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Implementation of the Innovative "Connecting Knowledge" Intervention to Improve Vulva Hygiene Practices in Cervical Cancer Prevention

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ABSTRACT

Background: *Persistent infection with human papillomavirus (HPV), the primary etiological factor of cervical cancer, is closely associated with inadequate genital hygiene practices, particularly improper vulvar care among adolescent females. Limited reproductive health literacy and the perception that such topics are sensitive or taboo often hinder adolescents from adopting preventive behaviours, highlighting the importance of peer-based educational approaches to improve knowledge and promote healthy hygiene practices. This study aims to analyse the effectiveness of the "Connecting Knowledge" educational intervention in enhancing knowledge and promoting appropriate vulva hygiene practices for cervical cancer prevention among adolescent females.* ***Methods:*** *The research design is a a quasi-experimental pre-test–post-test design without a control group. The sample will be selected using quota sampling, with inclusion criteria comprising third- and fifth-semester nursing students and adolescents aged 12–19 years. Group I consists of 10 third- and fifth-semester students from STIKES Telogorejo in Semarang; Group II comprises 20 individuals; and Group III comprises 40 adolescents from the Karang Ayu sub-district. Quantitative data were managed and analysed using SPSS, using a Paired t-test with a p-value of <0.05.* ***Results:*** *The results of this study show that the majority of respondents were aged 18 and p value ≤0.05, indicate that connecting knowledge influences adolescents' knowledge (0.005 and 0.012) and behaviour (0.012 and 0.034) regarding vulvar hygiene in the prevention of cervical cancer.* ***Conclusion:*** *The implementation of the innovative "Connecting Knowledge" intervention demonstrated a positive impact on adolescents' knowledge and vulva hygiene practices as part of cervical cancer prevention efforts. These findings suggest that peer-based educational strategies may enhance reproductive health awareness and promote healthier personal hygiene behaviours among adolescents. Future programs should expand the "Connecting Knowledge" intervention by involving multiple stakeholders and integrating cervical cancer prevention education into comprehensive adolescent nursing care to support sustained healthy behaviours.*

Introduction (Cambria Bold 12 pt)

Cancer is one of the most devastating diseases and the second leading cause of death and suffering worldwide. There were 604,000 new cases and 342,000 deaths in 2020. Around 90% of cases occur in low- and middle-income countries (WHO, 2022). The cause of cervical cancer is the Human Papilloma Virus (HPV), the transmission of which begins with poor personal hygiene, particularly inadequate vulva hygiene. Furthermore, risk factors for women developing cervical cancer include engaging in sexual activity at a young age or during adolescence, and poor personal hygiene, particularly vulva hygiene (Devi & Izah, 2023). Therefore, cervical cancer prevention is essential, one of which involves proper vulva hygiene. This begins during adolescence, which serves as a crucial early step in cervical cancer prevention. Cervical cancer remains a major public health problem and is the fourth most common cancer among women worldwide. The World Health Organization (WHO) reported that approximately 660,000 new cases and 350,000 deaths

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occurred globally in 2022, with nearly 94% of deaths occurring in low- and middle-income countries. Persistent infection with high-risk human papillomavirus (HPV) is responsible for almost all cases of cervical cancer, making HPV vaccination, reproductive health education, and early screening essential preventive measures. In Indonesia, cervical cancer continues to be one of the most prevalent cancers among women and contributes substantially to cancer-related morbidity and mortality. Although the government has expanded HPV vaccination and cervical cancer prevention programs, awareness and preventive behaviors among adolescents remain inadequate. Adolescence is a critical stage for establishing lifelong health behaviors; however, discussions related to reproductive health are often considered sensitive or taboo, limiting adolescents' access to accurate information and increasing the risk of misconceptions regarding reproductive health and disease prevention (WHO, 2025).

