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Meta-Analysis
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Meta Analysis: Effects of Peer, Family, and School Environment on Smoking Behavior in Adolescents

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ABSTRACT

Background: Smoking behavior is a behavior that is harmful to health, but there are still many people who do smoking activities, even someone starts smoking starting as a teenager. This study aimed to estimate the influence of peers, family, school on smoking behavior in adolescents through a meta-analysis of primary studies conducted by previous authors.
Subjects and Method: This was a systematic review and meta-analysis conducted following the PRISMA diagram and the PICO format. Population: Teenagers. Intervention: Smokers' peers, smokers' family members, schools apply smoking rules. Comparison: Peers don't smoke, family members don't smoke, schools don't enforce smoking rules. Outcome: Smoking. The online databases used are Google Scholar, Science Direct, and ProQuest with the words "Smoking peers" AND "Smoking parents" AND "Smoking policy school" AND "smoking" AND behavior AND adolescents AND "cross sectional" AND aOR. There were 16 cross-sectional studies published in 2013-2023 that met the inclusion criteria. Analysis was performed with RevMan 5.3.
Results: The meta-analysis included 16 cross-sectional studies from India, Korea, China, Hong Kong, Taiwan, South Africa, America, Chile, Denmark, Saudi Arabia and, Turkey. The total sample was 191,101. Smoking behavior increased with smoker peers (aOR= 5.04; 95% CI = 3.23 to 7.87; p< 0.001), smoker family members (aOR=2.04; 95% CI= 1.45 to 2.87; p< 0.001), and low smoking policy in school (aOR= 1.00; 95% CI= 0.65 to 1.54; p< 0.001).
Conclusion: There is influence of smoking peers, smoking families, smoking policies in schools with smoking behavior in adolescents.

Keywords: adolescents, peers of smokers, families of smokers, smoking policies.

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BACKGROUND

Smoking behavior is behavior that burns any of the tobacco products that are intended to be burned, smoked or inhaled including clove cigarettes, white cigarettes, cigars or other forms produced from the nicotina tabacum, nicotina rustica and other species or their synthetics whose smoke contains nicotine and tar. with or

without additives (Ministry of Health, 2013).

In Indonesia the percentage of smoking in the population aged ≥ 15 years in 2022 is 33.81%. Bandar Lampung has the highest number of smokers aged ≥ 15, namely 33.81% and then West Nusa Tenggara, 33.20%, then in third place, 33.16%, Bengkulu Province (BPS, 2022).

Cigarettes are easily available in developing countries at relatively low prices. Cigarette ads in developing countries appear 81 times more frequently than in high-income countries. Data from The Tobacco 2015 states that 66% of men in Indonesia smoke. Russia is in second place with 60% of male smokers over 15 years. Then followed by China (53%), Philippines (48%), Vietnam (47%), Malaysia (44%), India (24%), and Brazil (22%) (Drope et al, 2018).

The intervention carried out is an adolescent resilience intervention, where this intervention aims to fortify adolescents from disturbance or exposure to things that can be detrimental to the health of the adolescents themselves, such as cigarettes, drugs, alcohol and so on. In addition, adolescents are also supervised in preventing or reducing the level of consumption of these dangerous products.

The strategy that is carried out depends on the school wants and will implement any strategy that will facilitate or assist schools in monitoring and preventing their students from consuming dangerous goods, among these strategies are self-efficacy, brainstorming, teamwork, empathy, communication, aspirations, education, counseling, advocacy, as well as environmental factors such as school support, involvement of teachers in schools, peers and Health organizations in schools (Hodder et al., 2017). This study aims to estimate the influence of peers, family, school on smoking behavior in adolescents through a meta-analysis of primary studies conducted by previous authors.

SUBJECTS AND METHOD

1. Study Design

This study uses a systematic review method and meta-analysis using primary data, namely data from previous research results. Article search using 3 databases, namely: Google Scholar, PubMed, and Proquest. The keywords used are "Smoking peers" AND "Smoking parents" AND "Smoking policy school" AND tobacco OR OR cigarette AND cross sectional AND aOR. There were 16 primary studies that met the inclusion criteria of this study.

2. Step of Meta-Analysis

The meta-analysis was carried out in five steps as follows:

1) Formulate research questions in the PICO format (Population, Intervention, Comparison, Outcome).
2) Search for primary study articles from various electronic and non-electronic databases.
3) Conduct screening and critical assessment of primary research articles.
4) Perform data extraction and synthesize effect estimates into RevMan 5.3.
5) Interpret and conclude the results

3. Inclusion Criteria

The full paper article uses a cross-sectional study design, the research subject is adolescents, the influence of peers, family and school, the research outcome is adolescents smoking.

4. Exclusion Criteria

Articles not in English, Studies other than Cross Sectional, Articles prior to 2013.

5. Operational Definition of Variables

Influence of peers are influence of peers on adolescent smoking behavior.

The influence of family the influence of smoking parents on adolescent smoking behavior.

