Effects of Peers and Family Members on Smoking Habits in Adolescents: A Meta-Analysis

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ABSTRACT

Background: Nowadays, smoking is one of the biggest public health problems worldwide. It is a major cause of disease and mortality that can be prevented early. One out of 10 deaths worldwide is caused by tobacco use. 40 million people died each year due to tobacco. Adolescents start smoking in response to social effects, imitating the behavior of friends, family members, and others they admire. This meta-analysis study aimed to analyze the effect of peers and family members who smoked on smoking habits in adolescents.

Subjects and Method: Meta-analysis was conducted by searching for articles from databases such as PubMed, SpringerLink, Elsevier, Science Direct, and Google Scholar. The keywords were "peers" OR "parenting style" OR "family influence" AND "smoking" AND "behavior" AND "adolescents" AND "cross-sectional". The inclusion criteria were full-text articles with a cross-sectional design, English and Indonesian languages, students aged 14-24 years as the study subjects. The final results of the study were presented using the adjusted odds ratio (aOR). The articles were analyzed using Revman 5.3 software.

Results: 17 articles were analyzed. The results showed that peers and family members increased smoking habits in adolescents; the result was statistically significant with peers (aOR= 2.77; 95% CI= 1.67 to 4.60; p<0.001; I²= 96%) and family members (aOR= 1.69; 95% CI= 1.35 to 2.13; p<0.001; I²= 65%).

Conclusion: Peers and family members affect smoking habits in adolescents. It is statistically significant.

Keywords: Peers, family members, smoking habits, adolescents, cross-sectional


BACKGROUND

Nowadays, smoking is one of the biggest public health problems worldwide. It is a major cause of disease and mortality that can be prevented early (Ball et al., 2018).

The World Health Organization (WHO) stated that more than 4 million deaths occurred in a year due to tobacco. It increased to 10 million deaths per year by 2020. In American States, 440,000 people died each year due to diseases caused by smoking. In addition, 5.6 million people lost potential lives, 82 billion people lost productivity, and 75 billion people were in direct medical costs (Reda et al, 2019).

In general, smoking occurs during adolescence which results in smoking behavior in adult life (Moor et al., 2015). Smoking behavior is an activity of burning cigarettes or tobacco, inhaling the smoke, exhaling it, and repeating it until the cigarette runs out (Riadinata, 2018).
According to the ecological systems theory, an understanding of individual behavior must consider the environmental system where the individual is embedded as each system includes roles, norms, and rules that affect one another, thus building adolescents development. Smoking in adolescents is strongly associated with psychosocial factors in the family, school, and peer groups. Peer networks play an important role in smoking behavior in adolescents (Simetin et al., 2011).

Currently, there are around 1.2 billion smokers worldwide, which is close to 20% of the world’s population in 2014 (World Cancer Report-WHO, 2014). The results of a study by the WHO Report On The Global Tobacco Epidemic 2011 found that smoking habits did not only occur in developed countries, but also in developing countries in the African continent and the Asian region (WHO, 2015).

1.2 billion smokers were currently found in several regions: Asia Pacific by 56%, Europe by 24%, USA by 11%, and Africa and the Middle East by 9%. 10% or 121 million of these smokers came from 10 countries in the Southeast Asia, thus making this region had the largest number of smokers in the Asia Pacific. It contributed 20% of the causes of global tobacco deaths (SEATCA, 2014). Among the 1 billion smokers worldwide, 50% were young people consumed 6 trillion cigarettes per year. In 2020, 7 out of 10 smoking deaths would occur in LMICs (low- and middle-income countries). If current trends continue, tobacco would kill more than 8 million people worldwide each year by 2030 (Aryal, 2014). Based on these data, the authors were interested in investigating the effects of peers and family members on smoking habits in adolescents.

### SUBJECTS AND METHOD

#### 1. Study Design

This study was a systematic review and a meta-analysis. This study used secondary data from previous study results. The articles were obtained from several databases including PubMed, SpringerLink, Elsevier, Science Direct, and Google Scholar. The keywords were "peers" OR "parenting style" OR "family influence" AND "smoking" AND "behavior" AND "adolescents" AND "cross-sectional".

#### 2. Inclusion Criteria

The inclusion criteria were full-text articles with a cross-sectional study design and using English and Indonesian languages. The study subjects were students aged 14-24 years. The final results of the study were presented using the adjusted odds ratio (aOR).

