BRIEF REPORT

REVISED Independent predictors of comprehensive knowledge of HIV in general population: findings from the Myanmar Demographic and Health Survey (2015-16) [version 2; peer review: 3 approved with reservations]

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Abstract

Background: Myanmar has the third highest number of people living with HIV in Southeast Asia behind Indonesia and Thailand. The independent predictors of comprehensive HIV knowledge among general population are not known.

Methods: In this nationally representative study, we adopted a cross-sectional design using secondary data from the Myanmar Demographic and Health Survey (2015-16). We included all women and men aged 15-49 years who participated in the survey. We have provided weighted estimates as the analyses were weighted for the multi-stage sampling design. We used modified Poisson regression with robust variance estimates model to identify independent predictors of comprehensive knowledge.

Results: Of 17,622 analyzed, 3,599 (20.4%, 95% CI: 19.7, 21.1) had comprehensive knowledge of HIV. Late adolescents, those with less than a high school education, those involved in agriculture and the poorest two quintiles were less likely to have comprehensive knowledge of HIV.

Conclusion: In Myanmar, comprehensive knowledge of HIV among the general population needs to be improved and we identified certain independent predictors that could be specifically targeted by the national programme.

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Any reports and responses or comments on the

Keywords

Cross sectional survey, demographic health survey, HIV AIDS knowledge, risk factors, SORT IT

article can be found at the end of the article.

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REVISED Amendments from Version 1

- We have changed the Uganda data for both men and women in the introduction and change the reference for this information.
- We added more information in the data analysis section as per reviewer comments.
- We added the information regarding the key population in Myanmar in the discussion section.
- We also added the UNGASS's target of having comprehensive knowledge of HIV among youths.
- We discussed the lower proportion of HIV knowledge is alarming for prevention of mother to child transmission of HIV.
- More information is added and therefore, additional references are cited.
- We added an "access to media exposure" variable in the analysis as per the reviewer's comment.
- We removed a figure and added a table of predicted probabilities after the final model.
- We also added some footnotes under the table to make the table standalone.

Any further responses from the reviewers can be found at the end of the article

Introduction

Human immunodeficiency virus (HIV) infection is a global epidemic and is the second leading cause of death among infectious diseases after tuberculosis¹. During 2017, there were 1.8 million new infections, 37 million people living with HIV and nearly one million acquired immunodeficiency syndrome (AIDS) related deaths². The right knowledge and a positive attitude towards HIV along with awareness regarding availability of HIV counseling and testing services is a pre-requisite for meeting the first '90' of the UNAIDS '90-90-90' targets: by 2020, 90% of people living with HIV should know their HIV status.

Myanmar has the third highest number of people living with HIV in Southeast Asia behind Indonesia and Thailand. In 2015, the prevalence of HIV among adults aged 15–49 years was 0.59%, and 53% of estimated people living with HIV knew their status^{3,4}. The focus of the national AIDS programme is on testing key populations, pregnant women (to reduce mother to child transmission), people with sexually transmitted infections, tuberculosis patients and prisoners^{3,5}. Among young men who have sex with men in Myanmar (2015), having good HIV related knowledge was associated with HIV testing⁶.

In Uganda, nearly half of men and women aged 15–49 years (48%) from the general population had comprehensive knowledge of HIV in 2016⁷. The Myanmar Demographic and Health Survey (MDHS) 2015–16 reported that one in five respondents had comprehensive knowledge of HIV, three quarters were willing to care a family member with HIV/AIDS, and 29% were ever tested for HIV⁸. The independent predictors of

comprehensive HIV knowledge among the general population have not been analyzed or reported. Therefore, this study aimed to identify the factors associated with comprehensive of HIV knowledge among the general population. Understanding these will aid the programme in taking corrective actions and moving a step closer to attain the first '90' target by 2020.

Methods

Study design and population

In this nationally representative study, we adopted a cross-sectional design using secondary data from the MDHS 2015–16. We included all women and men aged 15–49 years who participated in the survey.

Setting

The Republic of the Union of Myanmar is divided administratively into the Nay Pyi Taw council territory, seven states and seven regions. There are 74 districts and 330 townships. Geographically, states and regions have diversities of plains, delta and hilly regions. The population is over 51 million, of which nearly 70% reside in rural areas⁹.

MDHS 2015–16

The detailed methodology was described in the MDHS 2015–16 report⁸. The sampling for MDHS 2015–16 was based on the 2014 census frame and excluded institutional populations (persons in hotels, barracks, and prisons) but included those from internally displaced population camps.

The survey followed a stratified two stage sample design. The first stage involved selecting clusters that were either a census enumeration area or ward/village tracts. Probability proportional to size sampling was used. Stratification was achieved by separating each state or region into urban and rural areas, each of which formed a separate sampling stratum. A total of 442 clusters (319 rural and 123 urban) were selected independently from total of 30 sampling strata. Second, using systematic random sampling, a fixed number of 30 households were sampled from each cluster. All men aged 15–49 years in every second selected household and all women aged 15–49 years in the selected households were interviewed using the pre-tested Myanmar language questionnaires. They were either residents or visitors who stayed the night before the survey. The response rate among women was 96% and men was 91%.

Comprehensive knowledge was considered as 'present' if a person (i) knew about condom use and that limiting sexual intercourse to one partner could prevent HIV and (ii) knew that a healthy looking person could have HIV and (iii) rejected the two most common local misconceptions about the transmission of HIV, which in Myanmar were that HIV could be transmitted through mosquito bites and that a person could get infected with HIV by sharing food with someone who has AIDS.

All completed questionnaires were entered into the tablets by the field editors after they were edited on paper in the field.

Data were re-entered and validated by data processing personnel in Nay Pyi Taw using the CSPro computer package⁸.

Data analysis

We analyzed the data extracted from MDHS 2015–16 using STATA (version 12.1 STATA Corp., College Station, TX, USA). We assessed comprehensive knowledge using proportions and 95% confidence intervals (CIs). In the multivariable model to identify independent predictors of comprehensive knowledge (predictive modelling), we used modified Poisson regression with robust variance estimates. We first tried a log binomial model. But because of lack of convergence, we proceeded with the modified Poisson regression to estimate prevalence ratios. We included age, sex and variables with a crude Chi square p-value of <0.2. Before including the variables in the model, we ruled out multicollinearity using variance inflation factor. We assessed the association between socio-economic and demographic factors and comprehensive knowledge (outcome) using adjusted prevalence ratios (aPR) and 95% CI. We first considered programmatically significant association if aPR was ≥ 1.5 or ≤ 0.67 , and then looked for statistical significance ($p < 0.05$) because MDHS 2015–16 had a large sample size. We tested the interaction among potential variables and due to not significant improvement, we decided to keep the simple model as final analysis.

We have provided weighted estimates as the analyses were weighted for the multi-stage sampling design. We used the probability of selection of clusters and households to derive the weights (inverse probability sampling).

Ethics approval

We obtained ethics approval from Ethics Review Committee, Department of Medical Research, Ministry of Health and Sports, Myanmar (Ethics/DMR/2018/163, dated 27 December 2018) and the Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease (The Union), Paris, France (EAG number 38/18 dated 23 August 2018). This study uses existing DHS data and re-analysis was done under the original consent provided by the participants.

Results

A total of 17,622 respondents participated in the survey. Their mean age was 31.5 (standard deviation: 9.9) years, with 2,541 (14.4%) being late adolescents. A total of 4,737 (26.8%) were men, 2,181 (12.4%) had no formal education and 3,121 (17.7%) were involved in agriculture (Table 1).

