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The Role of Chatbot Literacy, AI Trust, and HIV/AIDS Sensitivity in Shaping HIV/AIDS Literacy among Adolescents

Masruroh[1], Agus Susanto[2]*, Heny Noor Wijayanti[1]

1- Diploma in Midwifery, Universitas Respati Yogyakarta, Indonesia.
2- Bachelor of Applied Media Production, Politeknik Indonusa Surakarta, Indonesia.
(Corresponding Author) agussus@yahoo.com

Background and Objective: Adolescents represent a crucial population for HIV/AIDS prevention, yet their literacy and engagement with digital health resources remain inadequate. Purpose: This study aimed to examine the influence of chatbot literacy, trust in artificial intelligence, and HIV/AIDS sensitivity on HIV/AIDS literacy among late adolescents.

Material and Methods: A cross-sectional survey was conducted in August 2025 involving 926 students from senior and vocational high schools, recruited through stratified random sampling. Data were obtained via a validated questionnaire assessing HIV/AIDS literacy, chatbot literacy, AI trust, AI openness, chatbot choice, and HIV/AIDS sensitivity. The digital survey was distributed using QR codes. Descriptive statistics summarized characteristics; Chi-square tests identified associations; logistic regression determined independent predictors (odds ratios, 95% confidence intervals). Ethical clearance and informed consent/assent were secured.

Results: HIV/AIDS literacy differed significantly by age, gender, school type, and internet access ($p < 0.05$). Bivariate analysis showed that chatbot literacy, AI trust, and HIV/AIDS sensitivity were significantly associated with HIV/AIDS literacy ($p < 0.001$). Multivariate analysis confirmed that AI trust ($p < 0.001$), chatbot literacy ($p = 0.032$), and HIV/AIDS sensitivity ($p<0.001$) remained significant independent predictors.

Conclusion: HIV/AIDS literacy among adolescents is shaped by digital competence, AI trust, and health awareness. Strengthening these aspects may enhance youth engagement with health information and support preventive behaviors.

Keywords: Adolescents, AI trust, Digital literacy, HIV/AIDS literacy

Received: 04 October 2025
Accepted: 10 February 2026
Doi: 10.22038/jhl.2026.91443.1866

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Introduction

Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) remain major global public health challenges, particularly among adolescents, who are uniquely vulnerable due to biological, behavioral, and social factors (1–3). Adolescence is characterized by exploration of identity, peer influence, and engagement in risk behaviors, which collectively increase susceptibility to HIV infection (4). Globally, approximately 1.7 million adolescents aged 10–19 years are living with HIV, and new infections in this age group accounted for an estimated 160,000 cases in 2022 (5). These figures underscore persistent gaps in HIV knowledge, prevention behaviors, and access to age-appropriate health education interventions (6,7).

In Indonesia, the HIV epidemic among youth presents a growing concern. National health surveillance data indicate that young people aged 15–24 years represent a significant proportion of newly diagnosed HIV cases, with a prevalence of 0.4% in 2022 (8). Despite the national scale-up of health education programs and voluntary counseling and testing (VCT) services, HIV/AIDS literacy remains limited, with misconceptions regarding transmission routes, preventive measures, and stigma-related barriers hindering effective engagement with health services (9–11) These gaps highlight the critical need for interventions tailored to adolescents, particularly those leveraging innovative digital health technologies (12).

At the regional level, the Special Region of Yogyakarta (DIY) exemplifies the challenges of adolescent HIV prevention in Indonesia. Sleman Regency, one of the densely populated areas within DIY, exhibits particularly low levels of adolescent awareness and engagement in sexual health education programs (13). Data from the 2022 DIY Health Office report indicate that only 3.7% of young women of reproductive age participated in screening programs, reflecting limited access to, or utilization of, preventive health services (14). Such local epidemiological patterns underscore the urgency of identifying factors that can enhance HIV/AIDS literacy among adolescents in this context, as increased literacy has been associated with safer sexual behaviors, earlier testing, and reduced transmission risk (15).

