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The Effect of an Android-Based HIV/AIDS Monitoring Application on Adolescents' Knowledge and HIV/AIDS Screening

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Abstract

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) remain major global public health challenges, including in Indonesia, where adolescents are particularly vulnerable due to high-risk behaviors. This study aimed to evaluate the effectiveness of an Android-based HIV/AIDS monitoring application (PAHIVA) in improving adolescents' knowledge and facilitating early HIV/AIDS risk screening. A pre-experimental study with a one-group pretest–posttest design was conducted among 90 high school students in Singkawang City. Data on HIV/AIDS knowledge were collected using structured questionnaires before and after the intervention and analyzed using the Wilcoxon signed-rank test. The results showed a statistically significant increase in knowledge scores, with the median rising from 67 at baseline to 87 after the intervention ($p < 0.001$). A total of 76 participants demonstrated improved knowledge, while 14 showed no change. Additionally, the application-based screening identified 9 participants (10%) as being at high risk for HIV/AIDS, who were subsequently referred to the nearest Voluntary Counseling and Testing (VCT) clinic for further evaluation. In conclusion, the PAHIVA application was associated with improved knowledge and demonstrated potential as a preliminary HIV/AIDS risk screening tool among adolescents. This mobile health innovation may contribute to strengthening adolescent-focused HIV/AIDS prevention strategies, although further studies with more robust designs are recommended to confirm its effectiveness.

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1. INTRODUCTION

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) remain major global public health challenges (Arantes et al. 2023; Shao & Shao, 2023; Mark, 2024). It is estimated that approximately 4,000 people are newly infected with HIV each day, including 1,100 adolescents aged 15–24 years (Rahyani, 2023; Zhang et al., 2022). In 2021, around 650,000 people died from AIDS-related diseases (Portilla-Tamarit et al., 2024; Lu, 2025; UNAIDS, 2022), while approximately 2.1 million adolescents in low- and middle-income countries and 3.3 million children under the age of 15 are living with HIV/AIDS (Hudelson, 2015). These data indicate that adolescents constitute a significant and vulnerable population in the global HIV epidemic.

In Indonesia, the burden of HIV/AIDS continues to increase, with cumulative cases reaching 329,581 people living with HIV and 137,397 AIDS cases as of March 2022. The epidemic is increasingly dominated by younger populations, with approximately 51% of new HIV cases occurring among adolescents. Based on AIDS Epidemic Model (AEM) estimates, around 526,841 people were living with HIV in 2021, including approximately 27,000 new cases. Additionally, 12,533 HIV cases were reported among children aged 12 years and below (Kementerian Kesehatan Republik Indonesia, 2014). Regionally, West Kalimantan is among the provinces with the highest AIDS case rates, where adolescents aged 14–24 years contribute 38.3% of HIV cases and 45.5% of AIDS cases (Badan Penelitian dan Pengembangan Kesehatan, 2019), emphasizing the urgency of targeted interventions.

Adolescents, defined as individuals aged 10–19 years according to the World Health Organization, or 10–18 years based on national regulations, and 10–24 years for unmarried individuals (Kementerian Kesehatan Republik Indonesia, 2014), represent a large demographic group in Indonesia, totaling approximately 43.5 million people (18% of the population). This developmental stage is characterized by rapid physical, psychological, and intellectual changes, along with increased curiosity, exploration of sexuality, and a tendency toward risk-taking behaviors without adequate consideration. These characteristics heighten vulnerability to HIV infection and highlight the importance of adolescent-friendly health services, particularly in reproductive and sexual health education (Kementerian Kesehatan Republik Indonesia, 2014; Akinwale et al., 2022; Jacobs et al., 2023; Subramanian et al., 2023), as well as tailored HIV management approaches for adolescents (Mulawa et al., 2023; Obeagu, 2024).

Behavioral and environmental factors further increase adolescents' risk of HIV infection. Data show that the highest proportion of dating occurs among individuals aged 15–17 years, while premarital sexual activity is more prevalent among males aged 20–24 years (14.6%) and 15–19 years (4.5%), largely driven by curiosity (57.5%) (Kementerian Kesehatan Republik Indonesia, 2014). Additional risk factors include adolescent involvement in sex work, child labor, migration, sexual abuse, and forced sex trafficking (Greenbaum, Kaplan, & Young, 2023). Moreover, exposure to inappropriate sexual content through internet media contributes to increased sexual health risks among adolescents (Dadi, Dachew, & Tessema, 2024). Despite these risks, existing interventions predominantly rely on conventional education and facility-based screening, which may be limited in accessibility, engagement, and early detection capacity among adolescents.

