictor for aggressive behavior for boys. For both girls and boys indirect associations of paternal alcoholism and aggressive behavior of children were demonstrated(51). Malone, Lacono & McGue (2002), showed the positive association of paternal alcoholism with disruptive behaviors(41). In a study done in Croatia, it was revealed that the auto-aggressiveness of school students was associated with paternal alcoholism in the univariate analysis but not in the multivariate analysis(44).

Attention Deficit Hyperactive Disorder (ADHD)

In a twin study done by Knopik *et al* (2005), paternal alcohol dependence was significantly associated with ADHD (OR= 2.11, 95% CI= 1.39-3.22)(40). With further studies, this association was suspected to be influenced by indirect pathways(45). The association between paternal alcoholism and ADHD at 17 years was shown in a study done in Minnesota, United States(41). In another study, the standardized incidence ratio of ADHD among children who experienced paternal alcoholism was 2.15 (95% CI= 2.11 and 2.20) (43).

Other problems

Having a father with problem-drinking has been found to a significant predictor for getting 1 or more psychiatric disorders in 12-months (OR=1.47, $p<0.05$) or over the life time (OR=2.00, $p<0.05$)(48). In the study by Foley *et al* (2001), it was revealed that paternal alcoholism alone is not significantly associated with psychiatric symptoms of children. However when it is comorbid with paternal or maternal depression, the risk of children developing increased levels of a number of diverse conditions, including separation anxiety, depression, conduct symptoms and oppositional defiant behavior is increased(67).

In a study by Keller *et al* (2008), it was revealed that the paternal alcoholism is indirectly associated with internalizing and externalizing problems. The data collections were done while the children were in kindergarten and in the following two years(53). In the study by Adkison *et al* (2013), it was revealed that the association between paternal alcoholism and poor self-regulatory strategies of children may re-emerge in early adolescence(38). In the study of Eiden Leonard and Morrissey (2001), sons of fathers with alcohol-problems demonstrated higher rates of non-compliance on four measures of compliance than the children without alcoholic fathers(50).

In a 15 year follow up study, Raitasalo *et al* (2018) concluded that, for both girls and boys, paternal alcohol use is associated with a higher likelihood of “mental and behavioral disorders” among children. (42). Similarly a higher proportion (10.6%) was “ever diagnosed” with mental-health problems compared to the no-problem drinking parent group (6.2%). Similarly 7.1% of the exposed group, compared to a 3.7% of the no-problem drinking category had a mental health problem diagnosed in the previous 12months (39)

Discussion

This is the first systematic review with meta-analyses that evaluate the effects of paternal alcoholism covering a comprehensive scope of psycho-behavioral outcomes of children. Most of the pre-existing literature on related aspects, do confine to a narrow set of outcomes. Since psychological well-being and behavioral dynamics are inter-related, this review provides a better understanding of the association between paternal alcoholism versus the selected outcomes. The results reveal that the influence of paternal alcoholism extends throughout the life cycle of their offspring. Negative consequences generated by the said exposure include associations with internalizing behaviors, externalizing behaviors, anxiety, depression, personality disorders, impairment of self-perceived mental health, aggression, ADHD and non-compliance in children.

All the five meta-analyses done showed that there are significant negative outcomes in relation to depression, anxiety, internalizing behavior and externalizing behaviors of children. The robustness of these findings was verified with the unchanged findings following the sensitivity analysis. Both internalizing and externalizing behaviors of children lead to negative consequences (22–24). Some of these could be hidden and hard to detect. As an example, depression is associated with a high economic burden and is often undiagnosed(68). Anxiety is also found in high prevalence in the community, often undiagnosed and commonly associated with comorbidities(69). These disorders also influence the social

competence of those affected(24). In addition to the outcomes in the meta-analyses, the outcomes described in the narrative review highlight the negative influence of paternal alcoholism on the psycho-behavioral outcomes of children.

The study populations in the review include under-five category, adolescents, university students and adults as well. Negative implications of paternal alcoholism were observed for all these categories. This further strengthens the robustness of the findings and implies that the impact of paternal alcoholism extends throughout the life cycle of the children. Even in the studies that did not document a direct significant association between psychiatric issues and paternal alcoholism, positive associations have been noted when the exposed group was with associated comorbidities such as paternal depression (67). It is well-noted that the paternal alcoholism is associated with conditions such as reduced quality of marital relationships and behaviors which may make the father prone to depressive symptoms(14,18). This further complements the finding that paternal alcoholism does influence the psycho-behavioral well-being of the offspring through indirect pathways.