Adequate reproductive health knowledge is important for encouraging preventive behaviors, including proper vulva hygiene practices and awareness of HPV vaccination. Previous studies have shown that many adolescents have insufficient understanding of genital hygiene, menstrual health management, HPV infection, and cervical cancer prevention. Limited knowledge may reduce adolescents' ability to maintain reproductive health and increase their vulnerability to preventable health problems. Preliminary observations in Karang Ayu indicated that several adolescent girls had limited knowledge regarding appropriate vulva hygiene practices and cervical cancer prevention. Furthermore, awareness of HPV vaccination among adolescents was still relatively low, highlighting the need for innovative educational approaches that are acceptable and engaging for young people. Therefore, the innovative "Connecting Knowledge" intervention was developed to improve adolescents' knowledge and promote positive vulva hygiene behaviors as part of comprehensive cervical cancer prevention effort (WHO, 2025).

One factor that can influence adolescents to practise self-care, particularly vulva hygiene, is knowledge and behaviour. A lack of knowledge and accurate information among adolescents regarding reproductive health can lead to a lack of responsibility towards their reproductive health, including the actual behaviour required to practise good and proper personal hygiene (Amalia & Putri, 2021). The findings of Antarsih & Kusumastuti (2019) indicate that 53.5% of adolescent girls exhibit inadequate behaviour regarding primary prevention of cervical cancer. This is supported by the research of Amalia and Putri (2021), which found that 54.4%—or the majority of adolescents—exhibit poor behaviour in maintaining vulva hygiene.

Peer groups have an important role in supporting adolescent development; however, appropriate guidance is required to ensure that information shared among peers is accurate and does not lead to misconceptions regarding sexual and reproductive health, particularly in relation to cervical cancer prevention (Rahayu, Aminoto, & Madkhan, 2011, as cited in Ervyna, Utami & Surasta, 2015). The use of peer-based approaches has been reported as an effective strategy to encourage behavioural changes among adolescents by improving knowledge, attitudes, and health-related skills. Aisah, Sahar, and Hastono (2010) demonstrated that peer education could positively influence preventive behaviours related to anaemia, while Tarigan (2015) reported that group discussion approaches provided better effectiveness compared to lecture methods in improving health understanding.

Furthermore, peer groups create a supportive environment where adolescents can communicate, exchange experiences, and discuss sensitive reproductive health topics more comfortably (Fatimah et al., 2019). This is supported by Nazira and Devy (2017), who found that 57.6% of adolescent girls aged 15–23 years preferred discussing reproductive health concerns, including cervical cancer prevention, with their peers. Therefore, further innovation of peer-based educational strategies is needed to optimize adolescent involvement and strengthen reproductive health behaviours. The "Connecting Knowledge" method was developed as an innovative approach that combines peer interaction and health education to improve

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adolescents' knowledge and encourage appropriate vulva hygiene practices in cervical cancer prevention.

The "Connecting Knowledge" method is a tiered approach to health education. This programme begins with nursing students who have received health education via videos and booklets from researchers acting as tutors—individuals who possess higher qualifications and a deeper understanding of health. Subsequently, other adolescents in the Karang Ayu neighbourhood are recruited in a tiered manner: 10 individuals educate 20, and those 20 will in turn educate 40. This approach is based on the fact that adolescents are more open to communicating with peers due to their closeness and shared understanding; this study aims to improve adolescents' knowledge and behaviour regarding cervical cancer prevention through vulva hygiene.

Methods

Study Design

The research design is a quantitative study employing two methods: a quasi-experimental pre-test–post-test design without a control group. The quasi-experimental design was used to test whether the implementation of the 'Connecting Knowledge' intervention had an effect on improving vulva hygiene in knowledge and behaviour in the prevention of cervical cancer.

Setting

The study was conducted adolescents residing in Karang Ayu Subdistrict, Semarang. These settings were selected to represent the target population involved in adolescent reproductive health education and cervical cancer prevention initiatives. The research will be conducted from February to December 2024 at STIKES Telogorejo Semarang and among adolescents in the Karang Ayu district of Semarang.

