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**SMALL AREA ESTIMATION OF COMPREHENSIVE KNOWLEDGE OF WOMEN
AGES 15 TO 49 YEARS ON HUMAN IMMUNODEFICIENCY VIRUS
IN THE PHILIPPINES**

by

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ABSTRACT

With the rising trend in HIV cases in the Philippines, the country has been marked as the fastest growing HIV epidemic in Asia and the Pacific. With the continuous uprise of number of HIV cases, the current program on HIV is conceivably insufficient to end such epidemic unless individuals who are most at risk will be identified and located. In this research, comprehensive knowledge of women ages 15 to 49 years on HIV was estimated down to small areas, provincial level, using the 2017 National Demographic and Health Survey dataset. Based on the results, provinces of Surigao del Sur (Region XIII-Caraga), Benguet (Cordillera Administrative Region), and Ifugao (Cordillera Administrative Region) have the highest percentage of women with comprehensive knowledge on HIV with 61.9, 52.9, and 42.8 percent, respectively. Meanwhile, the lowest percentages were recorded in Tawi-tawi and Sulu in Autonomous Region in Muslim Mindanao with 3.4 and 7.3 percent, respectively. The results further revealed that the percentages were somewhat high in provinces near the metro cities.

Keywords: small area estimation, HIV, comprehensive knowledge

1. Introduction

Ending the epidemics of HIV/Acquired Immunodeficiency Syndrome (AIDS) and other communicable diseases in the Philippines by 2030 is one of the targets of the Sustainable Development Goal 3: Ensure Healthy Lives and Promote Well-being for All at All Ages.

The prevalence rate of HIV in the Philippines is rapidly increasing. Based on the UNAIDS Report on the global HIV epidemic, the estimated number of HIV infections in the Philippines has more than doubled than in the past six years, from 4,300 in 2010 to 10,500 in 2016. The Philippines, among several countries, has the fastest growing HIV epidemic in terms of percentage (Department of Health, n.d.).

The most recent publication of Epidemiology Bureau of the Department of Health (DOH) on HIV/AIDS & ART Registry of the Philippines shows a total of 5,673 new cases of HIV have been diagnosed during the first semester of 2019, or 31 newly diagnosed cases daily on the average. This is 274 higher than the same period of the previous year. The rapid increase may be a result of lack of knowledge on HIV. The results of the Philippines National Demographic and Health Survey (NDHS) 2017 show that only 25 percent of women have comprehensive knowledge on HIV.

¹ A master's thesis at the Polytechnic University of the Philippines

In 1998, the Philippine Government approved the Republic Act 8504, known as the Philippine AIDS Prevention and Control Act of 1998. The act aims to promote public awareness of the causes, modes of transmission, consequences, means, and prevention to control HIV/AIDS. However, the number of infected individuals continues to rise every year even after the act has been implemented.

Currently, the official statistics on HIV cases in the Philippines are based solely from the administrative recording system of the Department of Health—only individuals who visit HIV testing centers and get tested were the ones included.

Philippine National Demographics and Health Survey (NDHS) is one reference of reliable statistics related to HIV. The survey produced indicators like number or percentage of women who have heard of HIV, the prevention methods, comprehensive knowledge on HIV, discriminatory attitude, women who know where to be tested, and women who have been tested. However, with such data, the survey results are only limited to its domain, the region, due to small sample size.

The survey results at the regional level are inadequate to target and control the epidemics of HIV/AIDS in the Philippines since there are no policy-makers and planners at the regional level. From the current hierarchy of the Philippine Local Government, provincial governors are the highest who will benefit and use the statistics for the betterment.

In this study, the proportion of women ages 15 to 49 years with comprehensive knowledge on HIV by province is estimated using the Horvitz-Thompson (H-T) Estimator.

1.1 Limitations of the study

This research will use the Philippines NDHS 2017. The survey only covers women at their reproductive ages 15 to 49 years old. No men were included as respondents for the survey.

2. Methodology

2.1 Data Source

The Philippines NDHS 2017 was used in this study. The dataset was requested from the www.dhsprogram.com.