Among respondents, 3,599 (20.4%, 95% CI: 19.7, 21.1) had comprehensive knowledge of HIV. On unadjusted analysis, age, education, region, place of residence (urban or rural),

Table 1. Independent predictors of comprehensive knowledge* of HIV among the general population (age 15–49 years), Myanmar Demographic and Health Survey 2015–16[†].

Factors	Total		Comprehensive knowledge		PR	(95%CI)	aPR ^{††}	(95%CI)
	N	(col %)	n	(row %)				
Total	17622	(100.0)	3599	(20.4)				
Age in years								
15–19	2541	(14.4)	347	(13.7)	0.60	(0.54, 0.67) [†]	0.60	(0.52, 0.69) [†]
20–29	5103	(29.0)	1125	(22.1)	0.97	(0.91, 1.05)	0.86	(0.79, 0.93)
30–39	5368	(30.4)	1216	(22.7)	ref		Ref	
40–49	4610	(26.2)	911	(19.8)	0.87	(0.81, 0.94)	0.94	(0.87, 1.03)
Gender								
Male	4737	(26.9)	1055	(22.3)	ref		ref	
Female	12885	(73.1)	2544	(19.7)	0.89	(0.83, 0.94)	0.84	(0.78, 0.90)
Education [‡]								
No formal education	2181	(12.4)	55	(2.5)	0.04	(0.03, 0.05) [†]	0.08	(0.06, 0.12) [†]
Primary	6989	(39.7)	696	(9.9)	0.16	(0.15, 0.17) [†]	0.28	(0.25, 0.32) [†]
Secondary	6786	(38.5)	1817	(26.8)	0.43	(0.41, 0.46) [†]	0.62	(0.57, 0.67) [†]
High school and above	1664	(9.4)	1031	(61.9)	ref		ref	
Missing	2	(<0.1)	0	(0.0)	-		-	

Factors	Total		Comprehensive knowledge		PR	(95%CI)	aPR [^]	(95%CI)
	N	(col %)	n	(row %)				
Region [®]								
Delta and lowland	7673	(43.5)	1867	(24.3)	ref		ref	
Hills	2673	(15.2)	402	(15.0)	0.62	(0.56, 0.68) [^]	0.81	(0.72, 0.89)
Coastal	1385	(7.9)	198	(14.3)	0.59	(0.51, 0.67) [^]	0.92	(0.83, 1.03)
Plains	5891	(33.4)	1132	(19.2)	0.79	(0.74, 0.84)	0.88	(0.83, 0.96)
Place of residence								
Urban	5119	(29.0)	1870	(36.5)	ref		ref	
Rural	12503	(71.0)	1729	(13.8)	0.38	(0.36, 0.40) [^]	0.85	(0.79, 0.92)
Current marital status								
Never married	5924	(33.6)	1270	(21.4)	1.06	(0.99, 1.13)	0.86	(0.80, 0.92)
Married	10715	(60.8)	2160	(20.2)	ref		ref	
Widowed	453	(2.6)	79	(17.5)	0.87	(0.71, 1.06)	0.95	(0.77, 1.18)
Divorced	476	(2.7)	77	(16.2)	0.80	(0.65, 0.99)	0.91	(0.73, 1.13)
Separated	54	(0.3)	13	(23.0)	1.14	(0.70, 1.86)	1.25	(0.77, 2.05)
Occupation								
Not working and/or homemaker	3845	(21.8)	782	(20.3)	0.42	(0.39, 0.46) [^]	0.81	(0.73, 0.89)
Agriculture	3120	(17.7)	350	(11.2)	0.23	(0.21, 0.26) [^]	0.67	(0.58, 0.78) [^]
Manual labor	6481	(36.8)	971	(15.0)	0.31	(0.29, 0.34) [^]	0.77	(0.69, 0.85)
Clerical/sales/services	3092	(17.6)	981	(31.7)	0.66	(0.61, 0.71) [^]	0.93	(0.85, 1.01)
Professional/technical/managerial	1045	(5.9)	504	(48.2)	ref		ref	
Missing	39	(0.2)	11	(28.9)	-		-	
Wealth quintile								
First (poorest)	3165	(18.0)	167	(5.3)	0.13	(0.11, 0.15) [^]	0.39	(0.32, 0.48) [^]
Second	3324	(18.9)	351	(10.6)	0.26	(0.23, 0.29) [^]	0.65	(0.54, 0.71) [^]
Third	3612	(20.5)	578	(16.0)	0.39	(0.36, 0.42) [^]	0.75	(0.67, 0.84)
Fourth	3688	(20.9)	927	(25.1)	0.61	(0.57, 0.65) [^]	0.93	(0.85, 1.01)
Fifth	3833	(21.7)	1576	(41.1)	ref		ref	
Household size								
1-3	3584	(20.3)	818	(22.8)	ref		ref	
4-6	9856	(55.9)	1911	(19.4)	0.84	(0.79, 0.91)	0.94	(0.87, 1.01)
>6	4182	(23.8)	870	(20.8)	0.91	(0.84, 0.99)	0.93	(0.85, 1.02)
Moved in at this residence within last one year								
Yes	423	(2.4)	111	(26.1)	ref		ref	
No	17198	(97.6)	3488	(20.3)	0.78	(0.66, 0.91)	0.99	(0.84, 1.18)
Missing	1	(<0.1)	0	(0.0)	-		-	

Factors	Total		Comprehensive knowledge		PR	(95%CI)	aPR ^{^^}	(95%CI)
	N	(col %)	n	(row %)				
Exposure to mass media ^δ at least once a week								
Yes	12139	(68.9)	3028	(24.9)	ref		ref	
No	5483	(31.3)	570	(10.4)	0.42	(0.38, 0.45) [^]	0.77	(0.70, 0.85)

^δThe crude estimates presented here combine the sex-specific tables from the full Myanmar DHS report (table1 13.3.1 for women and 13.3.2 for men)

col %, column percentage; row %, row percentage; PR, prevalence ratio; aPR, adjusted prevalence ratio; CI, confidence interval; HIV, Human Immunodeficiency Virus.

*Composite measure that a person (i) knows about condom use and limiting sexual intercourse to one partner can prevent HIV, and (ii) knows that a healthy looking person can have HIV, and (iii) rejects the two most common local misconceptions about the transmission of HIV, which in Myanmar are that HIV can be transmitted through mosquito bites and that a person can become infected with HIV by sharing food with someone who has AIDS.

[^]Weighted estimates (for multistage survey design) for frequency, proportion and prevalence ratio.

[^]We first considered programmatically significant association if aPR was ≥ 1.5 or ≤ 0.67 , and then looked for statistical significance ($p < 0.05$).

^{^^}Adjusted analysis using modified Poisson regression with robust variance estimates, 41 records with at least one variable missing were excluded from the adjusted analysis.

^εEducation: primary = 5 years, middle = 4 years, high = 2 years

^φDelta and low land = Kayin, Bago, Mon, Yangon, Ayeyarwaddy; Hills = Kachin, Kayah, Chin, Shan; Coastal = Thaninthayi, Rakhine; Plains = Sagaing, Magway, Mandalay, Naypyitaw

^δtelevision, newspaper or radio.

occupation and wealth quintile were associated with comprehensive knowledge of HIV. On adjusted analysis, age, education, occupation and wealth quintile were identified as independent predictors.

When compared to adults aged 30–39 years, late adolescents were less likely to have comprehensive knowledge of HIV [aPR: 0.60 (95% CI: 0.52, 0.69)]. When compared to those educated to high school level and above, those educated less than high school level were less likely to have comprehensive knowledge, with those with no formal education being 92% less likely [aPR: 0.08 (95% CI: 0.06, 0.12)]. In addition, those involved in agriculture and belonging to the poorest two quintiles were less likely to have comprehensive knowledge (Table 1). The predicted probabilities of having HIV comprehensive knowledge after the final model was presented in Table 2.

