Health Sciences International Journal (HSIJ)
Vol. 4, No. 1, February 2026, pp. 69 – 83
ISSN: 3026-5037
DOI:https://doi.org/10.71357/hsij.v4i1.94

Original Research

Efficacy of the ABCDE health education poster in improving HIV prevention knowledge among coal mine workers

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ARTICLE INFO

Article history:
Received 12 October 2025
Accepted 26 January 2026
Published 28 February 2026

Keywords:
Health education
HIV
Coal miners
Poster
Barito Utara

ABSTRACT

Background: Coal mine workers are a highly vulnerable population to HIV transmission due to their unique working conditions, including remote locations and prolonged separation from family, which often lead to high-risk behaviors. Preliminary assessment among workers at PT. X in Barito Utara indicated a significant gap in HIV prevention knowledge.
Objective: This study aimed to analyze the efficacy of the ABCDE health education poster in improving HIV prevention knowledge among male coal mine workers.
Method: A pre-experimental, one-group pretest-posttest design was utilized. A sample of 30 male workers was recruited using accidental sampling. Data on HIV prevention knowledge were collected via a validated online questionnaire before (pretest) and immediately after (posttest) exposure to the ABCDE poster intervention. The Wilcoxon Signed Rank Test was employed to analyze the difference between pre- and post-intervention scores.
Results: The percentages knowledge significantly increased from pretest (72%) to posttest (86%) after the intervention, with the Wilcoxon test yielding a statistically significant result ($p < 0.001$). The highest improvement was observed in younger and more educated workers.
Conclusion: The IDI's ABCDE health education poster is an effective, low-cost, and efficient visual tool for rapidly increasing HIV prevention knowledge among coal mine workers. These findings support the integration of targeted visual media into Occupational Health and Safety (OHS) programs to address knowledge gaps in remote industrial settings.

1. Introduction

Human Immunodeficiency Virus (HIV) remains a substantial global health challenge, imposing severe impacts on public health systems, the economy, and social stability. While Antiretroviral Therapy (ART) is effective in suppressing viral replication, it does not eradicate the virus due to its ability to mutate and establish latency within the host's DNA (Lindegger, 2024; Mark, 2024; Nsubuga, 2024; Thalia, 2024). Although global efforts have reduced new

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HIV infections by 40% and AIDS-related deaths by 56% since 2010, the ongoing crisis threatens to trigger an additional 6 million new infections and 4 million deaths by 2029 (Joint United Nations Programme on HIV/AIDS, 2025).

HIV attacks the body's immune system (CD4+ T cells) (Nuriasti et al., 2025; Verma et al., 2018). It integrates its genetic material into the host's DNA, allowing it to persist in a latent state, which complicates eradication efforts. To date, a complete cure remains elusive, as Antiretroviral Therapy (ART) functions only to suppress viral replication. This underscores that prevention strategies constitute the most fundamental and crucial pillar in controlling this epidemic (Geretti, 2017; Rashid et al., 2025).

The situation in Indonesia is particularly concerning. Reports from the Ministry of Health (2023, 2024) indicate a sharp increase in cases, rising from 377,650 in 2022 to 503,261 in 2023. At the regional level, Central Kalimantan Province shows a consistent upward trend, with health profiles recording 264 cases in 2021, 339 in 2022, and 387 in 2023 (Centra Kalimantan Health Agency., 2024). This escalating prevalence confirms that the transmission chain remains uncontrolled, underscoring the fundamental and crucial role of prevention strategies in epidemic control.

Workers in the extractive sector, particularly those in remote coal mining areas, are identified as a highly vulnerable population for HIV transmission. The unique context of coal mining often exposes workers to sustained periods away from family supervision and support, combined with close proximity to high-risk areas (Baltazar et al., 2015; Dietler et al., 2022). The critical need for such prevention is exemplified by findings from a preliminary study conducted at PT. X in North Barito, which revealed alarming risk behaviors: nine out of ten interviewed employees admitted to having engaged with commercial sex workers, and six of them reported unprotected sex within the last year. These behaviors were attributed to factors such as discomfort with condom use and prolonged separation from their legal partners. More critically, the workers reported never having received any formal Communication, Information, and Education (CIE) on HIV prevention from the company or external public health providers (puskesmas). This highlights a dangerously low baseline knowledge of comprehensive prevention methods among the mining workforce, thereby accelerating the potential spread of sexually transmitted infections in this environment.