Previous studies emphasize the importance of educational interventions (Ningrum & Dwijayanti, 2021) and adolescent-specific HIV management strategies. However, there remains a gap in integrating digital, accessible, and user-centered approaches that combine education with early risk screening. This study introduces an Android-based application, *Pantau HIV/AIDS* (PAHIVA), which integrates interactive learning with early

risk detection features. This study lies in the integration of digital health education and self-screening within a single mobile platform, as well as the empirical evaluation of its effectiveness in improving adolescent knowledge and identifying HIV risk. Therefore, this study aims to assess the effectiveness of the PAHIVA application in supporting HIV/AIDS prevention among adolescents.

2. METHOD

This study employed a pre-experimental design using a one-group pretest–posttest approach to evaluate the effectiveness of the PAHIVA application in improving adolescents’ knowledge and facilitating early HIV/AIDS risk screening. The study was conducted at Senior High School 6 Singkawang, Indonesia. The study population consisted of all students enrolled at the school, from which 90 respondents were selected using a purposive sampling technique based on inclusion criteria, including willingness to participate, ownership of an Android smartphone, and the ability to operate mobile applications.

The intervention involved the use of the PAHIVA (*Pantau HIV/AIDS*) application, an Android-based platform designed to provide educational content on HIV/AIDS and facilitate early risk screening. The application was installed on participants’ smartphones, and respondents were given instructions on how to use its features prior to the intervention. Participants then engaged with the application over a specified period to access educational materials and complete the screening module.

Data on adolescents’ knowledge of HIV/AIDS were collected using structured questionnaires administered before (pretest) and after (posttest) the intervention. The questionnaire was developed based on relevant literature and consisted of items measuring knowledge related to HIV transmission, prevention, and risk factors. Prior to data collection, the instrument was tested for validity and reliability to ensure its appropriateness for measuring the intended constructs.

Data analysis was performed using statistical software. Descriptive statistics were used to summarize respondent characteristics and knowledge scores. The normality of the data distribution was assessed using the Kolmogorov–Smirnov test. As the data were not normally distributed, the non-parametric Wilcoxon signed-rank test was applied to examine differences between pretest and posttest scores. A p-value of less than 0.05 was considered statistically significant.

This study has received ethical approval from the Health Research Ethics Committee of the Pontianak Ministry of Health Health Polytechnic (No. 01/KEPK-PK.PKP/III/D/2024). Ethical considerations were adhered to by obtaining informed consent from all participants prior to data collection. Participants were assured of the confidentiality and anonymity of their responses and were informed that their participation was voluntary, with the right to withdraw from this study at any time without any consequences.

3. RESULTS AND DISCUSSION

Table 1. Changes in Adolescents’ HIV/AIDS Knowledge Before and After the PAHIVA Application Intervention.

Variable	N	Median+SD	Min-Max	Positif Rank-Ties	p-value
Knowledge					
Pretest	90	67.0+10.52	40-93	76-14	0.001*
Posttest	90	87.0+9.87			

*Wilcoxon Test

Table 1 shows that the median knowledge score increased from 67.0 (SD = 10.52) in the pretest to 87.0 (SD = 9.87) in the posttest, indicating an improvement in adolescents' knowledge after the intervention. The score range also shifted from 40–93 at baseline, reflecting variability in initial knowledge levels. Based on the Wilcoxon signed-rank test, 76 respondents exhibited positive rank changes (increased knowledge), while 14 respondents showed no change (ties). The statistical analysis revealed a significant difference between pretest and posttest scores ($p = 0.001$), indicating that the PAHIVA application had a statistically significant effect on improving adolescents' knowledge of HIV/AIDS.

Table 2. HIV/AIDS Screening Results Through PAHIVA Application.

Variable	Yes	%	Not	%
High Risk of HIV/AIDS	9	10	81	90
HIV/AIDS Risk Screening Item				
a. Have used drugs	1	1.1	89	98
b. Have used syringes	1	1.1	89	98
c. Have used syringes at the same time	0	0	90	100
d. Have had sexual intercourse	3	3.3	87	96
e. Sexual partners have HIV/AIDS	0	0	90	100
f. Having sex with more than one person	1	1.1	89	98
g. Not always using a condom during sexual intercourse	1	1.1	89	98
h. Having had the same sex	0	0	90	100
i. Have you ever used sex toys in conjunction with other people	0	0	90	100
j. Have parents with a history of HIV/AIDS?	0	0	90	100
k. Have had a tattoo or piercing	5	5.5	85	94

Based on Table 2, it shows that there are 9 out of 90 respondents (10%) who are at risk of HIV/AIDS and were directed by the PAHIVA application to visit the nearest VCT clinic from the location. The respondents were willing to openly fill out the questionnaire because they had been informed that the results of the questionnaire in question would not be known by others, including BK teachers and school principals.

