

The relationship between parental attitudes and children's alcohol use: A systematic review and meta-analysis

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Abstract

Aims The main aim was to assess the relationship between parental attitudes towards children's alcohol use and their child's alcohol use. Secondary aims included assessing the relationship between attitudes reported by parents and those perceived by children, and between perceived parental attitudes and children's alcohol use.

Methods Meta-analysis of studies reporting on the associations between parental attitudes towards children's alcohol use and children's self-reported alcohol use. Published, peer-reviewed cross-sectional and longitudinal studies were identified from the following databases up to April 2018: Medline, PsycINFO, EMBASE, Scopus and Web of Science. Quality assessment was done by using guidelines developed by Hayden, Cote and Bombardier. Pooled effect sizes were calculated by using random-effects meta-analyses, if there were at least two studies that could be included per analysis. Out of 7,479 articles screened, 29 were included comprising data from 16,477 children and 15,229 parents.

Results Less restrictive parental attitudes towards children's alcohol use were related to higher rates of alcohol use initiation (odds ratio (OR)=1.45, 95% confidence interval (CI) 1.17–1.80), alcohol use frequency (OR=1.52, 95% CI 1.24–1.86) and drunkenness (OR=1.58, 95% CI 1.35–1.85) among children. Less *perceived* restrictive parental attitudes were related to higher alcohol use frequency (OR=1.76 (95% CI 1.29–2.40). Perceived parental attitudes were not clearly related to alcohol use initiation. Parent-reported attitudes and perceived parental attitudes were weakly positively correlated ($r=0.27$, $p \leq 0.001$). The strength of the relationship between parental attitudes and children's alcohol use frequency attenuated with children's age. Study design, sample size, study location and levels of alcohol use frequency did not have a detectable effect on the relationship.

Conclusions Less restrictive parental attitudes towards children's alcohol use are associated with increases in children's alcohol use onset, alcohol use frequency and drunkenness. Children's perception of less restrictive parental attitudes is associated with children's alcohol use.

Keywords

Alcohol use, drunkenness, parents, attitudes, children, adolescents, meta-analysis, systematic review

Introduction

Alcohol use is one of the biggest risk factors for social and physical harm and disease development in the world (1). According to the European School Survey Project on Alcohol and Other Drugs, approximately 47% of 15–16-year-old students had consumed alcohol and 8% had been drunk by the age of 13 (2). Exposure to alcohol starts from early on; children as young as 2–6 years old become aware of alcohol and related norms (3,4). Additionally, positive and/or negative explicit expectancies towards alcohol use have been shown to develop from the age of four (4).

The parent's role stays important throughout the child's development (5,6), and home environment has a crucial role in alcohol use prevention (7), as parents are one of the main sources when learning norms, values and behaviours (8). A wide range of studies have been conducted to investigate the relationship between children's alcohol use and parent-related indicators. Parents' own alcohol use (9–11) and providing alcohol to children (10–12) are consistently associated with increased risk of children's alcohol use in longitudinal studies. Better quality of the parent-child relationship (10,11,13,14) and higher levels of monitoring (10,11) are considered as protective factors against alcohol use. Contradictory findings have been presented regarding parental support, involvement, general discipline, family conflict (10,11), communication (14), rules about alcohol and attitudes towards adolescents' alcohol use (10,11,15). While most of the aforementioned indicators are an example of establishing an action, attitudes are considered as one of the precursors of behaviour (16). It has been suggested that parental attitudes might be even more important than their behaviour in influencing children's alcohol use (17).

The relationship between parental attitudes and children's alcohol use has been previously assessed in three reviews (10,11,15). While all state that attitudes are related to alcohol use, none distinguished between attitudes reported by parents and perceived by children. Koning and colleagues (17) point out that both parents' and children's responses should be taken into account when investigating parent-related factors and children's alcohol use, as studies have shown that children's reports on their perceptions of parental attitudes and behaviour can differ from parents' own reports and vice versa (18–21). Similar discrepancies have been shown in other studies reporting on parent-related indicators (22,23). Therefore, this review applies a new approach, by only including studies with parent-child dyads. Additionally, as this review focuses on dyads, cross-sectional studies were included to increase the breadth and statistical power of meta-analyses.

The main objective of the current review is to assess the relationship between parental attitudes towards children's alcohol use and children's alcohol use, with the former reported by parents and the latter by children. Included articles will also be used to address secondary aims, where data allows: to assess the relationship between attitudes reported by parents and *perceived* by children, and between perceived parental attitudes and children's alcohol use.

Methods

The reporting of the review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (24). The review protocol is available on PROSPERO (registration number: CRD42017076694).

Inclusion and exclusion criteria

All studies reporting on associations between self-reported parental attitudes and children's alcohol use were included. Participants were considered as children if they were under 18-years old. When children's data included participants older than 17 (e.g. 16–19), the study was included if most participants were under 18 or if the results were presented for separate age groups. Neither time nor setting restrictions were applied. The search included all available peer-reviewed articles in English published until April 2018. Studies using only qualitative methods were excluded.

Search strategy and study selection

To find eligible studies, literature searches were conducted in Medline, PsycINFO, EMBASE, Scopus and Web of Science. MeSH terms were included in addition to text words in the former three. A full description of search terms is presented in the supplementary document (Table S1). The following information had to be presented in the abstract for the article to be included for full screening: (a) quantitative study design, (b) both children and parents described as participants, (c) information implying that parental attitudes and children's alcohol use were assessed. M.TÖ. and F.N. independently screened the titles and abstracts of ~5% of all articles against the inclusion criteria (agreement rate 98.9% [$\kappa=0.74$]). Afterwards M.TÖ. screened the titles and abstracts of all other articles. Full texts were obtained for all articles that met the inclusion criteria and where it was unclear or there was reason to think the study might have included parents and children as participants and/or parental attitudes as an exposure. Thereafter all three authors independently screened full texts (agreement rate 97.1% [$\kappa=0.93$]). Disagreements were resolved through discussion. Additional information was sought from study authors where it was necessary to resolve questions about eligibility. Reasons for exclusion were documented.

Outcomes

The main outcome was children's alcohol use (initiation, frequency, drunkenness). Initiation is typically assessed in studies by asking participants to indicate if they have consumed alcohol at least once (amount can vary from a sip to full drink(s)) and/or the age of alcohol use onset (2,48,49). Frequency of use and drunkenness are commonly measured by the frequency for any time period over one week (2,17,25). Additionally, drunkenness could be measured by the age of being drunk for the first time (2,25). In case some other indicator was used to report alcohol use, where appropriate, it was added to one of the three existing categories and highlighted in the text. When multiple alcohol use related indicators had been used, all were treated separately.

Exposures

The primary exposure was parental self-reported attitudes towards children's alcohol use. The secondary exposure was children's perceptions of parental attitudes. As researchers use

different definitions when referring to alcohol use related attitudes, approval/disapproval and norms were included (10,11,15,27–29).

Data extraction

The Cochrane Collaboration's data collection form for interventions (30) was modified to the review's context. To ensure consistency across reviewers, all authors independently tested the form on two included studies. Disagreements were resolved through discussion. If a study had been published in multiple publications, different sources were considered as one paper if the same results were reported; papers were treated separately if different outcome measures were used. When data differed across publications or important information was missing, study authors were contacted. The following data were extracted from each article: title, population description, setting, inclusion/exclusion criteria, method(s) of recruitment, study design, data collection method, duration of study, unit of allocation, analysis method, participants' description, baseline sample size, attrition rate, clusters, definitions of exposure and outcome measures, time points measured, distribution, results, number of participants included in the analysis. All the following results were extracted when reported on: 1) both parents separately and as a combined measure; 2) different subgroups; 3) cross-sectionally and longitudinally within a study.

