
Trends and Effectiveness of School-Based Interventions for STI Prevention among Indonesian Adolescents: A Bibliometric and Systematic Review

Tren dan Efektivitas Intervensi Berbasis Sekolah untuk Pencegahan IMS di Kalangan Remaja Indonesia: Tinjauan Bibliometrik dan Sistematis

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ABSTRACT

Sexually transmitted infections (STIs) among Indonesian adolescents remain a major public health concern due to low reproductive health literacy and inconsistent school-based education. This study synthesized trends and the effectiveness of school-based STI prevention programs using bibliometric and systematic review approaches. Data from four databases (2010–2025) were screened via PRISMA. 15 eligible studies, mostly quasi-experimental, involved adolescents aged 10–19 and used videos, games, print, or culturally adapted media. Interventions improved knowledge, moderately influenced attitudes, and rarely measured behavior. Interactive, multimedia programs with control groups had stronger impacts. Findings support integrating culturally relevant, interactive, and longitudinally evaluated STI education into national policy.

ABSTRAK

Infeksi menular seksual (IMS) pada remaja di Indonesia masih menjadi masalah kesehatan masyarakat yang serius. Kondisi ini tidak lepas dari rendahnya literasi kesehatan reproduksi dan belum konsistennya pelaksanaan pendidikan berbasis sekolah. Penelitian ini mensintesis tren dan efektivitas program pencegahan IMS berbasis sekolah menggunakan pendekatan bibliometrik dan tinjauan sistematis. Data dari empat database (2010–2025) disaring melalui PRISMA. 15 studi yang memenuhi syarat, sebagian besar kuasi-eksperimental, melibatkan remaja berusia 10-19 tahun dan menggunakan video, *game*, cetak, atau media yang diadaptasi dari budaya. Program multimedia interaktif dengan kelompok kontrol memiliki dampak yang lebih kuat. Temuan mendukung integrasi pendidikan IMS yang relevan secara budaya, interaktif, dan dievaluasi secara longitudinal ke dalam kebijakan nasional.

INTRODUCTION

Sexually transmitted infections (STIs) remain a significant public health challenge globally.¹ According to the World Health Organization (WHO), more than 1 million STIs are acquired every day worldwide, with adolescents and young adults accounting for a large proportion of new infections.² Risky sexual behaviors, lack of access to comprehensive sexual education, and insufficient knowledge about reproductive health influence the high incidence of STIs among this age group. School-based interventions have been recognized as effective platforms to deliver sexuality education and preventive measures, particularly in developing countries where schools often serve as a central hub for adolescent development.^{3,4}

Not knowing enough about STIs can have serious effects on both health and daily life. It may cause people to delay getting diagnosed and treated, allow infections to keep spreading, and even lead to infertility or a higher chance of getting HIV. It can also result in emotional and social problems, including stigma and discrimination. For teenagers, not understanding how to prevent STIs can lead to unsafe sexual behavior and make them less likely to use available health services.⁵

In the Southeast Asian region, Indonesia faces a growing concern regarding adolescent reproductive health. The Indonesian Demographic and Health Survey and data from the Ministry of Health have highlighted increasing rates of premarital sexual activity, early marriage, and STI cases among adolescents. A national health survey reported that less than 50% of Indonesian adolescents have adequate knowledge about STIs, including HIV/AIDS.⁶ Despite government efforts to implement sexuality education through school curricula and programs such as the *UKS (Usaha Kesehatan Sekolah)*, challenges remain in standardization, teacher capacity, and community support.^{7,8}

At the local level, disparities in implementation and outcomes of school-based STI prevention programs are evident across regions in Indonesia. Some schools integrate reproductive health into formal lessons or extracurricular activities, while others lack structured interventions entirely.⁹ Moreover, published studies on the effectiveness of such interventions in Indonesian school settings are

scattered and have not been systematically synthesized. The absence of a comprehensive map of evidence limits the potential to inform and improve national strategies for adolescent STI prevention.^{10,11}