Discussion

This study from Myanmar investigating the predictors of comprehensive knowledge of HIV among the general population had two strengths. First, we used data from a nationally representative survey. Second, the data were robust as double data entry and validation was done. There were some limitations as well. The study population might include some key affected population that could influence the true prevalence among general population. Comprehensive knowledge among key populations

in Myanmar were 52% (female sex workers), 60% (men who have sex with men), and 45% (people who inject drugs) respectively^{10–12}. Residual confounding cannot not be ruled out.

Comprehensive knowledge about HIV in the general population was relatively low and this was prominent among late adolescents. This is far behind the United Nations General Assembly Special Session on HIV/AIDS (UNGASS)'s target of 95% of youths have comprehensive knowledge of HIV/AIDS¹³. This finding is supported by studies from Uganda (2016), Nigeria (2013) and the Democratic Republic of Congo (2013) reporting 46%, 33%, and 28% among young women had HIV comprehensive knowledge respectively^{7,14}. Young people including late adolescents are particularly vulnerable because of high risk sexual behavior and substance use. They lack access to accurate and personalized HIV information and prevention services¹⁵. Furthermore, low proportion of comprehensive knowledge of HIV/AIDS among reproductive age women in general population is alarming for effective prevention of mother-to-child transmission of HIV.

Comprehensive HIV knowledge among those with no formal education was poor. Similar results were also found among Indonesian women (2012)¹⁶. This might be linked to not having access to information that is usually available as part of the curriculum and academic activities, resulting in a better

Table 2. Predicted probabilities (after the adjusted model) of having HIV comprehensive knowledge among general population (age 15–49 years), Myanmar Demographic and Health Survey 2015–16.

Factors	Predicted probabilities (%)	95%CI
Total	20.4	(19.7, 21.0)
Age in years		
15–19	13.8	(12.1, 15.1)
20–29	19.8	(18.7, 20.9)
30–39	23.1	(21.8, 24.4)
40–49	21.8	(20.4, 23.3)
Gender		
Male	23.1	(21.8, 24.5)
Female	19.4	(18.7, 20.2)
Education ^a		
No formal education	3.4	(2.3, 4.5)
Primary	11.4	(10.4, 12.4)
Secondary	24.8	(23.6, 26.0)
High school and above	40.0	(37.4, 42.7)
Region ^b		
Delta and lowland	21.8	(20.8, 22.8)
Hills	17.6	(15.9, 19.3)
Coastal	20.2	(18.3, 22.1)
Plains	19.4	(18.4, 20.5)
Place of residence		
Urban	22.1	(21.0, 23.2)
Rural	18.8	(17.7, 19.8)
Current marital status		
Never married	18.6	(17.5, 19.6)
Married	21.7	(20.8, 22.5)
Widowed	20.6	(16.3, 24.9)
Divorced	19.7	(15.5, 23.9)
Separated	27.1	(13.9, 40.4)
Occupation		
Not working and/or Home maker	19.8	(18.3, 21.2)
Agriculture	16.5	(14.6, 18.4)
Manual labour	18.8	(17.6, 20.1)
Clerical/Sales/Services	22.9	(21.5, 24.3)
Professional/technical/managerial	24.5	(22.6, 26.4)

Factors	Predicted probabilities (%)	95%CI
Wealth quintile		
First (poorest)	9.5	(7.8, 11.3)
Second	15.2	(13.4, 17.0)
Third	18.9	(17.3, 20.5)
Fourth	22.7	(21.3, 24.1)
Fifth	24.5	(23.1, 26.0)
Household size		
1–3	21.5	(20.1, 22.9)
4–6	20.1	(19.3, 21.0)
>6	20.1	(18.8, 21.3)
Moved in at this residence within last one year		
Yes	20.4	(19.8, 21.0)
No	20.5	(17.0, 24.0)
Exposure to mass media ⁶ at least once a week		
Yes	21.4	(20.6, 22.1)
No	16.5	(15.1, 17.9)

⁴Education: primary = 5 years, middle = 4 years, high = 2 years

⁵Delta and low land = Kayin, Bago, Mon, Yangon, Ayeyarwaddy; Hills = Kachin, Kayah, Chin, Shan; Coastal = Thaninthayi, Rakhine; Plains = Sagaing, Magway, Mandalay, Naypyitaw

⁶television, newspaper or radio.

understanding of HIV. Moreover, wealth was also a factor that influenced comprehensive knowledge of HIV. People belonging to the poorest two quintiles had poor comprehensive knowledge of HIV, similar to the findings from the Nigerian Demographic and Health Survey (2013)¹⁷. Accessing or learning health information could be minimal for those of the poorest quintiles as they might need to engage more with daily work for their living.

School health education and peer intervention programs should be strengthened to improve comprehensive knowledge among late adolescent. In 2017, the Ministry of Health and Sports issued standardized health messages in the local language for basic health staff. By using these, health promotion activities at the community level should specially be targeted towards late adolescents and socioeconomically disadvantaged people with no formal education. Furthermore, access to HIV preventive equipment such as condoms and creating safe environment is critical.

In conclusion, comprehensive knowledge of HIV among the general population needs to be improved in Myanmar and we identified certain independent predictors that could be specifically targeted. Further translational health education research should be done on the possible knowledge transfer mechanism for these sub-groups.

Data availability

Underlying data

The underlying data for this study is owned by the DHS Program (https://www.dhsprogram.com/data/dataset/Myanmar_Standard-DHS_2016.cfm?flag=0). The electronic data is available from the DHS Program under its terms of use (<https://dhsprogram.com/Data/terms-of-use.cfm>). Before downloading the data, users must register as a DHS user for reasons laid out on the DHS Program website (<https://www.dhsprogram.com/data/Registration-Rationale.cfm>) and dataset access is only granted for legitimate research purposes.

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[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
17. Faust L, Yaya S, Ekholuenetale M: **Wealth inequality as a predictor of HIV-related knowledge in Nigeria**. *BMJ Glob Health*. 2017; **2**(4): e000461.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

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Version 2

Reviewer Report 01 September 2021

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Akshaya Srikanth Bhagavathula

Institute of Public Health, College of Medicine and Health Sciences, UAE University, Al Ain, United Arab Emirates

Abstract

Please rephrase the sentence related to "not known".

Describe the variables related to HIV knowledge. The results section is poorly written. It is obvious that adolescents age group may not have sufficient knowledge, It raises questions whether Myanmar included the HIV/STD-related subjects in the school curriculum?

Results and conclusions are uncertain.

Introduction

90-90-90 target is not related to 90% of all people living with HIV will know their status, 90% of all people diagnosed will receive sustained antiretroviral therapy (ART), and 90% of all people receiving ART.

Paragraph 2 should be related to KAP levels in Myanmar, not related to testing, or other information. There are several studies conducted on this topic in Myanmar.

Sentence related to Uganda is not relevant to the Myanmar population. The authors can emphasize the research conducted in Myanmar: some references

<https://pubmed.ncbi.nlm.nih.gov/33749465/>,

J Adolesc Health. 2017 Feb;60(2S2):S45-S53. doi: 10.1016/j.jadohealth.2016.09.006. PMID: 28109340¹.

The authors should provide details on the MDHS survey and the importance of this on the Myanmar population.

Methods: In the abstract, it is mentioned as secondary data analysis, thus authors should specify it as secondary data analysis rather than describing it as a new study.

It was not clear: whether the authors used secondary data or designed a new survey.

Authors should describe the questionnaire, composition, pilot results, validity, and cutoff values to consider as good and bad knowledge.

Remove personal names and details in the methods.