Research Subject

The population for this study consists of students at STIKES Telogorejo and adolescents in the Karang Ayu subdistrict of Semarang. The sample will be selected using quota sampling, with inclusion criteria comprising third- and fifth-semester nursing students and adolescents aged 12–19 years (adolescent age as defined by the WHO). Group I consists of 10 third- and fifth-semester students from STIKES Telogorejo in Semarang; Group II comprises 20 individuals; and Group III comprises 40 adolescents from the Karang Ayu sub-district.

Instruments

The tool used in this study was the Vulva Hygiene Knowledge and Behaviour Questionnaire, the validity and reliability of which had been tested by previous researchers (Lestari, 2022). The negative items in the knowledge questionnaire were found in questions 3 and 9. The negative items in the behaviour questionnaire were 3, 9, 12, 13, 14 and 15.

Intervention

The research process for "connecting knowledge" consist of three phase. In this study, following the completion of administrative procedures and the obtaining of research permission, the researcher will conduct a pre-test on Group I using a knowledge and behaviour questionnaire administered via the Quizziz app, making it more engaging for the adolescents. Next, health education will be provided to the 10 members of Group I using video materials and booklets. Group I consists of nursing students who will receive health education and a demonstration on vulva hygiene directly from the researcher. The nursing students will serve as proper pioneers in delivering this education. This session will be delivered over two sessions, both offline and online. Subsequently, a post-test will be administered using the same questionnaire and materials. Next, Group I will administer a pre-test using the same methods and media, followed by health education and a demonstration for Group II. Group II consists of 20 adolescent girls from the Karang Ayu sub-district, with two sessions held both offline and online. The post-test will be conducted using the same methods and media. Group II, as the direct recipients of information

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from Group I—who possess a sound understanding of health—will be able to pass on accurate information in turn. Group I will then train Group II to disseminate the information to the next group of adolescents. In the end, Group II will then provide health education and demonstrations to Group III, comprising 40 other adolescent girls in the Karang Ayu sub-district, over two sessions held both offline and online. The post-test will be conducted using the same methods and media. Group III serves as the final recipients of the information, acting as an evaluation of knowledge transfer in this study.

Data Analysis

Quantitative data were processed and analysed using the Statistical Package for the Social Sciences (SPSS). The analysis was conducted on data obtained from the second and third groups using the Wilcoxon signed-rank test, as the variables were measured on an ordinal scale. Statistical significance was determined based on a p-value of <0.05.

Ethical Clearance

This research has obtained ethical approval from the Ethics Committee of STIKES Telogorejo Semarang, issued by the Institute for Research and Community Service (LPPM) with the ethical clearance number 011/I/P3M/STIKES/2024.

Results

1. Profile of respondents' characteristics by age

Table 1 Frequency Distribution of Respondents by Age

Age (year)	Connect 1	Connect 2
Mean	17,2	17,12
Median	18	18
Modus	18	18
Total	20	40

Table 1 shows the distribution of respondents' age characteristics in the Connect 1 and Connect 2 groups. The mean age of respondents was 17.2 years in Connect 1 and 17.12 years in Connect 2, with the median and mode age being 18 years in both groups, indicating that most respondents were adolescents aged 18 years.

2. The effect of the 'Connecting Knowledge' intervention on improving knowledge of vulva hygiene in each group

Table 2.1 Comparison of Knowledge Levels Before and After the Intervention

Knowledge	Groups							
	Connect 1				Connect 2			
	Pretest	%	Posttest	%	Pretest	%	Posttest	%
Poor	0	0	0	0	0	0	0	0
Adequate	8	20	0	0	27	67,5	16	40
Good	12	80	20	100	13	32,5	24	60
Total	20	100	20	100	40	100	40	100

Table 2 shows the comparison of respondents' knowledge levels before and after the 'Connecting Knowledge' intervention in the Connect 1 and Connect 2 groups. Before the intervention, most respondents had good knowledge in both groups (80% in Connect 1 and 32.5% in Connect 2), while after the intervention, all respondents in Connect 1 achieved a good knowledge level (100%) and the proportion of good knowledge in Connect 2 increased to 60%, indicating an improvement in knowledge of vulva hygiene following the intervention.