Influence of schools Influence of policies and regulations prohibiting smoking in schools.

Smoking behavior in adolescents smoking behavior in adolescents aged 10-19 years.

6. Instruments

Quality assessment in this study used a critical appraisal checklist for cross-sectional studies published by JBI (Joanna Briggs Institute, 2017).

7. Data Analysis

The collected articles were then screened using predetermined criteria. The study was a meta-analysis study that used secondary data in the form of data from the results of previous primary studies, in which the data processing used Review Manager (RevMan 5.3). The variety of study data was divided into two, namely the Fixed Effect Model (FEM) and Random Effect Model (REM). The results of data processing were presented in forest plots and funnel plots.

RESULTS

The primary article searches in this study used several databases The process of screening articles according to the research criteria can be seen in the PRISMA flow diagram (Figure 1). The initial search process obtained 20,030, then a selection of eligible articles was conducted so that 16 articles were included in the meta-analysis study, also figure 2 showed the research distribution map.

Study quality assessment was carried out quantitatively, where this study used study quality assessment for a cross-sectional study based on the Joanna Briggs Institute, in 2017. The results of the study quality assessment based on JBI can be seen in Table 1.

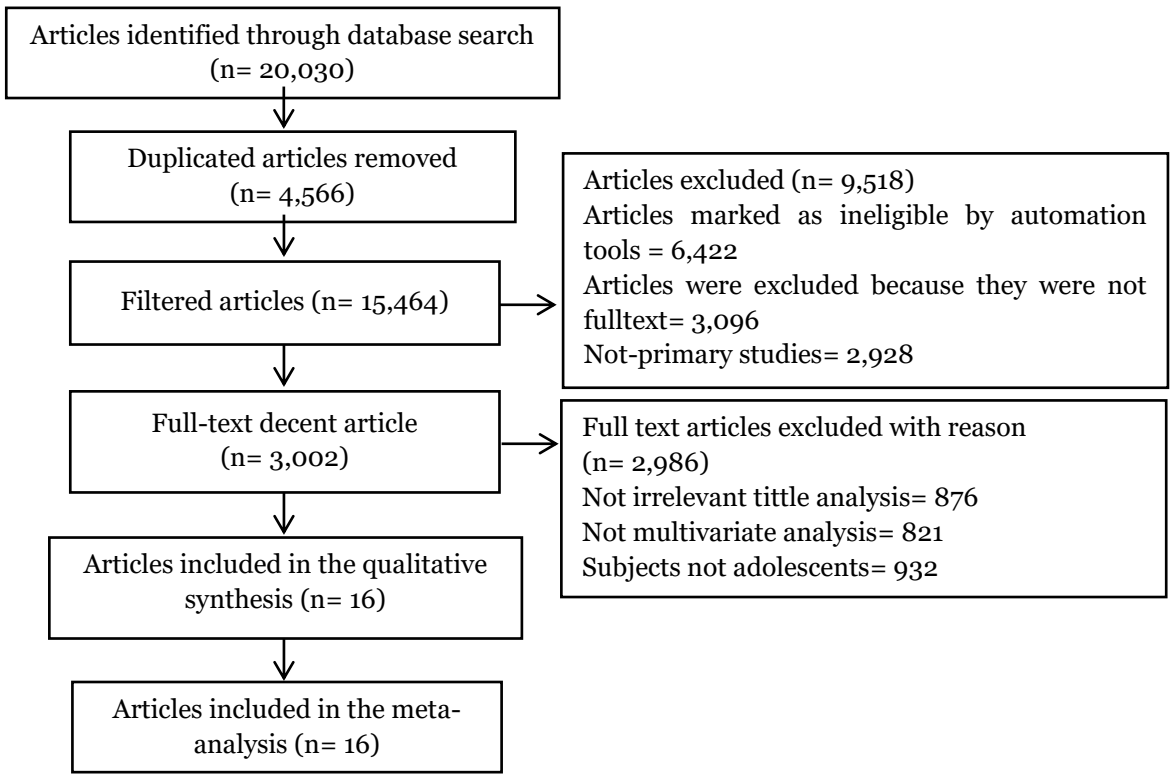

Figure 1. Results of Prisma Flow Diagrams

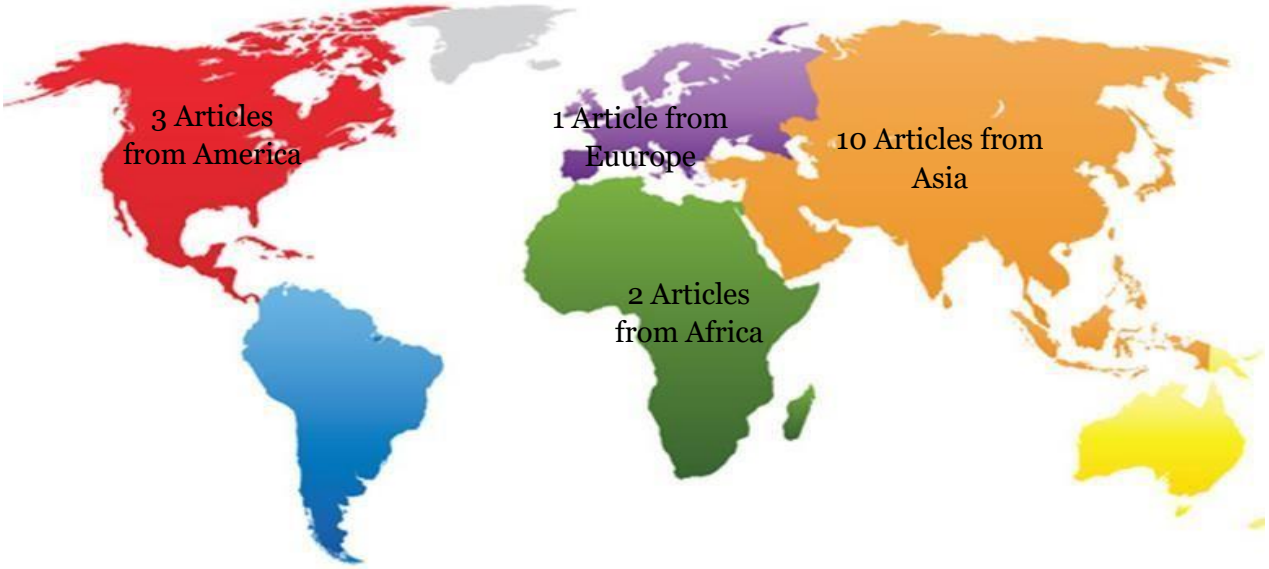

Figure 2. Resarch Distribution Map

Table 1. The Quality Assessment of Articles with a Cross-Sectional Study using JBI.

Primary Study	Criteria								
	1	2	3	4	5	6	7	8	Total
Abdulrahman et al. (2022)	2	2	2	2	2	2	2	2	16
Al-Zalabani dan Kasim (2015)	2	2	2	2	2	2	2	2	16
Anderson et al. (2019)	2	2	2	2	2	2	2	2	16
Braverman et al. (2015)	2	2	2	2	2	2	2	2	16
Demir et al. (2015)	2	2	2	2	2	2	2	2	16
Gaete et al. (2016)	2	2	2	2	2	2	2	2	16
Jiang et al. (2016	2	2	2	2	2	2	2	2	16
Karimy et al. (2013)	2	2	2	2	2	2	2	2	16
Kim et al. (2020)	2	2	2	2	2	2	2	2	16
