



Research Article

Knowledge, Attitude, and Testing of Human Immunodeficiency Virus Infection among 15- to 49-year-old Women in Sudan: An Analysis of the United Nations Children's Fund-Multiple Indicator Cluster Survey

Sagad Omer Obeid Mohamed^{1,*}, Hajir Mohamed Attaalmanan Ali¹, Esraa Abdeldaiem Mohamedien Ali², Samia Ali Mohammed Mustafa¹, Sana Hassan Mohamad Hassan¹, Thweaba Hassan Salih Omer¹, Fatima Ammar Hamed Suliman¹

¹Faculty of Medicine, University of Khartoum, Khartoum, Sudan

²Faculty of Medicine, University of Medical Sciences and Technology, Khartoum, Sudan

ARTICLE INFO

Article History

Received 01 March 2020

Accepted 21 May 2020

Keywords

Epidemiology

HIV

knowledge

MICS

ABSTRACT

Human Immunodeficiency Virus (HIV) infection is a major public health challenge worldwide. Evidence suggests that health-related behaviours are affected by the knowledge, attitude, and practice of individuals. The aim of this study was to assess the knowledge, attitude, and testing of HIV infection, and their associated factors among women of the reproductive age group in Sudan. We used the latest available data (2014) of the Sudan-Multiple Indicator Cluster Survey (MICS) obtained from the United Nations Children's Fund (UNICEF). Assessment of the knowledge, attitude, and testing of HIV infection, and their associated factors was performed using descriptive statistics, Chi-square test, and logistic regression analysis. A total of 12,703 women were included in this analysis. Only 38.1% of the respondents had an adequate level of knowledge about HIV infection, and 22.3% of them had a favourable attitude and tolerance toward dealing with HIV-infected persons. Both adequate knowledge and favourable attitude toward HIV patients were significantly associated with urban residence, higher level of education, and wealth index groups. The proportion of HIV testing among the respondents was only 4.30%, and the factors associated with HIV testing were urban residence [Odds Ratio (OR) = 2.482], highest levels of education (OR = 3.066), and highest wealth index groups (OR = 1.443). The study showed that a significant proportion of the participants lack requisite knowledge about HIV infection and a low level of HIV testing coverage. Further efforts are required to increase awareness of HIV and to disperse myths and misguided judgments regarding HIV infection.

© 2020 Dr. Sulaiman Al Habib Medical Group. Publishing services by Atlantis Press International B.V.

This is an open access article distributed under the CC BY-NC 4.0 license (<http://creativecommons.org/licenses/by-nc/4.0/>).

1. INTRODUCTION

Human Immunodeficiency Virus (HIV) infection is one of the major public health challenges worldwide and a global epidemic currently affecting approximately 37 million persons and resulted in the death of 1.1 million patients caused by HIV-related illnesses in 2015 [1–3]. It has been estimated that 0.8% of the world population aged 15–49 years are living with HIV [3]. Although the burden of the epidemic continues to vary considerably between countries and regions, women of reproductive age in Africa suffer a high burden of HIV and the African region remains most severely affected [3,4].

In Sudan, a study predicted the distribution of new HIV infections among the 15–49 year age group in Sudan in 2014 through the application of the Modes of Transmission (MoT) model, which is a mathematical model recommended by the Joint United Nations Programme on HIV/AIDS (UNAIDS) [4,5]. The MoT model estimated that the incidence rate of HIV in the 15–49 year age group was 330 per 1,000,000 person-year, and new HIV infections in 2014 reached 6012 cases [5].

*Corresponding author. Email: s.oom123@yahoo.com

Peer review under responsibility of the Dr. Sulaiman Al Habib Medical Group

Data availability statement: The dataset used during this study is available from the corresponding author on request.

(AIDS) [4,5]. The MoT model estimated that the incidence rate of HIV in the 15–49 year age group was 330 per 1,000,000 person-year, and new HIV infections in 2014 reached 6012 cases [5].