Education is central to improving health knowledge (Omole, 2025), but its efficacy is

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ISSN: 3026-5037 DOI:https://doi.org/10.71357/hsij.v4i1.94

highly dependent on selecting the appropriate media (Hayati et al., 2024; Kumar, 2024; Listiana & Jasa, 2023). Posters are valued as visual health promotion tools due to their capacity to convey messages concisely, clearly, and attractively through the combination of text and images. They are cost-effective and can be strategically placed to reach a wide audience (Koniah et al., 2025; Noor et al., 2023). In 2024, the Indonesian Medical Association (*Ikatan Dokter Indonesia* [IDI]) released its latest HIV prevention poster featuring the "ABCDE" mnemonic: *Anda jauhi sex, Bersikap saling setia, Cegah dengan kondom, Dihindari penggunaan narkoba, dan Edukasi bahaya & dampak HIV/AIDS* (abstinence, be faithful, use condom, no drugs, education) (IDI, 2024). Despite its potential, an in-depth literature search across various databases revealed a significant research gap: no previous study has specifically tested the effectiveness of this particular IDI-designed poster in improving HIV prevention knowledge. Most similar studies utilized generic posters or material from other sources. This knowledge gap necessitates an empirical evaluation of whether the latest, authoritative educational material from the IDI can effectively influence the level of understanding within a high-risk group such as coal mine workers.

The confluence of a highly vulnerable population, a low baseline of HIV prevention knowledge confirmed by preliminary data, and the availability of a promising, yet untested, educational medium (the IDI poster) underscores the urgency of this study. The findings are expected to serve as a critical initial evaluation for the company to consider the implementation of structured reproductive health programs. Therefore, this study aims to analyze the efficacy of the IDI's "ABCDE" health education poster in improving HIV prevention knowledge among male coal mine workers at PT. X in North Barito. The results will provide an evidence base for developing more effective and targeted health interventions within this company and similar contexts in the extractive industry.

2. Methods

Research design

This study employed a pre-experimental design with a one-group pretest-posttest design. In this design, the dependent variable (HIV prevention knowledge) was measured in a single group of participants before (pretest) and immediately after (posttest) the intervention, which was the exposure to the health education poster. This design was chosen to provide an initial assessment of the intervention's immediate effect in a relatively

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controlled setting, despite the inherent limitation of lacking a comparative control group. The research was conducted from June to July 2025.

Participants

The target population for this study comprised all male workers residing in the company barracks (mess) of PT. X, a coal mining company located in South Teweh, North Barito Regency, Central Kalimantan. As of March 2025, the total population was recorded at 102 individuals. The sampling technique used was accidental sampling, where participants were recruited based on their availability and willingness to participate during the data collection period. The study successfully collected data from 30 respondents who met the inclusion criteria: being a male mine worker residing in the company barracks and providing signed informed consent. The sample size was not determined via statistical power calculation due to the challenging logistical conditions of the remote mine site, the limited availability of workers during the shift cycle, and the inherently small total population of 102 individuals.

Data collection

Data collection was facilitated using an online questionnaire developed on Google Forms, consisting of three main components:

1. Demographic Data: Collected information on age, latest educational attainment, and previous sources of HIV prevention information.
2. Knowledge Questionnaire: The knowledge instrument was adopted and modified from a previous study by Sabda (2019). It consisted of 11 closed-ended statements using a Guttman scale (Yes/No answers), covering aspects of HIV prevention, including *Be Faithful*, *Abstinence*, *Condom use*, *Don't Inject*, circumcision, and transmission myths. The total knowledge score was converted into a percentage and categorized as: Poor (<56%), Sufficient (56%–75%), and Good (76%–100%).
3. Health Education Intervention: The intervention consisted of a digital HIV prevention poster officially released by the Indonesian Medical Association (IDI) in 2024. The poster visually articulated the "ABCDE" prevention strategy.

