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Interventions to Improve Sexual and Reproductive Health Related Knowledge and Attitudes Among the Adolescents: Scoping Review

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Abstract: Many interventions have been studied to improve sexual and reproductive health (SRH) knowledge and attitudes. These interventions aim to prevent adolescents from the risk of sexually transmitted infections (STIs), unwanted pregnancy, and abortion. The lack of comprehensive sex education contributes to adolescents' limited understanding of SRH. This study aims to describe reproductive health educational interventions aimed at preventing the RH triad (STIs, unintended pregnancies, and abortions) in adolescents. This study employed a scoping review method. Articles were searched from three databases: CINAHL, PubMed, and Scopus. The keywords used were: reproductive health, sex education, adolescent, knowledge, behavior, intervention. Inclusion criteria included quantitative intervention research, quasi-experimental, or randomized controlled trials; involving adolescents aged 10-19 years; describing at least one intervention to improve knowledge, attitudes, or awareness about reproductive health; and published in English or Indonesian between 2019-2024. Data were manually extracted and analyzed descriptively using qualitative methods. Based on the search results, 13 articles were identified that discussed interventions to improve adolescents' knowledge and attitudes towards reproductive health. The types of interventions included smartphone-based, school-based, game-based, educational, and family-based interventions. The duration of interventions varied from a few sessions to several months. Activities included watching videos, accessing educational materials through apps, participating in discussions and demonstrations at school, playing educational games, and engaging in interactive family sessions. These interventions generally aim to enhance adolescents' knowledge and attitudes towards reproductive health through various methods and durations. Further studies are needed to explore and develop more comprehensive and contextual interventions for diverse adolescent groups.

Keywords: adolescents, attitude, intervention, knowledge, reproductive health

Introduction

Reproductive health education interventions are important to prevent and reduce the ARH triad in adolescents. Adolescents, who are currently one of the large populations in Indonesia, are certainly expected to be a superior generation in the future.¹ Prevention of risky behavior in adolescents, especially related to sexuality, is one way to make Indonesian adolescents a superior generation.

Risky behavior in adolescents is called the Adolescent Reproductive Health Triad or ARH Triad² The ARH triad is a term used in government programs in Indonesia, which means the three problems of adolescent reproductive health (ARH), namely sexuality, HIV/AIDS and drugs.³ Regarding sexual risks, there are several problems faced by teenagers, such as exposure to pornography, unwanted pregnancies, sexually transmitted infections, abortion, and early marriage.^{4–6} Therefore, the issue of sexual risks is something that really needs attention because it will have an impact on the body or mental development of teenagers.

In research conducted by Meilani et al, said that as many as 57.5% of 80 teenagers in one high school in Yogyakarta had access to pornography through films, short videos and also images via social media.⁷ There are

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Sexuality problems in ARH can have a bad impact on teenagers. Pornography use is likely to have a negative effect on the quality of social relationships as well as a negative impact on psychosocial development.¹⁰ In early pregnancy, women who gave birth at 13–19 years of age reported more symptoms of anxiety and somatization than those who gave birth at a later age, and those who married at less than 25 years of age showed higher levels of depressive symptoms than those who married at older age.¹¹ In addition, early marriage can be a violation of children's basic rights to a good childhood, education, health and to make decisions about their own lives.¹² These impacts can be avoided by providing reproductive health education from an early age.

The ARH triad can occur due to a lack of information regarding reproductive health.⁶ Results of research carried out Solehati et al, showed that 81.4% of 668 teenagers in Bandung Regency had a poor level of reproductive health knowledge.⁵ This can happen because in Indonesia it is still taboo to talk about reproductive health and teenagers are still considered too young to talk about reproductive and sexual health because it can initiate sexual behavior^{13.} Apart from that, factors that can influence reproductive health knowledge are information media, health education, and the role of parents.¹⁴ Low levels of knowledge can cause teenagers to determine poor reproductive health attitudes and behavior.¹⁵ Reproductive health knowledge can determine teenagers' attitudes in avoiding the ARH triad.¹⁶