To tackle these problems, the Indonesian government has launched several initiatives. These include adding reproductive health education to school curricula, running the School Health Program (*Usaha Kesehatan Sekolah/UKS*), and providing adolescent-friendly health services (*Pelayanan Kesehatan Peduli Remaja/PKPR*). Nevertheless, there are still many obstacles, such as inconsistent program standards, limited teacher capacity, cultural sensitivities, and varying levels of community acceptance, all of which reduce the overall effectiveness and reach of these efforts.¹²

Given the urgency of STI prevention among adolescents and the pivotal role schools can play, there is a need to comprehensively explore both the scientific trends and the empirical evidence related to school-based interventions in Indonesia. Bibliometric analysis enables researchers to map the volume, focus, and collaboration patterns of scientific publications, while systematic review synthesizes findings from empirical studies to assess the effectiveness of interventions.¹³

Therefore, this study aims to analyze the development and distribution of school-based STI prevention research in Indonesia through a bibliometric and systematic review approach, to identify evidence gaps, dominant themes, and recommendations for future policy and practice.

MATERIAL AND METHOD

This study used a combined bibliometric analysis and systematic review. The bibliometric component aims to map trends in scientific publications, collaborative networks, and thematic developments in the field. At the same time, the systematic review synthesizes empirical evidence regarding the effectiveness and characteristics of these interventions. The study ran from February to April 2025 and focused on literature published between 2010 and 2025.

The research population consisted of scientific articles focusing on the prevention of sexually transmitted diseases through school programs aimed at adolescents in Indonesia. The inclusion criteria are: (1) original research, (2) Research carried out in Indonesian schools, including elementary, junior high, and senior

high schools, (3) involving adolescents, (4) aiming to prevent sexually transmitted infections (STIs), including HIV/AIDS and other related infections, and (5) published in English or Indonesian. Articles are excluded if (1) they are not available in full text, (2) they were conducted outside Indonesia, or (3) they are not relevant for research purposes.

A comprehensive literature search was conducted in PubMed, Scopus, Google Scholar, and GARUDA databases using Boolean operators and MeSH terms. We used a combination of keywords and MeSH terms for our search, including: ("sexually transmitted infections" OR "STIs" OR "HIV" OR "AIDS") AND ("adolescent" OR "teenager" OR "student") AND ("school-based intervention" OR "health education" OR "peer education") AND ("Indonesia").

RESULTS

The literature search and selection process is illustrated in the PRISMA diagram (Figure 1). A total of 261 articles were identified from four databases (PubMed, Scopus, Google Scholar, and GARUDA). Finally, 15 studies met the inclusion criteria and were included in the systematic review, and 254 studies were included in the bibliometric analysis.

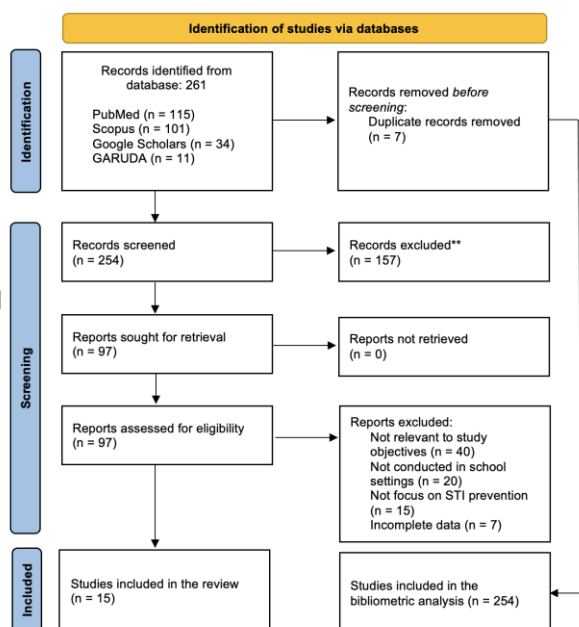


Figure 1. PRISMA Flow Diagram

The network visualization (Figure 2) reveals the thematic structure of the research landscape. The keyword "AIDS" appears as the most prominent node, indicating its central role in the literature. This term is closely linked with

keywords such as media, access, attention, child, and district, suggesting a strong emphasis on adolescent health education and regional program implementation.