Statistical analysis: How categorical/continuous variables are assessed. How the predicting variables were selected in the multivariate model.

The statistical analysis section is not clear. The authors should justify why the authors considered Poisson regression over logistic regression. I didn't see any count/rate increase and change in variability. The author should justify this. What is the relevancy of prevalence ratio on HIV knowledge?

There are several other comments that still exist. But the authors need to strengthen the methodology.

References

1. Aung PP, Ryan C, Bajracharya A, Pasricha N, et al.: Effectiveness of an Integrated Community- and Clinic-Based Intervention on HIV Testing, HIV Knowledge, and Sexual Risk Behavior of Young Men Who Have Sex With Men in Myanmar. *J Adolesc Health*. 2017; **60** (2S2): S45-S53 [PubMed Abstract](#) | [Publisher Full Text](#)

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology, HIV/AIDS, chronic diseases

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Version 1

Reviewer Report 24 February 2021

<https://doi.org/10.5256/f1000research.23839.r79872>

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Naohiro Yonemoto

Department of Public Health, Juntendo University School of medicine, Tokyo, Japan

The study would be valuable, but I have some comments below.

1. In introduction, third paragraph was not clear. Why did you mention "in Uganda" ?
2. Did you check validity and confidence as a composite measure of knowledge in "Comprehensive knowledge"? How to summarize them as composite score? This is a critical issue.
3. How to select socio-economic variables from original dataset? All?
4. You should more clearly describe the datasets.
5. You should describe data flow chart and align with STROBE statement.
6. You should discuss the difference of respondents by sex.
7. How to analyze them "with weights" in the model. You should more clearly describe them.
8. Wealth quintile was not clear. You should more clearly describe them.
9. How to handle missing data in the analysis?
10. You mentioned use of "robust variance". Why did you use it and was used for 95% CIs?
11. You should more clearly describe variables of education and regions. How long educated? Where? Map?
12. You should more clearly discuss the gap between knowledge (by respondent) and behaviors.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology and Biostatistics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 20 Jul 2021

Kyaw Lwin Show, Department of Medical Research, Yangon, Myanmar

REVIEWER 2

Naohiro Yonemoto, Department of Public Health, Juntendo University School of medicine, Tokyo, Japan

REVIEWER

The study would be valuable, but I have some comments below.

In introduction, third paragraph was not clear. Why did you mention "in Uganda" ?

AUTHORS

Thank you. We included Uganda as international example. We hope this is fine.

REVIEWER

Did you check validity and confidence as an composite measure of knowledge in "Comprehensive knowledge"? How to summarize them as composite score? This is a critical issue.

AUTHORS

Thank you. "Comprehensive knowledge" used as an outcome in this study was expressed in the DHS reports by many countries. It is the composite score and was considered as 'present' if a person (i) knew about condom use and that limiting sexual intercourse to one partner could prevent HIV and (ii) knew that a healthy looking person could have HIV and (iii) rejected the two most common local misconceptions about the transmission of HIV, which in Myanmar were that HIV could be transmitted through mosquito bites and that a

person could get infected with HIV by sharing food with someone who has AIDS. It is stated in the paper LINE 127 of revised manuscript with track changes.

REVIEWER

How to select socio-economic variables from original dataset? All?

AUTHORS

Thank you. At the first place, we reviewed the dataset and based on our experience and available literatures, we selected SES variables to be included in our study.

REVIEWER

You should more clearly describe the datasets.

AUTHORS

Thank you. We analyzed publically available (<https://dhsprogram.com/>) secondary data which is the MDHS 15-16 dataset and was described briefly in LINE 35-49 of the manuscript. We did not describe the details because of nature of the brief report allowing 2,500 words and it was already presented in MDHS 15-16 report.

REVIEWER

You should describe data flow chart and align with STROBE statement.

AUTHORS

Thank you. As analyzed publically available secondary data which is the MDHS 15-16 dataset, the data flow is described in the MDHS 15-16 report (dhsprogram.com) and we decided not to repeat the same in our manuscript to save the space. Thank you for suggesting to check the quality of reporting with STROBE statement which was very useful. We recognized that the sampling procedure and sample size calculation were not specifically mentioned in our report since they were previously described in DHS report and we have indicated it in the manuscript. [LINE 113 of revised manuscript with track changes]

REVIEWER

You should discuss the difference of respondents by sex.

AUTHORS

Thank you. The difference of respondents by sex is happened because of sampling design by the DHS methodology. In the DHS report, it was mentioned as "All women age 15-49 who are either permanent residents of the selected households or visitors who stayed in the households the night before the survey were eligible to be interviewed. In half of the selected households (every second households), all men age 15-49 who were either residents or visitors who stayed in the households the night before the survey were eligible to be interviewed." You may check the detail in the DHS report. (<https://dhsprogram.com/>)

REVIEWER

How to analyze them "with weights" in the model. You should more clearly describe them.

AUTHORS

Thank you. Because of non-proportional sample allocation by DHS methodology, weighting factors were added to the data file and calculated to be representative at the national level. This was also described in the MDHS 15-16 report and we did not repeat it to save the space. We hope this is fine.

REVIEWER

Wealth quintile was not clear. You should more clearly describe them.

AUTHORS

The wealth quantile was already classified as it is in the original dataset and we did not do any modification. In the DHS report, it was mentioned that the wealth index were derived from selected variables and you can see the detail in page number 9 of the MDHS report.

REVIEWER

How to handle missing data in the analysis?

AUTHORS

Thank you. Magnitude of missing data was minimal and hence, we did not include them in the model. However, we presented the number and proportion of missing data in the table.

REVIEWER

You mentioned use of "robust variance". Why did you use it and was used for 95% CIs?

AUTHORS

We used the robust option to obtain robust standard errors for the parameter estimates to control for mild violation of underlying assumptions.

REVIEWER

You should more clearly describe variables of education and regions. How long educated? Where? Map?

AUTHORS

Thank you. We have described education and regions as footnotes under the table 1.

REVIEWER

You should more clearly discuss the gap between knowledge (by responded) and behaviors.

AUTHORS

Thank you. We have added "Furthermore, access to HIV preventive equipment such as condoms and creating safe environment is critical" in the discussion. LINE 230 of revised manuscript with track changes

Competing Interests: There is no competing interests to declare.

Reviewer Report 21 April 2020

<https://doi.org/10.5256/f1000research.23839.r61622>

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Adam K. Richards

Community Partners International, Berkeley, CA, USA

This brief report uses data from the 2015-2016 Myanmar DHS to explore factors related to “comprehensive HIV knowledge” in the general Myanmar population. The authors should make it clear that the crude estimates presented in Table 1 combine the sex-specific tables from the full Myanmar DHS report (table1 13.3.1 for women and 13.3.2 for men); the modest novelty of the manuscript as currently written lies in the results modelled in a multivariate analysis of these independent variables.

My sense is that the manuscript could be strengthened by making several modest changes as outlined below.

Introduction

First paragraph: it is not at all clear that “the right knowledge and a positive attitude towards HIV... is a pre-requisite... [to meet the 90-90-90 goals]... at least when the definition of HIV knowledge is the one used by the DHS/in this manuscript. It is not unreasonable to propose that at least some of the knowledge domains (specifically, the ‘misperceptions’) may be less relevant when it comes to actual risk behaviors, care-seeking, adherence, stigma etc etc. [see below for additional discussion]

Outcome

The authors should consider presenting results using knowledge of “HIV prevention measures” as an alternative, or perhaps secondary outcome.