Quality assessment

All authors independently assessed the quality of included studies by using a modified version of guidelines developed by Hayden, Cote and Bombardier (31) and previously used in other similar reviews (11,13). Six domains were assessed for potential biases (Table 1) and quality items under domains were rated either "yes, +", "partly, ±", "no, -" or "unsure, ?" and given a score of 2, 1, 0 or 0, respectively. The bias for each domain was calculated by adding all scores and assessing if the final score was below/equal or above 50% of the maximum. The total score for each study ranged between 0 and 6, the latter indicating more biases. All three authors independently assessed the quality of included studies. Any disagreements were resolved by discussion.

Meta-analyses

In order to perform meta-analysis, effect sizes had to be available from at least two studies. The following rules were applied for the main analysis: 1) combined parental attitudes were preferred over maternal only and maternal attitudes over paternal only; 2) the most commonly reported subgroup across studies was included; if it was not possible to choose the most common subgroup, the one with the highest rate was included; 3) longitudinal results were preferred over cross-sectional; if several follow-ups were reported, the one that was most commonly reported across studies was included; 4) to maximise comparability of the studies (as different studies select different factors for adjustment and using coefficients facilitates combining data in meta-analysis), correlation coefficients, unadjusted results and direct/total effects were preferred over regression coefficients, adjusted results and indirect effects. A summary statistic was identified/calculated and the weighted average calculated for each study; pooled effect size (odds ratio (OR)) was calculated using a random-effects model (32,33). The identified effect sizes were inverted when the attitude measure was scaled from lenient to

restrictive. As some studies presented only ORs and p-values, a method suggested by Altman and Bland (34) was used to obtain confidence intervals (CI) from p-values. A value of 0.05λ (λ depends on the value of standardized regression coefficients (β), 1 when positive and 0 when negative) was added to β s to impute correlation coefficients (35). If the study did not report an exact p-value and it was not possible to calculate it, the value for a non-significant result was treated as $p>0.5$ and for a significant as $p\leq 0.05$. Heterogeneity was assessed by calculating the Q-statistic (36), T^2 -statistic (37), and I^2 -statistic (32). In case of high heterogeneity ($I^2>75\%$), a subgroup analysis of studies (minimum four per subgroup (38)) was performed taking into account related factors. Originally, participants' age and gender and study design were planned to include. Due to low number of studies reporting subgroup information on measures, only study design (cross-sectional, longitudinal) was included, and three additional indicators – sample size (number of participants below and over 500), location (Europe, USA), alcohol use frequency (lifetime, last year) – were added. Meta-regression between the age at the final assessment (Table S2) and the effect size of main outcomes was conducted. As the minimum suggested number of studies included in the analysis is 10 (39), only studies reporting on alcohol use frequency and drunkenness were included. Age ranges (e.g. 11–13) were transformed to a single (an average) number (e.g. 12), to be included in the analysis. Sensitivity analyses were performed to assess the robustness of the results, by excluding studies that highly influenced heterogeneity (33). In addition, studies were omitted one at a time to assure that the results were not influenced by a single study. It was also assessed how the results were affected by changing the target groups, follow-up times and outcome measures in individual studies when multiple results were presented. If comparable data were available from at least ten studies (40), funnel plots were used to assess the publication bias. Comprehensive Meta-Analysis 3.3.0 software was used to conduct meta-analyses (41).

Results

In total, 12,823 articles were identified through database searching (Figure 1). After removing duplicates, 7,468 articles were included in the initial screening. Additionally, three articles from other sources (i.e. previously published reviews (10,11,15,29)) were included. Out of 7,471 articles, 65 articles met the inclusion criteria and 38 had unclear information in the abstract, being eligible for full-text screening. In total, 29 articles were included in this review, comprising data from 16,477 children and 15,229 parents.

Study characteristics

Characteristics of the 23 included studies represented in 29 articles are shown in Table 2. Twelve studies were longitudinal (27,42–54), six cross-sectional (21,55–59), three randomised controlled trials (28,60–63) and two quasi-experimental (64,65). More than half – 14 – of the studies were carried out in the USA (27,28,42–46,48–50,52,53,55,58,59,66), with the other nine in Europe – four in Sweden (47,60,64,65), two in the Netherlands (17,51,54,61–63) and one in each of the following – Denmark (56), Ireland (57), Norway (21). The sample size of the included studies varied between 118 (50) and 2,599 (17). Seven studies (21,27,42,44,46,51,54,57,58,66) collected data from both parents, two studies only from mothers (49,55) and the rest did not specify parents by gender (17,28,43,45,47,48,50,52,53,56,59–65).

Quality of included studies

More than half of the studies had low quality on at least three domains out of six, outcome measurement being the most common, mostly due to not reporting on the measure's validity and/or reliability (Table 3, Table S3). One study (62) did not provide any effect sizes due to non-significant results, and four studies (42,58,61,64) presented only those results reaching statistical significance.

Parental attitudes and children's alcohol use initiation

Out of 29 included articles, 13 reported on parental attitudes (21,42,43,47,49,50,52,56,57,59,60,64,65), five on parental (dis)approval (27,46,48,58,66), nine on acceptability (17,44,45,51,53,54,61–63), two on parental norms (28,53) and one on beliefs (55) related to children's alcohol use. Alcohol use initiation was measured in seven papers (two were excluded from the analysis, as they were from the same study) using the following indicators – initiation (42,46,48) and sipping/tasting (27,45,55,66). The odds of children initiating alcohol use were 1.45 (95% CI 1.17–1.80) times higher if their parents had less restrictive attitudes (Figure 2) (27,42,45,48,55), with evidence of high heterogeneity ($\chi^2=25.47$, $p\leq 0.001$, $I^2=84.3\%$).

Parental attitudes and children's alcohol use frequency

Out of 29 articles, 18 reported on the relationship between parental attitudes and children's alcohol use frequency (17,21,28,42–45,48–50,52–54,58,59,61,63,64). Alcohol use frequency was measured by assessing lifetime use (17,21,43,48,50,52,59,64), use in the past 12 (28,45,58), six (42,44), three (49) and one (53,54,59) month(s), and weekly use (17,61,63). Sixteen associations from 13 papers (21,28,44,45,48–50,52–54,59,63,64) were included in the meta-analysis (five studies were excluded due to reporting no data (42,58), being from the same study that was already included (17,61) and reporting a result that was considered as an outlier (43)), and the results indicate that children had 1.53 (95% CI 1.24–1.90) times higher odds consuming alcohol if their parents had less restrictive attitudes (Figure 3). There was evidence of high heterogeneity ($\chi^2=147.96$, $p\leq 0.001$, $I^2=90.5\%$). Visual inspection of a funnel plot suggested the presence of publication bias (Figure S1), and this was supported by the Egger's test ($t=3.76$, $p=0.002$). By excluding one outlying study (45) that had a very small standard error, the result became non-significant, concluding there is no strong evidence for publication bias.