Liang et al. (2022)	2	2	2	2	2	2	2	2	16
Lin et al. (2022)	2	2	2	2	2	2	2	2	16
Lim et al. (2017)	2	2	2	2	2	2	2	2	16
Ramachandra et al. (2019)	2	2	2	2	2	2	2	2	16
Salma et al. (2019)	2	2	2	2	2	2	2	2	16
Talley et al. (2017)	2	2	2	2	2	2	2	2	16
Thakur et al. (2014)	2	2	2	2	2	2	2	2	16

Description of the question criteria:

1. Were the criteria for inclusion in the sample clearly defined?
2. Were the study subjects and settings described in detail?
3. Was the exposure measured in a valid and reliable way?
4. What were the standard criteria used for measuring objective conditions?
5. Were confounding factors identified?
6. Were strategies to deal with confounding factors stated?
7. Were the results measured in a valid and reliable way?
8. Was proper statistical analysis used?

Description of scoring: Yes= 2; Hesitate= 1; No= 0.

Table 3. Description of the study of peers on smoking behavior in adolescents.

Author (years)	Country	Study Design	Sample	P	I	C	O
Al-Zalabani & Kasim (2015)	Madinah, Saudi arabia	Cross-Sectional	3.400	Adolescents aged 11-19 years	Smoking friends	Friends don't smoke	Smoking
Demir et al. (2015)	Turki	Cross-Sectional	16.175	Adolescents aged 15-21 years	Have a friend who smokes	Don't have smoking friends	Smoking
Jiang et al. (2016)	Hongkong	Cross-Sectional	45.857	Students aged 14.8 – 19 years	Have a friend who smokes more than half a year	Have no smoking friends for more than half a year	Smoking
Karimy et al. (2013)	Iran	Cross-Sectional	365	Students aged 8-19 years	Smoker friend	Friends don't smoke	Smoking
Liang et al. (2022)	Taiwan	Cross-Sectional	27.524	Teenagers aged 12-18 years	Some friends smoke	Some friends don't smoke	Smoking
Lim et al. (2022)	Malaysia	Cross-Sectional	2.991	School students aged 16-17 years	Smoking friends	Friends don't smoke	Smoking
Lin et al. (2017)	China	Cross-Sectional	7.423	Middle and high school students	Smoking friends	Friends don't smoke	Smoking
Talley et al. (2017)	South Africa	Cross-Sectional	10.833	Students aged 13-15 years	Smoking friends	Friends don't smoke	Smoking
Tehakur et al. (2014)	North India	Cross-Sectional	720	Teenagers aged 14-19 years	Smoker's friends	Peers do not smoke	Smoking