There are two main implications of this review as far as policy planners are concerned. Firstly the psycho-behavioral aspects of the children of alcoholic fathers need to be given adequate emphasis. Policy planners must come up with strategies in accurately detecting positive paternal alcoholics as acceptable to the specific settings. The second is that the findings can be used in targeting behavior change of the alcoholics at appropriate settings. Sessions for newly married couples and ante-natal health education sessions for both parents are two such fora which can be used for this.

Most of the studies retained after the selection process have been conducted in Western settings. This implies that childhood mental health outcomes are less commonly evaluated in other settings, including lower and lower-middle income settings in which the chronic NCD burden is relatively high. The second inference may be that, even if such evaluations have been done, fewer publications are reported from such settings, suggesting that a greater focus on research and subsequent publication of results should be encouraged.

There is available literature on the mediating effects of other variables which influence these associations. Ohannessian (2015) reported that both maternal and paternal problem-drinking must be taken into context when interpreting the paternal effect on adolescent adjustment(70). It was shown that when paternal alcohol consumption was high, anxiety and depression symptomatology in children was lower when the problem drinking of the mother was low. It was also noted that there are significant interactions of the gender of the child on mental health conditions(35). These aspects must be explored more with further research.

There were several limitations of the study. No extensive effort was done in searching non-English articles. However the search strategy was not limited to English articles. The English abstracts of non-English articles which were in the databases were reviewed. However, none of the non-English articles were selected (owing to the eligibility criteria) to be included in the review, beyond the second round. The quality of evidence for numerical-outcome related meta-analyses was graded as "low". This is because

by default, the observational studies are started with a lower baseline of evidence level due to their non-randomized nature. Thirdly a subgroup analysis on the level of alcohol intake was not done. However this was taken into consideration in the interpretation of findings. Furthermore, to address this issue, in the evaluation of the level of quality, upgrading was not done for “dose response”.

Another limitation was the different time periods at which the outcome measurements had been done even when the tools were meant to measure the similar constructs. Yet the authors are confident in stating this has not resulted in biased estimates due to several reasons. Firstly all selected studies had used validated instruments in assessing the exposures and the outcomes. Secondly, in selection of the studies, clinical, methodological as well as statistical heterogeneity were taken into account(71,72). Thirdly the similar significant associations were observed when the meta-analysis was re-done getting SMD as the effect measure for numerical outcomes.

Conclusions

Positive associations of paternal alcoholism with the selected psycho-behavioral pathologies of children were detected in the meta-analysis. These findings are found to be robust with sensitivity analysis. The narrative review further demonstrated negative implications of paternal alcoholism on five identified thematic areas. Further research must be promoted especially focusing on the mediators of these associations.

Abbreviations

ADHD- Attention Deficit Hyperactive Disorder

CAPA-C- Child and Adolescent Psychiatric Assessment-Children’s Version

CBCL- Child Behavior Checklist

DSM- Diagnostic and Statistical Manual of Mental Disorders EMBASE- Excerpta Medica Database

GRADE- Grading quality of evidence and strength of recommendations

GRADEproGDT: GRADE guideline development tool

ICD- International Classification of Diseases

MD- Mean Difference

MEDLINE- Medical Literature Analysis and Retrieval System Online

NEO-Personality Inventory- Neuroticism-Extraversion-Openness Inventory

OR- Odds Ratio

PICOS sequence: Population-Intervention-Comparison-Outcome-Study sequence

PRISMA guidelines: Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines

PROSPERO- International prospective register of systematic reviews

PsycINFO- Database of abstracts of literature in the field of psychology produced by American Psychological Association

SADS-L- Schedule for Affective Disorders and Schizophrenia-the lifetime version SMD- Standardized Mean Difference

SF-12- Short Form 12

RDC- Research Diagnostic Criteria

UM-CIDI- University of Michigan Composite Diagnostic Index

Declarations

Ethics approval and consent: Not applicable.

Consent for publication: Not applicable.

