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Family-Based Interventions for Tobacco Cessation Among Adolescents: A Systematic Review of Effectiveness and Practical Implications

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Abstract **Background:** Tobacco use remains a major public health concern, contributing to approximately five million deaths annually, with projections rising to eight million by 2030. Family-based interventions have shown promise in reducing adolescent tobacco use by improving parental communication and setting household restrictions. **Aim:** This systematic review evaluates the effectiveness of family-based tobacco cessation interventions for children and adolescents, focusing on behavioral strategies and parental influence. **Methodology:** A systematic review was conducted using PubMed, Cochrane, Google Scholar, Lilac and Web of Science databases. Randomized controlled trials (RCTs) assessing the impact of family interventions on adolescent tobacco cessation were included. The RoB 2 and Robvis tools were used to assess the risk of bias. **Results:** Out of 984 identified studies, five RCTs met the inclusion criteria after duplicates and irrelevant articles were excluded. Family-based interventions were found to improve parent-child communication, enhance family bonding and reduce adolescent tobacco initiation rates. Interventions that involved active parental engagement, household smoking restrictions and behavioral counseling yielded better outcomes. While some interventions showed delayed effects, those tailored to individual family dynamics demonstrated greater long-term success. Studies indicated that cultural factors, family involvement intensity and parental smoking status influenced outcomes. The overall risk of bias across included studies was moderate. **Conclusions:** Family-based interventions are effective in promoting adolescent tobacco cessation by fostering communication, setting behavioral boundaries and strengthening family support. Future research should focus on developing culturally adaptable strategies and improving implementation frameworks for enhanced real-world impact.

Key Words Family-based Intervention, Adolescent Tobacco Cessation, Parental Influence, Behavioral Strategies, Smoking Prevention

INTRODUCTION

Tobacco use is a major public health concern, contributing to approximately five million fatalities annually, with this figure projected to rise to eight million by 2030, making it one of the leading causes of preventable death worldwide. The rising prevalence of smoking among teenagers has become a significant concern, with many adolescents experimenting with tobacco out of curiosity, peer influence, or an adventurous attitude, often resulting in addiction [1]. Despite global efforts to curb tobacco consumption, the increasing trend of adolescent tobacco use underscores the need for targeted prevention strategies to reduce the burden of tobacco-related illnesses [2,3].

Parental behavior has been consistently identified as a significant factor influencing adolescent tobacco use. Research embedded in the Hutchinson Smoking Prevention Project revealed that children of nonsmoking parents were least likely to start smoking, while children of parents who quit smoking had a 39% lower chance of smoking themselves [4,5]. Studies have shown that parental verbal disapproval of tobacco use and clear communication about its risks can play a protective role for adolescents [6]. Household

smoking restrictions and parenting styles are also influential. Authoritative parenting, characterized by structure and behavioral management, was found to discourage adolescent tobacco experimentation, whereas permissive parenting increased the likelihood of tobacco initiation [7].

Tobacco smoke exposes users to over 7,000 chemicals, with approximately 250 identified as harmful and nearly 69 recognized as carcinogenic. It has been well-established that smoking adversely impacts nearly every organ in the body, contributing significantly to the progression of respiratory and cardiovascular diseases [8]. For this, family-based interventions have emerged as a promising approach to addressing adolescent tobacco use. The adaptive intervention framework is particularly effective, as it customizes interventions to suit the unique communication styles, behavioral patterns and support needs of individual families. Unlike traditional intervention models that offer uniform strategies for all participants, adaptive interventions dynamically adjust targets and dosages to align with specific family dynamics, maximizing intervention effectiveness [9].

However, individual family dynamics can complicate the effectiveness of these interventions. Media influences, such as tobacco portrayals in films and advertisements, have been shown to increase adolescent curiosity about smoking and reduce their confidence in refusing tobacco when influenced by friends [10]. While household smoking restrictions are beneficial, their protective effect can be diminished by peer pressure or social environments where tobacco use is normalized. This highlights the complexity of designing family-based interventions that effectively mitigate external influences.

Given these factors, this systematic review aims to evaluate the effectiveness of family-based tobacco cessation interventions in reducing adolescent tobacco use. By analyzing the role of family communication, parenting strategies and household regulations, this review seeks to provide insights into developing practical and culturally adaptable interventions that can address the ongoing rise in adolescent tobacco consumption.