A significant proportion of HIV infections occur through vertical transmission, that is, from infected mothers to their infants during childbirth and through breastfeeding [6,7]. The rate can be lowered if effective interventions are implemented to prevent Mother to Child Transmission (MTCT) of HIV [6,8]. Women of reproductive age share the burden and risk of HIV infection if not being retained in care, and antenatal HIV testing is essential to decrease the risk of MTCT and improve maternal health [9,10]. A 2019 review on MTCT risks and challenges of MTCT uptake in sub-Saharan Africa showed that most women of reproductive age are not aware of their HIV status, and a significant number of women living with HIV remain undiagnosed and are not enrolled in any MTCT programs [6]. In addition, the MTCT of HIV is influenced by sociocultural norms and structural barriers such as fear, stigma, and discrimination [6].

As health-related behaviours are affected by different aspects of knowledge, attitude, and practice [11,12], increasing awareness and

changing behaviours remain as the highest priority for any effective HIV/AIDS control program. Sufficient knowledge about the disease is essential to prevent HIV transmission among women of the reproductive age group. Also, HIV testing is an important component of all strategies related to care, prevention, and treatment of HIV infection, and studies have shown that HIV-related stigma and knowledge about HIV and HIV risk behaviour influence HIV testing motivation for women [13,14].

There is a paucity of studies on knowledge and behaviour regarding HIV among the Sudanese population. The aim of this study was to assess participants' knowledge, attitude, and testing of HIV/AIDS among women of reproductive age in Sudan. Information gleaned from this study may encourage policymakers to give attention to planning and improving the quality of HIV management for women in Sudan.

2. MATERIALS AND METHODS

2.1. Source of Data

In this study, we used the latest available data (fifth round) of the Sudan-Multiple Indicator Cluster Survey (MICS). The latest available MICS was carried out from August to December in 2014 at the national level covering all 18 states of Sudan. MICS was conducted by the Central Bureau of Statistics and Ministry of Health, as part of the global MICS program. Financial support to carry out Sudan-MICS was provided by several international collaborators including World Health Organization, World Food Program, and the United Nations Population Fund [15].

The United Nations Children's Fund (UNICEF) developed the global MICS program to collect internationally comparable data on several indicators of the health situation of women and children, which allow countries to generate conclusive evidence for use in policies and to monitor progress toward the internationally agreed-upon commitments [13].

The Sudan MICS samples were drawn through multistage stratified clustered sampling to provide estimates for a range of indicators that assess the health situation of children and women at the national level in the 18 states of Sudan [15]. The sample size for the Sudan MICS 2014 was calculated as 18,000 households, and the number of households found to be occupied was 17,142. Of these, 16,801 were successfully interviewed. In the interviewed households, 20,327 women were identified. Of these, 18,302 were successfully interviewed, yielding a response rate of 90%.

2.2. Study Variables

The outcome variables were as follows: adequate knowledge, which was calculated, based on the sum of correct answers to the nine knowledge-based questions; favourable attitude toward dealing with HIV-infected persons, which was calculated based on the sum of correct answers to the three attitude-based questions; and the rate of ever having an HIV testing among the participants. Knowledge scores were computed and dichotomized based on the median into poor and adequate knowledge. Respondents with favourable attitude

were defined as those who answered all of the questions in indicating that they accept dealing with HIV-infected persons and they do not have any discriminative behaviour toward them.

The potential factors expected to be correlated with knowledge, attitude, and testing of HIV infection were selected based on the availability of the data. The factors assessed were: age group (15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49 years); area of residence (Urban, Rural); education (None, Primary, Secondary, Higher); marriage (Yes, No); and household wealth quintile index (Poorest, Second, Middle, Fourth, Richest). In addition, we assessed whether there an association between the outcome variables (knowledge, attitude, and HIV testing among the participants).

2.3. Statistical Analysis

Sample sociodemographic characteristics were presented with descriptive statistics in terms of the frequency and percentage of data. The analysis was done in two parts. In the first part, we performed the bivariate analysis for intergroup comparison with a Chi-square test (χ^2). Then, the selected significant variables were entered into the logistic regression models. The results of logistic regression were reported as adjusted Odds Ratios (OR) at a 95% Confidence Interval (95% CI). For data analysis, we used SPSS software version 20 (SPSS Inc., Chicago, IL, USA). The significance level for all analyses was set at $p < 0.05$.

3. RESULTS

3.1. Descriptive Statistics

After excluding those with missing data, the number of 15- to 49-year-old women whose data were complete and included in the analysis was 12,703 women. Most of the participants (20.1%) were in the age group of 15–19 years and 60.9% of the participants were living in rural areas. The sociodemographic characteristics of the participants are presented in Table 1. Status of knowledge, attitude, and testing of HIV infection among the respondents is presented in Table 2.