#### 3. Exclusion Criteria

The exclusion criteria were non-full-text articles, non-English articles, and published before 2000.

#### 4. Operational Definition of Variables

The article search was carried out by considering the eligibility criteria defined using the PICO model. The population of this study was adolescents. The intervention was peers and family members who smoked. The comparison was peers and family members who did not smoke. The outcomes were smoking habits.

**Peers** were people with a level of age and maturity that was about more or less the same, namely at the age of 12 and 13 years. **Family** was one of the first environments for a child or adolescent to get more knowledge before leaving the family circle. Family members consisted of father, mother, brother, and sister.

#### 5. Data Analysis

The data were processed using the Review Manager (RevMan 5.3). This study used a random-effect model.
RESULTS
The process of searching for articles through databases with journals is in Figure 1. The articles were obtained from 4 continents: Asia, Europe, America, and Africa.

1. The articles were obtained from 4 continents: Asia, Europe, America, and Africa.

Figure 1. PRISMA flow diagram
1. The effects of peers on smoking habits in adolescents

**a. Summary Source**

**Table 1. The description of the primary study included in the meta-analysis**

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Title</th>
<th>Country</th>
<th>Study design</th>
<th>Population and Sample</th>
<th>Intervention (I) and Comparison (C)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aryal et al. (2014)</td>
<td>Correlates of smoking susceptibility among adolescents in a peri-urban area of Nepal: A population-based-cross-sectional study in the Jhaukel-Duwakot health demographic surveillance site</td>
<td>Nepal</td>
<td>Cross-sectional</td>
<td>352 male and female respondents aged 14-16 years (n= 500)</td>
<td>I: Peers who smoked C: Peers who did not smoke</td>
<td>Peers affected smoking habits (it increased 2.45 times the susceptibility to smoke)</td>
</tr>
<tr>
<td>Backhouse et al. (2017)</td>
<td>Link between perceived smoking behaviour at school and student smoking status: A large survey among Italian adolescents</td>
<td>Italy</td>
<td>Cross-sectional</td>
<td>1.889 students aged 14-19 years (44% males and 56% females) (n= 1,889)</td>
<td>I: Peers who smoked C: Peers who did not smoke</td>
<td>Peers increased the susceptibility to smoke in adolescents</td>
</tr>
<tr>
<td>Gaffar et al. (2013)</td>
<td>Sociodemographic factors associated with tobacco smoking among intermediate ad secondary school students in Jazan Region of Saudi Arabia</td>
<td>Saudi Arabia</td>
<td>Cross-sectional</td>
<td>3,923 males and females aged 15-19 years (n= 4,100)</td>
<td>I: Peers who smoked C: Peers who did not smoke</td>
<td>Peers increased the prevalence of smoking habits (males; 19.1% and female 4.7%)</td>
</tr>
<tr>
<td>Hock et al. (2014)</td>
<td>Prevalence and factors associated with smoking intentions among non-smoking and smoking adolescents in Kota Tinggi, Johor, Malaysia</td>
<td>Malaysia</td>
<td>Cross-sectional</td>
<td>2.300 high school students aged 13-16 years</td>
<td>I: Best friends or peers who smoked C: Best friends or peers who did not smoke</td>
<td>Best friends or peers who smoked affected smoking habits</td>
</tr>
<tr>
<td>Huang et al. (2012)</td>
<td>Analysis of influential factors associated with the smoking behavior of Aboriginal school children in remote Taiwanese mountainous areas</td>
<td>Taiwan</td>
<td>Cross-sectional</td>
<td>630 males and 609 females of high school students aged ≥14 years (n= 1,239)</td>
<td>I: Peers or best friends who smoked C: Peers or best friends who did not smoke</td>
<td>Peers/best friends are a greater predictor of smoking habits in adolescents</td>
</tr>
<tr>
<td>Leatherdale et al. (2010)</td>
<td>The influence of friends, family, and older peers on smoking among elementary school students: Low risk students in high-risk schools</td>
<td>Canada</td>
<td>Cross-sectional</td>
<td>4,286 students in the 6th and 7th grade of 57 primary schools aged ≥12 years</td>
<td>I: Peers who smoked C: Peers who did not smoke</td>
<td>Peers who smoked significantly increased smoking habits in adolescents</td>
</tr>
<tr>
<td>Lim et al. (2020)</td>
<td>Smoking among school-going adolescents in selected secondary school in Peninsular Malaysia-Finding from the Malaysian adolescents health risk behaviour</td>
<td>Malaysia</td>
<td>Cross-sectional</td>
<td>2,991 high school students aged 16-17 years</td>
<td>I: Peers who smoked C: Peers who did not smoke</td>
<td>Peers increased smoking habits in adolescents. The prevalence of</td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Design</td>
<td>Sample Description</td>
<td>Comparison</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<td>-------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moor et al. (2015)</td>
<td>Europe</td>
<td>Cross-sectional</td>
<td>52,907 students aged 15 years from 35 countries in Europe dan South America</td>
<td>I: Peers who smoked C: Peers who did not smoke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purnaningrum et al. (2017)</td>
<td>Indonesia</td>
<td>Cross-sectional</td>
<td>100 adolescents aged 14-24 years</td>
<td>I: Peers group who smoked C: Peers group who did not smoke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reda et al. (2012)</td>
<td>Ethiopia</td>
<td>Cross-sectional</td>
<td>1,721 school-age children aged 13-19 years (n= 1,890)</td>
<td>I: Peers who smoked C: Peers who did not smoke</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Peers increased smoking habits by 100% in males and 81% in females. Peers group with high smoking habits would increase smoking habits among adolescents. Peers who smoked were important determinants of smoking behavior and habits in adolescents (32.4%), the prevalence was 11.8% in males and 1.1% in females. 41.0% of peers who smoked affected smoking habits in adolescents. 40% of peers who smoked affected smoking habits in adolescents.
b. Forest Plot

