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DECOMPOSITION OF HIV KNOWLEDGE IN URBAN-RURAL AREAS IN INDONESIA

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ABSTRACT

HIV/AIDS remains a public health crisis, HIV/AIDS remains a public health crisis, especially among male adolescents in Indonesia. This urgency stems from the rapid increase in cases among adolescents, who often lack adequate access to education and prevention resources. If left unaddressed, the epidemic could continue to spread among younger populations, leading to long-term social and economic consequences. Despite the crucial role of HIV knowledge in prevention, disparities exist between rural and urban areas. This study examines these disparities, identifying factors influencing HIV knowledge. This cross-sectional study employed a total of 10,943 male adolescents enrolled in a survey called Indonesia Demographic Health Survey (IDHS) 2017. To address those disparities, a stratification chi-square based on place of residence was employed. We also employed a multivariate decomposition analysis to examine which variables account for most gaps. Results found that only 15% of adolescents were knowledgeable (9.5% in urban and 5.5% in rural areas). Bivariate Analysis showed that education level and HIV test awareness were associated in both areas (p-value < 0.05), while wealth quintile and internet use were associated in urban areas only (p-values < 0.05). The HIV knowledge gap would decrease by 8% if internet use was equalized, by 11% if HIV testing awareness was equalized, by 17% if educational attainment was equalized, and by 24% if wealth quintiles were equalized. This calls for a multi-sectoral intervention targeting such factors for better HIV outcomes in Indonesia.

Keywords: decomposition analysis, HIV knowledge, male adolescents, rural, urban

Introduction

It has been notably known that HIV, which later will become AIDS if left untreated, remains a public health problem.[1] It attacks the immune system, thus, causing immune system failure later in life.[2] Individuals with HIV are prone to comorbidities; therefore affecting their quality of life if left unmanaged.[3] It also affects mental health where individuals with HIV are at risk of facing discrimination and stigmatization that lead to depression and suicidality.[4] The notable impact is also detrimental for young adolescents. This is because HIV will affect adolescents' educational attainment. Without a better educational attainment, adolescents with HIV will develop more risk in the future.[5] In addition, adolescents with HIV will be more likely to grow imperfectly as they are at risk of being underweight, wasting, stunting, or worse death.[6] In Indonesia, there has been a concerning rise in HIV cases among adolescent, with 2,881 cases reported in 2020, reflecting the vulnerability of this age group and a potential pandemic among adolescents. [8]

Aside from age, HIV problems also differ for different sexes. In Indonesia, a growing number of cases from 280,263 in 2017 to 338,760 in 2020 showed a disproportionate ratio of HIV cases among males and females.[7,8] HIV cases among males are twice higher than it was for females (30,721 cases among males and 17,579 cases among females in 2017).[8] Thus, this calls for a specific intervention in male adolescents.

A previous study showed that knowledge was related to HIV prevention action, as poor HIV knowledge translates into a worse barrier to accessing HIV-related services including education, testing, and also treatment.[9] Various studies identified that mass media, education, and wealth index were associated with good HIV knowledge.[10,11] However, it is also known that HIV knowledge was severely impacted by living places where living in rural areas decreases the odds of being knowledgeable as well as the odds of being in a higher wealth quintile.[12] This also translated into different rates of adoption of HIV risk behavior.[13] Thus, this raises a potential gap in looking for possible health policy interventions covering the factors influencing the HIV knowledge gap. While rural-urban remains an important issue in addressing the HIV knowledge gap, very few studies stratified their research with the place of residence aspect. Therefore, to address the research gap, we aim to address HIV knowledge disparity by stratifying the place of residences (rural and urban areas) and decomposing different factors that affect HIV knowledge in Indonesia. The objective to identify key barriers and opportunities for improving HIV knowledge. This approach also aims to inform targeted interventions that can enhance HIV education and prevention efforts in diverse communities across the country.