METHODS

Aim

The aim of this systematic review is to investigate the effectiveness of family-based tobacco cessation interventions among children and adolescents.

Structured Question

Is family-based tobacco cessation intervention effective among children and adolescents compared to other interventions?

Protocol and Registration

The systematic review follows PRISMA guidelines and the Preferred Reporting Items for Systematic Reviews guidelines. (PROSPERO registration no: CRD42024514092). The risk of bias was assessed using Cochrane risk of bias (RoB 2 and Robvis).

PICO Analysis

- **Population:** Children and adolescents (9-18 years) with tobacco usage
- **Intervention:** Family communication intervention in tobacco cessation
- **Comparison:** Alternative interventions in tobacco cessation
- **Outcome:** Abstinence from tobacco use

Inclusion Criteria

Studies were included if they:

- Followed the PICO Criteria
- Were clinical trials or randomized controlled trials (RCTs) assessing the effectiveness of family communication in adolescent tobacco cessation
- Included literature published in English or other languages

Exclusion Criteria

- Review articles and non-RCT studies were excluded
- Studies that lacked details on family intervention strategies were excluded

Data Sources

The search strategy involved five major databases: PubMed, Cochrane Database, Google Scholar, Web of Science and Lilac. Manual searches and screening of reference lists were conducted to identify additional relevant studies. Grey literature was also explored to minimize publication bias.

Search terms

((((Teen smoking) OR (Adolescent tobacco use) OR (Youth smoking) OR (Teenage smokers) OR (Tobacco initiation) OR (Nicotine addiction teens) OR (Hookah Teenagers) OR (Chillum) OR (Pipe smoking) OR (Pan chewing teenagers) OR (E- Cigarettes) OR (Dry snuff teenagers) OR (Hans teenagers) OR (Khaini teenagers) OR (Gutka youth) OR (Madhu teens)) AND ((Quitting tobacco family) OR (Family-based intervention tobacco) OR (Communication strategies tobacco) OR (Supportive family environment tobacco) OR (Tobacco cessation programs families) OR (Family intervention tobacco) OR (Tobacco cessation families) OR (Home based interventions tobacco))) AND ((Anti-smoking campaigns) OR (Tobacco control messages) OR (Public health communication) OR (Mass media interventions tobacco) OR (tobacco use counseling) Or (Individual counseling) Or (Group therapy tobacco use) OR (Media Advocacy tobacco))) AND ((Smoking cessation) OR (Tobacco abstinence) OR (Nicotine withdrawal) OR (Quitting smoking) OR (Smoke-free lifestyle) OR (Tobacco Withdrawal)) (Fig. 1-6).

			lifestyle) OR (Tobacco Withdrawal)) Filters: Randomized Controlled Trial		
#5	---	>	Search: ((((Teen smoking) OR (Adolescent tobacco use) OR (Youth smoking) OR (Teenage smokers) OR (Tobacco initiation) OR (Nicotine addiction teens) OR (Hookah Teenagers) OR (Chillum) OR (Pipe smoking) OR (Pan chewing teenagers) OR (E- Cigarettes) OR (Dry snuf teenagers) OR (Hans teenagers) OR (Khaini teenagers) OR (Gutka youth) OR (Madhu teens)) AND ((Quitting tobacco family) OR (Family-based intervention tobacco) OR (Communication strategies tobacco) OR (Supportive family environment tobacco) OR (Tobacco cessation programs families) OR (Family intervention tobacco) OR (Tobacco cessation families) OR (Home based interventions tobacco))) AND ((Anti-smoking campaigns) OR (Tobacco control messages) OR (Public health communication) OR (Mass media interventions tobacco) OR (tobacco use counseling) Or (Individual counseling) Or (Group therapy tobacco use) OR (Media Advocacy tobacco))) AND ((Smoking cessation) OR (Tobacco abstinence) OR (Nicotine withdrawal) OR (Quitting smoking) OR (Smoke-free lifestyle) OR (Tobacco Withdrawal))	27	06:46:14
#4	---	>	Search: (Smoking cessation) OR (Tobacco abstinence) OR (Nicotine withdrawal) OR (Quitting smoking) OR (Smoke-free lifestyle) OR (Tobacco Withdrawal)	55,562	06:45:45
#3	---	>	Search: (Anti-smoking campaigns) OR (Tobacco control messages) OR (Public health communication) OR (Mass media interventions tobacco) OR (tobacco use counseling) Or (Individual counseling) Or (Group therapy tobacco use) OR (Media Advocacy tobacco)	666	06:45:23
#2	---	>	Search: (Quitting tobacco family) OR (Family-based intervention tobacco) OR (Communication strategies tobacco) OR (Supportive family environment tobacco) OR (Tobacco cessation programs families) OR (Family intervention tobacco) OR (Tobacco cessation families) OR (Home based interventions tobacco)	11,728	06:45:04
#1	---	>	Search: (Teen smoking) OR (Adolescent tobacco use) OR (Youth smoking) OR (Teenage smokers) OR (Tobacco initiation) OR (Nicotine addiction teens) OR (Hookah Teenagers) OR (Chillum) OR (Pipe smoking) OR (Pan chewing teenagers) OR (E- Cigarettes) OR (Dry snuf teenagers) OR (Hans teenagers) OR (Khaini teenagers) OR (Gutka youth) OR (Madhu teens)	85,849	06:44:42