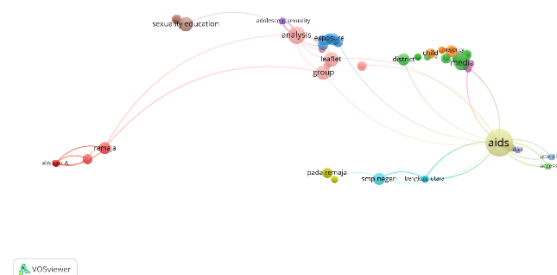


Figure 2. Network Visualization of the Topics Area

The overlay visualization (Figure 3) shows the temporal evolution of key research themes. Keywords shaded in yellow, including attention, access, and adolescent sexuality, indicate emerging topics between 2023 and 2025. Earlier interests, such as childhood and majority, appear in blue, reflecting earlier periods in the research timeline. This pattern suggests a shift toward more targeted and sensitive approaches in recent years.

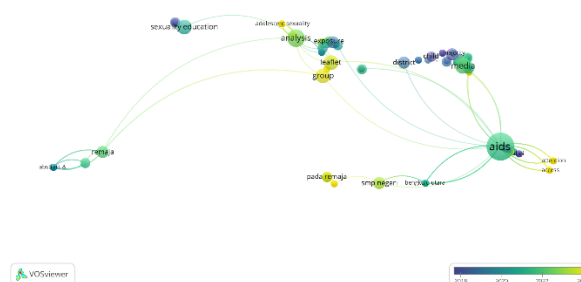


Figure 3. Overlay Visualization of the Topics Area

The density visualization (Figure 4) identifies areas of high research concentration. Bright yellow nodes such as "AIDS", "remaja" (adolescent), "media", and "analysis" indicate frequent use and strong co-occurrence across studies. These terms represent dominant research themes in the field, underlining their centrality in Indonesian school-based STI prevention discourse.

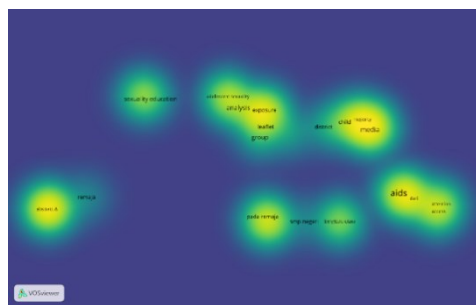


Figure 4. Density Visualization of the Topic Area

This study identified 15 school-based STI prevention interventions conducted across various regions in Indonesia. Most used quasi-experimental designs targeting adolescents aged 10–19 years, with sample sizes ranging from 30 to 3335. Interventions varied from audio-visual media and printed materials to educational games and culturally adapted formats. Knowledge improvement was the most reported outcome, with several studies also noting gains in attitudes and limited behavior change. Interventions using control groups showed stronger evidence of effectiveness, supporting the conclusion that school-based programs are generally effective in improving adolescent reproductive health literacy.

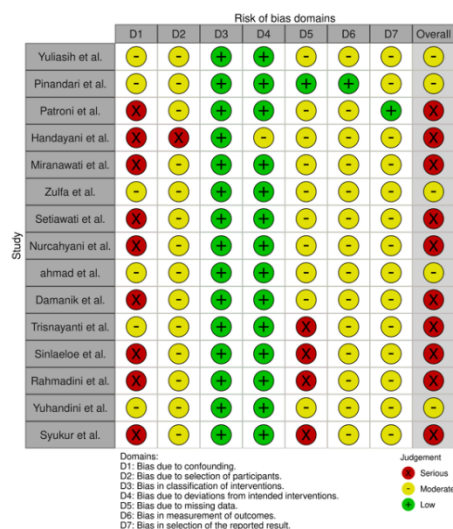
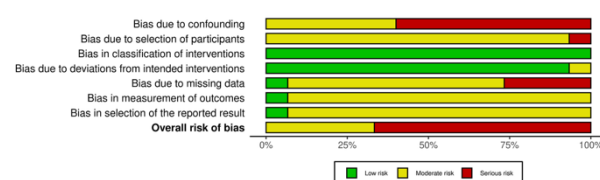


Figure 5. Traffic light plot showing domain-level risk of bias for each included study



(b)
Figure 6. Summary plot showing the distribution of risk of bias across domains.