I appreciate that the definition of ‘comprehensive HIV knowledge’ that is applied in other DHS surveys (and is comprised of four elements: one partner/condoms prevent HIV; PLWHA can be healthy; and 2 misconceptions NOT endorsed) though it is worth noting that most DHS surveys also present results for a subset composed of the first two of the four items in the comprehensive knowledge, often referred to as ‘HIV prevention measures.’ It would be useful to use this alternative definition, given the somewhat tenuous link between the misconceptions and HIV outcomes of commonly accepted value. Numerous studies demonstrate how individuals are capable of holding multiple beliefs about the etiology of disease while maintaining overall excellent adherence to risk behaviors, testing and treatment. For example, it is possible for TB patients in Bolivia to believe that traditional healers play a valuable role in the treatment of tuberculosis, but this belief does not impede their ability to seek out testing for TB and to strictly adhere to DOT (as long as structural barriers are addressed to enable access to care, payment for testing and treatment etc) – see *An Ethnography of Nonadherence: Culture, Poverty, and Tuberculosis in Urban Bolivia*. Jeremy A. Greene. *Culture, Medicine and Psychiatry* volume 28, pages

401–425(2004)¹. As the authors likely are aware, it is not uncommon in Myanmar for rural villagers to believe that malaria can be transmitted by eating papaya (or other fruits)... but this does not interfere with their excellent care seeking behavior and adherence to treatment – as evidenced by the impressive results of the large village malaria worker initiatives that have dramatically reduced transmission in endemic areas of Myanmar.

Stated more directly, there is a very real chance that it does not matter much whether or not someone believes HIV might be related to mosquitoes or food... as long as they also know that HIV is associated with real risk behaviors (unprotected sex; sharing needles etc), and that their practices align with lower risk behaviors.

I am not aware of studies demonstrating that misconceptions about HIV (specifically, mosquitoes and sharing food) meaningfully influence HIV risk behaviors, uptake of testing or treatment, HIV-related stigma or other meaningful outcome. If the authors are aware of such studies they might cite them as part of their choice to use the DHS definition of “comprehensive HIV knowledge” over alternative options that carry at least as much meaning – such as knowledge of HIV prevention messages.

I appreciate that knowledge related to PMTCT of HIV is not the specific emphasis of this brief report. Nonetheless, it is arguably at least as important an indicator of HIV related knowledge in the general population -- as the authors themselves imply in the introduction. (that is, HIV knowledge about the importance of limiting sex partners, condom use etc. is MUCH more valuable among key pops and perhaps migrants than it is among the general population; whereas every woman (and their male partners) who might get pregnant should be aware of HIV testing and treatment during pregnancy..

Exposures

The DHS includes questions related to media exposure (print, radio and television; and these answers are often combined into a composite indicator), and it would be valuable to include this in the model, as it might suggest possible means by which the low knowledge of HIV in Myanmar might be ameliorated. The authors should either include one or more of these variables, or explain their choice to omit them.

Did the authors consider estimating knowledge among important subpopulations who can be classified using DHS data? Unfortunately, information on most high risk HIV behaviors is not available from the DHS, though it may be useful to document HIV knowledge among respondents who are: recently sexually active; reported an STI; engaged in payment for sex; or who lived in particular states/regions. For example, given the extremely high prevalence of HIV among PWID in Kachin and Shan (from the recent IBBS), as well as the relatively common practice of injection drug use in those Northern regions, it is not inconceivable that HIV will become a generalized epidemic in that area; and partners of PWID are at especially high risk.

The lack of information on other HIV risk factors / key populations in the DHS (eg condom use; illicit injection history; same-sex-practices; migration history etc) is a limitation worth noting in the manuscript.

The model among adolescents likely should take advantage of the DHS variables specific to this group (ever attended school; attended school in the past year etc).

Statistical analysis

I appreciate and agree with the choice to present prevalence rate ratios (and not odds ratios). In the setting of an outcome of modest prevalence, most would choose to use glm with a binomial distribution and a log link function, and not a robust poisson regression. See for example Martin R Petersen and James A Deddens. BMC Med Res Methodol. A comparison of two methods for estimating prevalence ratios. 2008; 8: 9².

The results are unlikely to be qualitatively different using either method, though the authors might explain their choice to the reader (or consider using glm with a binomial distribution)

Modelling choices

Stratification / separate models for adolescents

The authors appropriately note that HIV knowledge is especially low among adolescents, though it is less clear why this might be the case. A reasonable *a priori* hypothesis is that the factors associated with HIV knowledge among adolescents are quite different than risk factors among young/middle age adults. [Some authors would even submit a separate manuscript J]. The authors should explain why they chose to estimate a single model for both older adults as well as adolescents. If the authors first conducted stratified analyses and observed similar associations; or if they formally explored the possible presence of interactions between adolescent and older ages, then they should say so. If these were not done, then I strongly encourage the authors to explore possible effect modification among adolescents, and to comment on whether results appear similar.

Interactions

Did the authors consider exploring effect modification by other variables in addition to adolescent vs adults? For example, are SES gradients of similar magnitude in urban and non-urban settings? A brief comment on whether interactions were considered for other/any variables would be useful.

Supplementary analyses

As above, as currently presented the unique novel contribution made by this manuscript is a multivariable/adjusted model. Most associations remain relatively similar in the adjusted model, and the simple analysis sets a somewhat low bar for publication in a peer reviewed manuscript, even as a Brief Report. It would be valuable to augment the manuscript with additional analysis that would require fairly little effort. Here are two straightforward suggestions:

Predicted probabilities

For example, the authors could present absolute predicted probabilities of comprehensive knowledge (or knowledge of HIV prevention practices) for different individuals who do and do not possess factors associated with HIV knowledge: for example, the authors might report the probabilities of HIV knowledge for residents of Myanmar who are:

1. highest wealth quintile; high school or higher education; urban; professional

2. poorest wealth quintile; no education; nonurban; agricultural worker

The authors might calculate predicted probabilities for two groups of adolescents; as well as two groups of adults (4 calculations total. Margins facilitates calculation of the difference between predicted probabilities, the standard error of that difference, confidence intervals etc though it may not be necessary to report that, due to the very large magnitude of the difference apparent on presentation of the point estimates.

What is the potential value of calculated predicted probabilities? First, it provides an intuitive presentation of adjusted estimates on an absolute scale, which complements the information presented on a relative scale (aPRR). Second, it helps to place the findings in context and more directly address several key questions the current manuscript touches on only indirectly. One such question is whether comprehensive knowledge is likely or possible, even when the most favorable conditions exist (ie could any combination of factors produce a predicted probability close to the UNGASS goal of 95% among adolescents?). In addition, presentation of predicted probabilities would create an even more stark contrast for disadvantages groups who comprise a large proportion of the population. This, in turn, might further highlight the important conclusion that efforts to improve HIV knowledge *per se* (via media, education etc) are unlikely to address the low overall HIV knowledge; and that improving HIV knowledge will require major development and social change. [see also the comment below related to school-based HIV education efforts –calculating predicted probabilities among adolescents who are advantaged in every way, including attendance at school, might provide a rough sense of the magnitude of the impact necessary to achieve targets set by UNGASS].

Predicted probabilities are easily accomplished in STATA using the ‘margins’ postestimation command (immediately after running the full model regression).

Summarize SES inequities using concentration index or similar health equity metric

The SES gradients (wealth and educational attainment) are very large, independent of each other, and not explained by observed variables in the model. Methods exist to summarize inequities in health outcomes using tools developed by others, such as the concentration index developed by the World Bank. User-written command `conindex` is available in STATA that facilitates calculation of the concentration index in the setting of complex survey such as the DHS (using the `svy:` prefix). I suggest that the authors report two relative CIs for HIV knowledge, using household wealth and educational attainment as the two respective ranking variables.