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Tables

Table 1: Characteristics of the studies selected for Meta-analysis

Study	Setting	Population/s	Exposure measurements	Selected outcomes measurements	Effect measure
1. Choi, 2013(29)	Chungam province, Korea	950 students in an academic high school	By Father-Short Michigan Alcoholism Screening Test. Filled by children.	-Depression with Beck's Depression Inventory -Anxiety with Beck's Anxiety Inventory -Measurements were taken at a mean age of 16.5 years	MD
2. Edwards, 2001(27)	New York, United states	A cohort of 213 families in a longitudinal study	Family History Research Diagnostic Criteria (RDC) for alcoholism by the partner as well as by the responses of the father for University of Michigan Composite Diagnostic Index (UM-CIDI) and with DSM-IV criteria	-2-3 year version of the Child Behavior Checklist (CBCL) -Selected measurements were when the child was 18 months	MD
3. Edwards, 2006(28)	New York, United states	A cohort of 191 families in a longitudinal study. Analysis was done for 176 families	RDC, UM-CIDI and DSM IV criteria	-CBCL -Selected measurements were when the child was three years	MD
4. Eiden, 2009(30)	New York, United States	112 children with parent alcoholic group and 101 without alcoholic group.	RDC, UM-CIDI and DSM IV criteria	-Relevant subscales of CBCL -Revised Child Manifest Anxiety Scale -Child Depression Inventory -Measurements were done at Grade 4	MD
5. Haugland 2003(31)	Norway	37 families with paternal alcohol problems and 1170 general	Cahalan's questionnaire	-Child Behavior Checklist -Measurements were done between 7-11 years	MD

		population sample			
6. Jacob, 1999(32)	California, United States	297 offspring of families those had participated in an assessment 5 years back	SADS-L questionnaire	-RDC diagnosis -Mean age at outcome assessment was 23.8 years	OR
7. Jacob, 2000(33)	California, United States	-393 adult offspring of families having participated in an assessment 10 years back	RDC, DSM IV	-NEO- Personality Inventory -RDC for depressive disorder and anxiety disorder -Social Adjustment Scale-Self Report -Mean age at outcome measurement was 27.1 years	OR
8. Loukas, 2001(34)	United States	Male children from 125 families with ad 83 families without an alcoholic father	-Lifetime Alcohol Problems Score	-Child Behavior Checklist -Measurements were done at 6-8 years	MD
9. Morgan, 2010(35)	Data from National Epidemiological data from United States	43093 non-institutionalized residents. Sample used for analysis consisted of 40374	-DSM IV version of Alcohol Use Disorder and Associated Disabilities Interview Schedule	-DSM IV version of Alcohol Use Disorder and Associated Disabilities Interview Schedule -Respondents were 18 years or over	OR
10. Puttler, 1998(36)	Michigan, United States	212 families of the MSU-UM Longitudinal study	-Diagnosis made by trained clinicians using DSM-IV criteria	-Child Behavior Checklist-Parent Version (CBCL) -Mean age of respondents was 5.63 years	MD
11. Singh 2017(37)	542 Schools in Chandigarh,	School going adolescents	-Using a structured questionnaire based on literature review	-Patient Health Questionnaire-	OR

India

(13-18 years)