Methods

This study utilized data from the 2017 Indonesian Demographic Health Survey (IDHS) and employed a cross-sectional study design. The Demographic Health Survey (DHS) officers collected

the dataset through interviews with both male and female population in Indonesia. However, the population for this study was 13,079 male adolescents from the age of 15–24 years old. This specific population was selected because adolescents would receive a more devastating impact had they been infected by HIV and also because of the prevalence of HIV was higher among males than females, as previously explained.[7,8] The exclusion criteria for this study were adolescents with missing values. Missing values in this study were 2,136 (16%). In the end, only 10,943 male adolescents were analyzed. The overall sampling process were explained in figure 1. There were no patients or any clinical data involved in this study. As this study utilized a secondary dataset, an ethical clearance was waived. However, the dataset in this study, IDHS 2017, received an ethical approval from IRB (Institutional Review Board) number: ICF IRB FWA00000845.

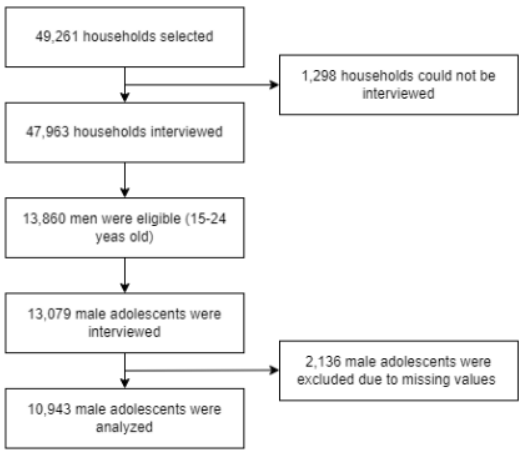

Figure 1. Sample Selection Process

The dependent of this variable was HIV knowledge. This was a composite variable from five questions in the IDHS 2017, derived from two misconceptions and three facts. The misconceptions were: 1) HIV can be transmitted by mosquito bites; and 2) one can get infected by sharing food with an HIV-infected person. In contrast, three other questions were: 1) know that a healthy-looking person can have HIV; 2) know that consistent use of condoms every time they have sex; and 3) having just one uninfected faithful sex partner can reduce their chances of getting infected. If adolescents responded with no for two misconceptions and yes for the rest, they would be categorized as *knowledgeable (good HIV knowledge)*; otherwise they had *poor HIV knowledge*. This coding aligned with a previous study before.[9]

The independent variable for this study included socio-demographic factors, media use, and HIV-related variables. Those variables were identified by previous studies. Socio-demographic factors in this study were wealth quintile and education level.[9,14] There were five wealth quintiles in

IDHS 2017: richest, richer, middle, poorer, and poorest. We categorized those quintiles into rich class (for richest and richer class), middle class, and lower class (for poorer and poorest). In contrast, there were five education levels in this study: primary school, junior school, senior school, academy and diploma, and university degree. We categorized those into three levels: below high school (for junior and senior school), senior high school, and above senior high school (diploma and university degree).

Other factors in this study included internet use and mass media exposure. Mass media exposure was a composite variable derived from three questions: 1) *listen to radio?*; 2) *watching television?*; and 3) *reading newspapers*? For each questions, IDHS provided three responses: at least once a week, less than once a week, and not at all. If adolescents answered with not at all for all three questions, they would be categorized as *not exposed*; otherwise *exposed*. Internet use measured the lifetime use of the internet with an answer of no and yes. Lastly, we also identified a variable of HIV testing awareness, asking if adolescents knew the place to get HIV tests.

Data analysis in this study was conducted using Stata version 17.0 (StataCorp, Texas, USA). Univariate analysis revealed the distribution of each variable. Bivariate analysis was conducted using chi-square to address the statistical significance and corrected F-statistics, accounting for weights, strata, and complex sample design. To address the disparity, the bivariate analysis was stratified by the place of residence (rural and urban). Variables that were not significant for both places of residence would not be accounted for in the multivariate model. Lastly, in multivariate analysis, we used a method called Multivariate Decomposition Analysis using the command *mvdcmp* in Stata.[15] The general term of decomposition was explained by equation (2). Supposed that there was a function in equation (1):

$$Y = F(X\beta) \quad (1)$$

Where Y denoted dependent variable and X was an $N \times K$ matrices of independent variables and β was the coefficient. The differences of two groups (group A and B for instance), if there were two groups being compared would be:

$$\overline{Y_A} - \overline{Y_B} = \overline{F(X_A\beta_A)} - \overline{F(X_B\beta_B)} = \overline{\{F(X_A\beta_A) - F(X_B\beta_A)\}} - \overline{\{F(X_B\beta_A) - F(X_B\beta_B)\}} \quad (2)$$

Thus, the $\overline{\{F(X_A\beta_A) - F(X_B\beta_A)\}}$ resembled an E or endowment, the explained component in our model. On the other hand, the $\overline{\{F(X_B\beta_A) - F(X_B\beta_B)\}}$ resembled an C or coefficient, the unexplained parts or coefficient effects. For any variable with more than two categories, we used normalization to corporate dummy variables. Statistical significance was set to 0.05.