Figure 1: Pubmed search

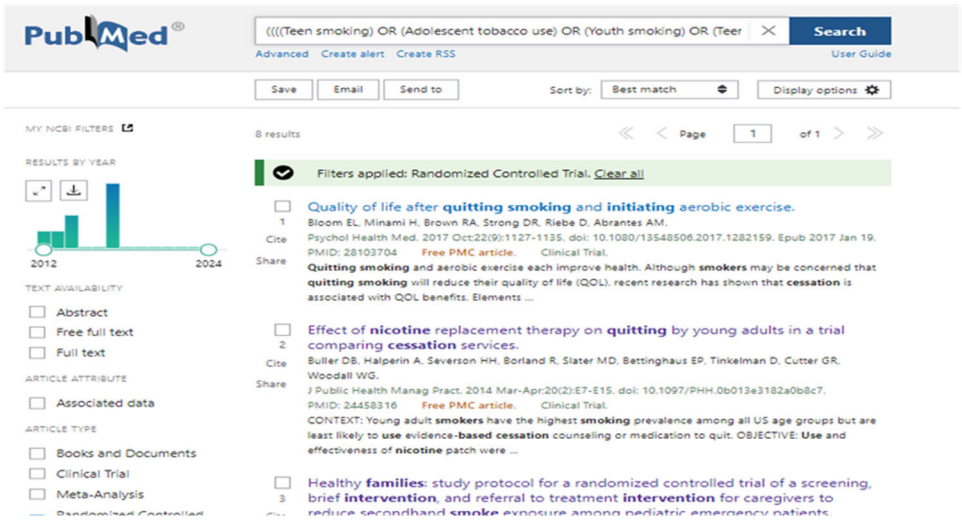

Figure 2: Pubmed search

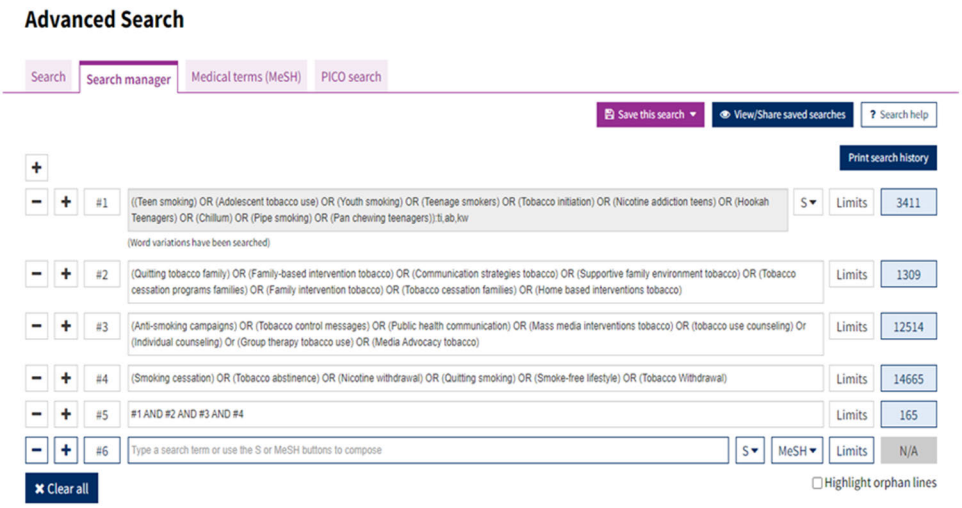

Figure 3: Cochrane search

Figure 4: Cochrane search

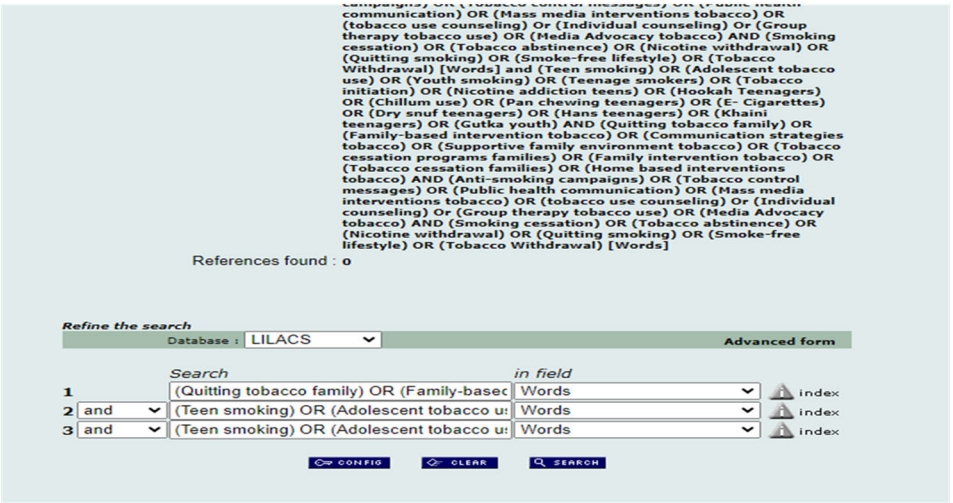

Figure 5: Lilacs

Figure 6: Web of science

Table 1: Data extraction table

S. no.	Author and Journal	Study Setting	Groups	Study Design	No of Participants	Age group	Operators and examiners	Conclusion
1.	Fang *et al.* [11]	United States	I- Family-based prevention program for substance use II – Control	Randomized control trial	98	10 – 14 years	Community agency staff members and focus groups	Mother-daughter dyads who received the intervention had stronger parent child closeness and better parent-child communication at follow-up than those who did not receive the intervention
2.	Fosco *et al.* [12]	Asia	I – Family based prevention II – Control	Randomized control trial	593	6^{th}-8^{th} grade	The Family Check-Up (FCU)	Family-centered intervention model that can be implemented with reasonable efficiency and long-lasting effects
3.	Bauman *et al.* [13]	United states	I - received a family-directed program featuring mailed booklets and telephone contacts by health educators II - Control	Randomized control trial	2395	12-14 year	Health educators	The family-directed program was associated with reduced smoking onset for non-Hispanic Whites, suggesting that it is worthy of further application, development and evaluation
4.	Hiemstra *et al.* [14]	Elementary schools, Netherlands	I - five activity modules, including a communication sheet for mothers, by mail at four-week intervals and one booster module one year after baseline II – Fact based intervention	Randomized control trial	1478	9-11 years old	Trained Master students	The study showed no effects of the home-based smoking prevention program 'Smoke-free Kids' on smoking initiation during adolescence
5.	Hiemstra *et al.* [15]	Netherlands	I - five activity modules, including a communication sheet for mothers, by mail at four-week intervals II – Fact based programs	Randomized control trial	1478	9-11 years	Trained Master students	It was found that mothers in the intervention condition were less positive towards smoking as compared to those in the control condition

Data Extraction

Two independent reviewers extracted data using a structured data extraction form. Extracted details included author information, journal, study setting, groups, sample size, age range and conclusions. Discrepancies were resolved through discussion.

Prisma Flowchart

A Prisma flowchart (Figure 7), was used for identification, screening, eligibility, inclusion and exclusion of the articles. It was used to track down the number of studies identified through database searches, how many were excluded or deemed irrelevant at each stage and ultimately, how many studies were included in the final analysis.