Parental attitudes and children's drunkenness

Out of 29 papers, nine reported on the relationship between parental attitudes and children's drunkenness (47,51,56,57,60–62,64,65). Drunkenness was assessed using the following measures – lifetime drunkenness (60,64), drunkenness (47) or hazardous drinking (57) in the past 12 months, drunkenness (60,65) or binge drinking in the past month (51,56), onset of monthly drunkenness in the past 30 months (65), onset of heavy weekly alcohol use (61), and heavy alcohol use during weekends (62). Ten associations from seven papers (47,51,56,57,60,64,65) included in the analysis (two studies were excluded due to not presenting any data) showed that having less restrictive attitudes increased the odds of children

reporting having been drunk by 1.54 (95% CI 1.30–1.84) times, with low-moderate heterogeneity ($\chi^2=13.47$, $p=0.10$, $I^2=40.6\%$) (Figure 4).

Perceived parental attitudes and children's alcohol use initiation

Nine papers out of 29 had information on children-reported perceived parental attitudes (21,27,42,46,49,52,58,59,66) related to children's alcohol use, and four addressed the relationship between perceived parental attitudes and children's alcohol use initiation (27,42,46,66). The data from two papers (27,42) were included in the meta-analysis (the other two (46,66) had the same sample as one of the included studies and were excluded from the analysis), and the results indicate that perceived attitudes were not related to alcohol use initiation (OR=1.65, 95% CI 0.93–2.94) (Figure S2), with evidence of high heterogeneity ($\chi^2=4.44$, $p=0.04$, $I^2=77.5\%$).

Perceived parental attitudes and children's alcohol use frequency

Six papers reported on the relationship between perceived parental attitudes and children's alcohol use frequency (21,42,49,52,58,59). Based on seven associations from five studies (one study was excluded from the analysis due to missing data (42)), children perceiving their parents' attitudes less restrictive was associated with 1.76 (95% CI 1.29–2.40) times higher odds of reporting consuming alcohol (Figure S3) (21,49,52,58,59). There was evidence of high heterogeneity ($\chi^2=32.42$, $p\leq 0.001$, $I^2=81.5\%$).

Parental attitudes and perceived parental attitudes

Perceived parental attitudes were reported as outcome measures in four papers (21,43,49,59). Six associations from four studies were included in meta-analysis, and the results indicate that there is a weak positive correlation ($r=0.27$, $p\leq 0.001$) between the measures (Figure S4), with evidence of high heterogeneity ($\chi^2=20.63$, $p\leq 0.001$, $I^2=75.8\%$).

Subgroup analyses and meta-regression

Planned subgroup analyses did not indicate any statistically significant differences by study design ($\chi^2=0.24$, $p=0.63$), sample size ($\chi^2=0.44$, $p=0.51$), study location ($\chi^2=3.52$, $p=0.06$) and alcohol use frequency ($\chi^2=1.40$, $p=0.24$) among studies that reported on parental attitudes and children's alcohol use frequency (Figure S5–S8). However, heterogeneity did decrease among three subgroups – studies involving less than 500 participants ($I^2=94.6\%$ vs $I^2=74.7\%$), studies from Europe ($I^2=82.8\%$ vs $I^2=65.2\%$) and studies reporting on lifetime alcohol use ($I^2=91.5\%$ vs $I^2=58.0\%$). The results from the meta-regression analysis indicate that a one-year increase in age relates to a 0.10 reduction in the association (log odds ratio) between parental attitudes and alcohol use frequency ($b=-0.10$, $P=0.02$; $R^2=58\%$) (Figure S9). A similar effect was not seen for drunkenness ($b=0.08$, $P=0.21$, $R^2=12\%$) (Figure S10).

Sensitivity analyses

Omitting each study by turn did not have an effect on the results. Additionally, changing the target groups, follow-up times and outcome measures within studies did not have an impact on the results. Initial analysis on the relationship between parental attitudes and children's alcohol use frequency included the results from a study by Ary and colleagues (43), but the effect size of that study (OR=20.52, 95% CI 10.09–41.73) differed from other results and it was

considered as an outlier. The study was removed from the analysis to assess its impact, but there was no meaningful influence.

Discussion

This systematic review and meta-analysis is the first to assess the relationship between parental attitudes and children's alcohol use in longitudinal and cross-sectional studies that have included parent-child dyads. The pooled estimates indicate that less restrictive parental attitudes increase the odds of children's alcohol use onset, alcohol use frequency and drunkenness. Perceived parental attitudes had similar effect on children's alcohol use, but not on alcohol use initiation. The relationship between parent-reported and perceived parental attitudes was weak, indicating that children have little awareness of their parents' attitudes towards their or children their age drinking.

The weak correlation between parents' reports and children's perceptions on attitudes does not mean that children perceive parental attitudes completely different from parents, rather their perceptions might be more skewed towards lenient attitudes. To some degree, participants might reflect on their own values and expectations (67,68), but this can also be the result of ignorance among children, if parents have not expressed their attitudes. Also, if the social norm supports parents introducing alcohol to children (69,70), it may override parents' own beliefs and encourage them engaging in the behaviour (71,72). This could make children perceive the parents more lenient, but parents considering themselves still restrictive.

Human behaviour is influenced by a variety of factors, attitudes and social norms being two of them (16) and as this review addresses two inter-related pathways (one's attitudes, other's behaviour), the reasons behind the investigated relationship are likely to be complex. Parents' have shown to have stricter attitudes towards alcohol use when children are younger (73–75). As children get older, the need for autonomy increases, there are more external factors (e.g. peer pressure, media (76,77)) influencing the behaviour and the strength of the parent-child relationship can be under pressure (78–80). Becoming more lenient is one way of granting autonomy and balancing the changes in the relationship (81). This is also supported by the finding from current meta-regression analysis, that the relationship between attitudes and alcohol use frequency was moderated by the children's age. The positive parent-child relationship is a central part of the authoritative parenting, which has shown to have a protective effect against alcohol use (82,83). This parenting style incorporates a myriad of factors and the combination of restrictive parental attitudes with other factors (e.g. quality of the relationship, rule-setting, communication) may explain the relationship between attitudes and alcohol use (assuming that parents with restrictive attitudes are more authoritative) (84).

Glatz et al (47) and Chramostova & Koning (85) have suggested that it is children's alcohol use that predicts parental attitudes rather than the other way around. Huver et al (86) has made similar conclusions regarding adolescents' smoking and related parental factors, but added that the attitude affecting behaviour relationship, while being weaker, still existed (5). When parents are confronted with children's alcohol use, it is possible that they change their attitudes towards the behaviour, potentially to reduce cognitive dissonance (85). Therefore, taking parental knowledge on children's alcohol use into account in future studies may offer a valuable insight,

as becoming less restrictive towards child's alcohol use could be a coping mechanism in response to becoming aware of their actual alcohol use (47). This contradicts Koning and colleagues' (17) view that suggests attitudes' superiority over behaviour. To get a clearer understanding of causal pathways and the combined influence of indicators, both, children and parents, and their attitudes and behaviour should be assessed in future research.

Comparing the findings with results from previous reviews (10,11,15) gives an indication that the source reporting on attitudes might have an effect on the outcome. For example, two reviews (10,11) presented contradictory findings on the relationship between parental attitudes and alcohol use initiation, but removing the studies with parent-reported attitudes is likely to support the result stating there is no relationship between perceived attitudes and behaviour. Sharmin and colleagues (15) focused on risky drinking, which would be roughly equivalent to drunkenness in this review, and found that perceived parental approval of alcohol use was related to higher risky drinking, but perceived disapproval did not predict lower risky drinking. The current review did not assess the relationship between perceived parental attitudes and drunkenness, but based on parents' own reports, there is a clear relationship between the two.