Attitudes toward sexuality are significantly influenced by prejudice, taboo, and cultural characteristics that prevent young people from acquiring adequate reproductive health knowledge.¹⁷ According to research Menshawy et al, there are differences in reproductive health attitudes between men and women.¹⁸ Men are more likely to recommend sexual education than women, men are more open to attending classes on sexual education than women, and women are less likely to discuss matters related to sex with their parents.¹⁸ Factors that can influence reproductive health attitudes in adolescents are gender, parents' education level, parents' income, and level of reproductive health knowledge.¹⁹ Reproductive health attitudes and knowledge can be improved with various types of interventions, one of which is providing health education.²⁰

Reproductive health educational interventions are important to prevent and reduce the ARH triad in adolescents. Teenagers, who currently constitute the population that dominates Indonesia, are certainly expected to become a superior generation in the future. Preventing the ARH triad, especially regarding sexuality, is one way to make Indonesian teenagers into a superior generation. Therefore, a scoping review is needed to describe reproductive health educational interventions to prevent the RH triad in adolescents.

Materials and Methods

Design

This research uses a literature review with a scoping review design. Scoping review is a systematic method of research carried out to explore and summarize existing evidence in the scientific literature related to a particular topic.²¹ The main aim of a scoping review is to provide a comprehensive understanding of the scope of a research topic by identifying and compiling a wide range of relevant literature. The present scoping review follows a five-stage methodological framework that includes (1) identifying research questions and (2) relevant studies, (3) selecting studies based on inclusion criteria, (4) mapping and interpreting data, and (5) summarizing and reporting results. Additionally, we adapted the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement accordingly.²²

Search Strategy and Eligibility Criteria

A comprehensive literature search will be conducted using the following electronic databases: PubMed, CINALH, and Scopus. The reason the author uses the PubMed database is because the database leads to several reference and abstract databases on natural sciences and biomedical topics, so its coverage is quite broad. CINAHL was chosen because it is a nursing-specific database, and Scopus covers many disciplines, including social sciences, natural sciences, health, and others. This makes it a good choice for interdisciplinary research.

Across all retrieved articles, analysis of the words contained in the title and abstract, as well as index terms will be performed to develop a complete search strategy. After that, a second search using all identified keywords and index terms will be performed across the entire database. Finally, the third step will include screening the reference lists of all studies selected for this scoping review to search for additional sources. The search strategy will cover 2019 to present. All identified references will be imported into the reference management software, Mendeley.

The search strategy included a series of relevant keyword combinations: ("sexual health" OR "reproductive health" OR "sexual behavior" OR "contraception" OR "contraceptive agents" OR "condoms" OR "pregnancy" OR "abortion" OR "termination of pregnancy" OR "sexually transmitted infections" OR "venereal diseases") AND ("Adolescent" OR "youth" OR "young people" OR "teenager" AND "knowledge" AND "Behavior" OR "Behaviour" AND "Intervention"). The research question used is: What interventions can improve knowledge and attitudes about adolescent reproductive health?

Inclusion and Exclusion Criteria

This study used the PRISMA Extension for Scoping to review literature on the topic of interventions to improve reproductive health knowledge and attitudes in adolescents. In this study there were inclusion and exclusion criteria. The inclusion criteria for this research are that articles are included if they meet the following criteria: (a) quantitative intervention research, quasi experiment or randomized controlled trial, both quantitative and qualitative; (b) involving youth aged 10 to 19 years; (c) explain at least one intervention to increase knowledge, attitudes and awareness of reproductive health; (d) explain one of them: condom use, sexual partners, sexual debut, contraceptive prevalence, sexually transmitted infections, unwanted pregnancy, abortion, or sexual/reproductive health knowledge. Only articles in English and Indonesian are included. Publish in 2019–2024.

Quality Appraisal

The journals have been analyzed using the critical evaluation method from the Joanna Briggs Institute (JBI) with good article standards above 75% based on the criteria and relevance of the topic. JBI critical appraisal is an important tool in assessing the quality, reliability, and relevance of published articles. The assessment criteria are given a score of "yes", "no", "unclear", and "not applicable", where each criterion that gets a score of "yes" is given 1 point, while other answers get 0 points. These points are then added up to determine the suitability of an article. The standard for article eligibility is to have a score above 75% according to the relevance of the topic and the assessment criteria used.