Recent advancements in digital health interventions, particularly chatbots and artificial intelligence (AI)-driven platforms, offer promising strategies to address these gaps. Chatbots provide interactive, personalized health information in real time, overcoming traditional barriers such as limited access to healthcare providers, stigma, and logistical constraints (16–18). Evidence suggests that adolescents engage more readily with digital tools that are perceived as trustworthy, accessible, and tailored to their informational needs. Constructs such as AI trust, openness to technology, and sensitivity to health-related content have been identified as critical determinants of engagement and effectiveness of digital health interventions (19,20).

Theoretical frameworks, including the Technology Acceptance Model (TAM) and Health Belief Model (HBM), provide conceptual underpinnings for understanding adolescent interaction with AI-based health tools. TAM posits that perceived usefulness and ease of use influence behavioral intention to engage with technology, whereas HBM emphasizes that perceptions of susceptibility, severity, benefits, and barriers guide health behavior (21,22). In the context of HIV/AIDS literacy, these frameworks suggest that adolescents' trust in chatbots, openness to AI interventions, prior experience with digital platforms, and sensitivity to HIV-related information collectively shape their ability to acquire and apply knowledge (23).

Despite increasing attention to digital health interventions, research examining the combined influence of chatbot literacy, AI trust, AI openness, chatbot usage, and HIV/AIDS sensitivity on HIV/AIDS literacy remains limited, particularly in Indonesia. Most prior studies have focused on knowledge acquisition in controlled settings or on adult populations, leaving a critical gap regarding late adolescents in high-risk yet under-studied regions such as Sleman Regency. Moreover, previous interventions often neglect to assess the interaction of personal, technological, and informational determinants of health literacy, limiting the ability to design comprehensive, evidence-based strategies. The current study addresses this gap by integrating individual and technological factors into a unified model of HIV/AIDS literacy among adolescents, providing novel insights into digital health education strategies within the Indonesian context.

The urgency of this research is reinforced by the persistent prevalence of risky behaviors among Indonesian adolescents, including early sexual debut, low condom use, and exposure to sexually explicit content through social media. Enhancing HIV/AIDS literacy through accessible, technology-driven interventions could reduce these behaviors,

promote early testing, and support broader public health goals. Additionally, findings from this study will contribute to the global discourse on AI-enabled health education, offering empirical evidence for tailoring digital interventions to adolescents' cognitive, social, and technological profiles.

The purpose of this study is to examine the influence of chatbot literacy, AI trust, AI openness, chatbot usage, and HIV/ AIDS sensitivity on HIV/AIDS literacy among late adolescents in Sleman Regency, DIY, Indonesia. Specifically, the study aims to quantify the associations between these factors and HIV/AIDS literacy levels, identify which determinants most strongly predict literacy outcomes, and provide evidence-based recommendations for digital health interventions targeting adolescents. By focusing on a high-risk, under-researched population and integrating theoretical and technological perspectives, this research seeks to advance the understanding of adolescent HIV/AIDS literacy and inform practical strategies for promoting sexual and reproductive health education.

Materials and Methods

A cross-sectional study was conducted in August 2025 in Sleman Regency, Special Region of Yogyakarta, Indonesia. The sample size was determined to meet the minimum requirements for cross-sectional analysis and to ensure adequate statistical power, particularly for multivariable analysis. To improve representativeness, a larger sample was intentionally recruited beyond the minimum requirement. A total of 926 adolescents participated in the study. Sampling was conducted using a multistage approach, in which senior high schools (SMA) and vocational high schools (SMK) were first selected, followed by the recruitment of eligible students within participating schools.

Participants were selected using stratified random sampling to ensure proportional representation from SMA and SMK. Inclusion criteria were: (1) aged 16–19 years, (2) currently enrolled in SMA/SMK in Sleman Regency, and (3) willing to participate. Students unable to comprehend the questionnaire were excluded. Sample size determination followed Isaac and Michael's table at a 95% confidence level, as the total population was unknown.