Table 4. aOR and 95% CI data of peers on smoking behavior in adolescents.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Al-Zalabani & Kasim (2015)	12.5	9.40	16.8
Demir et al. (2015)	5.08	3.72	6.92
Jiang et al. (2016)	1.28	0.72	2.27
Karimy et al. (2013)	3.76	1.20	11.76
Liang et al. (2022)	8.54	6.51	11.21
Lim et al. (2022)	4.40	1.38	14.03
Lin et al. (2017)	10.99	6.13	19.78
Talley et al. (2017)	5.10	3.89	6.9
Tehakur et al. (2014)	2.1	1.1	3.8

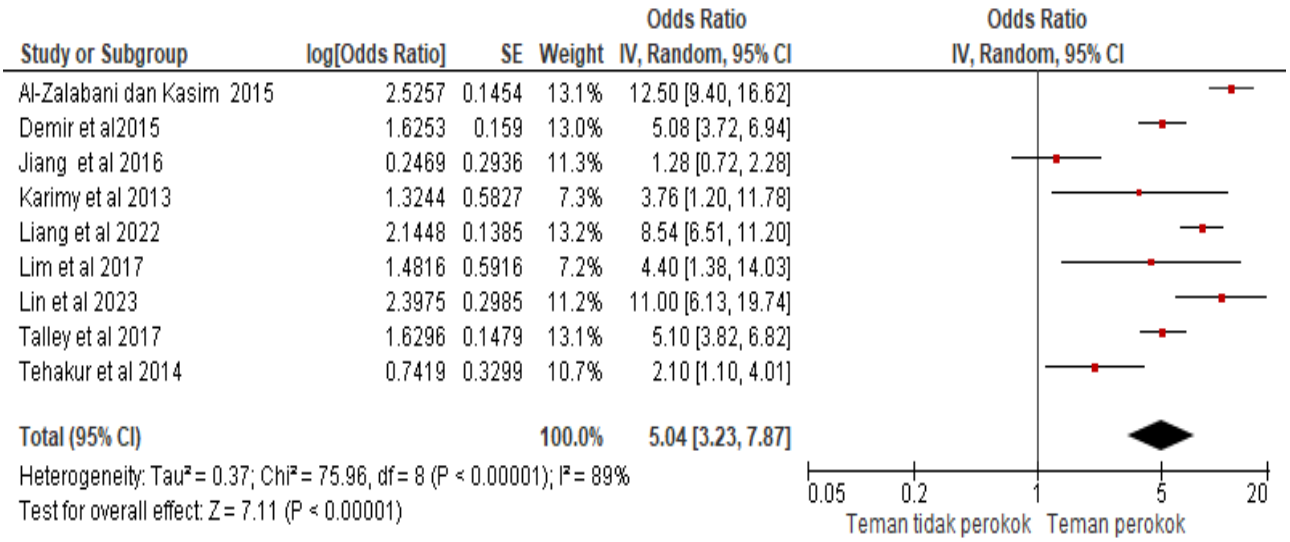

Figure 3. Forest plot of the influence of smokers' peers on smoking behavior in adolescents.

Forest plot in Figure 3 meta-analysis was performed on 9 articles of primary Indian studies with a sample size of 115,293. The meta-analysis showed that adolescents with smoking peers were 5.04 times more likely to smoke than their non-smoker peers (aOR= 5.04; 95% CI = 3.23 to 7.87; p<0.001).