9

-Respondents
were between
13-18 years

Table 2: Characteristics of the studies selected for narrative review

Study	Setting	Population	Exposure measurements	Outcome measurements
1. Adkison, 2013(38)	United States	197 families with 12 month-old infants at recruitment	RDC, UM-CIDI and DSM IV criteria	-Stroop Color and Word Test - Tower of London task -Stop-Signal Reaction Time -Measurements were done in grades 4 and 6
2. Balsa, 2009(39)	United States	12686 youths between years 14 and 22 in 1979, Re-assessments were done until 1994	Questionnaire of National Longitudinal Survey of Youth, 1979	-SF-12 Mental Health Index - Diagnosis of a mental health condition in last 12 months(39)- Diagnosis of a mental health condition ever -Measurements were done at 40 years
3. Chen, 2005(47)	United States	A nationally representative sample of college students of 27430	-DSM-IV approximate criteria	-Mental Health subscale of SF-36
4. Cuijpers, 1999(48)	Netherlands	A random sample of Dutch population (N=7147) with data from "Netherlands Mental Health Survey and Incidence Study"	-Respondents' self-reports	-Respondents' self-reports
5. Edwards, 2006b(49)	United States	A sample of 226 families selected from birth records for Erie County	RDC, UM-CIDI and DSM IV criteria	-Aggression subscale of the CBCL -Measurements were done at child age of 18, 24, 36 and 48 months
6. Eiden, 2001(50)	United States	215 families with 12-month old children	RDC, UM-CIDI and DSM IV criteria	-According to guidelines of Kochanska and Akshan (1995) -Measurements were done at 18 and 24 months
7. Finan, 2015(51)	United States	Adolescents from 14-19 years and their parents	Short Michigan Alcoholism Screening Test	-Child Behavior Checklist -Mean age of the participants was 16.15 years
8. Foley, 2001(67)	United States	850 twin families	DSM-III-R criteria	-Child and Adolescent Psychiatric Assessment-Children's Version (CAPA-C) -Ages of twins was between of 8-17 years
9. Grekin, 2005(52)	Brisbane, Australia	816 families with children born between 1981-1984 in a Mother's Hospital	Using structured Clinical Interview for the DSM-IV	-Self-report items from National Youth Survey

				-The mean age of the sample was 15 years and two months
10. Keller, 2008(53)	United States	235 families from a midsize and large city	Parental Alcohol Experiences Scale	-Internalizing and externalizing subscales of CBSL -Data collection was done at baseline, 1 year later and 2 years later
11. Kelley 2010(46)	Southeastern United States	627 students attending a university	Children of Alcoholics Screening test	Depression-Dejection subscale of the Profile of Mood States questionnaire
12. Kelley, 2011(54)	United States	436 undergraduate university students in southeastern Virginia	Children of Alcoholics Screening Test	-Profile of Mood States questionnaire -The average age was 21.93 years
13. Knopik, 2005(40)	United States	1936 adolescent female twin pairs born during 1975-1985	DSM-IV incorporated Semi-Structured Assessment of the Genetics of Alcoholism	-Items derived from the Diagnostic Interview for Children and Adolescents -Average age was 14.4 years
14. Knopik 2009(45)	Vietnam	727 twin fathers, and 1116 children	DSM-IV incorporated Semi-Structured Assessment of the Genetics of Alcoholism	-Items derived from the Diagnostic Interview for Children and Adolescents -Average child age was 19.1 years
15. Malone 2002(41)	Minnesota, United States	2426 twin subjects	Using substance abuse module	-Revised Diagnostic Interview for Children and Adolescents -Twins were 11 or 17 years of age
16. Raitasala 2018(42)	Finland	57377 children born in 1997 and their parents	Using ICD-10 criteria	-Using ICD-10 criteria -Children were followed up until the end of 2012
17. Tripkovic 2013(44)	Croatia	Sample of 701 school students from 14-19 years	Using a specially designed questionnaire	Using the Report on Youth Aged 11-18 and the Scale of Auto-destructiveness
18. Sundquist 2014(43)	Sweden	49348 individuals with ADHD	ICD-9 and ICD-10 guidelines	-ICD-9 and ICD-10 codes -46.3% were between 10-19 years

Due to technical limitations, Table 3 has been placed in the supplementary files section.

Table 4: Summary of Finding Table for the meta-analyses of numerical outcomes

Effect of paternal alcoholism on the psycho-social well-being of children						
Outcome	Anticipated absolute effect		Risk of the children with alcoholic fathers	No of participants (studies)	Comments	Quality of evidence/ GRADE
	Risk of comparison group					
Internalizing behavior	N/A	MD 2.02	higher (1.16 to 2.88 higher)	1742 (4 studies/ 6 comparisons)	Exposed group had significantly higher means in three sub-groups(28,31) and higher non-significant means in three sub-groups(27,36)	Low ^c
Externalizing behavior	N/A	MD 2.13	higher (1.11 to 3.16 higher)	1614 (5 studies/ 7 sub-group)	Exposed group had statistically significant higher means in three sub-groups(28,31,34) and higher non-significant means in two sub-groups(27,31) One study was excluded from meta-analysis considering statistical heterogeneity(36)	Low ^d
Anxiety	N/A	MD 0.72	higher (0.2 higher to 1.23 higher)	1316 (2 studies/ 4 comparisons)	Exposed group had significantly higher means in one sub-group(29) and statistically non-significant higher values in three sub-groups(29,30)	Low ^b
Depression	N/A	MD 3.20	higher (1.72 higher to 4.69 higher)	960 (1 study/ 2 sub-groups)	Exposed group had significantly higher means in both sub-groups (29)	Low ^b