Data were collected using a structured questionnaire assessing HIV/AIDS literacy and independent variables, including chatbot literacy, AI trust, AI openness, chatbot choice,

and HIV/AIDS sensitivity. The questionnaire items were developed by the authors with reference to previously validated instruments (e.g., HKQ-18 for HIV/AIDS literacy; AI Literacy Questionnaire, Trust in Automation Scale, AI Openness Scale). Each construct was measured using six Likert-type items on a 4-point scale (1 = strongly disagree to 4 = strongly agree). The questionnaire underwent pilot testing with 30 students, demonstrating good internal consistency reliability (Cronbach's alpha > 0.80) and clarity (24–26). Content validity was ensured through expert review and theoretical alignment with the cited psychometric frameworks. Item responses were coded numerically and summed to generate total scores for each variable, with all scales treated as unidimensional and no subscales applied. The questionnaire was distributed online via a QR code. Students scanned the QR code using smartphones to access and complete the survey digitally, minimizing physical contact. Trained research assistants facilitated the process, ensuring adherence to instructions. Completion time ranged from 15–20 minutes per participant.

Data were coded and analyzed using IBM SPSS Statistics version 25. Descriptive statistics summarized participant characteristics and HIV/AIDS literacy levels. Participants were categorized by age groups, while other sociodemographic variables were analyzed according to their original questionnaire response options. HIV/AIDS literacy was categorized into "good" and "not good" based on the total score, using the median as a pragmatic cut-off point in the absence of established or validated thresholds for the instrument, with scores above the median classified as "good" and scores below or equal to the median classified as "not good." This approach was adopted to support interpretability and the application of logistic regression, while acknowledging the continuous nature of the underlying data. For bivariate analysis, Chi-square tests were conducted using binary variables, with all independent variables dichotomized in the same manner as HIV/AIDS literacy (e.g., high vs. low, yes vs. no) to ensure comparability. Logistic regression was applied to identify predictors of HIV/AIDS literacy, with odds ratios (ORs) and 95% confidence intervals (CIs) used to quantify effect sizes. Statistical significance was set at $p < 0.05$.

Results

A total of 926 senior high school and vocational high school students in Sleman, Indonesia completed the questionnaire. Descriptive results are presented as frequencies and percentages in accordance with the categorical analytical framework of the study. **Table**

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1 summarizes both the sociodemographic characteristics of participants and their association with HIV/AIDS literacy. The majority of participants were aged 16–17 years (62%) and female (70%). Most students attended senior high school (52%) or vocational high school (48%), and a large majority had access to the internet (93%).

Several notable patterns emerge from the bivariate analysis. Female students demonstrated a higher proportion of good HIV/AIDS literacy (74.5%) compared to male students (25.5%), and students aged 16–17 years had the highest literacy level (64.4%). Students attending senior high school were more likely to exhibit good literacy (58.2%) than those in vocational high schools (41.8%). Moreover, nearly all students with internet access showed good literacy (96.4%), while only a small fraction of those without access did (3.6%). All associations were statistically significant ($p < 0.05$).

Building on the findings from sociodemographic variables in **Table 1**, the analysis was extended to examine the relationship between key independent variables and HIV/AIDS literacy among late adolescents, as summarized in **Table 2**. This approach aimed to identify which factors related to digital literacy, AI perception, and HIV/AIDS sensitivity are associated with better literacy outcomes. As presented in **Table 2**, several notable patterns emerge. Students with good chatbot literacy were significantly more likely to demonstrate good HIV/AIDS literacy (65.5%) compared to those with poor chatbot literacy (34.5%), corresponding to an odds ratio (OR) of 2.13. High AI trust was associated with the highest proportion of good literacy (69.0%) relative to low AI trust (31.0%), with an OR of 3.42. Similarly, students with high HIV/AIDS sensitivity (56.1%), high AI openness (59.8%), and high chatbot choice (63.6%) showed markedly better literacy compared to their low-category counterparts, with ORs ranging from 1.85 to 2.63. All associations were statistically significant ($p < 0.001$), highlighting the importance of digital competence, AI perception, and sensitivity to HIV/AIDS in shaping adolescents' literacy levels.