Results

Accordingly, there were 15% of adolescents with good knowledge. Among that number, 9.5% lived in urban areas and only 5.5% lived in rural areas. Figure 2 explained clearly the distribution of HIV knowledge in each question.

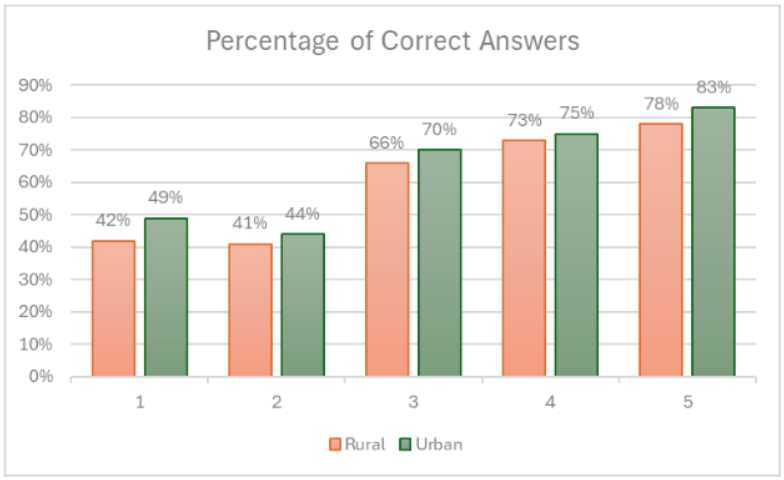

Figure 2. Distribution of Correct Answers for Each Question[1]

[1]The notation for each question respectively: 1) HIV can be transmitted by mosquito bite; 2) one can get infected by sharing food with HIV-infected person; 3) know that a healthy-looking person can have HIV; 4) know that consistent use of condoms every time they have sex; and 5) having just one uninfected faithful sex partner can reduce their chances of getting infected

For most questions, the numbers of adolescents with correct answers were higher in urban areas than in rural areas. The highest correct percentage was in the last question, which asked about whether having just one uninfected faithful sex partner can reduce their chances of getting infected. *P-value* significance showed an independent significant association between place of residence and HIV knowledge (*p-value* < 0.001), with adolescents living in rural areas having lower odds of 0.75 (95% CI: 0.63–0.88) than the urban counterparts. This independent association suggested that living in rural areas was a risk factor. Therefore, further analysis would decompose different socio-demographic factors in rural and urban areas.

Based on the Table 1, we found that wealth quintiles were associated with HIV knowledge in urban areas (*p-value*: < 0.001; F-statistics: 15.114). The proportion of the knowledgeable in the rich class (19%) was higher than in urban areas (15%). In regards to education level, we found that education level was associated with HIV knowledge in both areas (*p-value*: < 0.001) and the proportion of knowledgeable individuals above senior high school level was higher (26%) in urban areas than in rural areas (21%). In regards to media, we found that internet use was associated with HIV knowledge in urban areas (*p-value*: < 0.001), but not in rural areas. However, mass media exposure was not associated in both areas. Lastly, knowing about HIV tests was associated with HIV knowledge in both areas (*p-value* < 0.001).

Table 1. Distribution of HIV Knowledge, stratified by place of residence

Variable	Rural			Urban		
	HIV Knowledge (n, %)					
	Knowledgeable	Poor Knowledge	*P-value*; F-Statistics	Knowledgeable	Poor Knowledge	*P-value*; F-Statistics