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Table 2.2 The Effect of the Intervention on Knowledge

	Group			
	Connect 1	**p-value**	**Connect 2**	**p-value**
Negative Rank	0	0.005	4	0.012
Positive Rank	8		15	
Ties	12		21	
Total	20		40	

Table 2.2 presents the effect of the 'Connecting Knowledge' intervention on respondents' knowledge levels in both groups. The Wilcoxon test showed a significant difference in knowledge before and after the intervention in the Connect 1 group (p = 0.005) and Connect 2 group (p = 0.012), indicating that the intervention effectively improved respondents' knowledge of vulva hygiene.

3. The effect of the "Connecting Knowledge" innovation intervention on improving vulva hygiene behaviour in each group

Table 3.1 Comparison of Behaviour Before and After the Intervention

Behaviour	**Group**							
	Connect 1				**Connect 2**			
	Pretest	**%**	**Posttest**	**%**	**Pretest**	**%**	**Posttest**	**%**
Poor	0	0	0	0	1	2.5	0	0
Adequate	14	70	5	25	32	80	28	70
Good	6	30	15	75	7	17.5	12	30
Total	20	100	20	100	40	100	40	100

Table 3.1 shows the comparison of respondents' behaviour levels before and after the 'Connecting Knowledge' intervention in the Connect 1 and Connect 2 groups. Before the intervention, most respondents had adequate behaviour (70% in Connect 1 and 80% in Connect 2), while after the intervention, respondents in Connect 1 achieved a good behaviour level (75%) and the proportion of good behaviour in Connect 2 increased from 17,5% to 30%, indicating an improvement in behaviour of vulva hygiene following the intervention.

Table 3.2 The Effect of the Intervention on Behaviour

	Group			
	Connect 1	**p-value**	**Connect 2**	**p-value**
Negative Rank	1	0.007	1	0.034
Positive Rank	10		7	
Ties	9		32	
Total	20		40	

The statistical analysis reveals that the intervention elicited a significant positive shift in behavior across both groups, as demonstrated by the predominance of positive ranks over negative ranks. Specifically, the Connect 1 group showed a highly significant behavioral improvement (p value = 0.007), while the Connect 2 group also exhibited a statistically significant advancement (p value = 0.034).

Discussion

Based on Table 1, the median and mode for age in Connect 1 and 2 were both 18. Adolescent peers serve as a forum for sharing with friends; as a means of communication, they may pose a risk of behavioural change. The findings of this study are consistent with the research

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by Utomo, Rochmawati, and Sulistyani (2020), which found that peers can influence adolescent behaviour. Adolescents and their peers have a significant influence not only on socialising but also on decision-making, which can be influenced by peers (Nurlaila, Astuti, Ernawati, Herniyatun, Rahmawati, & Puspitasari, 2024). Adolescents spend more time with their peers, so their influence is greater than that of the family. Furthermore, peers are able to contribute and set an example for other adolescents, including in terms of healthy behaviour (Rusiana et al., 2021).

According to Table 2.1, in the Connect 1 group, knowledge levels improved from previously 'adequate' and 'good' to 100% 'good'. In the Connect 2 group, the majority of participants whose knowledge was previously 'adequate' now have 'good' knowledge. The findings of Balu, Limbu, and Gustam (2024) indicate that peer education among adolescents is capable of enhancing their knowledge. Furthermore, Widiyastuti, Nurcahyani, and Sriyatin (2024) state that peer education using the youth ambassador method can improve the average knowledge of adolescents. Peers are a form of social support provided by adolescents of the same age; moreover, adolescents spend much of their time outside the home with their friends. It is this that can influence adolescents' knowledge and mindset (Jahja, 2013). In line with research conducted by Kumalasari (2016), it was found that among adolescents, 24 students (42.1%) possessed good knowledge. Based on Table 2.2, in the Connect 1 group, 8 respondents experienced an increase in knowledge, 12 respondents maintained the same level of knowledge, and none experienced a decrease in knowledge. In the Connect 2 group, 15 respondents experienced an increase in knowledge, 21 respondents maintained the same level of knowledge, and 4 respondents experienced a decrease in knowledge. The test results for the Connect 1 group yielded a p-value of 0.005 and for the Connect 2 group a p-value of 0.012, indicating that in both groups there was an effect of the provision of connecting knowledge on the respondents' knowledge. This is consistent with the research by Sri and Yanni (2024), which found that peer involvement among adolescents can influence their knowledge in education. Furthermore, research conducted by Adila, Ramadhan, Mufida, Surury, and Handari (2022) found a significant relationship between peers and knowledge.