Table 1. Sociodemographic Characteristics and HIV/AIDS Literacy among Adolescents (n = 926)

Variable	Category	Total N(%)	Health Literacy		χ^2	p-value
			Not Good N(%)	Good N(%)		
Age	<16	313 (33.8)	141 (34.9)	172 (33.0)	7.15	0.028
	16–17	575 (62.1)	239 (59.2)	336 (64.4)		
	>17	38 (04.1)	24 (05.9)	14 (02.7)		
Gender	Male	279 (30.1)	146 (36.1)	133 (25.5)	12.29	<0.001
	Female	647 (69.9)	258 (63.9)	389 (74.5)		
	Senior High School	477 (51.5)	173 (42.8)	304 (58.2)	21.67	<0.001

School Type	Vocational High School	449 (48.5)	231 (57.2)	218 (41.8)		
Grade	10	442 (47.7)	197 (48.8)	245 (46.9)	19.30	<0.001
	11	378 (40.8)	142 (35.1)	236 (45.2)		
	12	106 (11.4)	65 (16.1)	41 (07.9)		
Internet Access	None	63 (06.8)	44 (10.9)	19 (03.6)	18.89	<0.001
	Available	863 (93.2)	360 (89.1)	503 (96.4)		

Note: χ^2 = Pearson Chi-Square test

Table 2. Independent Factors Associated with HIV/AIDS Literacy among Adolescents (n = 926)

Variable	Variable Category	HIV Literacy			χ^2	p-value	OR (95 CI for OR)
		Not Good	Good	Total			
		N (%)	N (%)	N			
Chatbot Literacy	Not good	244 (60.4)	160 (34.5)	404			
	Good	218 (39.6)	304 (65.5)	522	31.63	<0.001	2.127 (1.632 – 2.771)
AI Trust	Low	245 (60.2)	162 (31.0)	407			
	High	159 (39.8)	360 (69.0)	519	81.05	<0.001	3.424 (2.608 – 4.497)
HIV/ AIDS Sensitivity	Low	268 (65.0)	229 (43.9)	497			
	High	136 (35.0)	293 (56.1)	429	46.23	<0.001	2.521 (1.926 – 3.300)
AI Openness	Low	258 (55.1)	210 (40.2)	468			
	High	146 (44.9)	312 (59.8)	458	50.88	<0.001	2.625 (2.008 – 3.432)
Chatbot Choice	Low	208 (52.3)	190 (36.4)	398			
	High	196 (47.7)	332 (63.6)	528	21.15	<0.001	1.854 (1.424 – 2.415)

Note. χ^2 = Pearson Chi-Square; OR = Odds Ratio; CI = Confidence Interval

To further investigate the independent contributions of digital literacy and HIV/AIDS-related factors, a multivariate logistic regression analysis was conducted, with the results presented in **Table 3**. This analysis allows for identifying which variables independently predict HIV/AIDS literacy among late adolescents after controlling for other factors. As shown in **Table 3**, AI trust emerged as the strongest predictor of HIV/AIDS literacy, with an odds ratio (OR) of 1.175 (95% CI: 1.106–1.249, $p < 0.001$). HIV/ AIDS sensitivity (OR = 1.156, 95% CI: 1.090–1.225, $p < 0.001$) and chatbot literacy (OR = 1.056, 95% CI: 1.005–1.110, $p = 0.032$) were also significant predictors. In contrast, AI openness and chatbot choice did not show significant independent effects. These findings underscore that adolescents' trust in AI, awareness of HIV/AIDS issues, and familiarity with chatbots play a meaningful role in shaping HIV/AIDS literacy, even when accounting for multiple influencing factors simultaneously.