MD- mean difference, N/A- not applicable,

^{a,b,c,d} started with a low baseline rating as these were non-RCT studies and were not up-graded

Table 5: Summary of Finding Table for the meta-analyses of categorical outcomes

Outcomes	Assumed risk ^a	Corresponding risk ^b	Relative effect	No. of participants (studies)	Quality of evidence GRADE
Anxiety	95 per 1000	186 per 1000 (176 to 197)	OR=2.18 (2.03-2.33)	40640 (2 studies)	Moderate ^c

^aTotal events divided by the total participants in the control group

^bFunction of “assumed risk” and the “relative effect”

^c started with a low baseline rating as non-RCT studies and up-graded for “large magnitude effect” (1 point)

Table 6: Sensitivity analysis with random and fixed model assumptions

	Heterogeneity	Effect measure (CI)	Heterogeneity For SMD	SMD (CI)
Internalizing behavior with fixed-model assumption	I ² value- 0% P=0.58	MD= 2.02 (1.16 to 2.88)	I ² value- 42% P=0.13	SMD= 0.34 (0.21 to 0.47)
Internalizing behavior with random-model assumption	I ² value- 0% P=0.58	MD= 2.02 (1.16 to 2.88)	I ² value- 42% P=0.13	SMD= 0.36 (0.18 to 0.53)
Externalizing behavior with fixed-model assumption	I ² value- 0% P=0.44	MD= 2.13 (1.11 to 3.16)	I ² value- 46% P=0.12	SMD= 0.34 (0.20 to 0.48)
Externalizing behavior with random-model assumption	I ² value- 0% P=0.44	MD=2.17 (1.02 to 3.32)	I ² value- 46% P=0.12	SMD=0.35 (0.16 to 0.55)
Anxiety (numerical) with fixed-model assumption	I ² value- 31% P=0.23	MD= 0.72 (0.20 to 1.23)	I ² value- 0% P=0.58	SMD= 0.21 (0.09 to 0.33)
Anxiety (numerical) with random-model assumption	I ² value- 31% P=0.23	MD= 0.95 (0.06 to 1.85)	I ² value- 0% P=0.58	SMD= 0.21 (0.09 to 0.33)
Depression (numerical) with fixed-model assumption	I ² value- 0% P=0.72	MD= 3.20 (1.72 to 4.69)	I ² value- 0% P=0.84	SMD= 0.36 (0.22 to 0.51)
Depression (numerical) with random-model assumption	I ² value- 0% P=0.72	MD= 3.20 (1.72 to 4.69)	I ² value- 0% P=0.84	SMD= 0.36 (0.22 to 0.51)
Anxiety (categorical) with fixed-model assumption	I ² value- 0% P=0.78	OR= 2.18 (2.03 to 2.33)	Not relevant	Not relevant
Anxiety (categorical) with random-model assumption	I ² value- 0% P=0.78	OR= 2.18 (2.03 to 2.33)	Not relevant	Not relevant