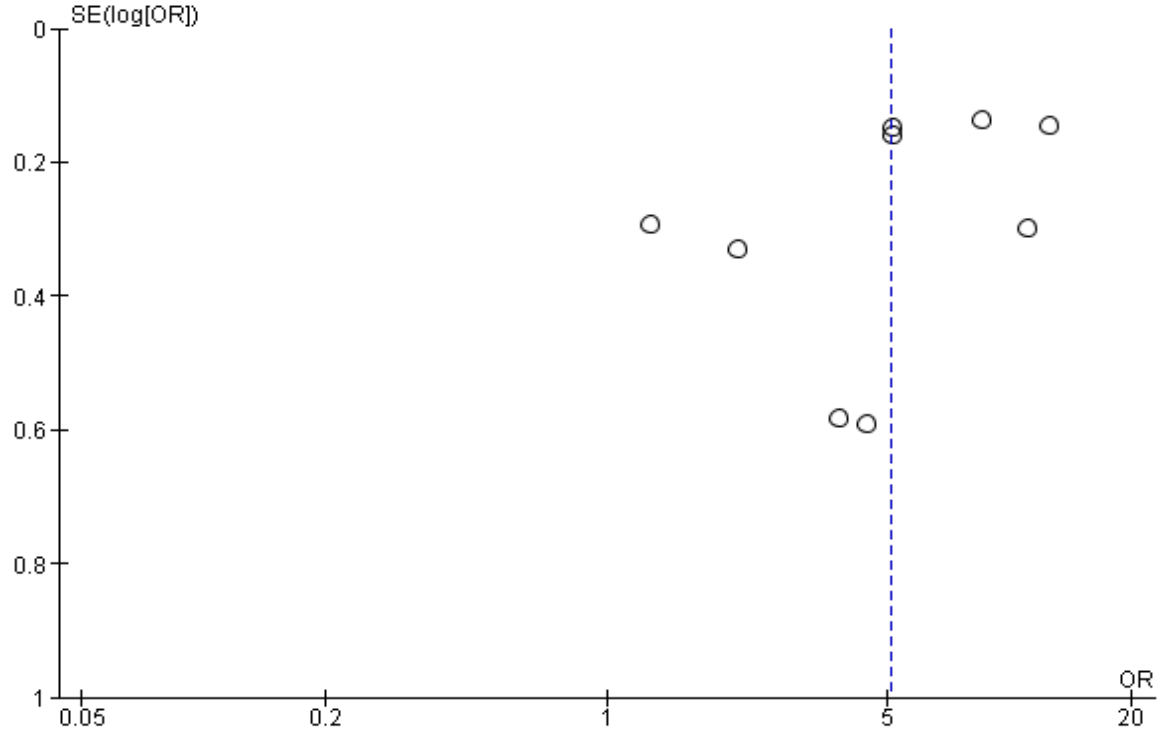

Figure 4. Funnel plot of the influence of smokers' peers on smoking behavior in adolescents.

The funnel plot in Figure 4 shows that the distribution of effect estimates between studies is more or less symmetrical, that is, the distribution or distribution of effect estimates to the right and left of the average vertical line of effect estimates is relatively the same. Thus, this funnel plot indicates that there is no publication bias.

Table 5. Description of family smokers on smoking behavior in adolescents.

Author (years)	Country	Study Design	Sample	P	I	C	O
Abdulrahman al. (2022)	Saudi Arabia	Cross-Sectional	772	Student	Smoker's family member	Non-smoker family members	Smoking
Al-Zalabani& Kasim (2015)	Saudi Arabia	Cross-Sectional	3,400	Teens aged 11-19 years	Both parents smoke	Both parents do not smoke	Smoking
Demir et al. (2015)	Turkey	Cross-Sectional	16,175	Adolescents aged 15-21 years	Parents (father)	Parents (father) did not smoke	Smoking
Gate et al. (2016)	Chili	Cross-Sectional	45,273	Students aged 12-21 years	Smokers' family.	Parents don't smoke	Smoking
Lin et al. (2022)	China	Cross-Sectional	7,423	Middle and high school students	Old man smoking	Both parents do not smoke	Smoking
Talley et al. (2017)	South Africa	Cross-Sectional	10,833	Students aged 13-15 years	Both parents smoke	Parents do not smoke	Smoking
Tehakur et al. (2014)	India	Cross-Sectional	720	Teenagers aged 14-19 years	Old man smoking	Family members do not smoke	Smoking

Table 6. Table 4. aOR and 95% CI data of family smokers on smoking behavior in adolescents.

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Abdulrahman al. (2022)	2.63	1.73	3.99
Al-Zalabani& Kasim (2015)	2.95	1.60	5.22
Demir et al. (2015)	0.97	0.70	1.35
Gate et al. (2016)	1.71	1.64	1.78
Lin et al. (2022)	5.35	2.09	13.67
Talley et al. (2017)	1.13	0.80	1.59
Tehakur et al. (2014)	4.9	2.5	9.5

The forest plot in Figure 5. shows that there was an effect of attitude toward the use of HPV immunization services, and the effect was statistically significant. Female adolescents with a positive attitude about HPV immunization were 4.10 times more likely to use HPV immunization services than those with a negative attitude (aOR= 4.10;

CI 95%= 2.78 to 6.05; p< 0.001), the forest plots also show the heterogeneity of effect estimates across the studies was high (I^2= 88%; p< 0.001). Thus, the calculation of the average effect estimates was carried out with a random effect model approach.