Table 3. Logistic Regression Results on HIV/AIDS Literacy among Late Adolescents

Variable	B	S.E.	Wald	df	p-value	OR	95% CI for OR
Chatbot Literacy	0.054	0.025	4.614	1	0.032	1.056	1.005 – 1.110
AI Trust	0.162	0.031	26.841	1	<0.001	1.175	1.106 – 1.249
AI Openness	0.008	0.031	0.073	1	0.788	1.008	0.949 – 1.071

Chatbot Choice	-0.030	0.028	1.208	1	0.272	0.970	0.919 – 1.024
HIV/AIDS Sensitivity	0.145	0.030	23.801	1	<0.001	1.156	1.090 – 1.225
Constant	-5.719	0.580	97.250	1	<0.001	0.003	—

Notes: B = regression coefficient, S.E. = standard error, Wald = Wald chi-square test, df = degrees of freedom, p-value = probability value, OR = odds ratio, 95% CI for OR = 95% confidence interval for odds ratioF

Finally, to evaluate the overall explanatory power of the logistic regression model, goodness-of-fit statistics were examined, as summarized in **Table 4**. This step provides an indication of how well the selected independent variables collectively account for variations in HIV/AIDS literacy among late adolescents. As presented in **Table 4**, the model's -2 Log Likelihood value was 1112.71, with Cox & Snell R^2 of 0.155 and Nagelkerke R^2 of 0.208. These results suggest that the model explains approximately 16–21% of the variance in HIV/AIDS literacy, indicating a moderate level of explanatory power while highlighting the potential influence of other unmeasured factors.

Table 4. Model Summary of Logistic Regression

Step	-2 Log Likelihood	Cox & Snell R^2	Nagelkerke R^2
0	—	—	—
1	1112.708[a]	0.155	0.208

Note: Step 0 = null model; Step 1 = final model with all predictors (AI trust, HIV/AIDS sensitivity, chatbot literacy, AI openness, chatbot choice)

Discussion

The present study explored the determinants of HIV/AIDS literacy among late adolescents, considering sociodemographic characteristics, digital literacy, AI perception, and HIV/AIDS sensitivity. The findings reveal that factors such as age, gender, school type, internet access, chatbot literacy, AI trust, and HIV/AIDS sensitivity meaningfully influence literacy levels. Multivariate analysis further identifies AI trust, HIV/AIDS sensitivity, and chatbot literacy as independent predictors, indicating that both technological competence and health-related awareness shape adolescents' engagement with HIV/AIDS information (27–29).

Analysis of sociodemographic variables suggests that female students and those in mid-adolescence demonstrate higher literacy, consistent with prior studies showing that older adolescents and females are more proactive in health information-seeking behaviors (30,31). School type appears to influence literacy as well, highlighting the role of the educational environment in facilitating access to knowledge and reinforcing structured learning (32–34). The significance of internet access emphasizes the importance of connectivity in providing exposure to relevant health information and supporting self-directed learning.

Digital literacy and perceptions of AI emerge as particularly salient factors in shaping HIV/AIDS literacy. Students with higher chatbot literacy and greater trust in AI demonstrate better literacy outcomes. This finding provides an important refinement to the Technology Acceptance Model (TAM). While TAM emphasizes perceived ease of use and usefulness as drivers of technology adoption, the present study indicates that adoption alone is insufficient; what matters more are evaluative trust and practical competence (35). This suggests that interventions aimed at adolescent health cannot rely solely on providing technological access but must also cultivate skills in digital navigation and foster critical trust in health-related AI applications (21,36,37). Such insights are crucial in designing community-based health programs that integrate digital tools into routine educational and preventive practices.

HIV/AIDS sensitivity, interpreted via the Health Belief Model (HBM), also proves significant. Students who perceive themselves as susceptible to HIV/AIDS and acknowledge the seriousness of the condition are more motivated to seek and internalize relevant knowledge. This underscores that awareness is effective only when paired with perceived personal risk and motivation to act. In community health practice, this aligns with the emphasis on shaping both cognition and affect to drive behavioral change (22,38,39). The findings suggest that educational interventions for adolescents should not only transmit factual knowledge but also intentionally shape health beliefs to sustain preventive practices.