Data Extraction and Analysis

To extract data, the author uses a table containing the author and year, country, objective, population or sample size, research method, type of intervention, and results (Figure 1). This step is to make it easier for writers to analyze articles that have been screened.

The author analyzes the articles that have been collected using descriptive analysis. In accordance with the extraction data table created, the author will enter the required data according to the table columns. There is another table created by researchers that only contains intervention steps. However, this table was not included in the extraction data table because there were too many, so this table is to make it easier for the author to find intervention steps. The results of the article review will be described and discussed with studies that have been conducted previously. The types of interventions obtained will be classified according to similar interventions.



Figure I PRISMA Flow Diagram.

Note: Adapted from Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021; 372. Creative Commons.

Results

Based on the search results, 13 articles were found that met the inclusion and exclusion criteria. Five studies used Quasi Experiment methodology and 8 articles used A randomized controlled trial. Sample sizes ranged from 64 to 1210 participants, mostly male and female adolescents aged 10–24 years, and one study focused on male adolescents. The search results found that research was conducted in developing countries (India and Peru) and developed countries (United States, Finland, and Nigeria). The results of the critical appraisal of 13 articles showed results above 75% (Table 1). This was done in four studies conducting school-based interventions. Two studies conducted family-based interventions. Six studies conducted smartphone-based interventions. One study intervened with games. One study regarding sexual hygiene education (Table 2).

Author, Published Year	JBI Critical Appraisal Tool	Study Design
Scull et al (2022) ²³	84.6% (11/13)	RCT
Alekhya et al (2023) ²⁴	76.9% (10/13)	RCT
Martínez-García et al (2023) ²⁵	76.9% (10/13)	RCT
Wendt et al (2022) ²⁶	84.6% (11/13)	RCT
Perez-Lu et al (2022) ²⁷	76.9% (10/13)	RCT
Millanzi et al (2022) ²⁸	92.3% (12/13)	RCT
Guilamo-Ramos et al (2020) ²⁹	84.6% (11/13)	RCT
Wirsiy et al (2022) ³⁰	84.6% (11/13)	RCT
Yakubu et al (2019) ³¹	84.6% (11/13)	RCT
Tu et al (2019) ³²	88.9% (8/9)	Quasi Experimental
Pakarinen et al (2023) ³³	77.8% (7/9)	Quasi Experimental
Boti Sidamo et al (2023) ³⁴	88.9% (8/9)	Quasi Experimental
da Silva Carvalho et al (2023) ³⁵	100% (9/9)	Quasi Experimental

Table I JBI Critical Appraisal Tool

Table 2 Extraction Data

No.	Author(s)/ Year	Country	Purpose	Population/ Sample Size	Method	Intervention	Results
Ι.	Scull et al (2022) ²³	United States	To improve youth's critical thinking about media messages and provide medically accurate information and skill development related to sexual health and communication.	There are 590 students in grades 9 and 10.	A randomized controlled trial	Media AwareWeb- based standalone program.	Media Awareeffective web-based program to positively improve middle school students' media, sexual health, and sexual health communication outcomes (M =2.17, SD = 0.08).
2.	Alekhya et al (2023) ²⁴	India	This study was to assess the effectiveness of SRH education among adolescent girls in urban areas of Odisha, India.	790 students in grades 9 and 10.	A randomized controlled trial	Sexual Reproductive Health education.	The research results showed significant proportional changes in knowledge, attitudes and practices related to Sexual and Reproductive Health (p-value <0.001).
3.	Pakarinen et al (2023) ³³	Finland	The aim of this study was to describe the attitudes, knowledge and sexual behavior of adolescents before and after sexual health promotion interventions. Intervention.	Adolescent students aged 15–19 years.	A quasi- experimental study	Sexual health promotion interventions.	There was a significant difference before and after the intervention regarding better knowledge and more frequent Sexually Transmitted Infection (STI) testing (p-value < 0.05)
4.	Boti Sidamo et al (2023) ³⁴	Ethiopia	This study aims to assess the influence of curriculum-based sexual and reproductive health education (CBSRHE) on knowledge and attitudes about SRH services in order to have safer sexual behavior in first year students at Arba Minch University.	832 students aged 19 years.	A quasi- experimental study	Curriculum-based sexual and reproductive health education (CBSRHE).	There was a statistically significant difference between the intervention and control groups in terms of changes in contraceptive use, knowledge and attitudes (p <0.01).
5.	da Silva Carvalho et al (2023) ³⁵	Brazil	The aim of this study was to examine the effect of board games on female prisoners' knowledge about STIs.	64 women aged 18 years.	A quasi- experimental study	Previna board game.	The results showed that the Previna board game significantly increased players' knowledge about STIs, and this increase in knowledge remained significant during the follow-up period. (p<0.001).