Data analysis

The data obtained from the pretest and posttest questionnaires were statistically analyzed to measure the change in respondents' knowledge levels across the Poor, Sufficient, and Good categories. Descriptive statistics were utilized to present the profile of the

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respondents and the frequency distribution of knowledge levels before and after the intervention. Since the knowledge data did not meet the normality assumption for parametric tests, as indicated by the Shapiro-Wilk test result of $p < 0.05$, the significance of the poster intervention's effectiveness was analyzed using the Wilcoxon Signed Rank Test for paired samples. Statistical analysis was performed with the aid of the Statistical Package for Social Studies (SPSS) software, version 26.

Ethical consideration

This research adhered strictly to the principles of health research ethics. Formal ethical approval was secured from the Ethics Committee of Sari Mulia University, under certificate number 256/KEP-UNISM/VI/2025. The principle of informed consent was applied digitally, where prospective participants received a thorough explanation of the study's objectives, procedures, risks, and benefits before voluntarily agreeing to their participation. The confidentiality of all respondent identities and data was strictly maintained, with data presented only in aggregated and anonymous form for reporting purposes. The study posed no significant physical or psychological risks (non-maleficence); conversely, it provided a direct benefit (beneficence) through increased awareness and knowledge of HIV prevention. The principle of justice was ensured by offering equal opportunity for participation to all employees who met the inclusion criteria and guaranteeing the freedom to withdraw from the study at any time without any consequence.

3. Results

Respondent characteristics

Prior to analyzing the intervention's effectiveness, the demographic characteristics of the study sample were identified to provide a comprehensive context of the participants' profile. The distribution of respondents based on age group, highest educational attainment, and self-reported sources of HIV prevention information is presented in Table 1. This profile is crucial for understanding the sample background and offering initial insights into factors that might influence their baseline knowledge levels.

Table 1. Respondent characteristics (n=30)

Characteristic	Category	Frequency (f)	Percentage (%)
Age	Young adult (20-40 years)	25	83.3
	Middle-aged adult (41-59 years)	5	16.7

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Education	Senior High School	18	60.0
	Higher Education	12	40.0
Source of HIV information*	Never received information	6	20.0
	Teacher	5	16.7
	Health worker	4	13.3
	Mass media	4	13.3
	Combination of various sources	11	36.7

* Categories are simplified for presentation; respondents could select more than one source.

Knowledge level before and after intervention

The data in Table 2 reveals a marked improvement in HIV prevention knowledge following the poster intervention. The most substantial shift was observed in the proportion of respondents with Good knowledge, which doubled from 40.0% during the pretest to 80.0% in the posttest. Concurrently, the proportion in the Poor knowledge category decreased markedly from 16.7% to 3.3%. These changes indicate a clear positive effect of the educational material in elevating overall knowledge levels among the participants.

Table 2. Distribution of HIV prevention knowledge levels before and after intervention (n=30)

Measurement Time	Knowledge Level	Frequency (f)	Percentage (%
Pretest	Poor	5	16.7
	Sufficient	13	43.3
	Good	12	40.0
Posttest	Poor	1	3.3
	Sufficient	5	16.7
	Good	24	80.0

Effectiveness of the Educational Poster Intervention

The statistical analysis confirms that the observed improvement in knowledge was highly significant and not due to chance. The result of the Wilcoxon Signed Rank Test, as shown in Table 3, yielded a Z-statistic of -3.750 with an p-value < 0.001. This indicates a statistically significant increase in knowledge scores from the pretest to the posttest at the 99.9% confidence level, robustly supporting the effectiveness of the educational poster intervention.

Table 3. Comparison of pretest and posttest knowledge scores

Comparison	Z Statistic	p-value
Posttest - Pretest	-3.750	<0.001*

*Significant at $p < 0.001$

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4. Discussions

The findings of this study provide strong empirical evidence regarding the efficacy of the health education poster as a strategic intervention for improving HIV prevention knowledge within a frequently overlooked high-risk population: coal mine workers. The statistically significant increase in knowledge scores from pretest to posttest ($p<0.001$), characterized by a proportion of respondents in the "Good" knowledge category more than doubling from 40.0% to 80.0% (Table 2), underscores the potential of well-designed visual aids to rapidly convey critical health information.