Transmission of HIV from mother to child during pregnancy and through breastfeeding was recognised by 62.2%, 62.8%, and 49.1% of the participants, respectively. Regarding HIV knowledge, the mean score was 7 ± 1.75 and the median was 6. Overall, only 38.1% were found to have an adequate level of knowledge about HIV infection. Only 22.3% of the respondents had a favourable attitude toward accepting dealing with HIV-infected persons. The proportion of HIV testing among the respondents was 4.30% (Table 2).

3.2. Results of Bivariate Analysis

Among the assessed variables, age group, maternal education, area of residence, and wealth index groups were found to have a significant association with level of knowledge, attitude toward HIV patients, and HIV testing. The results also showed that women with adequate knowledge are more likely to have a favourable attitude ($\chi^2 = 207.15$, $p = 0.001$) and to undergo HIV testing ($\chi^2 = 65.85$, $p = 0.001$).

3.3. Results of Logistic Regression Analysis

Regarding knowledge, women belonging to older age groups were more likely to have an adequate level of knowledge about HIV. The OR among women in the 40–44 years and 45–49 years age groups was 1.596 and 1.724 times that of the youngest group, respectively. In addition, women living in urban areas were more likely to have an adequate knowledge than those living in rural areas (OR = 1.180; 95% CI, 1.086–1.138; $p = 0.001$). The results showed that those women in the highest wealth index group were more likely to have adequate knowledge (OR = 1.536; 95% CI, 1.016–2.323). Moreover, women with a secondary and higher level of education are more likely to have an adequate level of knowledge, with an OR of 2.751 and 3.023, respectively (Table 3).

Table 1 | Sociodemographic characteristics among the participants

Variables	N	(%)
Age group (years)		
15–19	2551	20.1
20–24	2249	17.7
25–29	2301	18.1
30–34	1781	14.0
35–39	1734	13.7
40–44	1143	9.0
45–49	944	7.4
Area of residence		
Rural	7734	60.9
Urban	4969	39.1
Educational level		
None	2800	22.0
Primary	4254	33.5
Secondary	3845	30.3
Higher	1804	14.2
Ever married		
Yes	8505	67.0
No	4198	33.0
Wealth index		
Poorest	1682	13.2
Second	1923	15.1
Middle	2332	18.4
Fourth	2926	23.0
Richest	3840	30.2

The participants' attitude toward HIV-infected patients was significantly affected by urban residence (OR = 1.116; 95% CI, 1.015–1.226; $p = 0.023$) as well as higher levels of education and wealth index (Table 3). The most significant factor associated with attitude was the higher maternal education (OR = 3.057; 95% CI, 2.537–3.683; $p = 0.001$). Similarly, HIV testing was significantly influenced by urban residence (OR = 2.482; 95% CI, 2.034–3.028; $p = 0.001$) as well as higher levels of education and wealth index (Table 3).

4. DISCUSSION

This study highlighted the low levels of adequate knowledge, favourable attitude, and testing of HIV infection and their associated factor among women of the reproductive age group in Sudan based on a large dataset. The finding that age, maternal education, residence, and socioeconomic status have a significant association with knowledge, attitude, and testing of HIV is consistent with and reaffirms findings from several studies [1,16,17].

Regarding knowledge about HIV prevention in this study, 79.8% believed that having a monogamous uninfected partner would protect against HIV. This may be attributable to the common belief in conservative and highly religious Sudanese societies, among which HIV is surrounded by myths and taboos and HIV infection is linked to sexual practices outside the marriage frame [18]. Furthermore, only 35.6% of the participants reported that the HIV can be prevented by proper use of condoms, which may be attributed to the nature of the study population's residency, as most of our participants (60.9%) are from rural areas, where residents view condoms as something to be only used for contraception.

Misconceptions about HIV transmission routes were also reported; for example, 24.8% and 22.4% of the participants considered mosquito bites and sharing food as transmission routes for HIV, respectively. One finding highlights the necessity of educational programs that target closed conservative communities to increase awareness and reduce the stigma toward HIV-infected patients.