The interpretation of the results from the meta-analysis process can be seen through a forest plot. Figure 3 shows that peers who smoked 2.77 times significantly increased smoking habits in adolescents (aOR=2.77; 95% CI=1.67 to 4.60; p<0.001; I²=96%). Therefore, the distribution of data was heterogeneous (random-effect model).

c. Funnel Plot

Based on figure 4, there was no publication bias indicated by the symmetrical plots on the right and left, where 7 plots were on the right and 5 plots were on the left. The plot on the left of the graph had a standard error between 0 and 0.5. Besides, the plot on the right had a standard error between 0 and 0.5.
2. The effects of family members on smoking habits in adolescents

a. Summary Source

Table 2. The description of the primary study included in the meta-analysis

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Title</th>
<th>Country</th>
<th>Study design</th>
<th>Population and sample</th>
<th>Intervention (I) and Comparison (C)</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| Alves et al. (2016) | The role of parental smoking on adolescents and its social patterning: A cross-sectional survey in six European cities | Europe        | Cross-sectional | 11,015 male and female students as the respondents aged 14-16 years                    | I: Family members (parents) who smoked  
C: Family members (parents) who did not smoke                                                                 | The prevalence of parents who smoked was higher occurred in adolescents with low socioeconomic status |
| Bakhruji et al. (2017) | Carious lesions of permanent molars and oral health practices of parents and peers in Saudi male adolescents | Saudi Arabia  | Cross-sectional | 294 students aged 12-15 years                                                          | I: Family members who smoked  
C: Family members who did not smoke                                                                 | Family members increased the susceptibility to smoke in adolescents |
| Hashmi et al. (2014) | Family and peer effect on young and adolescent smoking in Bangladesh | Bangladesh    | Cross-sectional | 995 male students aged 10-24 years                                                      | I: Family members who smoked  
C: Family members who did not smoke                                                                 | 45% of adolescents were more susceptible to smoke if there were family members who smoked Family members who smoked affected smoking habits |
| Hock et al. (2014)  | Prevalence and factors associated with smoking intentions among non-smoking and smoking adolescents in Kota Tinggi, Johor, Malaysia | Malaysia      | Cross-sectional | 2,300 high school students aged 13-16 years                                             | I: Family members who smoked  
C: Family members who did not smoke                                                                 | Family members who smoked were a stronger predictor of smoking habits in adolescents |
| Huang et al. (2012) | Analysis of influential factors associated with the smoking behavior of Aboriginal school children in remote Taiwanese mountainous areas | Taiwan       | Cross-sectional | 630 males and 609 females of school-age children aged ±14 years (n=1,239)               | I: Family members who smoked  
C: Family members who did not smoke                                                                 | Family members (parents) who smoked affected smoking habits in adolescents |
| Lehtren et al. (2020) | School achievement and oral health behaviour among adolescents in Finland: A national survey | Finland       | Cross-sectional | 45,877 students aged 14-20 years                                                        | I: Family members (parents) who smoked  
C: Family members (parents) who did not smoke                                                                 | Family members (parents) who smoked affected smoking habits in adolescents |