This paper has several limitations. First, the search criteria were softened during the screening, as there were abstracts with unclear information. Despite this limitation, the final list of included papers gives a comprehensive overview of the topic. Second, all models except one showed high between-study heterogeneity, limiting the generalisability of the findings. The results from the sensitivity analyses showed that excluding and grouping the studies did not change the direction and significance of the relationships. High heterogeneity could be due to variation in follow-up times, outcome and predictor measures, and confounding factors (e.g. parenting variables, psychosocial variables, demographics). Third, some studies excluded non-significant results, which might have resulted in increased pooled effect size. However, it is rather unlikely as the missing results were related to different outcomes and including 1–2 studies would not have a significant influence on the pooled effect size. Fourth, definitions of measures varied across studies (e.g. from single questions to complex constructs regarding attitudes, and from weekly use to lifetime regarding alcohol use).

Despite the limitations, this paper has the following strengths. Parental attitudes were reported by parents themselves, as there can exist a mismatch between actual and perceived attitudes (18–21). Both longitudinal and cross-sectional studies were included, creating a larger evidence base and increasing the analysis power. There can be a considerable time-lag as the change in one's attitude might not be followed by the change in other's behaviour in short time (87), but attitudes are not stable and might change over time. Including cross-sectional studies adds an opportunity to investigate the indicators measured at the same time. As the results indicate, regarding alcohol use frequency, the pooled effect size is higher for cross-sectional studies, but there is no statistically significant difference between cross-sectional studies and studies with longitudinal nature.

This paper provides novel insights when assessing the relationship between parental attitudes and children's alcohol use by focusing on parent-child dyads, including a broader set of studies and assessing the effect on various moderating factors on the relationship. The results show that children's awareness of their parents' attitudes can be different from actual attitudes, and

there is an association supporting that parents may delay alcohol use onset, but also influence children's behaviour afterwards, although the effect may attenuate as the age increases.

Alcohol use does not occur in a closed system, and therefore is not influenced by only one factor. Greater emphasis should be placed on assessing the individual, combined and bidirectional influence of parental factors to understand which indicators have stronger effect alone and combined, and what kind of effects the indicators have on each other. Focusing on parents' role in alcohol use prevention and reduction is crucial as parents' role stays important throughout childhood.

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Figures

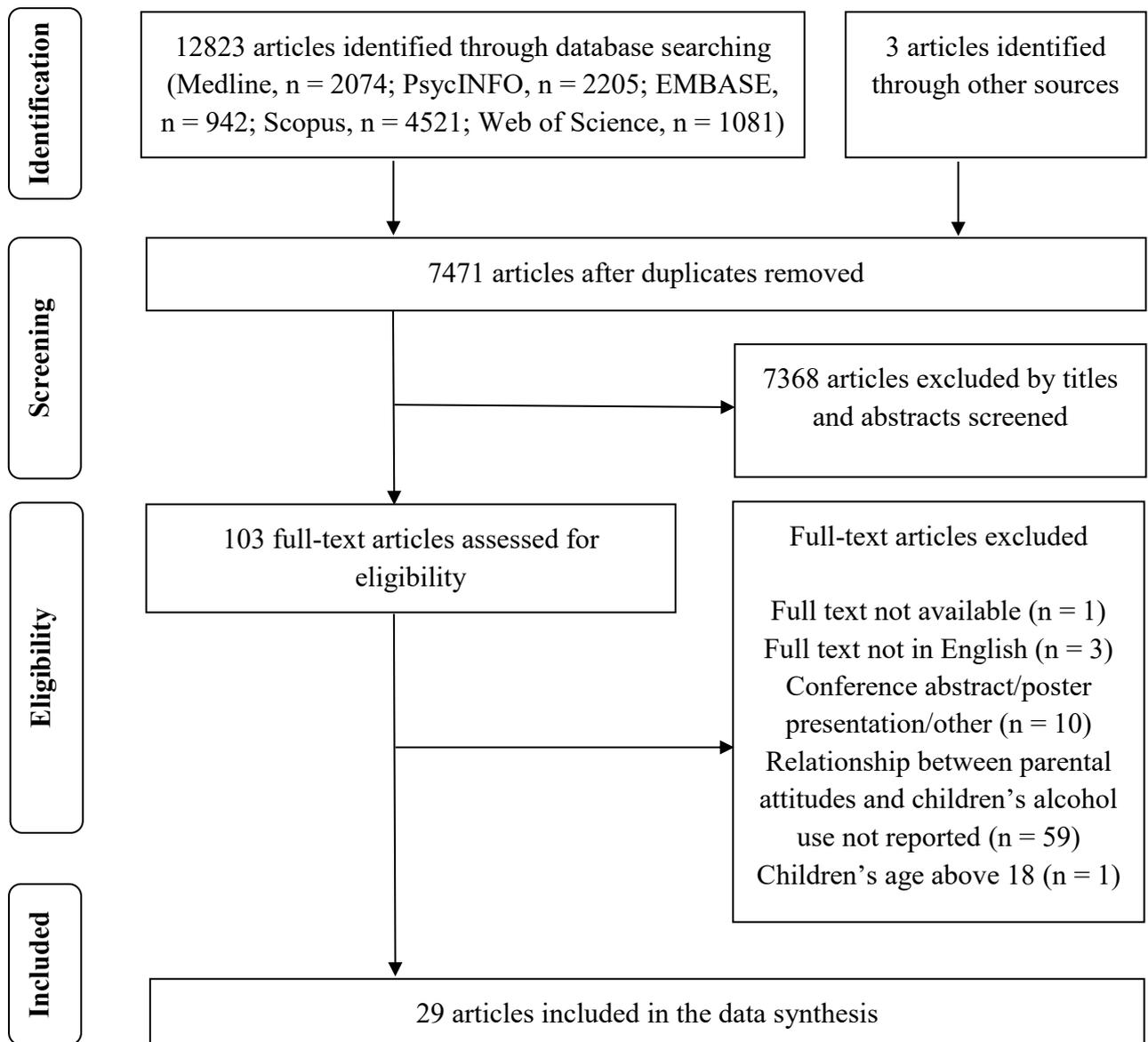


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram of study selection process.