(Continued)

Table 2 (Continued).

No.	Author(s)/ Year	Country	Purpose	Population/ Sample Size	Method	Intervention	Results
6.	Martínez- García et al (2023) ²⁵	United States	To test the mobile application Crush which aims to improve sexual health by promoting the use of SRH services and contraception among adolescent girls.	1210 girls aged 14–18 years.	A randomized controlled trials	Crush: mobile application Sexual and Reproductive Health.	The research results show that the Crush application can increase knowledge, attitudes and self-efficacy related to key SRH behaviors and may be a strategy for delivering SRH education to adolescent girls. (p<0.05).
7.	Wendt et al (2022) ²⁶	United States	This study examines the impact of Healthy U, a program designed specifically for justice-involved young men.	Teenage boys, ages 14–19 years.	A randomized controlled trials	Healthy U is an application-based program.	The research results showed that healthy U significantly and meaningfully increased positive attitudes towards condom use and negative attitudes towards sexual health behavior, as well as increased intentions to use condoms and contraceptives (p < 0.05).
8.	Perez-Lu et al (2022) ²⁷	Peru	To see the effect of the ARMADILLO text message intervention in increasing knowledge of sexual and reproductive health among adolescents in Peru.	712 participants aged 13–17 years n.	A randomized controlled trial.	ARMADILLO intervention text messages.	ARMADILLO SMS content had a significant (but small) influence on participants' contraceptive-related knowledge.
9.	Millanzi et al (2022) ²⁸	Tanzania	This study designed and tested the effect of integrated reproductive health (reproductive health) learning materials in problem-based pedagogy (PBP) to improve safe sexual behavior soft skills among adolescents in Tanzania.	Teenagers 10–19 years old, a total of 660 teenagers.	A randomized controlled trials	Integrated reproductive health (RH) lesson materials in a problem-based pedagogy (PBP).	The results showed that the soft skills coefficient was significantly higher among adolescents in PBP than in the control group (p<0.01).
10.	Guilamo- Ramos et al (2020) ²⁹	African Americans	To evaluate the efficacy of Families Talking Together (FTT), a triadic abstract intervention to reduce adolescent sexual risk behavior.	900 families with teenagers aged 11–14 years.	A randomized controlled trials	Families Talking Together (FTT)	This study shows that the triadic FTT intervention is efficacious in delaying sexual debut and reducing risky sexual behavior among adolescents (p<0.05).
11.	Wirsiy et al (2022) ³⁰	Africa	This study tested the efficacy of weekly one-way educational text messages to improve adolescent girls' perceptions of sexual-reproductive health.	398 female adolescent participants aged 10–19 years.	A randomized controlled trial	Mobile-based adolescent sexo-reproductive health scheme (MASHS).	The results show statistical significance so that there is an overall increase in the perception of female adolescents after the intervention and not by chance.
12.	Yakubu et al (2019) ³¹	Ghana	This study aims to assess an educational intervention program on sexual abstinence based on the Health Belief Model (HBM) among adolescent girls in Northern Ghana.	363 teenagers aged 13–19 years.	A randomized controlled trials	Sexual abstinence education.	The educational intervention guided by HBM significantly increased adolescents' sexual abstinence and knowledge about pregnancy prevention in the intervention group (P < 0.003).
13.	Tu et al, (2019) ³²	Taiwan	The aim of this study was to develop messages in a benefit framework (benefits from performing the behavior) and a harm framework (costs of not performing the behavior) and to identify the impact of these messages on cervical cancer awareness and vaccination intentions against human papillomavirus (HPV) linked to cervical cancer.	565 students 15–16 years old.	A quasi- experimental study	HPV framed message film.	The results showed that gain-frame and loss-frame messages both increased HPV knowledge (d = 2.147–2.112) and attitudes towards HPV vaccination (d = 0.375–0.422).