Using the keywords in an electronic search databases PubMed (8), Cochrane (138), Web of Science (238), Google scholar (600) and Lilac (0) which yielded a total of 984 articles. Out of 984, 220 were duplicate records and were removed. The studies were narrowed down to 5 by excluding the duplication, different intervention groups and different study settings. About 5 articles were selected based on eligibility criteria.

Using the RoB 2 tool, the risk of bias was assessed. Five RCTs were assessed for the risk of bias. Fang *et al.* [11] and Fosco *et al.* [12] and Bauman *et al.* [13], showed a low risk of bias where as Hiemstra *et al.* [14,15] showed moderate risk of bias (Figure 8a).

Quality Assessment and Level of Evidence

The RoB 2 and Robvis tools were used to assess the risk of bias. Studies were further classified using the Oxford Centre for Evidence-Based Medicine (2009) framework (Table 1).

RESULTS

Risk of Bias

The RoB 2 tool was utilized to assess the risk of bias across the included studies. Among the five RCTs assessed, studies by Fang *et al.* [11], Fosco *et al* [12] and Bauman *et al.* [13] demonstrated a low risk of bias, indicating strong methodological rigor and reliable outcomes. Conversely, studies by Hiemstra *et al.* [14] and Hiemstra *et al.* [15] were identified as having a moderate risk of bias, suggesting a need for cautious interpretation of their findings (Figure 8b).