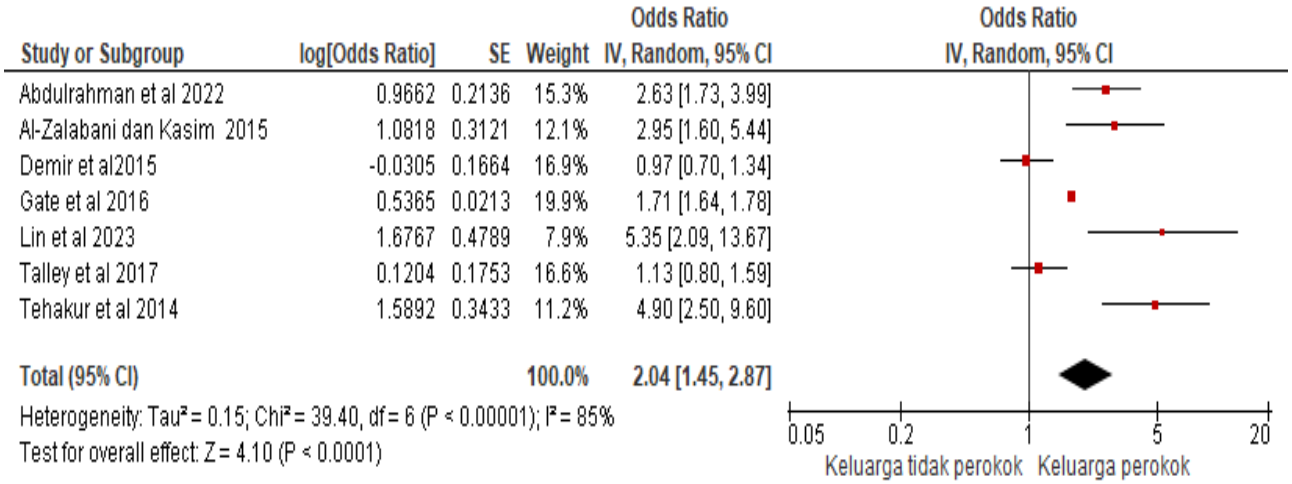

Figure 5. Forest plot of the influence of smoking families on smoking behavior in adolescents.

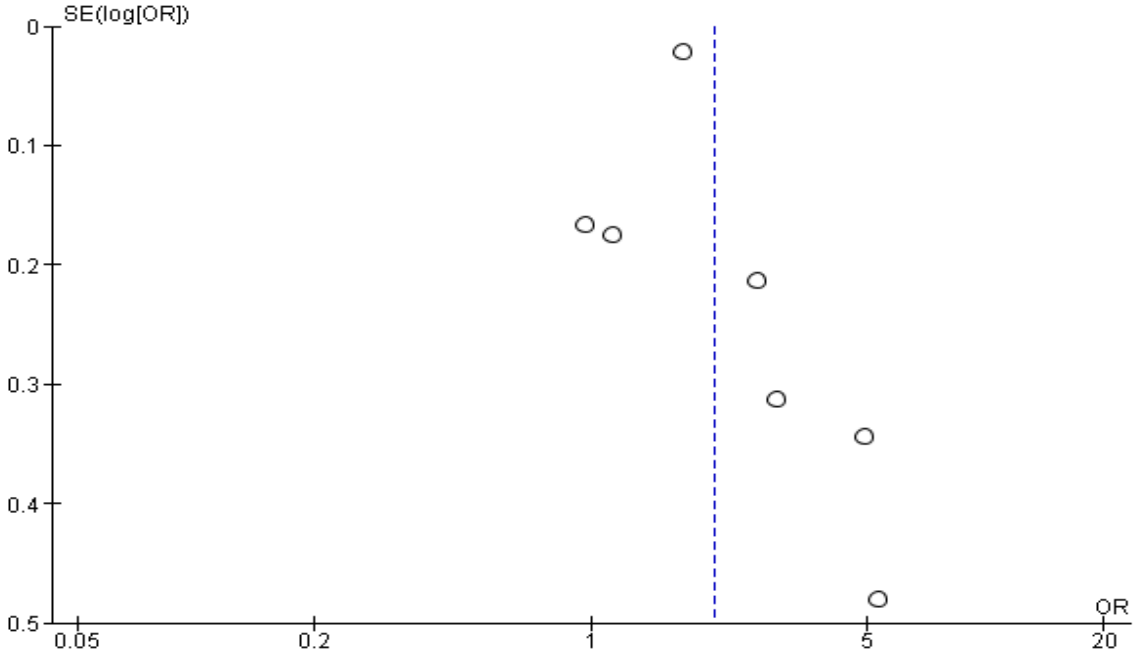

Figure 6. Forest plot of the influence of smoking families on smoking behavior in adolescents.

The funnel plot in Figure 6 shows that the distribution of effect estimates between studies is less symmetrical, that is, the distribution or distribution of effect estimates to the right and left of the vertical line of the average effect estimate is not relatively the same. Thus, this funnel plot indicates publication bias.

Table 7. Description of the studies of school on smoking behavior in adolescents.