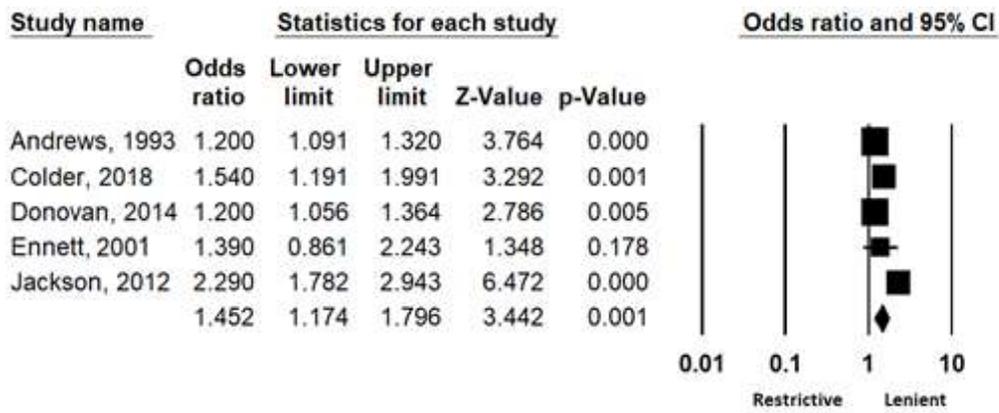
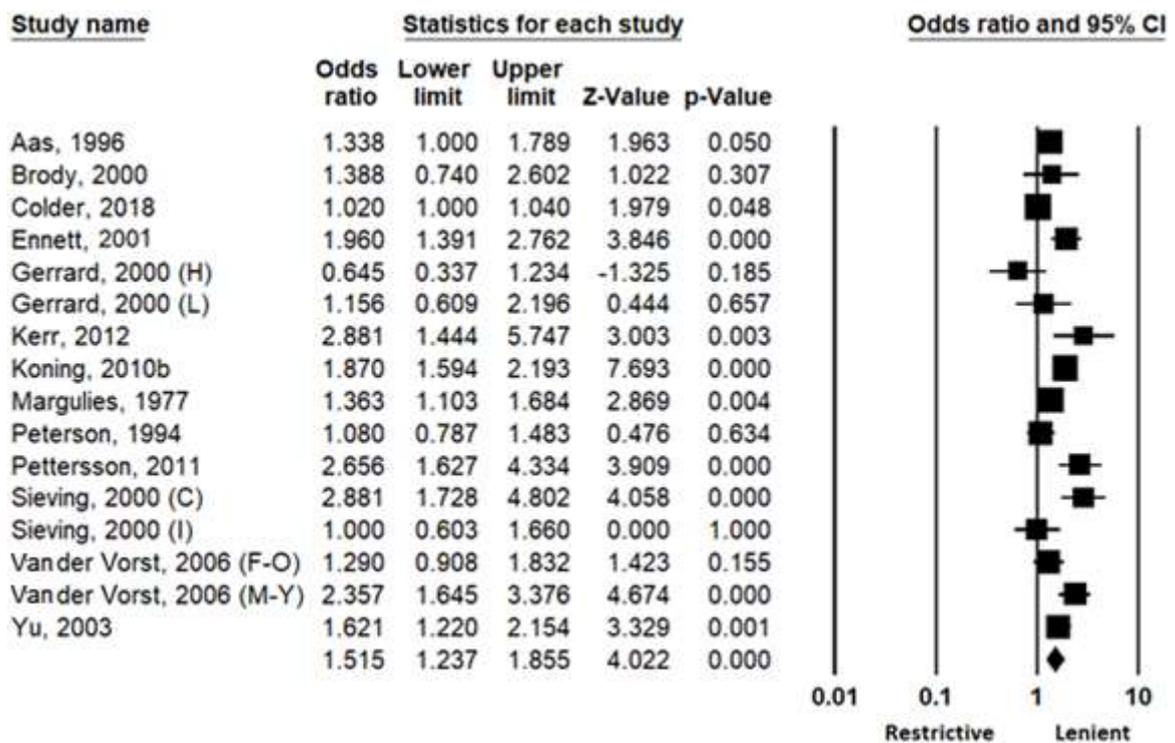
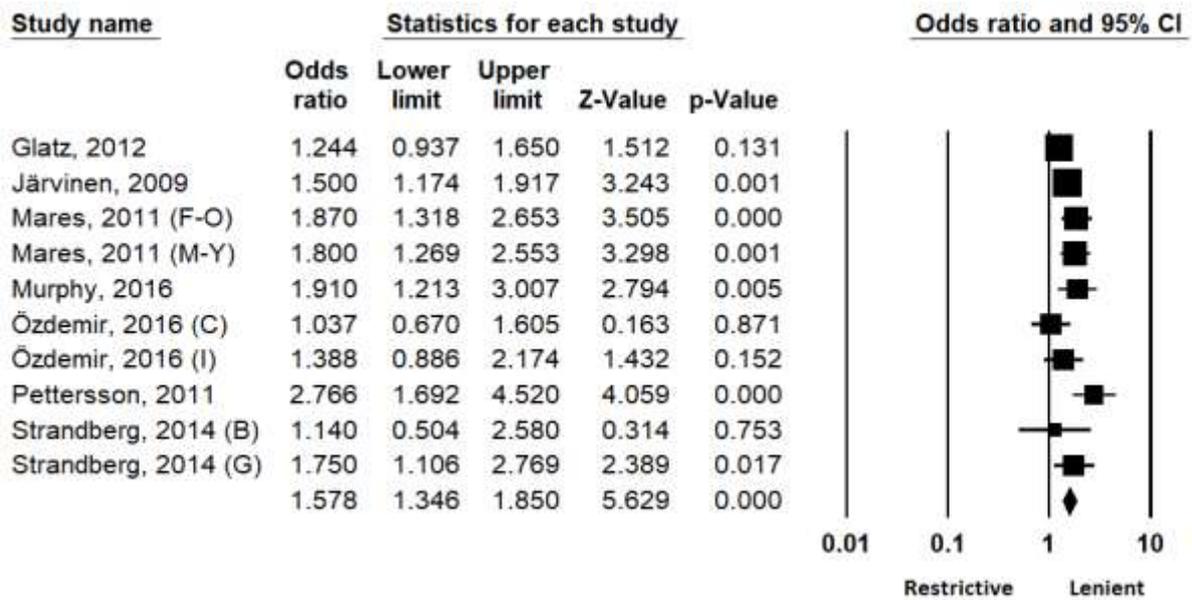


Figure 2. Forest plot for meta-analysis of parental attitudes towards children’s alcohol use and children’s alcohol use initiation.



H – high self-esteem, L – low self-esteem, I – intervention, C – control, F-O – fathers-older children, M-Y – mothers-younger children

Figure 3. Forest plot for meta-analysis of parental attitudes towards children’s alcohol use and children’s alcohol use frequency.



F-O – fathers-older children, M-Y – mothers-younger children, I – intervention, C – control, B – boys, G – girls

Figure 4. Forest plot for meta-analysis of parental attitudes towards children’s alcohol use and children’s drunkenness.

Tables

Table 1. Methodological quality assessment criteria

Domain	Description
Study participation	A. The sampling frame and recruitment are described adequately, including the period and place of recruitment B. The inclusion and exclusion criteria are described adequately C. The sample is representative and or/random D. The baseline study sample (i.e., individuals entering the study) is adequately described for relevant key characteristics (at least for age and gender)
Study attrition	E. The response rate at follow-up is adequate F. Participants lost to follow-up are adequately described for key characteristics G. There are no major differences in key characteristics and outcomes between participants who provided data at time 2 and those who did not
Predictor measurement	H. The description or definition of predictor variable is clear I. Continuous variables are reported or appropriate cut-points (i.e. not data-dependent) were used J. The predictor measurement and method are adequately valid and reliable to limit misclassification bias
Outcome measurement	K. The description or definition of outcome variable is clear L. The outcome measurement and method were adequately valid and reliable to limit misclassification bias
Confounding measurement	M. Confounders are accounted for in the study design (matching for key variables, stratification, or initial assembly of comparable groups) or in the analysis
Analysis	N. There is sufficient presentation of data to assess the adequacy of the analysis O. The strategy for model building (i.e., inclusion of variables) is appropriate and is based on a conceptual framework or model P. The selected analysis model is adequate for the design of the study Q. There is no selective reporting of results