The results of this study demonstrated that 76 respondents experienced an increase in knowledge after the implementation of the PAHIVA application, while 14 respondents showed no change. The median knowledge score increased from 67 before the intervention to 87 after the intervention, with a statistically significant difference ($p = 0.001$). These findings indicate that the PAHIVA Android-based application has a significant effect on improving adolescents' knowledge of HIV/AIDS. In addition, the screening results revealed that 9 out of 90 respondents (10%) were identified as being at high risk for HIV/AIDS and were subsequently directed to the nearest Voluntary Counseling and Testing (VCT) clinic. The willingness of respondents to complete the screening honestly may be attributed to the assurance of confidentiality, as participants were informed that their responses would not be disclosed to teachers or school authorities.

Human Immunodeficiency Virus (HIV) is a virus that attacks the body's immune system, while Acquired Immunodeficiency Syndrome (AIDS) is a condition characterized by a collection of symptoms resulting from immune system failure. HIV is transmitted through body fluids such as blood, semen, vaginal fluids, and breast milk, and it progressively weakens the immune system, increasing susceptibility to opportunistic infections (Bekker et al. 2023; Li et al., 2023). Given these characteristics, efforts to reduce

HIV incidence among adolescents must focus on both increasing knowledge and promoting early detection through screening.

Improving adolescents' knowledge and expanding access to HIV/AIDS screening are essential strategies in preventing the spread of HIV. Health screening plays a crucial role in identifying risky behaviors and potential health problems that may affect the reproductive system, thereby influencing future health decision-making. Currently, HIV screening is primarily conducted through Voluntary Counseling and Testing (VCT), which provides both diagnostic and counseling services. However, several barriers limit the effectiveness of VCT services, including inadequate prevention-focused policies, limited availability of trained personnel, stigma and discrimination, lack of motivation among clients, and reluctance to access health services. These challenges highlight the need for innovative approaches in HIV prevention and management, including the "getting to zero" strategy, which aims to expand early detection and treatment coverage among adolescents. Mobile phone-based applications have emerged as a promising tool to support counseling and encourage HIV testing (Retnaningsih, 2016).

The use of HIV/AIDS screening applications among adolescents represents an innovative and accessible alternative for prevention efforts. Application-based interventions are particularly suitable for adolescents because they are simple, interactive, and easy to use. Mobile health applications for HIV screening typically incorporate several key features, including data recording, output and resource linkage, information provision, testing services, user interaction, and online statistics. These features can enhance awareness of risky behaviors, such as unsafe sexual practices and exposure to inappropriate sexual content through digital media. Given that adolescents spend approximately 5–6 hours per day accessing digital information, mobile-based interventions provide a strategic opportunity to deliver health education effectively (Chiou, 2020; Darmawati & Lindayani, 2020; Agarwal et al., 2016). Therefore, the PAHIVA application serves as a relevant digital solution to increase the reach of patient-centered health services, particularly in early disease identification and prevention of HIV/AIDS.

The PAHIVA application is an Android-based screening tool designed to support adolescents in understanding HIV/AIDS, identifying risky behaviors, and accessing early detection services. With support from health workers through initial counseling, adolescents can better comprehend HIV transmission and prevention strategies. Furthermore, early detection through the application may encourage adolescents to seek follow-up examinations and confirmatory testing. This aligns with the Minister of Health Regulation No. 74 of 2014, which emphasizes the importance of providing HIV counseling and testing services to all individuals, including adolescents, as part of comprehensive health services (Menteri Kesehatan Republik Indonesia, 2014). In regions with high HIV transmission rates, such as Pontianak City and Singkawang, the implementation of application-based screening can serve as a community-based prevention strategy involving multidisciplinary collaboration, including nursing, midwifery, information technology, and laboratory health professionals.

Despite these promising findings, this study has several limitations. First, the use of a pre-experimental one-group pretest–posttest design without a control group limits the ability to establish causal relationships. Second, the relatively small sample size and the use of purposive sampling from a single school reduce the generalizability of the findings. Third, the study relied on self-reported data, which may be subject to response bias. Finally, the short duration of the intervention did not allow for the assessment of long-term effects on behavior change or actual HIV testing uptake. Therefore, future studies

employing more rigorous designs, larger and more diverse samples, and longer follow-up periods are recommended to further validate the effectiveness of the PAHIVA application.

4. CONCLUSION

In conclusion, the findings demonstrate that the use of the PAHIVA application was associated with a significant improvement in adolescents' knowledge of HIV/AIDS, as evidenced by the increase in median knowledge scores following the intervention. In addition, the application successfully identified a proportion of adolescents at risk for HIV/AIDS and facilitated their referral to appropriate Voluntary Counseling and Testing (VCT) services. These results indicate that the PAHIVA application is a feasible and effective digital tool for delivering health education and conducting preliminary risk screening among adolescents. By integrating educational content with self-screening features, the application contributes to increasing awareness, promoting early detection, and supporting informed health decision-making. Therefore, PAHIVA has the potential to be incorporated into adolescent-focused HIV/AIDS prevention strategies, particularly in settings with limited access to conventional health services.

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