Figures

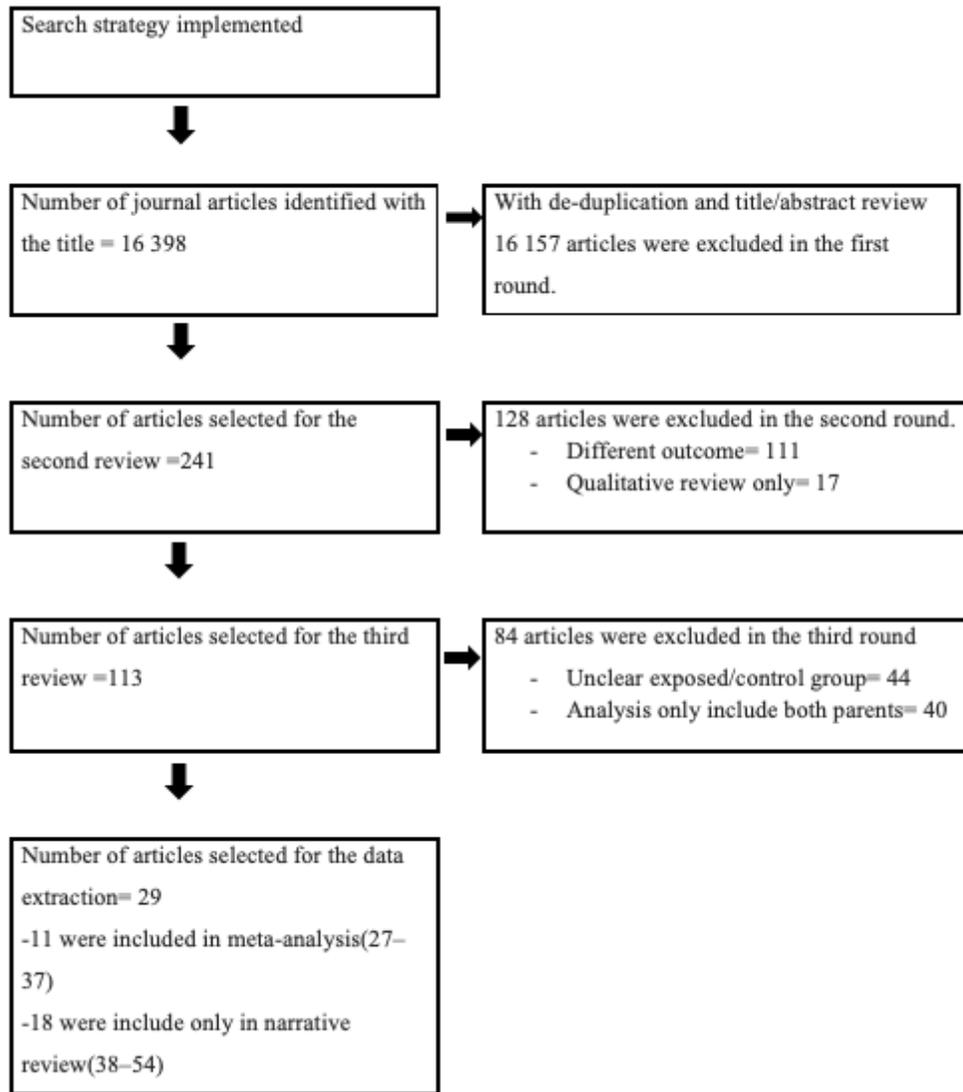


Figure 1

Flow of the selection process of articles

Population	Exposure	Comparison	Outcome	Study design
-Eligibility criteria	-How was the exposure defined	-Number of comparison groups	-Primary and secondary outcomes	-Type of design
-Characteristics of the participants		-Number participated in the paternal non-alcoholic arm exposure	-How the outcomes were measured	-Year of conduct
			-Number of participants with each outcome	-Study setting

Figure 2

Extracted variables

Internalizing behavior

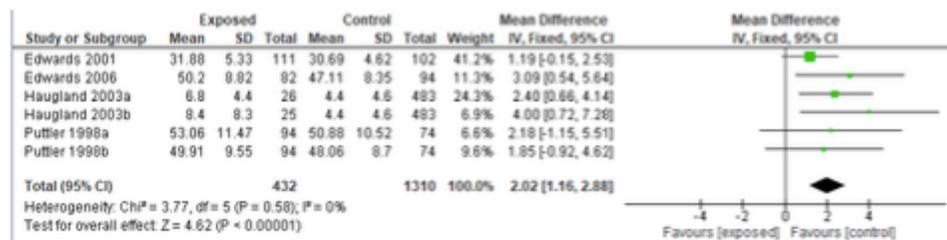


Figure 3A: Forrest plot for the outcome of “internalizing behavior”

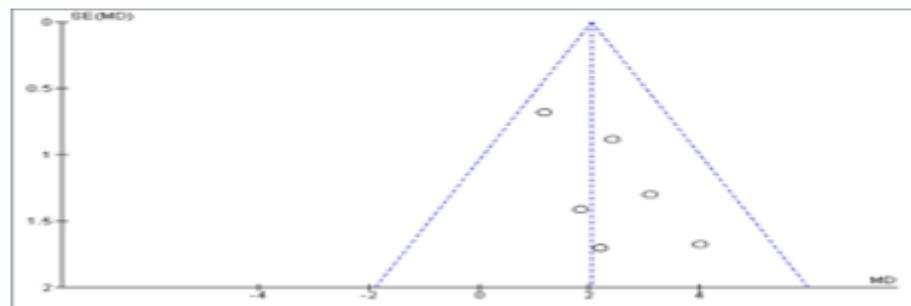


Figure 3B: Funnel plot for the outcome of “internalizing behavior”