The risk of bias assessment (Figure 5 and 6) indicated that most studies had a moderate to serious risk of bias, especially in areas related to confounding factors and missing data. In general, studies that used quasi-experimental designs with control groups showed lower risk of bias than those that relied on single-group pre-post designs.

DISCUSSION

This study aimed to synthesize evidence on school-based interventions for preventing sexually transmitted infections (STIs) among Indonesian adolescents through a combination of bibliometric analysis and systematic review. The findings support the initial hypothesis that such interventions are effective in improving adolescents' knowledge, attitudes, and, to a lesser extent, behaviors related to reproductive health.

The bibliometric analysis reveals that research on school-based STI prevention in Indonesia is still limited and fragmented, though growing in recent years. This has also been explained in previous research that sexual and reproductive health education in Indonesian schools is fragmented and spread across various subjects. While research is growing, challenges such as cultural taboos and inadequate teacher training hinder effective school-based STI prevention efforts.^{14,15} Most publications emerged in the last five years, indicating increasing academic attention, yet collaboration between institutions and regions remains suboptimal. Similar findings have been reported in Southeast Asia, where adolescent reproductive health research is increasing but lacks integration and strategic continuity.¹⁶

Table 1. Systematic Review Tabulation Results

Author (Year)	Location (School level)	Design	N (Age)	Intervention	Outcome	Main Result
Yuliasih et al (2025) ¹⁷	Sumedang, Indonesia (SMA)	Quasi-exp. (control)	166 (18–19)	Video & e-leaflet	Knowledge, attitude, practice	Significant improvement in both groups (p<0.001)
Pinandari et al (2023) ¹⁸	Semarang, Indonesia (SMP)	Quasi-exp.	3335 (10–14)	Teacher-led CSE (SEHAT)	Knowledge, attitude, skills	Increased pregnancy knowledge, gender attitude, and communication
Patroni et al. (2019) ¹⁹	Bengkulu, Indonesia (SMA)	Pre-post	125 (16–17)	Sex ed on deviant behavior	Knowledge	Significant knowledge gain
Handayani et al (2019) ²⁰	Semarang, Indonesia (SMA)	Correlational	178 (17–19)	School's role in sex ed	Reproductive behavior	Significant effect of school role (p=0.023)
Miranawati et al (2014) ²¹	Tapos, Indonesia (SMA)	Pre-post	62	Audio-visual media	Knowledge	Significant improvement
Zulfa et al. (2019)	East Java, Indonesia	Pre-post	62 (15–16)	SEM video	Knowledge, attitude	Significant improvement
Setiawati et al. (2023)	Riau, Indonesia (SMA)	Pre-post (online)	50 (12–15)	Zoom-based RH education	Knowledge	Significant knowledge gain (p<0.001)
Nurchahyani et al ²²	Kuningan, Indonesia (SMP)	Quasi-exp.	40 (10–12)	<i>Pupuh Sunda</i> cultural media	Knowledge	Significant improvement
Ahmad et al. (2021)	Dumai, Indonesia (SMP)	Pre-post	40	Snake & hopscotch game	Knowledge, attitude	Snake game improved knowledge; both improved attitude (p<0.05)
Damanik et al (2020) ²³	Medan, Indonesia (SMA)	Pre-post	133 (15–17)	Leaflet	Media access, attitude	Significant improvement
Trisnayanti et al (2024) ²⁴	Kuta, Bali, Indonesia (SMA)	Quasi (control)	84 (15–17)	Video on TRIAD KRR	Knowledge	Significant gain in intervention group
Sinlaeloe et al (2024) ²⁵	Lobalain, Indonesia (SMP)	Pre-post	60 (13–15)	Video + leaflet	Knowledge, attitude	Significant improvement
Rahmadini et al (2022) ²⁶	Bogor, Indonesia (SMP)	Pre-post survey	53 (13–15)	Lecture & group discussion (STI)	Knowledge	Significant gain after intervention