Wealth Quintile						
Rich class	171 (15%)	997 (85%)	0.093; 2.377	707 (19%)	2996 (81%)	<0.001; 15.114
Middle class	139 (15%)	801 (85%)		173 (14%)	1048 (86%)	
Lower class	280 (11%)	2163 (89%)		136 (11%)	1090 (89%)	
Education Level						
Above senior high school	87 (21%)	332 (79%)	<0.001; 7.856	306 (26%)	880 (74%)	<0.001; 33.683
Senior high school	371 (13%)	2519 (87%)		616 (15%)	3382 (85%)	
Below senior high school	131 (11%)	1108 (79%)		93 (10%)	869 (90%)	
HIV Test Awareness						
Yes	217 (18%)	997 (82%)	<0.001; 18.658	469 (21%)	1774 (79%)	<0.001; 27.779
No	313 (11%)	2962 (89%)		546 (14%)	3357 (86%)	
Mass Media Exposure						
Exposed	579 (23%)	3922 (77%)	0.125; 2.347	1002 (16%)	5092 (84%)	0.266; 1.238
Not exposed	11 (13%)	39 (87%)		13 (23%)	42 (77%)	
Internet Use						
Yes	540 (13%)	3505 (87%)	0.154; 2.028	995 (17%)	4913 (83%)	0.008; 7.064
No	49 (10%)	454 (90%)		20 (8%)	221 (92%)	

Variables that were significant (*p-value* < 0.05) in either rural or urban were analyzed further using decomposition analysis. Decomposition analysis revealed that 101.52% of HIV knowledge differences can be attributed to the factors examined in this research. We found that, by equalizing wealth quintile among the poor and the rich would be decreasing the HIV knowledge gap among urban and rural to 24.87% and 24.82%, respectively. In addition, equalizing the educational level in urban and rural areas so that the below senior high school level in rural areas was as similar as those in urban areas would decrease the HIV knowledge gap by about 17%.

In return, equalizing the educational level for above high school level in rural areas would lead to a 17% HIV knowledge gap decrease. In addition, addressing HIV testing awareness would lead to an 11% decrease in the HIV knowledge gap. Lastly, addressing internet use in rural areas would lead to an 8% decrease in the HIV knowledge gap. However, internet use was not statistically significant in the multivariate models. We identified that equalizing wealth status would be the most powerful and equalizing internet access would be the least relevant.

In contrast, the decomposition analysis showed an unexplained component of -1.52%. This suggests that the unaccounted-for factors slightly reduced the overall explained differences in HIV knowledge. If rural adolescents experienced similar impacts as their urban counterparts with respect to wealth (for poor categories) and education level (for below high school categories), the HIV knowledge gap between rural and urban areas would be expected to increase by 2.47% due to wealth and 2.21% due to educational disparities. Details for the decomposition analysis are shown in Table 2.

Table 2. Decomposition Analysis

Variables	Endowment (E)			Coefficient (C)		
	Coefficient	Percent Contribute	P-value	Coefficient	Percent Contribute	P-value

Internet Use						
Yes	0.00293	8.24	0.244	0.00242	6.81	0.954
No	1					
Know HIV Test						
Yes	0.00389	10.94	0.001	0.00242	-1.85	0.952
No	1					
Education Level						
Above high school	0.00595	16.74	0.000	-0.00079	-2.21	0.952
Senior high school	-0.00009	-0.24	0.466	0.00070	1.97	0.952
Below senior high school	0.00574	16.16	0.000	0.00016	0.46	0.952
Wealth Quintile						
Rich class	0.00883	24.87	0.001	0.00091	2.57	0.952
Middle class	-0.00000	-0.01	0.955	-0.00040	-1.12	0.952
Lower class	0.00882	0.008	24.82	-0.00088	-2.47	0.953

Discussion

In this study, we successfully identified the disparity between rural and urban areas and decomposed each factor in both places of residence. These findings also serve as the underscoring approach to designing strategic health policy interventions to minimize the HIV knowledge gap in rural areas. The wealth quintile acted as the most substantial variable that intervening the factor would lead to the highest decrease of HIV knowledge gap. We argue that this was because of the sociodynamic of rural areas, where economic gaps disproportionately affect rural areas. On average, the income of economic intake, pointed out by income, was 1.7 times higher in urban areas than it was in rural areas.[16] It was also noted that more poor people were in rural areas (12.22%) than in urban areas by 2023 (7.29%).[17] This finding was important as a previous study found that wealth was heavily associated with HIV knowledge, meaning that wealthier adolescents showed lower odds of having poor HIV knowledge.[18] This, in return, puts rural adolescents at risk for further risky behavior, such as condom-less sex.[19] It was also important to understand that poor rural adolescents may not be able to afford a better quality of education,[20] thus causing them to be poorly educated about HIV. This also explained why this study found that equalizing education levels in rural areas would decrease the HIV knowledge gap. Adolescents in rural areas were less likely to complete their education,[21] thus the number of adolescents with low education levels was notability high in this study. This finding implied a complex and dynamic association between education level and wealth quintile in rural areas compared to urban areas.