| Li et al. (2020)    | Prevalence of Smoking and Its Associated Risk Factors Among Secondary School Students in Kelantan, Malaysia | Malaysia      | Cross-sectional | 1,500 male and females students aged 13-17 years                                         | I: Family members who smoked  
C: Family members who did not smoke                                                                 | Family members who smoked affected smoking habits in adolescents |
<table>
<thead>
<tr>
<th>Study Authors</th>
<th>Study Title</th>
<th>Country</th>
<th>Study Design</th>
<th>Sample Size</th>
<th>Study Population</th>
<th>I: Family members who smoked (parents who smoked and/or parents who smoked)</th>
<th>C: Family members who did not smoke</th>
<th>Family members who smoked (parents who smoked and or a parent who smoked) increased smoking habits in adolescents. The prevalence of smoking was 14.6% in males and 1.1% in females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lim et al. (2020)</td>
<td>Smoking among school-going adolescents in Peninsular Malaysia-Finding From the Malaysian adolescents health risk behaviour (MyaHRB) Study</td>
<td>Malaysia</td>
<td>Cross-sectional</td>
<td>2,991</td>
<td>High school students aged 16-17 years</td>
<td>I: Family members who smoked (parents who smoked and or a parent who smoked)</td>
<td>C: Family members who did not smoke</td>
<td></td>
</tr>
<tr>
<td>Reda et al. (2012)</td>
<td>Determinants of cigarette smoking among school adolescents in Eastern Ethiopia: A Cross-Sectional Study</td>
<td>Ethiopia</td>
<td>Cross-sectional</td>
<td>1,721</td>
<td>Adolescents aged 13-19 years (n= 1,890)</td>
<td>I: Family members who smoked</td>
<td>C: Family members who did not smoke</td>
<td></td>
</tr>
</tbody>
</table>
b. Forest Plot

The interpretation of the results from the meta-analysis process can be seen through a forest plot. Figure 5 shows that family members who smoked 1.69 times significantly increased smoking habits in adolescents (aOR= 1.69; 95% CI= 1.35 to 2.13; p<0.001; I²= 65%). Therefore, the distribution of data was heterogeneous (random-effect model).

c. Funnel Plot

Based on figure 4, there was no publication bias indicated by the symmetrical plots on the right and left, where 6 plots were on the right and 3 plots were on the left. The plot on the left of the graph had a standard error between 0 and 0.1. Besides, the plot on the right had a standard error between 0 and 0.8.

Figure 5. The effects of family members on smoking habits in adolescents

Figure 6. The funnel plot of the effects of family members on smoking habits in adolescents
Most of the statistical results reported were problems (data duplication) (Murti, 2018). This systematic study and meta-analysis study used a study that controlled for confounding factors. Therefore, the relationship or effect of exposure to the occurrence of disease estimated by the study was not the same as the relationship or effect that occurred in the target population, which means that the study result was invalid (incorrect) (Murti, 2018). This systematic and meta-analysis study used a study that controlled for confounding factors. It was shown from the inclusion criteria, namely multivariate analysis. The
The statistical result was in the form of the adjusted odd ratio (aOR).

Estimates of the combined effect of peers and family members on smoking habits in adolescents were processed using the RevMan 5.3 application with the generic inverse-variance method. The results of the systematic study and meta-analysis were in the form of a forest plot and a funnel plot. The forest plot showed visually the variation in heterogeneity (Akobeng, 2005 in Murti, 2018). The funnel plot showed the relationship between the effect size of the study and the sample size of the various studies examined which could be measured in many different ways (Murti, 2018).