Smartphone-Based Intervention

In smartphone-based intervention research, it is carried out in different ways. In research conducted by Scull et al, using Media Aware.²³ Media Aware, a comprehensive web-based sexual health education program for middle school students designed to build critical analysis skills related to sexual and/or romantic media messages, sexual health knowledge, and communication skills. The content of the website is not only material but peer videos and animated lesson slides, students

interact with the content through quizzes and simulations, which allows practice of the knowledge and skills taught in this program. Media Aware consists of four lessons that can fit into four 45-minute class periods.

Another intervention regarding reproductive health is the Human Papillomavirus (HPV) framed message film (HFMF). Intervention carried out by Tu et al, use HFMF is an educational message delivered using two communication strategies, namely Gain-framed messages and Loss-framed messages.³² This message was sent to teenagers with two types of messages, namely Gain-Framed Message about the benefits of doing a behavior and the opposite Loss-Framed is the consequence of not taking that action. In the context of this research, the message contains HPV vaccination. The research results show that loss framed provided statistically significant greater attention to health education and expressed more concern about sexual health than participants who received HPV education messages with a benefit frame.

Another research that uses smartphone-based methods is the Crush smartphone application.²⁵ The Crush app delivers content about contraceptive methods, STIs, health clinic navigation, healthy relationships, and pregnancy information through multimedia features, including animations, videos, audio dialogues, comic stories, graphics, and quizzes, to increase engagement and support different types of learners. The research results show that smartphone-based interventions using applications can improve teenagers' knowledge and attitudes.

Apart from the Crush application, there is the Healthy U application which aims to provide sexual health education to prevent prevention of independent fatherhood for young people involved in the justice system.²⁶ This intervention is specifically for teenage boys who are on trial. Web Healthy U contains content on puberty, Pregnancy, Birth Control, HIV, STDs, Healthy Relationships, and Condom Negotiations. Healthy U is aligned with Centers for Disease Control and Prevention or CDC's National Health Education Standards. The material is presented using film methods, interaction games, narrative drama, and imagination challenges. The two articles that discuss smartphone-based interventions using the web present material with interesting features. This is also shown by research results which state that interventions using the web can improve attitudes and knowledge about sexual and reproductive health, especially positive attitudes towards condom use and critical thinking about media messages regarding sexual and reproductive health.

Apart from using applications, increasing knowledge of sexual and reproductive health can be done using SMS text messages. This intervention was carried out by Perez-Lu et al, which uses ARMADILLO (Adolescent/Youth Reproductive Mobile Access and Delivery Initiative for Love and Life Outcomes) text messages to increase knowledge of adolescent sexual and reproductive health in Peru.²⁷ One of the message domains conveyed by ARMADILLO text messages is "How to protect myself?" Apart from ARMADILLO text messages, there are interventions that use text messages, namely the Mobile-based Adolescent Sexo-reproductive Health Scheme (MASHS).³⁰ Text messages contain precautions for unsafe sexual health practices. The results of this study are significant, although the effect is not small, but it can increase teenagers' knowledge about contraception.

Intervention using text messages was also carried out by Wirsiy et al, using the Mobile-based adolescent sexo-reproductive health scheme (MASHS).³⁰ MASHS intervention is carried out by sending one-way text messages in the afternoon on Monday, Wednesday and Friday between 16.00–18.00 WIB. The content of the message is motivating and acts as a reminder and signal to act, examples are as follows. The results of this study showed that the average value of knowledge, attitudes and practices each increased significantly.