The 'Connecting Knowledge' programme involves delivering health education in small groups, initiated by nursing students who have received training via videos and booklets provided by the researchers. These nursing students act as tutors and subsequently recruit other adolescents in the Karang Ayu neighbourhood in a tiered manner: 10 students recruit 20 adolescents, and those 20 then educate 40 more. This knowledge-sharing initiative establishes a peer-to-peer network involving two people at each stage. Adolescent girls perceive their peers as better able to understand and relate to what is happening to their bodies; they are seen as non-preachy and share similar growth and developmental stages. Peer-led education is readily accepted by adolescents because discussing the reproductive system is still considered a taboo subject. Research findings indicate that peer-to-peer education methods are effective in enhancing knowledge (Suryani & Lundy, 2022). In line with the research by Nuryani and Paramata (2018), peer education among adolescents is effective in improving knowledge. Supported by the research of Ratna, Mariza, Yuviska, & Putri (2023), there was an increase in the average knowledge score before the educational video on vulva hygiene was provided, with an average of 59.710, to an average of 76.004 after the educational video on vulva hygiene was provided. Furthermore, other literature indicates that peer group influence, where education is provided by peers, can enhance adolescents' knowledge (Mulyani & Khoirunisa, 2020).

Based on Table 3.1, the majority of participants in the Connect 1 group exhibited adequate behaviour regarding cervical cancer prevention—particularly vulva hygiene—prior to the intervention, and the majority demonstrated good behaviour following the intervention. In the Connect 2 group, the majority exhibited adequate behaviour both before and after the intervention. According to SPSS calculations, there was a change in scores in terms of ratios;

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however, as this study used an ordinal scale, there were categories that showed no change or remained in the 'moderate' category. Adolescence is a transitional phase towards adulthood, characterised by the pursuit of self-identity, new experiences, and a balance between personal interests and those of others (Ardhiyanti, 2023). Behavioural changes can be influenced by peers and a social culture that prioritises interaction with the outside world over interaction with parents (Nurdianti, Marlina, & Sumarni, 2021). Furthermore, behavioural changes are also influenced by the education received by adolescents, as well as the role of the media and social media, which have been examined in previous research (Thanasas, Lavranos, Gkogkou, & Paraskevis, 2020). Newspapers, magazines, television, and social media are other sources of information regarding cervical cancer prevention. Research in Turkey indicates that peer education can improve knowledge and behaviour regarding reproductive health. Peer group education methods are more effective in enhancing adolescents' knowledge (Grijns, 2018).

According to Table 4.5, in the Connect 1 group, 10 respondents exhibited an improvement in behaviour, whilst 9 respondents maintained their original behaviour. In the Connect 2 group, 7 respondents exhibited an improvement in behaviour, whilst 32 respondents maintained their original behaviour. The test results for Group 1 yielded a p-value of 0.007 and for Group 2 a p-value of 0.034, indicating that in both groups there was an effect of the provision of connecting knowledge on the respondents' behaviour.

Adolescents seek information on reproductive health from a variety of sources. The family, as the primary source of education, is often unable to provide sufficient information because the subject is still considered taboo. The lack of sources of reproductive health information contributes to some of the difficulties experienced by adolescents. Evidence suggests that friends and the mass media are the main sources of reproductive health information. Based on the research findings, adolescents feel uncomfortable discussing reproductive health with their parents. Some adolescents obtain information about reproductive health through discussions with peers (Anggraini et al., 2022). Education using audiovisual media and peers constitutes a comprehensive intervention that is acceptable to adolescents and can therefore change their behaviour. This study, in line with the research by Anastasya (2024), highlights the importance of comprehensive reproductive health education and the empowerment of adolescents to make appropriate decisions regarding their reproductive health.