The effect of peers on smoking habits in adolescents
There were 12 articles of observational study with a cross-sectional design as a source of a meta-analysis of the effects of peers on smoking habits in adolescents. The result of the forest plot of the articles showed that peers who smoked 2.77 times increased smoking habits in adolescents; it was statistically significant (aOR=2.77; 95%CI=1.67 to 4.60; p <0.001; I²=96%).

This is in line with a study conducted by Aho et al. (2018), who conducted a survey in the spring of 2013 involving 34,776 secondary school students in Finland, that having close friends or peers of male and female who smoked increased smoking behavior in adolescents (37% of women and 36% of men smoked every day).

Based on a study conducted by Smet et al. (2020) in Semarang, Indonesia, with a total sample of 6,276 middle-school students aged 11-17 years which aimed to determine the type of cigarette, the prevalence, and determinants of smoking behavior among adolescents showed that family members and peers who smoked increased significantly from 8.2% to 38.7%.

Based on another study conducted by Balogun et al. (2020) in the Ibadan Utara area, Nigeria, with a total sample of 240 Public-Middle-School students aged 15-24 years showed that the involvement of parents who smoked and peer pressure who smoked increased smoking habits among adolescents (p > 0.001).

Nakaseko et al. (2020) conducted a study among adolescents in the Republic of Vanuatu with a sample of 157 students in 7th and 8th grade with a mean age of 13.3 years. It showed that parents, siblings, and peers who smoked increased significantly the smoking habit in adolescents in the Republic of Vanuatu (p < 0.05).

The effect of family members on smoking habits in adolescents
There were 8 articles of observational study with a cross-sectional design as a source of a meta-analysis of the effects of family members on smoking habits in adolescents. The result of the forest plot of the articles showed that family members who smoked 1.69 times increased smoking habits in adolescents; it was statistically significant (aOR=1.69; 95% CI= 1.35 to 2.13; p <0.001; I²= 65%).

This is in line with a study conducted by Balogun et al. (2019) that the involvement of parents who smoked and the parenting patterns of parents who smoked significantly affected attitudes towards smoking. Therefore, adolescents with smoking parents had the most positive tendency to smoke.

According to a study conducted by Skullberg et al. (2019) in Weh Island, Indonesia, having siblings and parents who smoked increased the risk factors for smoking in adolescents. More than a third of boys in the 13-15 year-age group were found to smoke. This is in line with a study conducted by Huang et al. (2012) that
family members increased the risk factors for smoking in adolescents.

Based on a study conducted by Gaffar et al. (2013), parents who smoked had a very high effect on the risk factors for smoking in adolescents. Another study conducted by Li et al. (2020) showed that the prevalence of males who smoked was significantly higher than females. This is supported by at least one of the parents who smoked.

According to Smet et al. (2020), children aged 11-15 years old were more susceptible to smoke. At 17 years of age, smoking behavior in adolescents has not only increased significantly but it would continue in their lifestyle, thus making them more difficult to quit smoking. However, the effects of the family who smoked with the risk of smoking uptake and its consequences for future health were aspects that have not been systematically reviewed and measured (Bee, 2011).

Based on a meta-analysis of 12 cross-sectional studies of the effects of peers on smoking habits in adolescents, peers who smoked 2.77 times increased smoking habits in adolescents; it was statistically significant (aOR=2.77; 95%CI=1.67 to 4.60; p<0.001; I²=96%).

Based on a meta-analysis of 8 articles of the effect of family members on smoking habits in adolescents, family members who smoked 1.69 times increased smoking habits in adolescents; it was statistically significant (aOR=1.69; 95%CI=1.35 to 2.13; p<0.001; I²=65%).

This study was conducted by combining previous studies obtained from 17 primary studies conducted in several countries including Nepal, Italy, Saudi Arabia, Malaysia, Taiwan, Canada, Europe, Indonesia, Ethiopia, Bangladesh, and Finland.

**AUTHOR CONTRIBUTION**
Florida was the main researcher who selected the topic, searched, and collected the data. Agus Kristiyanto and Bhisma Murti played a role in analyzing the data and reviewing the documents.

**CONFLICT OF INTEREST**
This study did not have any conflict of interest.

**FUNDING AND SPONSORSHIP**
This study used personal funds from the main researcher.

**ACKNOWLEDGEMENT**
We would like to thank the database provider such as PubMed, SpringerLink, Elsevier, Science Direct dan Google Scholar.

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