School-Based Interventions

From the article search results, three articles were found discussing school-based interventions to increase knowledge of sexual and reproductive health. Research conducted by Pakarinen et al, carry out school-based sexual health promotion interventions.³³ Promotion of sexual health was carried out for 11 weeks and was carried out for 45 minutes by the teacher in charge of the intervention. Intervention material regarding sexually transmitted infections and condoms. Researchers used PowerPoint but provided material from the web that was easily accessible regarding sexual health, posters pasted in the school environment, leaflets, and provided condoms for vocational school students. The results of the study showed that there were significant differences before and after the intervention regarding better knowledge and more frequent Sexually Transmitted Infection (STI) testing. The results of the study showed that there were significant differences before and after the intervention Sexually Transmitted Infection (STI) testing. The results of the study showed that there were significant differences before and more frequent Sexually Transmitted Infection (STI) testing. The results of the study showed that there were significant differences before and more frequent Sexually Transmitted Infection (STI) testing.

The second article describes a school-based intervention to test a sexual and reproductive health curriculum. Participants in this research were students at the beginning of the year and for 16 weeks.³⁴ In one day, sexual and reproductive health learning is carried out for 3 hours. Learning provides space for students to brainstorm, role play and demonstrate. The results showed that there were statistically significant differences between the intervention and control groups in terms of changes in contraceptive use, knowledge and attitudes.

The third article that discusses school-based interventions is integrated reproductive health learning in problem-based pedagogy education (PBP).²⁸ This research intervention discusses theoretical and practical concepts of learning materials and real-life problems regarding sexual and reproductive health. The intervention was carried out for 2 sessions per week for 4 weeks. Lessons last 30–90 minutes and are given by research assistants who have been trained and are experts in reproductive health. The results showed that the soft skills coefficient was significantly higher among adolescents in the PBP than in the control group.

The final article uses the handbook as an intervention.²⁴ There are two handbooks, namely the first handbook on Adolescent Health Statistics, the Female Reproductive System, Puberty, and Menstrual Health and the second handbook on Pregnancy, Contraception, STIs/RTIs, and HIV/AIDS. This research was conducted for three months and 2 hours per session and learning was carried out by means of presentations. The research results showed significant proportional changes in knowledge, attitudes and practices related to sexual and reproductive health.

Game Intervention

There is an article that discusses interventions to improve reproductive health with games. Research conducted by da Silva Carvalho et al, uses a board game called Previna to increase knowledge about sexually transmitted infections (STIs).³⁵ After playing the Previna board game, participants will fill out an instrument about STIs after 15 days of playing the game. There are types of cards, namely prevention cards, multiple choice cards, challenge cards, and risk cards. The results of this research show a significant increase in players' knowledge about STIs. This is because the game is attractive, so that participants absorb the material more easily. The board game "Previna" has been validated and can be considered as an important pedagogical tool in the construction of knowledge with respect to the prevention, treatment and control of Sexually Transmitted Infections in the context of women's prisons.³⁶

Education

There is one article that discusses a sexual abstinence-based educational intervention program based on the Health Belief Model (HBM) behavior change theory.³¹ The educational material provided is based on the five pillars of HBM, namely pre-contemplation, contemplation, preparation, action, and maintenance. Apart from that, there is the formation of self-efficacy and decision balance for teenagers in determining reproductive health attitudes and behavior. The educational intervention guided by HBM significantly increased sexual abstinence and adolescent knowledge about pregnancy prevention in the intervention group.

Family-Based Intervention

Family-Based Intervention (FTT) is one intervention that can increase contraceptive knowledge.²⁹ This intervention involves mothers who have teenage children and are given material on how to communicate about sex, condoms, and strategies for monitoring and written intervention material (family workbook) for mothers to use with their teenagers at home which is designed to support parents' mastery of effective communication about sex and monitoring or supervision strategies. The intervention was carried out for 45–60 minutes. This research involved mothers of teenagers for intervention. The research results show that the triadic FTT intervention is efficacious in delaying sexual debut and reducing risky sexual behavior among adolescents.

Discussion

The results of the scoping review show that there are five types of interventions that can improve reproductive health knowledge and attitudes in adolescents, namely school-based, smartphone-based, game, family-based and health education interventions. Research that uses school-based interventions provides opportunities for adolescents to learn and

discuss with teachers and friends. In accordance with previous research, using school-based interventions by means of tutoring, discussions, group work, role playing, and using posters to improve adolescent reproductive health.³⁷ Apart from that, health workers or teachers who carry out youth-friendly health education interventions in schools show a loving attitude, thereby providing teenagers with comfortable discussions and increasing knowledge about sexual and reproductive health.