Discussion

The major finding was already known: that “comprehensive knowledge of HIV,” as defined by the DHS is low in Myanmar; and that the distribution of knowledge demonstrates stark patterning according to axes of power and advantage, such as wealth, education, occupation, urban residence etc. It likely is worth stating that adjusting for the factors included in the multivariable model had little influence on what was documented already (in the DHS report tables).

If the authors believe that the more strict definition of HIV knowledge (that requires respondents to correctly identify mosquitoes and food as NOT influencing risk of HIV) is in fact important, that it would be fair to say that an overall prevalence of 20.4% is extremely (abysmally?) low. If, however, they believe that in fact it is not crucial that the general population possesses the HIV knowledge specific to these questions, then it may be reasonable to describe this percentage in less stark terms: perhaps simply ‘low’ would suffice; I would avoid saying ‘relatively’ low, as this begs the question ‘relative to what?’ the ideal? Other countries?

Absolute prevalence of comprehensive knowledge should be reported for each country compared to Myanmar (eg Nigeria, DRC and Uganda).

The adolescent figures can be placed in the context of the UNGASS goal to achieve comprehensive knowledge among 95% of adolescents. (!)

The SES gradients (wealth and educational attainment) are striking, independent, and are not explained by observed variables included in this model. This likely deserves greater emphasis.

Why single out “the poorest two quintiles” for having “poor comprehensive knowledge”... when only 41% possessed comprehensive knowledge even the highest wealth quintile? [hint: predictive margins may be useful here]

As above, it would be valuable to report a secondary outcome of the two HIV prevention methods, which results in a slightly higher prevalence 54% among women and 62% among men (p205 in the DHS). It would be valuable to know whether or not the associations appear similar when this more common outcome is used in place of the stricter “comprehensive knowledge” outcome is used (the PRRs will likely be somewhat smaller in magnitude if the denominator/baseline value is larger, though this can be taken into account in your interpretation).

The manuscript might contrast HIV Knowledge in the general population with that reported among key populations (ie from the respective IBBS among PWID and FSW).

Given the concentration of HIV risk among key populations – that in Myanmar include migrants, as noted in the more recent strategic plans of MOHS/NAP – the authors could more explicitly state the value of reporting HIV knowledge among the general public. One way to do this is to highlight the emphasis of NAP on PMTCT, and make explicit that the women in the present analysis are women of reproductive age.

If a large number of children and adolescents do not attend school (attendance ratios are 83% for primary and only 60% among adolescents) then it is not clear how school-based HIV education would address the gap in HIV knowledge among this vulnerable group.

Addressing the massive SES gradients in HIV knowledge is an admirable goal, though it’s not at all clear what a “targeted” approach might look like, or whether it makes much sense given the low knowledge overall, and in every subgroup presented – though calculating the predictive margins might help to highlight whether it would be reasonable to omit certain subgroups from a ‘targeted’ campaign.

Minor points

Introduction

The findings from Uganda belong in the discussion (along with DRC and Nigeria).

Methods: the paragraph that begins “Comprehensive knowledge was considered...” should read “present” [drop as ‘yes’]

Results: second paragraph -- repeating “17,622 respondents” is redundant

Figure 1 – I am not sure what is added by presenting the sampled clusters on a map, in the particular manuscript. Consider mapping the prevalence of the primary outcome of HIV knowledge. Since the crude prevalence of comprehensive knowledge by state/region is already provided in the DHS report (albeit separately for men and women, and in tabulated format); then the authors might present predicted probabilities ‘adjusted’ (standardized) for age, sex and nonurban residence...

References

1. Greene JA: An ethnography of nonadherence: culture, poverty, and tuberculosis in urban Bolivia. *Cult Med Psychiatry*. 2004; **28** (3): 401-25 [PubMed Abstract](#) | [Publisher Full Text](#)
2. Petersen MR, Deddens JA: A comparison of two methods for estimating prevalence ratios. *BMC Med Res Methodol*. 2008; **8**: 9 [PubMed Abstract](#) | [Publisher Full Text](#)

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: epidemiology of infectious and chronic disease; design and analysis of complex surveys; health services research; health inequity

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 20 Jul 2021

Kyaw Lwin Show, Department of Medical Research, Yangon, Myanmar

REVIEWER 1

Adam K. Richards, Community Partners International, Berkeley, CA, USA

REVIEWER

This brief report uses data from the 2015-2016 Myanmar DHS to explore factors related to “comprehensive HIV knowledge” in the general Myanmar population. The authors should make it clear that the crude estimates presented in Table 1 combine the sex-specific tables from the full Myanmar DHS report (table1 13.3.1 for women and 13.3.2 for men); the modest novelty of the manuscript as currently written lies in the results modelled in a multivariate analysis of these independent variables.

My sense is that the manuscript could be strengthened by making several modest changes as outlined below.

AUTHORS

Thank you for your time and kind effort providing comments. We agree with you that novelty of the manuscript lies in the multivariable analysis. As the result of reviewer input, we believe the manuscript has significantly improved. We have added the footnote in the Table 1 "The crude estimates presented here combine the sex-specific tables from the full Myanmar DHS report (table1 13.3.1 for women and 13.3.2 for men)".

REVIEWER

Introduction

First paragraph: it is not at all clear that "the right knowledge and a positive attitude towards HIV... is a pre-requisite... [to meet the 90-90-90 goals]... at least when the definition of HIV knowledge is the one used by the DHS/in this manuscript. It is not unreasonable to propose that at least some of the knowledge domains (specifically, the 'misperceptions') may be less relevant when it comes to actual risk behaviors, care-seeking, adherence, stigma etc etc. [see below for additional discussion]Outcome

The authors should consider presenting results using knowledge of "HIV prevention measures" as an alternative, or perhaps secondary outcome.

AUTHORS

Thank you for your comment. We ran the model with the same method for "knowledge on HIV prevention measures". We found that compared to those educated high school and above, those educated less than high school were 34% less likely [aPR: 0.66 (95% CI: 0.63, 0.69) : those with no formal education were 63% less likely [aPR: 0.37 (95% CI: 0.33, 0.41)] to have comprehensive knowledge. Other than education, we found no significant differences between categories across variables which is similar to the comprehensive knowledge result. Moreover, the percentage for the specific questions regarding HIV preventive measures and misperceptions were also already presented in the MDHS report. Therefore, we would like to keep current definition of outcome and we would like to compare it with the results of other studies conducted in different countries.

REVIEWER

I appreciate that the definition of 'comprehensive HIV knowledge' that is applied in other DHS surveys (and is comprised of four elements: one partner/condoms prevent HIV; PLWHA can be healthy; and 2 misconceptions NOT endorsed) though it is worth noting that most DHS surveys also present results for a subset composed of the first two of the four items in the comprehensive knowledge, often referred to as 'HIV prevention measures.' It would be useful to use this alternative definition, given the somewhat tenuous link between the misconceptions and HIV outcomes of commonly accepted value. Numerous studies demonstrate how individuals are capable of holding multiple beliefs about the etiology of disease while maintaining overall excellent adherence to risk behaviors, testing and treatment. For example, it is possible for TB patients in Bolivia to believe that traditional healers play a valuable role in the treatment of tuberculosis, but this belief does not impede their ability to seek out testing for TB and to strictly adhere to DOT (as long as structural barriers are addressed to enable access to care, payment for testing and treatment etc) – see An Ethnography of Nonadherence: Culture, Poverty, and Tuberculosis in Urban Bolivia. Jeremy A. Greene. *Culture, Medicine and Psychiatry* volume 28, pages 401–425(2004)¹. As the authors likely are aware, it is not uncommon in Myanmar for rural villagers to believe that

malaria can be transmitted by eating papaya (or other fruits)... but this does not interfere with their excellent care seeking behavior and adherence to treatment – as evidenced by the impressive results of the large village malaria worker initiatives that have dramatically reduced transmission in endemic areas of Myanmar.