This result aligns with the core principles of health promotion, which posit that educational materials must be accessible, easy to understand, and engaging to effectively modify the cognitive domain (Koniah et al., 2025; Kulkarni et al., 2022). The poster, specifically using the "ABCDE" framework, successfully translated the complex subject of HIV transmission and prevention into a simple and memorable structure (Tanjung et al., 2022). This structural clarity likely contributed to the observed knowledge gain by reducing cognitive load, allowing the workers to efficiently assimilate and retain the key messages. The immediate and visible improvement suggests that even a single, brief exposure to a strategically designed visual intervention can address existing knowledge gaps and misconceptions, establishing a new cognitive baseline for prevention awareness among this workforce.

The demographic profile of the respondents offers a critical context for interpreting these findings. The sample was dominated by Young Adults (83.3%) and individuals with at least Senior High School education (100% collectively), creating an inherently receptive audience for the intervention. Research indicates that Millennials and Generation Z, who constitute the majority of this sample, are digital natives who have developed high-level visual literacy and the capacity to process information quickly from multimedia sources (Cortés Quesada et al., 2022; Jiao et al., 2023; Smeaton, 2023). The poster, even in its static form, aligns with their accustomed mode of information consumption. Furthermore, the positive correlation between higher educational attainment and better knowledge outcomes, as evidenced by all respondents with higher education achieving a "Good" knowledge score post-intervention, is consistent with the extant literature (Liu et al., 2020; Mandiwa et al., 2021; Tandiola et al., 2024). Studies argue that formal education fosters superior literacy skills

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and a more developed capacity for critical thinking, which facilitates the comprehension and application of new health information (Adhikari & Joshi, 2024; Calero-Mieles & Barban-Forte, 2024; Pérez Gutiérrez & Pino Juste, 2024). Therefore, the success of this intervention was likely amplified by the sample's inherent characteristics, suggesting that similar approaches would be highly suitable for workforces with comparable demographic compositions.

A particularly striking finding was that 20.0% of the respondents reported never having received any information on HIV prevention prior to this study (Table 1). This sharp information deficit highlights a systemic failure in occupational health outreach within the extractive industry. The fact that these individuals operate in a high-risk setting, due to the proximity of their work camps to high-risk areas (lokalisasi), underscores a critical gap in both public health policy and corporate social responsibility. The pretest results, which showed that a proportion of these individuals had "Poor" knowledge, directly link the lack of information to profound vulnerability. Studies emphasize that inadequate exposure to health information is a primary driver of high-risk behavior and negative reproductive health outcomes (Lee et al., 2022; Saparini et al., 2023). The intervention in this study served as a primary, and for some, the first formal educational source on HIV, demonstrating the urgent need for companies like PT. X to implement routine and mandatory health education programs. Relying on informal sources like peers or unverified media content is insufficient and potentially hazardous, as it can perpetuate myths and misinformation (Dong et al., 2024).

Analysis of specific questionnaire items revealed nuanced insights into the miners' pre-existing knowledge structure. The item "Not sharing injection needles is a way to prevent HIV transmission" was the most frequently answered correctly in both the pretest and posttest. This suggests that the message regarding the danger of needle-sharing, often associated with drug use, has been successfully disseminated through broader public health campaigns or media—a finding supported by Abbasi (2017), who identifies it as a key risk factor. Conversely, the item with the most errors, both before and after the intervention, was "Not engaging in sexual intercourse at all is a way to prevent HIV transmission." A number of respondents incorrectly answered "False," indicating a fundamental misunderstanding of the most absolute form of sexual transmission prevention. This is critical, given that unprotected heterosexual contact remains the most common transmission route (Mayer & Beyrer, 2007).