Figure 3

3A: Forrest plot for the outcome of “internalizing behavior”. 3B: Funnel plot for the outcome of “internalizing behavior”

Externalizing behavior

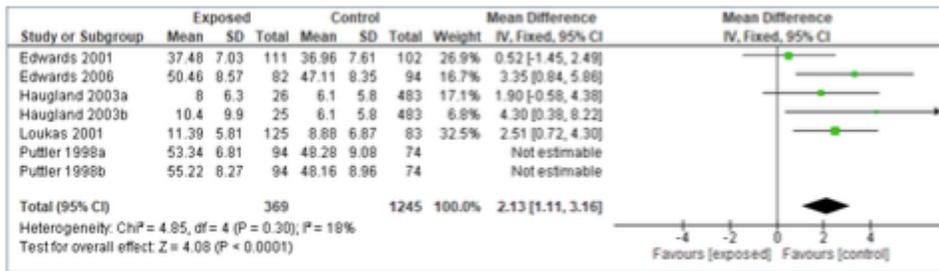


Figure 4A: Forrest plot for the outcome of “externalizing behavior”

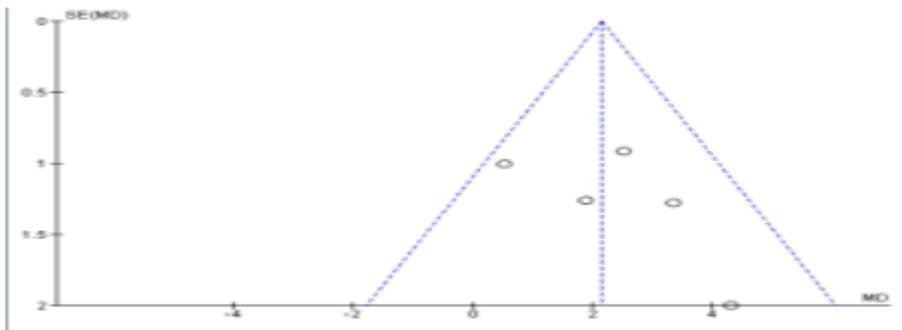


Figure 4B: Funnel plot for the outcome of “externalizing behavior”

Figure 4

4A; Forrest plot for the outcome of “externalizing behavior”. 4B: Funnel plot for the outcome of “externalizing behavior”

Anxiety as a numerical variable

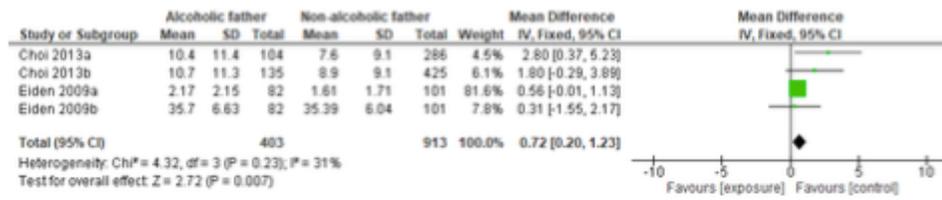


Figure 5A: Forrest plot for the outcome of “anxiety as a numerical variable”

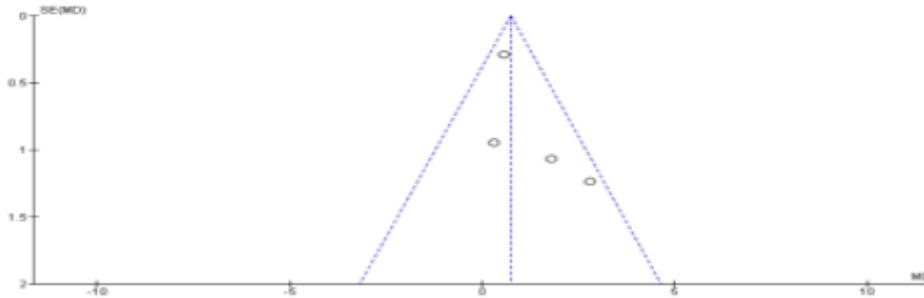


Figure 5B: Funnel plot for the outcome of “anxiety as a numerical variable”