Stated more directly, there is a very real chance that it does not matter much whether or not someone believes HIV might be related to mosquitoes or food... as long as they also know that HIV is associated with real risk behaviors (unprotected sex; sharing needles etc), and that their practices align with lower risk behaviors.

I am not aware of studies demonstrating that misconceptions about HIV (specifically, mosquitoes and sharing food) meaningfully influence HIV risk behaviors, uptake of testing or treatment, HIV-related stigma or other meaningful outcome. If the authors are aware of such studies they might cite them as part of their choice to use the DHS definition of “comprehensive HIV knowledge” over alternative options that carry at least as much meaning – such as knowledge of HIV prevention messages.

I appreciate that knowledge related to PMTCT of HIV is not the specific emphasis of this brief report. Nonetheless, it is arguably at least as important an indicator of HIV related knowledge in the general population -- as the authors themselves imply in the introduction. (that is, HIV knowledge about the importance of limiting sex partners, condom use etc. is MUCH more valuable among key pops and perhaps migrants than it is among the general population; whereas every woman (and their male partners) who might get pregnant should be aware of HIV testing and treatment during pregnancy..

AUTHORS

Thank you for the detailed comment. We realized the value of having HIV prevention measures as a secondary outcome. However, since our study's focus was on comprehensive knowledge of HIV and short reports does not allow us to expand the manuscript (maximum 2 tables/figures and 2500 words); we would like to stick to our current outcome. We also found that misconceptions of HIV transmission have been associated with HIV testing in some DHS paper (mentioned below). In this connection, in order to meet the first 90 of UNAIDS 90-90-90 goal, we decided to keep comprehensive knowledge (preventive knowledge + misconceptions) as our outcome of interest.

<https://www.dovepress.com/what-are-the-determinants-of-misconception-about-hiv-transmission-amon-peer-reviewed-fulltext-article-HIV>

<https://bmcinthealthhumrights.biomedcentral.com/articles/10.1186/s12914-016-0089-8#Tab3>

REVIEWER

Exposures

The DHS includes questions related to media exposure (print, radio and television; and these answers are often combined into a composite indicator), and it would be valuable to include this in the model, as it might suggest possible means by which the low knowledge of HIV in Myanmar might be ameliorated. The authors should either include one or more of these variables, or explain their choice to omit them.

AUTHORS

Thank you for pointing out this. We included exposure to at least one of the mass media (television, newspaper, radio) at least once a week in the model and added the values in the table 1.

REVIEWER

Did the authors consider estimating knowledge among important subpopulations who can be classified using DHS data? Unfortunately, information on most high risk HIV behaviors is not available from the DHS, though it may be useful to document HIV knowledge among respondents who are: recently sexually active; reported an STI; engaged in payment for sex; or who lived in particular states/regions. For example, given the extremely high prevalence of HIV among PWID in Kachin and Shan (from the recent IBBS), as well as the relatively common practice of injection drug use in those Northern regions, it is not inconceivable that HIV will become a generalized epidemic in that area; and partners of PWID are at especially high risk.

AUTHORS

Thank you for this interesting comment. Because short reports does not allow us to expand the manuscript (maximum 2 tables/figures and 2500 words), we could not cover all the aspects and we decided to estimate knowledge among general population in this paper. We have published a paper regarding HIV testing among STIs which knowledge variable was an independent variable. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7310811/>

REVIEWER

The lack of information on other HIV risk factors / key populations in the DHS (eg condom use; illicit injection history; same-sex-practices; migration history etc) is a limitation worth noting in the manuscript.

AUTHORS

Thank you. We have stated "The study population might include some key affected population that could influence the true prevalence among general population" as a limitation in our manuscript. LINE 201 of revised manuscript with track changes

REVIEWER

The model among adolescents likely should take advantage of the DHS variables specific to this group (ever attended school; attended school in the past year etc).

AUTHORS

Thank you. We agree with your point. We have also analyzed separate models for adolescents and non-adolescents and found similar results as combined one except regional variation prominent among adolescents. In the adolescent model, compared to delta and lowland region, those residing in hilly region (aOR=0.51, 95%CI: 0.34,0.78) and plain region (aOR=0.67, 95%CI: 0.51, 0.88) had significant lower comprehensive knowledge. Considering this is a short report with limited tables and the need for a clear and simple message, we decided against presenting another model for adolescents in this manuscript. We hope this is fine.

REVIEWER

Statistical analysis

I appreciate and agree with the choice to present prevalence rate ratios (and not odds ratios). In the setting of an outcome of modest prevalence, most would choose to use glm with a binomial distribution and a log link function, and not a robust poisson regression. See for example

Martin R Petersen and James A Deddens. BMC Med Res Methodol. A comparison of two methods for estimating prevalence ratios. 2008; 8: 9².

The results are unlikely to be qualitatively different using either method, though the authors might explain their choice to the reader (or consider using glm with a binomial distribution)

AUTHORS

Thank you. We first tried a log binomial model. But because of lack of convergence, we proceeded with the modified Poisson regression to estimate the prevalence ratios. We have also mentioned in the manuscript. LINE 141 of manuscript with track changes

REVIEWER

Modelling choices

Stratification / separate models for adolescents

The authors appropriately note that HIV knowledge is especially low among adolescents, though it is less clear why this might be the case. A reasonable *a priori* hypothesis is that the factors associated with HIV knowledge among adolescents are quite different than risk factors among young/middle age adults. [Some authors would even submit a separate manuscript J]. The authors should explain why they chose to estimate a single model for both older adults as well as adolescents. If the authors first conducted stratified analyses and observed similar associations; or if they formally explored the possible presence of interactions between adolescent and older ages, then they should say so. If these were not done, then I strongly encourage the authors to explore possible effect modification among adolescents, and to comment on whether results appear similar

AUTHORS

Thank you for your comment. We tried the potential interaction across variables (including age category and other variables), included in the model and tested for model selection using AIC/BIC results. However, the models with interaction(s) was not significantly improved compared to the simple model. Therefore, we decided to present the simple model in our manuscript. We have added the information in the manuscript. LINE 148 of revised manuscript with track changes

REVIEWER_

Interactions

Did the authors consider exploring effect modification by other variables in addition to adolescent vs adults? For example, are SES gradients of similar magnitude in urban and non-urban settings? A brief comment on whether interactions were considered for other/any variables would be useful.

AUTHORS

Thank you for your comment. We tried the potential interaction across variables (including age category and other variables), included in the model and tested for model selection using AIC/BIC results. However, the models with interaction(s) was not significantly improved compared to the simple model. Therefore, we decided to present the simple first model in our manuscript. We have added the information in the analysis. LINE 148 of revised manuscript with track changes

REVIEWER**Supplementary analyses**

As above, as currently presented the unique novel contribution made by this manuscript is a multivariable/adjusted model. Most associations remain relatively similar in the adjusted model, and the simple analysis sets a somewhat low bar for publication in a peer reviewed manuscript, even as a Brief Report. It would be valuable to augment the manuscript with additional analysis that would require fairly little effort. Here are two straightforward suggestions:

Predicted probabilities

For example, the authors could present absolute predicted probabilities of comprehensive knowledge (or knowledge of HIV prevention practices) for different individuals who do and do not possess factors associated with HIV knowledge: for example, the authors might report the probabilities of HIV knowledge for residents of Myanmar who are:

1. highest wealth quintile; high school or higher education; urban; professional
2. poorest wealth quintile; no education; nonurban; agricultural worker

The authors might calculate predicted probabilities for two groups of adolescents; as well as two groups of adults (4 calculations total. Margins facilitates calculation of the difference between predicted probabilities, the standard error of that difference, confidence intervals etc though it may not be necessary to report that, due to the very large magnitude of the difference apparent on presentation of the point estimates.