Yuhandini et al (2021) ²⁷	Cirebon, Indonesia (SMA)	Quasi (2 groups)	80 (15–17)	Audio-visual & webtoon	Knowledge, attitude	Both media improved knowledge; only AV improved attitude
Syukur et al (2023) ²⁸	Gorontalo, Indonesia (SMK)	Community outreach	SMK students (NA)	STI prevention counseling	Knowledge	75% could recall STI info after session

SMA: senior high School; SMP: Junior high school; SMK: vocational school; NA: not available

This study most interventions demonstrated significant improvements in knowledge, with moderate gains in attitudes and limited evaluation of behavior change. Consistent with global literature, interactive approaches such as videos, group discussions, and games were generally more effective than passive methods like printed materials. For instance, interventions using video-based education reported greater improvements in knowledge and attitudes compared to control groups.^{29,30}

Most of the papers reviewed independently used a wide range of educational media. Besides audio-visual tools (videos), they also used printed materials (leaflets and booklets), interactive ways (games, group discussions, and web-based platforms), and culture-specific media like Pupuh Sunda.²² However, most of the media were audio-visual-based, with those using videos showing the biggest success in changing knowledge and attitudes.²¹ Indeed, quite a few research works using video-based education and control groups have demonstrated significantly higher scores after the intervention than those using traditional or passive methods.³¹

Games, group discussions, and webtoon-based education were also very effective methods for increasing students' attention and fostering attitudinal change, with these approaches usually being more interactive.²⁷ Conversely, printed materials such as leaflets and booklets, though effective to some extent in knowledge enhancing, by and large exhibited less influence on attitudes and behavioral outcomes, especially when used singly without other forms.²³ An example is a study that revealed the use of booklets was more beneficial than the use of leaflets. Nevertheless, the booklet and the leaflet are still less effective than multimedia-based interventions.²⁵

Considering this, it is evident that multi-sensory and participatory methods of learning, especially those that consist of visual and interactive aspects, prove to be more successful in educating adolescents about reproductive health.

The results also remarkably corroborate a recent review, that showed school-based STI prevention interventions in Indonesia generally help adolescents to increase their knowledge as well as change their attitudes towards reproductive health. The review also pointed out that educational approaches which are interactive and culturally adapted. Besides, the paper accentuated the vital role of schools as effective and sustainable delivery channels of reproductive health education to adolescents.³²

Taken together, these findings reinforce the role of schools as strategic platforms for delivering adolescent sexual health education. Yet, to strengthen effectiveness and equity, future interventions should adopt interactive and culturally sensitive approaches, ensure broader geographic coverage, and include long-term follow-up to assess behavioral impacts. In addition, strengthening collaboration across sectors, particularly between health and education, is essential to scale and sustain effective STI prevention programs in Indonesia.

CONCLUSION AND RECOMMENDATION

This review concludes that school-based interventions in Indonesia are generally effective in improving adolescents' knowledge and attitudes related to STI prevention, though evidence on long-term behavioral change remains limited. The increasing volume of publications in recent years reflects growing interest in adolescent reproductive health; however, research remains fragmented, with regional and institutional disparities in implementation.

To enhance the effectiveness and sustainability of STI prevention efforts, future programs should prioritize interactive and culturally appropriate methods, such as audio-visual media and community-based tools. Additionally, longitudinal studies are needed to evaluate the durability of intervention outcomes, particularly behavior change. Greater inter-sectoral collaboration between education, health, and community stakeholders is also essential to expand program coverage, improve quality, and ensure policy alignment. Integrating comprehensive sexual education into the national curriculum with adequate teacher training and consistent monitoring will be key to addressing current gaps and protecting adolescent health in Indonesia.

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