The advantage of school-based interventions is that schools are an easy place for learning about sexual and reproductive health in the midst of economic problems that make it difficult to obtain effective and reliable health information.²⁴ Schools are an important resource in building knowledge about sexual behavior and enabling adolescents to make informed decisions regarding their sexual behavior.³³ In addition, school-based interventions provide positive motivation in making better decisions³⁸ Like previous research which used the Information-Motivation-Behavioral Skills Model guide in school-based interventions so that teenagers have the motivation to increase knowledge and positive reproductive health behavior.³⁸ Good knowledge will influence a person's attitude in supporting good things and vice versa.⁵

Improving reproductive health knowledge and attitudes can be done using smartphone-based methods. The use of smartphone technology equipped with the internet provides greater opportunities to search for information and is low cost to spread health messages on a large scale.³⁹ Mobile-based interventions are generally well received by users and are suitable for use in health education interventions.⁴⁰ Many of them have proven effective in reducing health risk behavior and improving health, especially reproductive health knowledge and attitudes.^{41,42}

In accordance with previous research, using applications to increase awareness and use of sexual and reproductive health services in adolescents with research results has proven to be significant.⁴³ Teenagers spend more than seven hours per day using media, making this an advantage for smartphone-based interventions.⁴⁴ Other research uses applications on Android and reading material about reproductive health within four weeks showed significant results in increasing reproductive health knowledge.⁴⁵ Therefore, smartphone-based interventions have been proven to increase adolescent reproductive health knowledge.

Improving knowledge and attitudes about reproductive health can be done through games. Like the previous article which uses a playboard intervention to increase reproductive health knowledge in children with special needs.⁴⁶ This research uses learning media with the Cone of Experience principle which illustrates that the use of the "audio-visual" function can increase understanding by 20%, "demonstration" by 30%, and "doing exercises" by 75% which has been applied to paper doll media and board game.⁴⁷

Apart from board games, improving knowledge and attitudes about reproductive health can be done on a family basis. One of them is Families Talking Together (FTT), which is a family-based intervention to improve adolescent reproductive health.⁴⁸ Parents play an important role in providing information about adolescent reproductive health. Previous studies have used FTT to promote the HPV vaccine, administer the HPV vaccine, train student nurses to communicate with teen parents, and support parent-child sexual health communities.⁴⁹ Results showed that levels of sexual activity remained low in both groups during the six-month follow-up period.

Improving reproductive and sexual health can be done with health education based on the health belief model behavior change theory. There are other studies that use other theories of behavior change, namely the trans-theoretical model.¹⁵ In this study, the research used five stages of behavior change based on the transtheoretical model, namely pre-contemplation, contemplation, preparation, action, and maintenance. This behavior change process provides knowledge and motivation for teenagers to make changes to healthy sexual and reproductive health behavior.⁵⁰ Using the behavioral change model theory has the advantage of having its own concept in order to change negative behavior to positive, such as attitudes towards adolescent reproductive health.⁵¹

Determining interventions to improve reproductive health knowledge and attitudes can be carried out based on the researcher's objectives. Based on the results of the scoping review, school-based, smartphone-based, game-based and family-based interventions have their respective advantages. But the most important thing Providing reproductive health knowledge should be given from an early age according to age stages, especially during adolescence. Adolescents have distinctive behaviors such as experimenting, taking risks, and the process of reaching sexual and reproductive maturity.^{52,53} Therefore, appropriate interventions are needed to increase knowledge and attitudes about adolescent reproductive health.

Conclusion

Based on the results obtained, there are several types of interventions to improve knowledge and attitudes about reproductive health, namely education, smartphone-based, school-based, games and family-based. These interventions have their respective advantages and each intervention is proven to increase knowledge and attitudes regarding adolescent reproductive health. This intervention can be an implication for nurses in carrying out reproductive health education using various different approaches. Nurses can provide reproductive health education by adjusting their approach based on the results of the scoping review. Another suggestion for implications is that nurses can conduct research based on research gaps found regarding increasing knowledge and attitudes about reproductive health in adolescents.

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