Table 2. Description of characteristics of the included studies

Study	Country	Design	Adolescents' age at BL	No. of participants* included in the analysis	Exposure				Outcome				Results*		
					Measure	Target group	Age ^a	Measured	Measure	Time frame	Target group	Age ^a		Measured	
Aas <i>et al.</i> 1996	NOR	CS	M=13.3 (7 th grade)	348 (B), 257 (G), 605 (O)	Attitudes on alcohol use	M, F	OC	BL	Alcohol use ^b	LT ^b	B, G, O	–	BL	G-M – r=0.17 (p≤0.01), G-F – r=0.06 (p>0.05), B-M – r=0.09 (p≤0.05), B-F – r=0.10 (p≤0.05), O-M – r=0.08 (p≤0.05), O-F – r=0.12 (p≤0.01)	
									Perception of parental attitudes on alcohol use	–	B, G	OA			G-M – r=0.18 (p≤0.01), G-F – r=0.11 (p≤0.05), B-M – r=0.09 (p>0.05), B-F – r=0.20 (p≤0.001)
									Perception of parental attitudes on alcohol use	LT ^b	B, G, O	–			B – r=0.22 (p≤0.001), G – r=0.19 (p≤0.001), O – r=0.21 (p≤0.001)
Andrews <i>et al.</i> 1993	USA	LNG	11–15 (M=13.2)	MS – 180 (init.), 288 (maint.); FS – 125 (init.), 129 (maint.)	Attitudes on alcohol use	M, F	AG	BL	IN, maintenance (≤6 MO)	IN, ≤6 MO	A	–	12 MO	IN (M) – no data presented (p>0.05), IN (F) – AOR**=1.20 (95% CI 1.10–1.33); ≤6 MO – no data presented (p>0.05)	
					Perception of parental attitudes on alcohol use	A									IN (M) – AOR**=1.30 (95% CI 1.14–1.48), IN (F) – AOR**=1.18 (95% CI 1.08–1.28); ≤6 MO – no data presented (p>0.05)
Ary <i>et al.</i> 1993	USA	LNG	11–17	173	Attitudes on alcohol use	P ^c	OC	BL	Alcohol use ^d	LT ^d	A	–	BL, 12 MO	BL-BL – r=0.59 (p≤0.05), BL-12 MO – r=0.64 (p≤0.05)	
						P							OC/AG ^c		–
Brody <i>et al.</i> 2000	USA	LNG	10–12	132	Acceptability of alcohol use	M, F	14, 15	BL	Beer, wine use	≤6 MO	A	–	24 MO	Beer – M (14yo) – r=0.09 (p>0.05), M (15yo) – r=0.08 (p>0.05), F (14yo) – r=0.16 (p>0.05), F (15yo) – r=0.15 (p>0.05); Wine – M (14yo) – r=0.11 (p>0.05), M (15yo) – r=0.10 (p>0.05), F (14yo) – r=0.31 (p≤0.05), F (15yo) – r=0.28 (p≤0.05)	

Colder <i>et al.</i> 2018	USA	LNG	12	740 (sipping), 530 (alcohol use)	Acceptability of alcohol use	P	AG	BL	SP, alcohol use	SP (BL), ≤12 MO (7 Y)	A	–	BL, 7Y	SP – AOR**=1.54 (95% CI 1.19–1.99), ≤12 MO – AOR**=1.02 (95% CI 1.00–1.04)
Donovan & Molina 2008	USA	CS	8, 10	204 (8yo), 222 (10yo)	Approval of sipping Perception parental approval of sipping	M, F A	SAC SOA	BL	SP	SP	A	–	BL	8yo (M) – OR=1.29 (95% CI 1.1–1.5), 10yo (M) – OR=1.18 (95% CI 1.1–1.3); 8yo (F) – OR=1.02 (95% CI 0.9–1.2), 10yo (F) – OR=1.18 (95% CI 1.03–1.3) 8yo – OR=1.78 (95% CI 1.3–2.4), 10yo – OR***=1.84 (95% CI 1.53–2.21)
Donovan & Molina 2011*	USA	LNG	10	393 (MS), 297 (FS) 393	Approval of drinking Perception parental approval of drinking	M, F A	SAC SOA	At child age 10	IN	IN	A	–	By age 14	M – OR=0.99 (95% CI 0.81–1.21), F – OR=1.17 (95% CI 1.01–1.36) OR=1.12 (95% CI 1.02–1.22)
Donovan & Molina 2014*	USA	LNG	8/10	286 (PS), 286 (MS), 206 (FS) 237	Approval of sipping Perception parental approval of sipping	M, F, P A	SAC SOA	BL	SP	SP	A	–	By age 12	P – OR=1.20 (95% CI 1.06–1.37), M – OR=1.15 (95% CI 1.02–1.28), F – OR=1.16 (95% CI 1.03–1.31) OR=2.37 (95% CI 1.38–4.09)
Ennett <i>et al.</i> 2001	USA	LNG	12–14 (M=13.6)	195 (init.), 281 (esc.)	Disapproval of alcohol use	P	OC	BL	IN, escalation	IN, LT	A	–	12 MO	IN – AOR=1.39 (95% CI 0.86–2.24); escalation – AOR=1.96 (95% CI 1.39–2.76)
Gerrard <i>et al.</i> 2000	USA	LNG	15/17	126 (A ^f), 125 (A ^g)	Attitudes on alcohol use	M	OC	BL, 12 MO	Alcohol use ^h Perception of parental attitudes on alcohol use	≤3 MO –	A ^f , A ^g	– OA	BL, 12 MO	BL-BL – r ^f =0.12 (p>0.05), r ^g =0.07 (p>0.05), BL-12 MO – r^f=0.04 (p>0.05), r^g=0.12 (p>0.05) , 12 MO-12 MO – r ^f =0.19 (p≤0.05), r ^g =0.02 (p>0.05) BL-BL – r^f=0.38 (p≤0.05), r^g=0.06 (p>0.05) , BL-12 MO – r ^f =0.18 (p≤0.05), r ^g =0.03 (p≤0.05), 12 MO-12 MO – r ^f =0.24 (p≤0.05), r ^g =0.30 (p≤0.05)