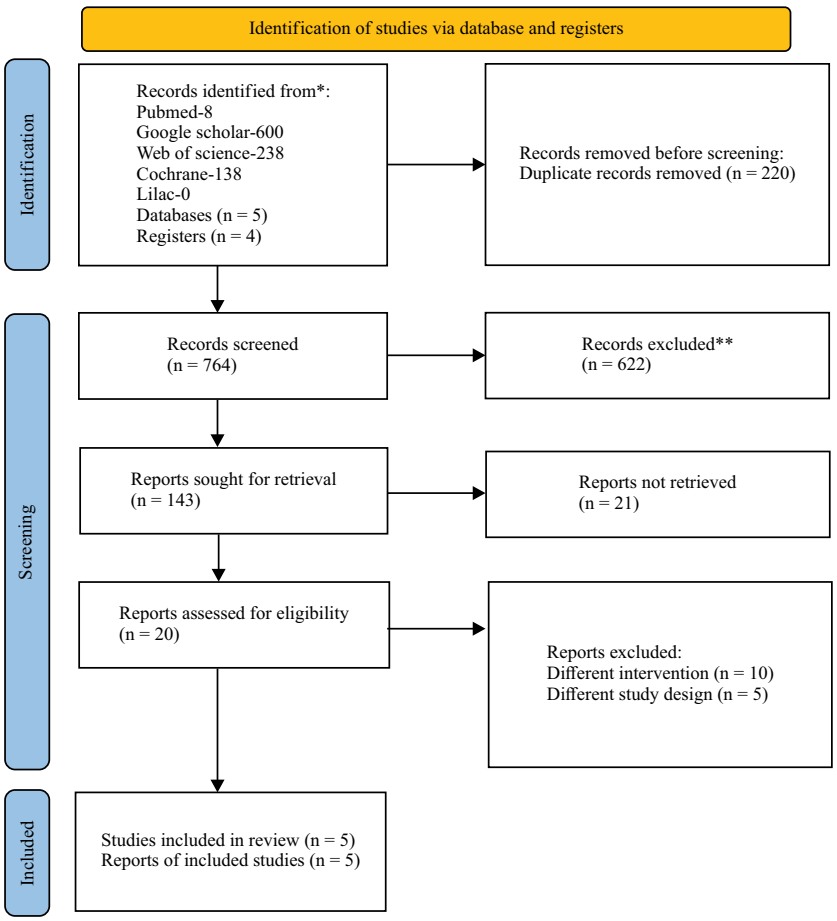

Figure 7: Prisma flowchart

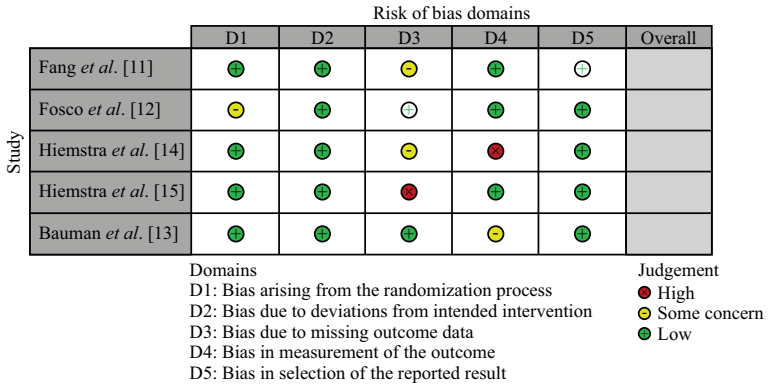

Figure 8a: Risk of Bias of the selected studies using Rob 2 tool and Robvis tool

Study	D1	D2	D3	D4	D5	Overall
Fang *et al*. [11]	Low	Low	Some concern	Low	Low	Low
Fosco *et al*. [12]	Some concern	Low	Low	Low	Low	Low
Hiemstra *et al*. [14]	Low	Low	Some concern	High	Low	Some concern
Hiemstra *et al*. [15]	Low	Low	High	Low	Low	Some concern
Bauman *et al*. [13]	Low	Low	Low	Some concern	Low	Low

Figure 8b: Risk of Bias of the selected studies using Rob 2 tool and Robvis tool

Table 2: Level of evidence of the selected studies

Si. No.	Author & year	Study design	Level of evidence
1	Fang *et al.* [11]	Randomized control trial	3
2	Fosco *et al.* [12]	Randomized control trial	3
3	Bauman *et al.* [13]	Randomized control trial	3
4	Hiemstra *et al.* [14]	Randomized control trial	3
5	Hiemstra *et al.* [15]	Randomized control trial	3

Study Outcomes

The study by Fang *et al.* [11] evaluated a family-based intervention designed to improve mother-daughter relationships. The intervention group demonstrated stronger emotional closeness and improved parent-child communication compared to the control group. Additionally, mothers in the intervention group reported setting more rules and conditions regarding tobacco use than those in the control group. The strengthened family relationship fostered by the intervention was linked to a notable reduction in adolescent tobacco use. The study concluded that fostering improved parent-child dynamics through structured family interventions can significantly support adolescent tobacco cessation (Table 2).

The study by Fosco *et al.* [12] investigated the impact of the Family Check-Up (FCU), a school-based family intervention aimed at improving self-regulation and reducing behavioral risks. The intervention targeted students from 6th to 7th grade and was found to significantly improve self-regulation skills while reducing antisocial behavior and substance use, including tobacco. By the time participants reached 8th grade, students in the intervention group reported notably lower rates of tobacco use. This study highlighted the importance of early intervention in establishing healthier behavioral patterns among adolescents (Table 2).