Author (years)	Country	Study Design	n	P	I	C	O
Andresen et al. (2019)	Denmark	Cross-Sectional	899	Middle school students	The school is protected by a law on smoke-free school grounds	Schools are not protected by laws against smoke-free school grounds	Smoking
Braverman et al. (2014)	America	Cross-Sectional	1192	Students (5,691), Lecturers / staff (2,051)	Support a smoke-free campus policy	Does not support a smoke-free campus policy	Smoking
Ramachandran et al. (2019)	America	Cross-Sectional	417	University of Mississippi student	Students support a smoke-free campus	Students do not support a smoke-free campus	Smoking
Kim et al. (2020)	Korea	Cross-Sectional	949	Teenagers aged 10-19 years	School declared tobacco free	The school does not declare tobacco free	Smoking
Liang et al. (2022)	Taiwan	Cross-Sectional	280	Teenagers aged 12-18 years	Anti-smoking regulations in schools	There are no anti-smoking regulations in schools	Smoking
Salma et al. (2019)	Sudan	Cross-Sectional	958	Students and students	Smoking policy in schools	There is no smoking policy in the school	Smoking
Talley et al. (2017)	South Africa	Cross-Sectional	1283	Students aged 13-15 years	The school implements anti-smoking education in schools	Schools do not implement anti-smoking education in schools	Smoking

Table 8. aOR and 95% CI data of school on smoking behavior in adolescents.

Author (year)	aOR	95% CI	
		Lower Limit	Upper Limit
Andresen et al. (2019)	0.86	0.75	0.97
Braverman et al. (2014)	1.94	1.85	2.04
Kim et al. (2019)	0.99	0.58	1.68
Liang et al. (2020)	0.81	0.61	0.99
Ramachandran et al. (2019)	0.71	0.55	0.91
Salma et al. (2019)	0.95	0.55	1.64
Talley et al. (2017)	1.09	0.82	1.43

Forest plot in Figure 7 meta-analysis was conducted on 7 primary study articles from Taiwan, Denmark, Sudan, South Africa, Korea and America with a sample size of 16,961. The meta-analysis showed that adolescents attending schools with no smoking policies were 1.00 times more likely to smoke than those without smoking

policies at school (aOR=1.00; 95% CI= 0.65 to 1.54; p<0.001).

The forest plot also shows low heterogeneity of effect estimates between primary studies with I^2= 02% (p=0.99). Thus, the calculation of effect estimation is carried out using the fixed effect model approach.

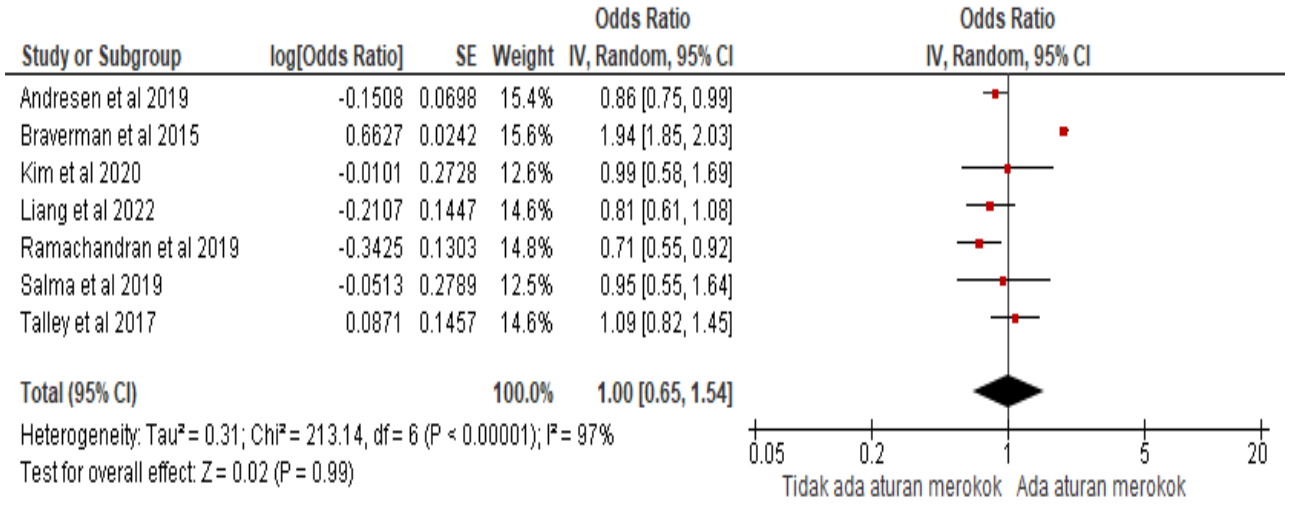

Figure 7. Forest plots of the influence of school smoking policies on smoking behavior in adolescents.