					Perception of parental attitudes on alcohol use	A ^f , A ^g	OA		Alcohol use ^h	≤3 MO	-			BL-BL - r ^f =0.21 (p≤0.05), r ^g =0.25 (p≤0.05), BL-12 MO - r ^f =0.38 (p≤0.05), r ^g =0.20 (p≤0.05), 12 MO-12 MO - r ^f =0.32 (p≤0.05), r ^g =0.35 (p≤0.05)
Glatz <i>et al.</i> 2012	SWE	LNG	13-14 (M=13.54)	638, 494 (only 24 MO)	Attitudes on alcohol use	P	SAC	BL, 24 MO	Drunkenness	≤12 MO	A	-	BL, 24 MO	BL-BL - β ^{**▲} =0.11 (p>0.05), BL-24 MO - β ^{**▲} =0.06 (p>0.05), 24 MO-24 MO - r ^{**} =0.15 (p=0.01)
Jackson <i>et al.</i> 2012	USA	CS	M=9.2 (3 rd grade)	1050	Prosipping beliefs	M	AG	BL	SP	SP	A	-	BL	OR=2.29 (95% CI 1.78-2.94)
Järvinen & Østergaard 2009	DNK	CS	15 (9 th grade)	1034 (st. 2 & 4), 1032 (st. 5)	Attitudes on alcohol use (statements 2, 4 & 5)	P	AG	BL	Binge drinking ⁱ	≤1 MO	A	-	BL	Statement 2 - OR=1.16 (95% CI 0.89-1.50), statement 4 - OR=1.50 (95% CI 1.17-1.91), statement 5 - OR=1.20 (95% CI 0.94-1.53)
Kerr <i>et al.</i> 2012	USA	LNG	7	118	Attitudes on alcohol use ^j	P	OC	7 & 9 Y	Early alcohol use ^k	LT	A, P, OS	-	BL-72MO	r=0.28 (p≤0.001)
Koning <i>et al.</i> 2010a	NLD	CS	11-14 (M=12.16)	2599 (LT), 2122 (IF), 1494 (FR)	Acceptability of alcohol use	P	12/13	BL	Alcohol use	LT, WY (IF, FR)	A	-	BL	LT - r ^{**} =0.24 (p≤0.001), IF - AOR ^{**} =2.56 (95% CI 1.69-3.85), FR - AOR ^{**} =4.00 (95% CI 2.38-6.67)
Koning <i>et al.</i> 2010b ^{**}	NLD	RCT	11-14 (M=12.16)	2051	Acceptability of alcohol use	P	13/14	10 MO	Alcohol use	WY	A	-	22 MO	r ^{**} =0.17 (p≤0.001)
Koning <i>et al.</i> 2012 ^{**}	NLD	RCT	11-14 (M=12.16)	2381	Acceptability of alcohol use	P	12/13	BL	Onset	WY ^l , HEWY ^m	A	-	34 MO	WY - AOR=1.20 (95% CI ^{***} 0.92-1.56); HEWY - no data presented (p>0.05)
Koning <i>et al.</i> 2013 ^{**}	NLD	RCT	11-14 (M=12.16)	1064	Acceptability of alcohol use	P	15	34 MO	Alcohol use	HEWE ^m	A	-	50 MO	No data presented (p>0.05)
Mares <i>et al.</i> 2011	NLD	LNG	Younger - M=13.36 Older - M=15.22	428	Acceptability of alcohol use	M, F	13	BL	Binge drinking ⁱ	≤1 MO	A	-	36 MO	M (younger) r=0.16 (p≤0.001), M (older) r=0.16 (p≤0.001), F (younger) r=0.17 (p≤0.001), F (older) r=0.17 (p≤0.001)
Margulies <i>et al.</i> 1977	USA	LNG	14-18 ⁿ	1142 (A), 1199 (G), 735 (B) 1936	Attitudes on alcohol use Perception of parental attitudes on alcohol use	P A	OC OA	BL	Use of distilled spirits	LT	A, G, B A	-	5-6 MO	A - r=0.085 (p≤0.01), G - β=-0.001 (p>0.05), B - β=-0.012 (p>0.05) r=0.054 (p≤0.05)

Murphy <i>et al.</i> 2016	IRL	CS	Median 17	338 (MS, st. 3 & 6), 266 (FS, st. 3), 267 (FS, st. 6)	Attitudes on alcohol use (statements 3 & 6)	M, F	AG	BL	Hazardous drinking ^a	≤12 MO	A	-	BL	Statement 3 – M – OR=1.91 (95% CI 1.21–3.00) , F – OR=1.34 (95% CI 0.80–2.25); statement 6 – M – OR=3.38 (95% CI 2.12–5.38), F – OR=4.41 (95% CI 2.57–7.58)
Needle <i>et al.</i> 1986	USA	CS	11–13	196 (beer), 188 (wine), 197 (liquor)	Disapproval of alcohol use	M, F	OC				A			No data presented (p>0.05)
				MD – 223 ^p , 186 ^a (beer), 224 ^p , 187 ^a (wine), 217 ^p , 183 ^a (liquor); FD – 211 ^p , 180 ^a (beer), 212 ^p , 181 ^a (wine), 207 ^p , 177 ^a (liquor)	Perception of parental disapproval of alcohol use	A	OA	BL	Beer, wine, liquor use	≤12 MO		A ^p , A ^q	-	BL
Özdemir & Koutakis 2016	SWE	QE	12–13 (7 th grade)	A ^r – 339 (BL), 256 (18 MO), 264 (30 MO); A ^s – 312 (BL), 268 (18 MO), 242 (30 MO)	Attitudes on alcohol use	P	SAC	BL, 18, 30 MO	Drunkenness (≤1 MO), onset of monthly drunkenness (BL → 18/30 MO)	≤1 MO, BL → 18/30 MO	A ^r , A ^s	-	BL, 18, 30 MO	≤1 MO – BL-BL – r**r=-0.08 (p>0.05), r**s=0.06 (p>0.05), BL-18 MO – r**r =0.09 (p>0.05) , r**s=0.01 (p>0.05) , BL-30 MO – r**r=0.03 (p>0.05), r**s=0.03 (p>0.05), 18 MO-18 MO – r**r=-0.05 (p>0.05), r**s=0.11 (p>0.05), 30 MO-30 MO – r**r=0.06 (p>0.05), r**s=0.09 (p>0.05); BL → 18/30 MO – BL-18 MO – r**r=0.04 (p>0.05), r**s=0.03 (p>0.05), BL-30 MO – r**r=0.08 (p>0.05), r**s=0.01 (p>0.05), 18 MO-18 MO – r**r=-0.07 (p≤0.01), r**s=0.12 (p>0.05), 30 MO-30 MO – r**r=-0.16 (p≤0.01), r**s=0.05 (p>0.05)