Interestingly, general AI openness and chatbot choice did not independently predict literacy outcomes. This finding challenges the assumption that a willingness to engage with technology automatically results in knowledge gains. Rather, trust in AI coupled with practical competence appears to be the decisive factor (40,41). Such insights are particularly relevant for educational and community programs integrating digital tools, highlighting that the quality and meaningfulness of interaction matters more than the mere presence of technology (42).

Study Limitations and Strengths: Strengths of this study include a large, representative sample and stratified random sampling, which strengthen internal validity. The integration of digital literacy, AI perception, and health belief measures provides a multidimensional view of literacy determinants. Structured, validated questionnaires ensured reliability, and logistic regression enabled identification of independent

predictors while controlling for confounders. These features make the findings highly relevant for designing digital health interventions for adolescents.

Some limitations of this study should be acknowledged. The cross-sectional design limits the ability to draw causal conclusions, and reliance on self-reported data may be affected by social desirability, which could inflate reported knowledge or behaviors. The model accounted for only a moderate proportion of the variance in HIV/AIDS literacy, suggesting that other influential factors, such as parental guidance, peer influence, or exposure to structured school-based health programs, were not fully captured. In addition, the focus on a specific regional context may restrict the applicability of these findings to adolescents in areas with different educational systems, cultural norms, or levels of digital access.

Looking forward, longitudinal or experimental studies could clarify causal relationships and evaluate interventions targeting both digital literacy and AI trust. Investigating the role of social networks, parental influence, and school curricula may provide further insight into adolescent HIV/AIDS literacy. Expanding research across diverse adolescent populations would allow for the identification of contextual factors that moderate these effects, supporting the design of sustainable and scalable digital health interventions.

Conclusion

This study concludes that digital literacy, trust in artificial intelligence, and HIV/AIDS sensitivity are central determinants of health literacy among late adolescents. The findings emphasize that competence in navigating digital platforms, confidence in AI-based health tools, and heightened awareness of HIV/AIDS risks significantly shape the ability of adolescents to acquire and apply relevant knowledge. These elements collectively highlight the interaction between technological readiness and health-related awareness in influencing literacy outcomes. Importantly, trust in artificial intelligence emerges not merely as a dimension of technology acceptance, but as a critical cognitive and affective factor that shapes adolescents' engagement with digital health information and their willingness to rely on AI-supported health guidance.

Practical implications indicate the importance of developing school- and community-based initiatives that enhance digital skills, strengthen confidence in digital health resources, and foster awareness of HIV/AIDS risks to promote preventive behaviors. By addressing both technological and psychosocial dimensions, this study contributes to

advancing adolescent health literacy and offers strategic insights for policymakers, educators, and health practitioners in supporting comprehensive health care and community empowerment. Future research is encouraged to explore these relationships using more nuanced measurement scales and longitudinal designs to better capture the dynamic development of AI trust and health literacy across different adolescent contexts.

Acknowledgments: The authors gratefully acknowledge the financial support provided by the Ministry of Science, Technology, and Higher Education of the Republic of Indonesia through the PFR (Regular Fundamental Research) grant scheme.

Availability of Data and Materials: The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of interest: There are no conflicts of interest.

Consent for publication: Not applicable

Ethics Approval and Consent to Participate: This study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2000 revision) and relevant national guidelines. Ethical approval was obtained from the Institutional Ethics Committee of Politeknik Kesehatan Kementerian Kesehatan Semarang, Indonesia (No. 1049/EA/F.XXIII.38/2025). Written informed consent was obtained from participants aged 18 years and above, while participants under 18 years provided written assent together with parental consent through formal school channels. Participation was voluntary, and confidentiality was ensured through the anonymization of all personal data.

Funding: Funding was provided by the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia.

Authors' Contributions: MM served as the lead author and coordinated the study implementation, manuscript preparation, and revision. AS contributed to the conceptual and methodological direction of the study and supported the validation of research procedures and findings. HNW was involved in data collection and ensured adherence to the approved research protocol. All authors reviewed and approved the final version of the manuscript.

AI Declaration: In line with COPE and publisher guidelines, AI tools were used only for language editing and did not influence the study design, data collection, analysis, or conclusions. The authors remain fully responsible for the content of this article.

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