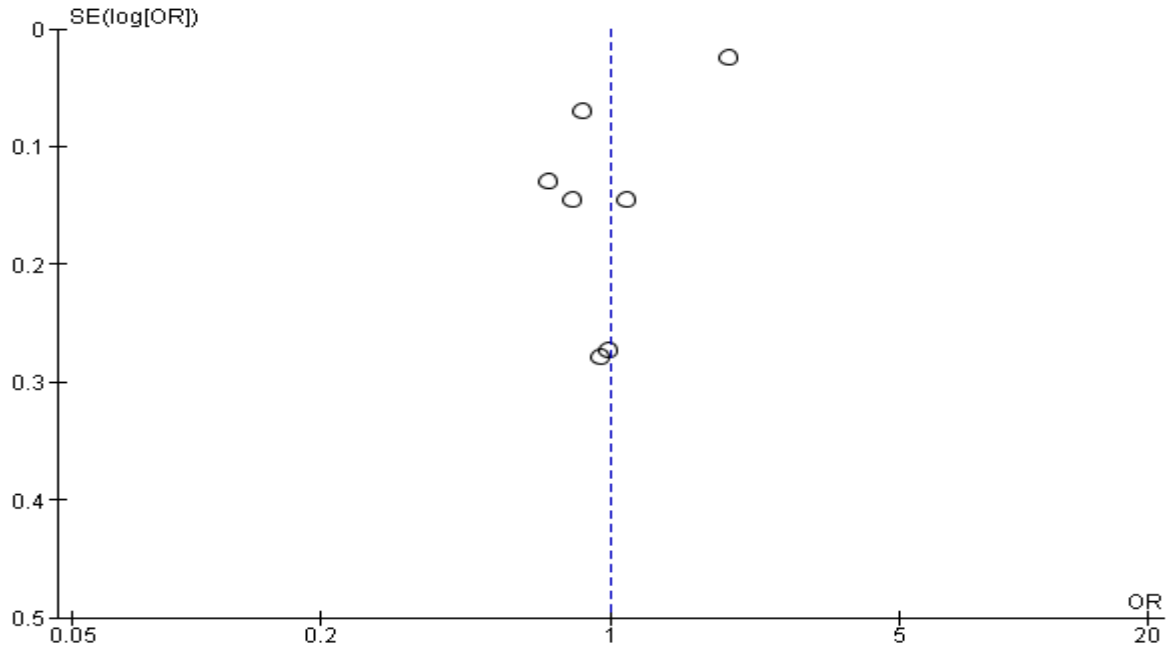

Figure 8. Funnel plots of the influence of school smoking policies on smoking behavior in adolescents.

The funnel plot in Figure 8 shows that the distribution of effect estimates between studies is less symmetrical, that is, the distribution of effect estimates to the right and left of the average vertical line of effect estimates is relatively the same. Thus, this funnel plot indicates that there is no publication bias.

DISCUSSION

1. The influence of peers on smoking behavior in adolescents

Peer influence plays an important role during adolescence, when new identities, friendships, and peer group affiliations are solidified and parental influence gradually diminishes. Peers have a profound effect on one another and can encourage the experimentation of risky behavior when there is normative pressure to do so. There is also substantial evidence that adolescents' use of tobacco and alcohol is strongly related to their use of friends (Huang et al., 2014).

Based on the results of this meta-analysis, it shows that there is a possibility to have a smoking habit 5.04 times compared to adolescents without peers who are smokers (aOR= 5.04; 95% CI= 3.23 to 7.87; p< 0.001). This study is supported by Skulberg et al. (2019) which showed that peer influence influences smoking behavior in adolescents (aOR= 5.20; 95% CI= 1.6 to 16.5; p< 0.001).

2. The influence of the family on smoking behavior in adolescents

Parental smoking can also increase the risk of a child's use of cigarettes through the child's school failure, psychological stress, or weak attachment to parents, as well as factors such as parents' low education or older sibling's use of cigarettes (Vuolo & Staff, 2013). Results of meta-analysis of 7 articles originating from America, Saudi Arabia, Turkey, Chile, South Africa, China. The sample size is 58,874. This meta-analysis showed that adolescents with family members who smoked were 2.04 times more likely to have a smoking habit than adolescents without family members who smoked which was statistically significant (aOR= 2.04; 95% CI= 1.45 to 2.87; p< 0.001).

This study is in line with a cross sectional study conducted by Liang et al. (2022) which reported that parental smoker are related to smoking behavior in adolescents (aOR= 1.65; 95% CI= 1.38 to 1.97).

3. The effect of school on smoking behavior in adolescents

The importance of schools addressing health promotion and risk factor prevention at the ward level has become a concern in recent years. Prevention of tobacco use among young people is one example. The introduction and enforcement of anti-tobacco policies in schools can in principle be considered a very promising prevention strategy. However, there is no consensus or prevailing view on the definition of a school tobacco policy or the effectiveness of the policy (Niederdeppe et al., 2018).

The results of the meta-analysis of 7 articles originating from Taiwan, Denmark, Sudan, South Africa, Korea, America. The sample size is 58,874. This meta-analysis showed that it was 1.00 times more likely for adolescents to have a smoking habit than schools with smoking policies that were not statistically significant (aOR= 1.00; 95% CI= 0.65 to 1.54; p< 0.001). This study is in line with Talley et al. (2017) which examined the student and school-level effects of student exposure to school anti-smoking education on cigarette use. It found that smoke-free schools increased the likelihood of non smoking behavior in students aged 13 to 15 years (aOR= 1.09; 95% CI= 0.820 to 1.45).

AUTHOR CONTRIBUTION

Anse Putra is the main researcher who selects topics, searches for and collects data, analyzes data, and writes research papers. Hanung Prasetya and Bhisma Murti as assistants in this study.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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