Furthermore, while the poster was highly effective overall, the differential

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improvement across demographic subgroups warrants attention. Although both age groups showed improvement, the Young Adult cohort achieved a significantly higher proportion of "Good" knowledge (84%) compared to the older adult cohort (60%). This generational disparity in knowledge acquisition may be attributable to differences in digital fluency and learning preferences, as some researchers have found that older generations often experience a steeper learning curve with information presented in modern formats (Bhattacharjee et al., 2020; Liang et al., 2025; Xu et al., 2024). Similarly, while both high school and higher education graduates improved, the latter group achieved a perfect 100% "Good" knowledge level. This reinforces the theory that higher education provides a more robust scaffold for effective learning (Masava et al., 2022). This disparity does not diminish the poster's value but highlights that a one-size-fits-all approach may be inadequate. To achieve universal comprehension, supplementary or tailored educational strategies may be required to bridge the gap for older workers and those with lower formal education, ensuring equitable health outcomes across the workforce.

The theoretical implications of this study re-affirm the potential of visual communication within the Health Belief Model (HBM). The poster effectively enhanced perceived susceptibility and severity by clearly outlining the consequences of HIV, while simultaneously boosting perceived benefits and self-efficacy by providing easy-to-follow, actionable prevention steps (the ABCDE method). According to Silva (2022), visual media has an 89% effectiveness rate for retention in human memory compared to text media. The poster acts as a "cue to action," a critical component of the model, by making the abstract threat of HIV tangible and the path to prevention clear. However, it is vital to recognize that this study measured a change in knowledge, which is a necessary precursor but not a guarantee of behavioral change. While increased knowledge is the essential first step, the transition to sustained safe practices, such as consistent condom use or partner reduction, requires addressing more complex psychosocial, economic, and environmental barriers that fall outside the scope of this intervention.

Limitations and future research

Although the findings of this study are promising, several methodological limitations must be acknowledged. First, the use of the one-group pretest-posttest design without a control group inherently restricts internal validity. This makes it challenging to draw definitive

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conclusions on causality, as the observed knowledge gain may have been influenced by confounding variables, including the testing effect or simultaneous historical factors. Second, the knowledge measurement conducted immediately post-intervention only reflects short-term retention. In the context of health education, the knowledge retention over time is crucial, given that the *forgetting curve* is a well-documented phenomenon. Third, the reliance on self-reported data collected via an online questionnaire potentially introduced social desirability bias, especially after subjects were exposed to the educational material. Finally, the use of a non-probability sampling method, namely accidental sampling, limits the sample's representation and consequently restricts the generalization of the findings to the wider population of mine workers, both at PT. X and similar sites.

Future research is strongly recommended to build upon these positive initial findings while addressing the identified limitations. The most critical improvement would be to conduct a longitudinal study utilizing a Randomized Controlled Trial (RCT) design. This design would involve the random assignment of subjects to an intervention group (receiving the poster) and a control group (receiving a placebo intervention on a different health topic). Knowledge assessment should be performed at three stages: *baseline*, *immediately post-intervention*, and at defined *follow-up intervals* (e.g., 3 and 6 months) to verify long-term retention and the durability of the knowledge. Additionally, to bridge the gap between the cognitive and behavioral domains, subsequent studies must integrate measures of behavioral intention and, ideally, objective data on high-risk behavior change. Lastly, given the finding that the single poster's effectiveness varied across subgroups, future interventions need to explore comparative multi-media approaches. For instance, the poster could be supplemented with a more detailed *booklet* or short educational videos. This aims to accommodate diverse learning styles, enhance engagement, and ensure optimal and equitable knowledge dissemination and behavioral impact across the entire workforce.

5. Conclusion

Based on the study results, it can be concluded that the HIV prevention health education poster from the Indonesian Medical Association (IDI) proved to be statistically effective in significantly increasing the knowledge of coal mine workers at PT. X in North Barito. The highest increase was observed among the young adult group and workers with a higher educational background. This finding highlights the substantial potential of well-designed

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visual media as an efficient and low-cost health intervention to address information gaps in high-risk populations at remote workplaces.

The implications of this research encourage the company to integrate similar posters into broader and more sustainable Occupational Health and Safety (OHS) programs. However, to ensure long-term impact and equitable reach, these health education interventions must be supplemented with multi-method strategies (such as lecture sessions or detailed booklets) to reach all worker subgroups, especially the older and less formally educated, and must be followed by efforts to facilitate the transition from increased knowledge to sustained behavioral change.

6. Conflict of interest

All authors declare no conflict of interest.

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