The high level of negative attitudes toward HIV-infected people might be attributable to a lack of awareness and misconception about the transmission of the disease. Stigma and discrimination

Table 2 | Knowledge, attitude, and practice toward HIV infection among the participants

Item	Statement	Yes (%)	No (%)	Do not know (%)
Knowledge	Can avoid AIDS virus by having one uninfected partner	79.8	9.1	11.1
	Can get AIDS virus through supernatural means	10.9	75.7	13.3
	Can avoid AIDS virus by using a condom correctly every time	35.6	25.2	39.2
	Can get AIDS virus from mosquito bites	24.8	63.2	12.1
	Can get AIDS virus by sharing food with a person who has AIDS	22.4	66.7	10.9
	Healthy-looking person may have AIDS virus	46.4	37.6	16.1
	AIDS virus from mother to child during pregnancy	62.2	22.8	15.0
	AIDS virus from mother to child during delivery	62.8	21.0	16.2
	AIDS virus from mother to child through breastfeeding	49.1	33.6	17.3
Attitude	Should female teacher with AIDS virus be allowed to teach in school	43.9	49.7	6.4
	Would buy fresh vegetables from shopkeeper with AIDS virus	28.7	66.6	4.7
	Willing to care for person with AIDS in household	86.1	8.6	5.3
HIV testing	Ever been tested for AIDS virus	4.30	95.7	0.00

Table 3 | Logistic regression results of the factors associated with the outcome variables

Variables	Knowledge			Attitude			HIV testing		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Age group (years)									
15–19	Ref	–		Ref	–		Ref	–	
20–24	1.131	0.993–2.289	0.064	1.051	0.909–1.216	0.502	1.435	1.008–2.041	0.045
25–29	1.240	1.078–1.427	0.003	0.990	0.844–1.161	0.899	2.247	1.577–3.203	0.001
30–34	1.320	1.134–1.537	0.001	0.901	0.756–1.074	0.244	2.165	1.482–3.161	0.001
35–39	1.128	0.965–1.318	0.131	1.104	0.928–1.315	0.264	2.635	1.811–3.835	0.001
40–44	1.717	1.448–2.037	0.001	1.121	0.924–1.359	0.247	2.323	1.538–3.510	0.020
45–49	1.688	1.407–2.026	0.001	1.063	0.863–1.310	0.567	2.003	1.277–3.142	
Residence									
Rural	Ref	–		Ref	–		Ref	–	
Urban	1.180	1.086–1.138	0.001	1.116	1.015–1.226	0.023	2.482	2.034–3.028	9.001
Education									
None	Ref	–		Ref	–		Ref	–	
Primary	1.678	0.965–2.000	0.001	1.554	1.337–1.807	0.001	1.868	1.353–2.580	0.001
Secondary	2.550	1.906–3.971	0.001	2.425	2.068–2.843	0.001	2.431	1.734–3.408	0.001
Higher	3.395	1.994–4.584	0.001	3.057	2.537–3.683	0.001	3.066	2.095–4.488	0.001
Married									
No	Ref	–		Ref	–		–	–	
Yes	0.948	0.855–1.052	0.317	1.016	0.905–1.142	0.783	–	–	
Wealth index									
Poorest	Ref	–		Ref	–		Ref	–	
Second	1.236	1.049–1.456	0.011	1.125	0.922–1.373	0.246	1.511	0.933–2.448	0.093
Middle	1.716	1.864–2.006	0.001	1.375	1.138–1.661	0.001	1.672	1.060–2.636	0.027
Fourth	1.969	1.687–2.299	0.001	1.674	1.392–2.013	0.001	1.375	0.870–2.171	0.173
Richest	2.495	2.121–2.936	0.001	1.834	1.514–2.222	0.001	1.443	0.905–2.301	0.123

toward people with HIV infection are prevalent in several areas of the world because of ignorance, low level of knowledge, insufficient commitment toward public health education, the weak role of the media, and misconception about the transmission of the disease, leading to a negative impact on the well-being of HIV patients and deleterious effects on their treatment and quality of life [19–22]. A recent systematic review on knowledge gaps of sexually transmitted infections in Africa showed the widespread HIV-related stigma and the need to enforce the attitude toward HIV patients [23]. Another systematic review on intervention to reduce HIV-related stigma and discrimination indicated that training popular opinion leaders is effective in improving attitude and compliance to universal precaution [21].