The study by Hiemstra *et al.* [14] evaluated the effectiveness of a family-based intervention administered to younger children to develop positive habits before adolescence. However, the intervention showed no significant impact on tobacco cessation in this younger age group. The authors suggested that the lack of immediate behavioral changes may indicate the limited influence of early intervention in preventing long-term tobacco use. The study recommended targeting adolescents closer to their teenage years to achieve better outcomes (Table 2).

The study by Hiemstra *et al.* [15] acknowledged potential delays in the effectiveness of family-based interventions for tobacco cessation. While no immediate impact was observed, the authors proposed that positive effects may emerge over time as children transition into adolescence. This study emphasized the need for extended follow-up periods to better assess long-term intervention effectiveness (Table 2).

Bauman *et al.* [13] evaluated the family matters program, a family-directed intervention that involved mailed booklets

and telephone support from health educators, demonstrated a significant reduction in smoking initiation among non-Hispanic Whites. However, the intervention did not significantly affect the initiation of smokeless tobacco or alcohol use. The authors acknowledged that the program's success was limited to certain racial/ethnic groups, emphasizing the need for culturally tailored strategies to enhance intervention outcomes across diverse populations (Table 2).

Summary of Findings

Overall, the included studies indicate that family-based interventions play a critical role in promoting adolescent tobacco cessation. Interventions that emphasized parent-child communication, structured parental involvement and emotional bonding demonstrated the most significant positive outcomes. Notably, interventions targeting adolescents closer to their teenage years appeared to yield better results than those focusing on younger children. Moreover, cultural factors and the intensity of parental engagement influenced intervention success. Future research should focus on developing culturally adaptable strategies, enhancing long-term follow-up and exploring ways to improve intervention effectiveness across diverse family structures.