What is the potential value of calculated predicted probabilities? First, it provides an intuitive presentation of adjusted estimates on an absolute scale, which complements the information presented on a relative scale (aPRR). Second, it helps to place the findings in context and more directly address several key questions the current manuscript touches on only indirectly. One such question is whether comprehensive knowledge is likely or possible, even when the most favorable conditions exist (ie could any combination of factors produce a predicted probability close to the UNGASS goal of 95% among adolescents?). In addition, presentation of predicted probabilities would create an even more stark contrast for disadvantages groups who comprise a large proportion of the population. This, in turn, might further highlight the important conclusion that efforts to improve HIV knowledge *per se* (via media, education etc) are unlikely to address the low overall HIV knowledge; and that improving HIV knowledge will require major development and social change. [see also the comment below related to school-based HIV education efforts –calculating predicted probabilities among adolescents who are advantaged in every way, including attendance at school, might provide a rough sense of the magnitude of the impact necessary to achieve

targets set by UNGASS].

Predicted probabilities are easily accomplished in STATA using the 'margins' postestimation command (immediately after running the full model regression).

AUTHORS

Thank you for this insightful comment. We have included the predicted probabilities across categories in Table 2.

REVIEWER

Summarize SES inequities using concentration index or similar health equity metric
The SES gradients (wealth and educational attainment) are very large, independent of each other, and not explained by observed variables in the model. Methods exist to summarize inequities in health outcomes using tools developed by others, such as the concentration index developed by the World Bank. User-written command `conindex` is available in STATA that facilitates calculation of the concentration index in the setting of complex survey such as the DHS (using the `svy:` prefix). I suggest that the authors report two relative CIs for HIV knowledge, using household wealth and educational attainment as the two respective ranking variables.

AUTHORS

Thank you for this interesting comment. We ran the analysis for concentration index/concentration curve and found that "The HIV comprehensive knowledge was concentrated among richer people, more educated people and who hold better job title". However, short reports does not allow us to expand the manuscript (maximum 2 tables/figures and 2500 words); we would like to stick as it is. We hope this is fine.

REVIEWER

Discussion

The major finding was already known: that "comprehensive knowledge of HIV," as defined by the DHS is low in Myanmar; and that the distribution of knowledge demonstrates stark patterning according to axes of power and advantage, such as wealth, education, occupation, urban residence etc. It likely is worth stating that adjusting for the factors included in the multivariable model had little influence on what was documented already (in the DHS report tables).

AUTHORS

We agree. We believe that reporting where the poor knowledge of HIV was concentrated can be beneficial for a resource constraint country like Myanmar. We hope this is fine.

REVIEWER

If the authors believe that the more strict definition of HIV knowledge (that requires respondents to correctly identify mosquitoes and food as NOT influencing risk of HIV) is in fact important, that it would be fair to say that an overall prevalence of 20.4% is extremely (abysmally?) low. If, however, they believe that in fact it is not crucial that the general

population possesses the HIV knowledge specific to these questions, then it may be reasonable to describe this percentage in less stark terms; perhaps simply 'low' would suffice; I would avoid saying 'relatively' low, as this begs the question 'relative to what?' the ideal? Other countries?

AUTHORS

Thank you. We have removed "relatively" in the manuscript. . LINE 206 of revised manuscript with track changes

REVIEWER

Absolute prevalence of comprehensive knowledge should be reported for each country compared to Myanmar (eg Nigeria, DRC and Uganda).

AUTHORS

Thank you. We revised it. LINE 209 of manuscript with track changes

REVIEWER

The adolescent figures can be placed in the context of the UNGASS goal to achieve comprehensive knowledge among 95% of adolescents.

AUTHORS

Thank you. We revised it. LINE 207 of manuscript with track changes

REVIEWER

The SES gradients (wealth and educational attainment) are striking, independent, and are not explained by observed variables included in this model. This likely deserves greater emphasis.

Why single out "the poorest two quintiles" for having "poor comprehensive knowledge"... when only 41% possessed comprehensive knowledge even the highest wealth quintile? [hint: predictive margins may be useful here]

AUTHORS

Thank you for this comment. We have added predicted probabilities as Table 2.

REVIEWER

As above, it would be valuable to report a secondary outcome of the two HIV prevention methods, which results in a slightly higher prevalence 54% among women and 62% among men (p205 in the DHS). It would be valuable to know whether or not the associations appear similar when this more common outcome is used in place of the stricter "comprehensive knowledge" outcome is used (the PRRs will likely be somewhat smaller in magnitude if the denominator/baseline value is larger, though this can be taken into account in your interpretation).

The manuscript might contrast HIV Knowledge in the general population with that reported among key populations (ie from the respective IBBS among PWID and FSW).

AUTHORS

Thank you. We have included comprehensive knowledge among key population in Myanmar according to IBBS survey in the discussion. LINE 202 of manuscript with track changes

REVIEWER

Given the concentration of HIV risk among key populations – that in Myanmar include migrants, as noted in the more recent strategic plans of MOHS/NAP – the authors could more explicitly state the value of reporting HIV knowledge among the general public. One way to do this is to highlight the emphasis of NAP on PMTCT, and make explicit that the women in the present analysis are women of reproductive age.

AUTHORS

Thank you for this valuable comment. We included “Furthermore, low proportion of comprehensive knowledge of HIV/AIDS among reproductive aged women in general population is alarming for effective prevention of mother-to-child transmission of HIV.” LINE 214 of manuscript with track changes

REVIEWER

If a large number of children and adolescents do not attend school (attendance ratios are 83% for primary and only 60% among adolescents) then it is not clear how school-based HIV education would address the gap in HIV knowledge among this vulnerable group.

AUTHORS

Thank you. We revised the sentence as “School health education and peer intervention program should be strengthened to improve comprehensive knowledge among late adolescent.” LINE 225 of manuscript with track changes

REVIEWER

Addressing the massive SES gradients in HIV knowledge is an admirable goal, though it's not at all clear what a “targeted” approach might look like, or whether it makes much sense given the low knowledge overall, and in every subgroup presented – though calculating the predictive margins might help to highlight whether it would be reasonable to omit certain subgroups from a ‘targeted’ campaign.

AUTHORS

Thank you for this interesting comment. We have included predicted probabilities as Table 2.

REVIEWER

Minor points

Introduction

The findings from Uganda belong in the discussion (along with DRC and Nigeria).

AUTHORS

Thank you. We have revised it in the manuscript. LINE 209 of manuscript with track changes

REVIEWER

Methods: the paragraph that begins "Comprehensive knowledge was considered..." should read "present" [drop as 'yes']

AUTHORS

Thank you. We have revised it in the manuscript. LINE 127 of manuscript with track changes

REVIEWER

Results: second paragraph -- repeating "17,622 respondents" is redundant

AUTHORS

Thank you. We have revised it.

REVIEWER

Figure 1 – I am not sure what is added by presenting the sampled clusters on a map, in the particular manuscript. Consider mapping the prevalence of the primary outcome of HIV knowledge. Since the crude prevalence of comprehensive knowledge by state/region is already provided in the DHS report (albeit separately for men and women, and in tabulated format); then the authors might present predicted probabilities 'adjusted' (standardized) for age, sex and nonurban residence...

AUTHORS

Thank you for your comment. We excluded the map figure and included the predicted probabilities by SES after adjusted model is presented in Table 2.

Competing Interests: There is no competing interests.

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