The identified poor knowledge and attitude in this study could have a negative impact on the quality of HIV-health service delivery in Sudan. It has been reported that fear of stigma and discrimination limits the utilization and efficacy of HIV health services such as counselling and testing programs across several sub-Saharan African countries [24,25]. Most of the barriers to uptake of MTCT prevention programs were hinged on issues around stigma and sociocultural beliefs, as well as poor health services. Improvement of health services utilization and engagement in care require creating a supportive stigma-free environment to ensure that women can navigate the sociocultural barriers that limit access to health services [25].

More efforts should be made to prevent vertical transmission in upcoming generations by increasing HIV routine testing. These efforts should include integrating HIV testing services into family planning services, which can contribute to achieving comprehensive

sexual and reproductive health and rights [26]. Moreover, establishing outreach accessible screening centres is important to keep track of infected individuals in the early stages, as a previous study reported that the majority of pregnant women in Sudan are not reached for counselling to get tested for HIV [27]. It has been shown that integration of HIV testing into family planning services is feasible and has the potential for positive outcomes such as improved accessibility, stigma alleviation, and quality of antenatal care [26].

The findings of this study need to be considered in the context of several limitations; the self-reported nature of the study, recall bias, and the secondary data source used for this analysis, which allowed us little control over the variables to include in the analysis.

5. CONCLUSION

The study showed that a significant proportion of the participants lack requisite knowledge about HIV. There was a low level of favourable attitude toward HIV patients. Further efforts are required to increase awareness of HIV and to disperse myths and misguided judgments regarding HIV infection. Teaching programs should be strengthened to correct the misconceptions and to encourage favourable attitudes toward patients with HIV.

CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

AUTHORS' CONTRIBUTION

SM conceptualized the research idea and undertook data analysis. SM, HA, EA, SM, SH, TO and FS interpreted the results and drafted the manuscript. All authors revised and approved the final manuscript.

ACKNOWLEDGMENTS

UNICEF is gratefully acknowledged for making the data from the Sudan MICS available to us for analysis. The dataset used during this study is available from the corresponding author on request.