Peterson <i>et al.</i> 1994	USA	LNG	12–13 (7 th grade)	450	Parent norms about alcohol use (statement 1) (OC); acceptability of alcohol use (statements 2 & 3) (AG)	P	OC, AG	BL	Current alcohol use	≤1 MO	A	–	24 MO	Statement 1 – AOR**=1.08 (95% CI 0.78–1.47) , statement 2 – AOR**=1.05 (95% CI 0.74–1.49), statement 3 – AOR**=1.27 (95% CI 0.89–1.82)	
Pettersson <i>et al.</i> 2011	SWE	QE	~13 (7 th grade)	229 (A [†]), 280 (A [‡])	Attitudes on alcohol use	P	SAC	BL	Alcohol use, drunkenness	LT	A [†] , A [‡]	–	27 MO	Alcohol use – $\beta^{†**\Delta}=0.21$ ($p \leq 0.01$); β^{\ddagger} =no data presented ($p > 0.05$); drunkenness – $\beta^{†**\Delta}=0.27$ ($p \leq 0.01$); β^{\ddagger} =no data presented ($p > 0.05$)	
Sieving <i>et al.</i> 2000	USA	RCT	6 th grade	200 (A [†]), 213 (A [‡])	Parent norms about alcohol use	P	AG ^w	BL	Alcohol use	≤12 MO ^x	A [†] , A [‡]	–	12, 24 MO	BL-12 MO – $r^{\Delta}=0.00$ ($p > 0.01$), $r^{\ddagger}=0.28$ ($p \leq 0.001$) , BL-24 MO – $r^{\Delta}=0.12$ ($p > 0.05$), $r^{\ddagger}=0.19$ ($p \leq 0.05$)	
Strandberg <i>et al.</i> 2014	SWE	RCT	~13 (7 th grade)	895 (G), 857 (B)	Attitudes on alcohol use	P	SAC	BL	Drunkenness	LT, ≤1 MO	G, B	–	30 MO	LT – G – AOR**=1.18 (95% CI 0.71–1.96), B – AOR**=1.43 (95% CI 0.50–4.17); ≤1 MO – G – AOR**=1.75 (95% CI 1.11–2.78) , B – AOR**=1.14 (95% CI 0.50–2.56)	
Van der Vorst <i>et al.</i> 2006 ^{***}	NLD	LNG	Younger – M=13.36 Older – M=15.22	428 (BL), 416 (12 MO)	Acceptability of alcohol use	M, F	13	BL	Alcohol use	≤1 MO ^y	A	–	BL, 12 MO	BL-BL (total effects) – M (younger) $\beta^{\Delta}=0.30$ ($p \leq 0.05$), M (older) $\beta^{\Delta}=0.19$ ($p \leq 0.05$), F (younger) $\beta^{\Delta}=-0.01$ ($p \leq 0.05$), F (older) $\beta^{\Delta}=0.08$ ($p \leq 0.05$); BL-12 MO (total effects) – M (younger) $\beta^{\Delta}=0.23$ ($p \leq 0.05$) , M (older) $\beta^{\Delta}=0.14$ ($p \leq 0.05$), F (younger) $\beta^{\Delta}=-0.01$ ($p \leq 0.05$), F (older) $\beta^{\Delta}=0.07$ ($p \leq 0.05$)	
Yu 2003	USA	CS	15–18	639 (LT), 470 (≤1 MO)	Attitudes on alcohol use	P	OC	BL	Alcohol use	LT, ≤1 MO	A	OA	BL	–	LT – $r=0.132$ ($p \leq 0.01$) , ≤1 MO – $r=0.081$ ($p > 0.05$)
				593					Perception of parental attitudes on alcohol use	–					
				640 (LT), 470 (≤1 MO)	Perception of parental attitudes on alcohol use	A	OA		Alcohol use	LT, ≤1 MO					LT – $r=0.251$ ($p \leq 0.01$) , ≤1 MO – $r=0.097$ ($p \leq 0.05$)

*Per target group. **Inverted effect size. ***New CI was calculated due to asymmetry. *Same study as Donovan & Molina 2008. **Same study as Koning et al 2010. ***Same study as Mares et al 2011. [▲]0.05 added to the effect size. ^aTarget group’s attitudes towards alcohol use at specific age. ^bAlcohol use score was calculated as a sum of six z-transformed items that assessed frequency of lifetime and last three months use and frequency of drunkenness in the past 6 months. ^cCombined measure – parent self-report attitudes + perceived parent attitudes. ^dCombined measure – lifetime use and a monthly rate variable indicating the number of times alcohol was used. ^eCombination of three measures – first two assess OC/OA, the last AG. ^fAdolescents with low self-esteem. ^gAdolescents with high self-esteem. ^hLatent variable (frequency of drinking + excessive drinking). ⁱFive or more units on one occasion. ^jCombined measure – the mean of mother and father binary variables (below and above 21) at both waves was calculated to form the construct. ^kMean of standardized indicators from child self-reports (ages 7-13), parent reports (ages 5-13), and observer report (9 years). ^lOnly among monthly users. ^mBoys minimum six, girls minimum five glasses per week/weekend. ⁿSecondary school students. ^oAUDIT-C. ^pWith older siblings. ^qWithout older siblings. ^rIntervention group. ^sControl group. ^tProgramme group. ^uComparison group. ^vReference group. ^wCombined measure – measuring beliefs about the acceptability of underage alcohol use, as well as parents’ attitudes and practices related to their own child’s use + perceived parent norms around underage drinking. ^xAlcohol use (past month and year) + alcohol misuse (episodes of 5 or more drinks in a row over the past 2 weeks, frequency of being “really drunk so you fell down or got sick”, and frequency of alcohol use in the past week). ^yCombined – alcohol use frequency in the past 4 weeks + intensity of drinking (number of glasses of alcohol the respondents had drunk in the previous week during weekdays and during the weekends in contexts at home and outside the home. A – adolescent, AG – adolescents in general, B – boy, BL – baseline, CI – confidence interval, CS – cross-sectional, F – father, FD – fathers’ disapproval, FR – frequent, G – girl, HEWE – heavy weekend use, HEWY – heavy weekly use, IN – initiation, IF – infrequent, LNG – longitudinal, LT – lifetime, M – mother, MD – mothers’ disapproval, MO – month(s), O – offspring, OA – own age, OC – parents’ own child, OR – odds ratio, OS – observer, P – parents, PS – parents’ sample, QE – quasi-experimental, RCT – randomised controlled trial, SAC – children the same age as (own) child, SOA – same as own age, SP – sipping, WY – weekly, Y – year(s). **Bold** – included in the main analyses.

Table 3. Methodological quality assessment of included studies

Study	Study participation	Study attrition	Predictor measurement	Outcome measurement	Confounding measurement	Analysis	Number of biases
Aas <i>et al.</i> 1996	-	NA	-	-	-	+	4
Andrews <i>et al.</i> 1993	+	-	-	-	+	+	3
Ary <i>et al.</i> 1993	+	-	+	-	-	+	3
Brody <i>et al.</i> 2000	+	-	+	-	-	+	3
Colder <i>et al.</i> 2018	+	-	-	-	+	+	3
Donovan & Molina 2008	+	NA	+	-	-	+	2
Donovan & Molina 2011	+	+	+	+	+	+	0
Donovan & Molina 2014	+	+	+	-	+	+	1
Ennett <i>et al.</i> 2001	-	+	+	-	+	+	2
Gerrard <i>et al.</i> 2000	-	-	-	-	-	+	5
Glatz <i>et al.</i> 2012	+	-	-	-	-	+	4
Jackson <i>et al.</i> 2012	-	NA	+	-	+	+	2
Järvinen & Østergaard 2009	+	NA	+	-	-	-	3
Kerr <i>et al.</i> 2012	+	-	+	-	-	+	3
Koning <i>et al.</i> 2010a	+	NA	+	+	+	+	0
Koning <i>et al.</i> 2010b	+	+	+	-	-	+	2

Koning <i>et al.</i> 2012	+	-	+	-	+	+	2
Koning <i>et al.</i> 2013	-	-	+	-	-	+	4
Mares <i>et al.</i> 2011	-	+	+	-	-	+	3
Margulies <i>et al.</i> 1977	-	-	-	-	+	+	4
Murphy <i>et al.</i> 2016	+	NA	+	+	+	+	0
Needle <i>et al.</i> 1986	+	NA	-	+	-	+	2
Özdemir & Koutakis 2016	-	+	-	-	-	+	4
Peterson <i>et al.</i> 1994	-	-	+	-	+	+	3
Pettersson <i>et al.</i> 2011	-	-	+	-	-	+	4
Sieving <i>et al.</i> 2000	-	-	-	-	-	+	5
Strandberg <i>et al.</i> 2014	+	+	-	-	+	+	2
Van der Vorst <i>et al.</i> 2006	+	-	+	-	-	+	3
Yu 2003	+	NA	+	-	+	+	1