DISCUSSION

Tobacco use among adolescents and children presents a significant public health concern, underscoring the urgent need for effective intervention strategies. This systematic review highlights the role of family-based interventions in promoting tobacco cessation by fostering improved communication, building trust and creating supportive home environments. Although a meta-analysis was not conducted due to the heterogeneity of the included studies, the findings provide valuable insights into the positive impact of family engagement on adolescent tobacco cessation efforts.

Effective family communication has been shown to play a pivotal role in influencing adolescent behavior. Families that adopt a non-judgmental, understanding approach create a safe space where adolescents feel encouraged to discuss their struggles and progress in the cessation process. Establishing clear rules and expectations regarding tobacco use further reinforces family support, promoting accountability and healthier decision-making among adolescents [16,17].

The included studies demonstrate that family-based interventions were particularly effective in enhancing parent-child communication and improving follow-up adherence. This improved engagement not only contributed to tobacco cessation success but also resulted in notable reductions in antisocial behaviors among teenagers in school settings [18,19]. These broader social and behavioral improvements highlight the dual benefit of family interventions, fostering both tobacco cessation and improved adolescent well-being.

Notably, family-based interventions demonstrated greater effectiveness in teenagers compared to children aged 10-11 years, likely because older adolescents are more cognitively equipped to understand the risks of tobacco use and actively participate in cessation strategies. Consequently, intervention strategies tailored to teenagers appeared to yield more promising outcomes than those targeting younger children [20].

However, the success of these interventions varied across different racial and ethnic groups. One study reported improved outcomes primarily among non-Hispanic Whites, while results were less effective in other racial/ethnic populations. This discrepancy emphasizes the need for culturally tailored interventions that account for diverse family values, communication styles and social influences [21,22]. Developing adaptable intervention models that reflect the cultural norms and environmental contexts of different populations will improve the overall success of family-centered strategies.

For optimal results, personalizing intervention strategies to align with each family's dynamics is crucial. Effective programs should consider factors such as family structure, communication preferences and cultural background to ensure interventions are accessible and engaging. Additionally, recognizing a family's readiness for change and incorporating collaborative goal-setting can further improve intervention outcomes. Regular follow-ups are equally vital, allowing intervention strategies to be adjusted based on the family's progress and changing needs [23-25].

CONCLUSION

Family communication has proven to be a valuable tool in promoting adolescent tobacco cessation by fostering trust, enhancing awareness and creating a supportive environment. Effective interventions should be tailored to accommodate the unique dynamics, cultural backgrounds and individual needs of each family. Striking a balance between family support and encouraging adolescent autonomy is crucial for ensuring long-term success. While family-based interventions have shown positive outcomes, challenges such as inconsistent family support, socioeconomic barriers and cultural differences must be addressed to enhance their effectiveness. Future research should focus on developing culturally sensitive and adaptable intervention models, incorporating strategies that build adolescents' coping mechanisms alongside family involvement. By combining personalized communication strategies, stronger family bonds and greater adolescent independence, family-based interventions can serve as a powerful approach to reducing adolescent tobacco use. Further studies with larger sample sizes and extended follow-up periods are recommended to provide more conclusive evidence and refine intervention frameworks for improved public health outcomes.

Limitations

While family-based interventions have shown significant promise, several limitations must be considered. The generalizability of findings may be limited, as family values, socioeconomic status and cultural differences can influence outcomes. Additionally, the success of these interventions may vary when family members provide inconsistent support, potentially undermining the adolescent's motivation to quit tobacco. Moreover, excessive reliance on family involvement may inadvertently foster dependency, limiting the adolescent's ability to develop independent coping mechanisms for maintaining long-term abstinence.

To address these challenges, future research should prioritize interventions that combine family engagement with strategies that foster individual resilience. Designing programs that balance family support with personal skill-building will empower adolescents to sustain tobacco-free behaviors independently, improving long-term cessation outcomes.

Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

Ethical Considerations

This systematic review was conducted in adherence to ethical guidelines, including those established by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. Since this review involved secondary data analysis from previously published studies, no direct interaction with human participants was required. However, the included studies were assessed for their respective ethical approvals, informed consent protocols and participant confidentiality measures to ensure that ethical standards were maintained across the reviewed literature. Any identified concerns related to ethical practices in the included studies have been duly reported.

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