REFERENCES

- [1] Okonkwo U, Ameh S, Otu A, Okpara H. HIV-related knowledge, attitude and practices of healthy adults in Cross River State Nigeria: a population based-survey. *Pan Afr Med J* 2017;27;170.
- [2] UNAIDS. UNAIDS data 2018. Jt UN Programme HIVAIDS; 2018, p. 376. Available from: <http://www.unaids.org/en/resources/documents/2018/unaids-data-2018>.
- [3] Del Rio C. The global HIV epidemic: what the pathologist needs to know. *Semin Diagn Pathol* 2017;34;314–17.
- [4] Case KK, Ghys PD, Gouws E, Eaton JW, Borquez A, Stover J, et al. Understanding the modes of transmission model of new HIV infection and its use in prevention planning. *Bull World Health Organ* 2012;90;831–8A.
- [5] Nasirian M, Kianersi S, Karamouzian M, Sidahmed M, Baneshi MR, Haghdoost AA, et al. HIV modes of transmission in Sudan in 2014. *Int J Health Policy Manag* 2020;9;108–15.
- [6] Yah CS, Tambo E. Why is mother to child transmission (MTCT) of HIV a continual threat to new-borns in sub-Saharan Africa (SSA). *J Infect Public Health* 2019;12;213–23.
- [7] Falnes EF, Tylleskär T, de Paoli MM, Manongi R, Engebretsen IM. Mothers' knowledge and utilization of prevention of mother to child transmission services in northern Tanzania. *J Int AIDS Soc* 2010;13;36.
- [8] Ndubuka J, Ndubuka N, Li Y, Marshall CM, Ehiri J. Knowledge, attitudes and practices regarding infant feeding among HIV-infected pregnant women in Gaborone, Botswana: a cross-sectional survey. *BMJ Open* 2013;3;e003749.
- [9] Drake AL, Wagner A, Richardson B, John-Stewart G. Incident HIV during pregnancy and postpartum and risk of mother-to-child HIV transmission: a systematic review and meta-analysis. *PLoS Med* 2014;11;e1001608.
- [10] WHO/UNICEF/UNAIDS. Global update on HIV treatment 2013: results, impact and opportunities. WHO report in partnership with UNICEF and UNAIDS; 2013. Available from: https://www.unaids.org/sites/default/files/media_asset/20130630_treatment_report_en_0.pdf.
- [11] Mursy SMEM, Mohamed SOO. Knowledge, attitude, and practice towards Hepatitis B infection among nurses and midwives in two maternity hospitals in Khartoum, Sudan. *BMC Public Health* 2019;19;1597.
- [12] Klett-Tammen CJ, Krause G, Seefeld L, Ott JJ. Determinants of tetanus, pneumococcal and influenza vaccination in the elderly: a representative cross-sectional study on knowledge, attitude and practice (KAP). *BMC Public Health* 2016;16;121.
- [13] Staveteig S, Wang S, Head SK, Bradley SEK, Nybro E. Demographic patterns of HIV testing uptake in Sub-Saharan Africa. DHS Comparative Reports No. 30. Calverton, Maryland, USA: United States Agency for International Development (USAID); 2013.
- [14] Kuehne A, Koschollek C, Santos-Hövenner C, Thorlie A, Müllerschön J, Tshibadi CM, et al. Impact of HIV knowledge and stigma on the uptake of HIV testing – results from a community-based participatory research survey among migrants from sub-Saharan Africa in Germany. *PLoS One* 2018;13;e0194244.
- [15] Central Bureau of Statistics (CBS) and UNICEF Sudan. Multiple Indicator Cluster Survey 2014 of Fieldwork, Key Findings. Khartoum, Sudan: UNICEF and Central Bureau of Statistics (CBS); 2014.
- [16] Zarei E, Khabiri R, Tajvar M, Nosratnejad S. Knowledge of and attitudes toward HIV/AIDS among Iranian women. *Epidemiol Health* 2018;40;e2018037.
- [17] Ijeoma A, Ejikeme A, Theodora O, Chika O. Knowledge, attitude, willingness of HIV counseling and testing and factors associated with it, among long distant drivers in Enugu, Nigeria: an opportunity in reduction of HIV prevalence. *Afr Health Sci* 2018;18;1088–97.
- [18] Mohamed BA, Mahfouz MS. Factors associated with HIV/AIDS in Sudan. *BioMed Res Int* 2013;2013;971203.
- [19] Dong X, Yang J, Peng L, Pang M, Zhang J, Zhang Z, et al. HIV-related stigma and discrimination amongst healthcare providers in Guangzhou, China. *BMC Public Health* 2018;18;738.
- [20] UNAIDS. Fact sheet on stigma and discrimination; 2003. Available from: https://data.unaids.org/publications/fact-sheets03/fs_stigma_discrimination_en.pdf.
- [21] Feyissa GT, Lockwood C, Woldie M, Munn Z. Reducing HIV-related stigma and discrimination in healthcare settings: a systematic review of quantitative evidence. *PLoS One* 2019;14;e0211298.
- [22] Chambers LA, Rueda S, Nico Baker D, Wilson MG, Deutsch R, Raeifar E, et al. Stigma, HIV and health: a qualitative synthesis. *BMC Public Health* 2015;15;848.
- [23] Badawi MM, SalahEldin MA, Idris AB, Hasabo EA, Osman ZH, Osman WM. Knowledge gaps of STIs in Africa; systematic review. *PLoS One* 2019;14;e0213224.
- [24] Erena AN, Shen G, Lei P. Factors affecting HIV counselling and testing among Ethiopian women aged 15–49. *BMC Infect Dis* 2019;19;1076.
- [25] Dirisu O, Eluwa G, Adams E, Torpey K, Shittu O, Adebajo S. “I think this is the only challenge... the stigma” Stakeholder perceptions about barriers to antenatal care (ANC) and prevention of mother-to-child transmission (PMTCT) uptake in Kano state, Nigeria. *PLoS One* 2020;15;e0232028.
- [26] Narasimhan M, Yeh PT, Haberlen S, Warren CE, Kennedy CE. Integration of HIV testing services into family planning services: a systematic review. *Reprod Health* 2019;16;61.
- [27] Idris AKM, Elsamani EZ, Elnasri AEA. Sociodemographic predictors of acceptance of voluntary HIV testing among pregnant women in a large maternity hospital, Omdurman, Sudan. *East Mediterr Health J* 2015;21;273–9.