In addition, we found that equalizing internet use in rural areas would also decrease the HIV knowledge gap. A previous study noted that internet use helped adolescents access quality health information, therefore increasing their HIV knowledge.[22] However, internet use remained a challenge in limited-resources areas, in this case, rural areas. The disparity of internet use also widened when it came to non-Java Island locations.[23] Many people in rural areas experienced expensive internet subscriptions and poor-quality internet connections. In turn, if many HIV interventions now utilize internet use,[24] this affected the ability of rural adolescents to access such interventions.

In regard to HIV testing awareness, we found that equalizing HIV testing awareness helped adolescents in rural areas to have better HIV knowledge. However, this also remained a challenge. Individuals in rural areas were likely not to get themselves screened or tested for HIV.[25] This could be attributed to previous findings of poor knowledge and educational level, however access to HIV testing remained a challenge as well. There was a lack of HIV testing facilities and access in rural areas.[12] In addition, HIV testing awareness could also be affected by prevailing stigma in rural areas,[26] thus causing people to be not fully aware of HIV risks among them. In contrast, we also found that mass media exposure was not significantly associated with HIV knowledge. This finding was different from other studies before.[27] We argue that this was due to the lack of statistical variance in our study. Mass media was a composite variable and very few adolescents were not exposed to HIV knowledge in this study compared to others,[28] despite being a similar composite variable.

All the endeavors to close the gap in wealth, education attainment, HIV testing awareness, and internet use among rural and urban areas need to be done through multi-sectoral intervention. Cooperation between cross-ministries including the Ministry of Health, Ministry of Economics, and Ministry of Communication is pivotal to addressing the gap between the wealth quintile and education level and enhancing internet penetration in both areas to reduce the HIV knowledge gap. Moreover, rural areas are known for the significance of their sociocultural influence on the community; therefore, it is imperative to consider this influence in developing the intervention scheme to decrease the HIV knowledge gap. We recommend increasing HIV knowledge among low-education-level residents in rural areas by involving multi-stakeholders from the local community, including the leaders and trusted individuals, to develop small peer group-based interventions while contextualizing the approach with locally accepted values and social interactions.[29] The small groups will discuss the HIV knowledge materials that are aligned with the suitable method and are culturally familiar to the rural residents. For example, utilizing oral-based knowledge sharing is preferable to paper-based intervention in some rural communities. Also separating youth peer groups from adult peer groups as sexuality-related open discussions among youth can be considered inappropriate in local culture. This recommendation is supported by previous studies that found small group-based interventions encourage more discussions and decrease hesitation among participants in asking sensitive questions.[30]

Our study added several relevancies to reproductive health schemes. Despite utilizing data in 2017, we traced back the relevance of the findings to current public health issues. Our study's strength also came from the fact that we utilized a nationally representative dataset, thus making the generalization of the result easier. In addition, we also employed a decomposition analysis, thus providing the expected results by numbers if relevant stakeholders were willing to address such factors. While our study successfully identified the fact that HIV knowledge disparity existed and

could be intervened with various factors, this study also came with limitations. Given that this study was a secondary dataset, covariates residual might prevail, especially from variables that were not adjusted due to lack of data availability in the dataset, such as religiosity, family norms, and parental support. In addition, we could not also deny the possibility of recall bias during the data collection process. However, during data entry, DHS program officers utilized a double-entry method, which helped reduce potential errors and bias.

Conclusion

We found that there were more knowledgeable adolescents in urban areas than in rural areas. It was identified that by equalizing the wealth quintile and also education level in rural areas, the HIV knowledge gap would decrease. Similarly, equalizing internet use and HIV testing awareness also lead to a decreasing gap. These gaps in wealth, education level, internet use, and HIV testing awareness need to be addressed through multi-sectoral intervention with an emphasis on contextualizing rural socio-cultural influences to develop effective program interventions.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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