Figure 5

5A: Forrest plot for the outcome of “anxiety as a numerical variable”. 5B: Funnel plot for the outcome of “anxiety as a numerical variable”

Depression as a numerical variable

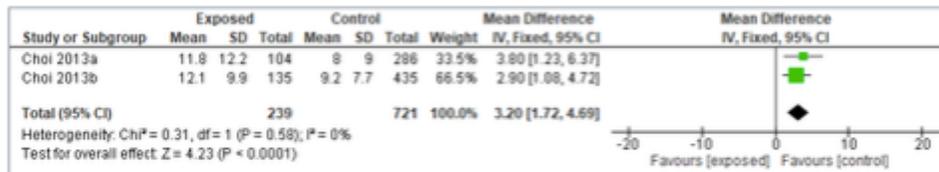


Figure 6A: Forrest plot for the outcome of “depression”

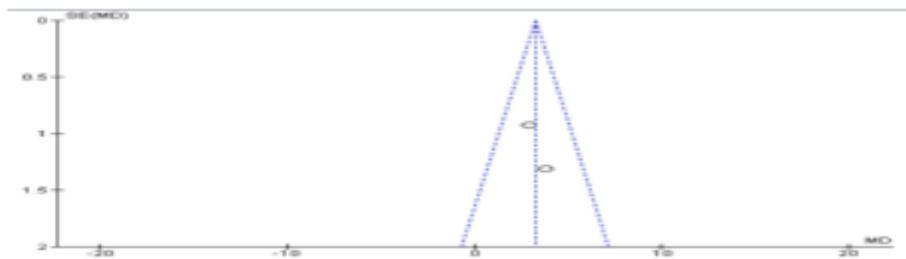


Figure 6B: Funnel plot for the outcome of “depression”

Figure 6

6A: Forrest plot for the outcome of “depression”. 6B: Funnel plot for the outcome of “depression”

Anxiety as a categorical variable

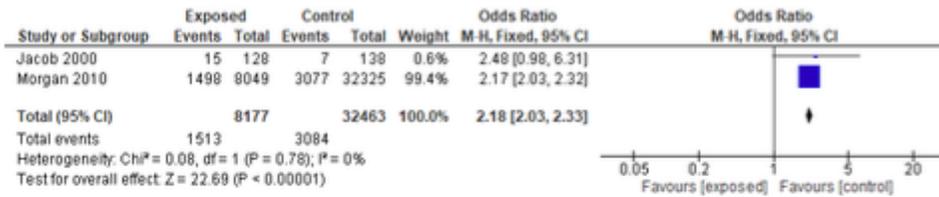


Figure 7A: Forrest plot for the outcome of “anxiety as a categorical variable”

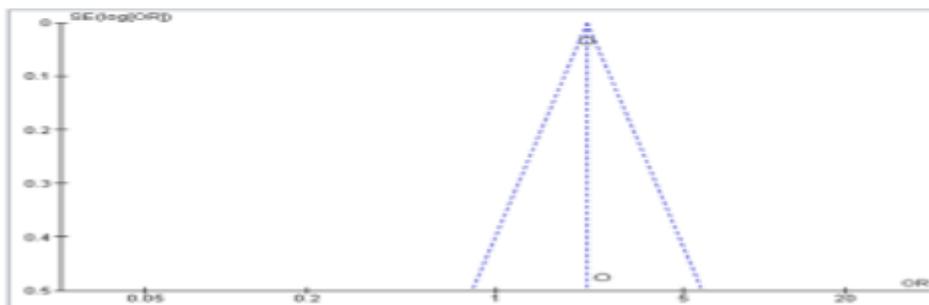


Figure 7B: Funnel plot for the outcome of “anxiety as a categorical variable”

Figure 7

7A: Forrest plot for the outcome of “anxiety as a categorical variable”. 7B: Funnel plot for the outcome of “anxiety as a categorical variable”

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table3.png](#)
- [Supplementarymaterials.docx](#)
- [FilledPRISMA2009checklistforBMCPediatrics.docx](#)