contributed to improvements in vulva hygiene practices among adolescent girls. Peer education is considered an effective health promotion strategy during adolescence because information delivered by individuals of a similar age is often perceived as more relatable, trustworthy, and socially acceptable. Through peer interactions, adolescents may feel more comfortable discussing sensitive reproductive health topics, thereby facilitating greater engagement and knowledge acquisition. Nevertheless, behavioral change is a complex and gradual process that extends beyond the acquisition of knowledge alone. Sustained improvements in vulva hygiene practices may require continuous reinforcement, supportive family involvement, adequate menstrual hygiene facilities, access to clean water and sanitation, privacy for personal hygiene practices, and positive social norms that encourage healthy reproductive health behaviors. Therefore, while the observed post-intervention improvements are encouraging, long-term behavioral maintenance is likely influenced by broader environmental and social determinants that were not directly addressed in the current intervention (WHO & UNICEF, 2023; UNICEF, 2021).

The results should also be interpreted with caution due to the methodological limitations of the study design. As this study employed a one-group pretest–posttest approach without a control group, the observed improvements cannot be attributed solely to the peer-group education intervention. Several alternative explanations may have contributed to the increase in post-test scores, including testing effects resulting from repeated exposure to the questionnaire, increased familiarity with the assessment items, social desirability bias, short-

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term recall of educational content, and natural developmental changes occurring during adolescence. These factors may have inflated the measured effect of the intervention and limited the ability to establish a causal relationship between peer education and behavioral outcomes. Future studies should consider incorporating a control group, larger sample sizes, and longer follow-up periods to evaluate the sustainability of behavior change and to provide stronger evidence regarding the effectiveness of peer-led reproductive health education in promoting vulva hygiene practices and supporting cervical cancer prevention efforts (Polit & Beck, 2021; Shadish et al., 2002).

However, there are barriers to behavioural change, namely the adolescent phase in which young people prioritise privacy regarding their reproductive health (Kirubarajan, Leung, Li, Yau & Sobel, 2021). This is consistent with the developmental stage of adolescence, during which young people tend to trust their peers more than others, including their parents. To reduce these barriers, external engagement with adolescent groups—such as healthcare providers—is required. Healthcare providers must receive training in youth-friendly communication techniques, cultural competence, and sensitivity to gender and socio-cultural factors that may influence adolescents' perceptions and behaviour. By encouraging open and non-judgemental communication and providing age-appropriate information and support, particularly for adolescents, healthcare providers can create a supportive environment that encourages adolescents to seek care, ask questions, and engage in preventive behaviours, particularly regarding cervical cancer and reproductive hygiene (Anastasya, 2024). It can therefore be concluded that comprehensive reproductive health education is vital in promoting sound decision-making and fostering positive hygiene behaviours among adolescents.

Conclusion

The results of this study show that the majority of respondents were aged 18, whereas the WHO defines adolescence as the age range 12–19 years. Regarding the knowledge variable, this study concluded that there was a change in each group from a majority rated as 'adequate' to 'good'. The results of this study also had p-values of 0.05 and 0.012 (p-value < 0.05); it can therefore be concluded that the 'connecting knowledge' innovation intervention had an effect on adolescents' knowledge regarding cervical cancer prevention. The results of this study show a change in behaviour in the Connect 1 group (20 respondents) from a majority rated as 'adequate' to 'good', and in the Connect 2 group (40 respondents), the majority remained in the 'adequate' category. The p-values in this study were 0.012 and 0.034 (p-value < 0.05); it can be concluded that the "Connecting Knowledge" innovation intervention has an effect on adolescents' behaviour regarding cervical cancer prevention. It is recommended that further research should incorporate additional interventions and involve a wider range of stakeholders, thereby providing adolescents with a safe space to look after their health without feeling embarrassed to speak openly. Cervical cancer prevention begins in adolescence and continues into adulthood, and could be incorporated as one of the interventions within comprehensive nursing care.

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