The NDHS 2017 is the sixth Demographic and Health Survey (DHS) conducted in the Philippines as part of The DHS Program implemented between 1993 and 2017 and the 11th National Demographic Survey since 1968.

The survey is divided into two sets: the Household Questionnaire and the Woman's Questionnaire. For the purpose of this study, the Woman's Questionnaire was used, specifically its Section 10: HIV/AIDS.

The samples were selected using the Master Sample Frame which was constructed sourced from Philippine Statistics Authority, a repository of official statistics in the Philippines.

A two-stage stratified sampling design was employed in this study. During the first stage, 1,250 primary sampling units (PSUs) were selected through systematic sampling while in the last stage, an equal take of either 20 or 26 sample housing units were selected from each sampled PSU

using systematic random sampling. The PSUs are randomly assigned and selected set of geographic areas with non-overlapping and discernable boundaries. It can be a whole barangay, a portion of large barangay, or combinations of small barangays with about 100 to 400 households.

In cases where a housing unit contained more than one household, a maximum of three was randomly selected for an interview. All women ages 15 to 49 in the sample household were selected to represent the household and was eligible for interview.

2.2 Estimation Procedure

Under Section 10: HIV/AIDS, women ages 15 to 49 years were asked if they have heard of HIV or AIDS. If they answered 'yes', their knowledge on HIV will be assessed through the series of questions below:

1. HIV is the virus that can lead to AIDS. Can people reduce their chance of getting HIV by having just one uninfected sex partner who has no other sex partners?
2. Can people reduce their chance of getting HIV by using a condom every time they have sex?
3. Is it possible for a healthy-looking person to have HIV?
4. Can people get HIV from mosquito bites?
5. Can people get HIV by sharing food with a person who has HIV?

If the respondent answered 'yes' to the first three questions and 'no' to the succeeding, then she indeed has comprehensive knowledge on HIV/AIDS.

With the answers gathered, the proportion of women ages with comprehensive knowledge will then be calculated using the formula of H-T Estimator for Proportion:

$$\hat{P}_i^D = \frac{\sum_h \sum_a \sum_j w_{haj} y_{i-haj}}{\sum_h \sum_a \sum_j w_{haj} x_{i-haj}}$$

where w_{haj} is the final weight associated for woman j in the PSU a in the stratum h in the province i

$y_{i-haj} = 1$ if the j^{th} woman in the a^{th} primary sampling unit (PSU) in the h^{th} stratum of the i^{th} province who have a comprehensive knowledge on HIV. Otherwise, zero.

x_{i-haj} is the j^{th} woman in the a^{th} primary sampling unit (PSU) in the h^{th} stratum of the i^{th} province

The H-T Estimator is one of the direct estimation techniques for generating small area statistics. This technique is an unbiased estimator for a parameter for any design, with or without replacement.

This small area estimation technique is easy to calculate and unbiased for large sample. This is used especially when no auxiliary data is available. However, it requires to have sample for each small area to produce reliable estimates. (National Research Council, 2013)

The estimates produced will then be evaluated using the Coefficient of Variation (CV). It will determine how reliable the estimates are. The CV is computed using the formula below:

$$CV(\hat{P}_i^D) = \frac{\sqrt{MSE}}{\hat{P}_i^D} \times 100\%$$

where

$$MSE = (\hat{P}_i^D)^2 \left[\frac{\sum_{h \in i} \frac{1}{a_h(a_h - 1)} \sum_a (y_{i-ha} - \frac{\hat{Y}_{i-h}}{a_h})^2}{(\hat{Y}_i)^2} + \frac{\sum_{h \in i} \frac{1}{a_h(a_h - 1)} \sum_a (x_{i-ha} - \frac{\hat{X}_{i-h}}{a_h})^2}{(\hat{X}_i)^2} - \frac{\sum_{h \in i} \frac{1}{a_h(a_h - 1)} \sum_a (y_{i-ha} - \frac{\hat{Y}_{i-h}}{a_h})(x_{i-ha} - \frac{\hat{X}_{i-h}}{a_h})}{\hat{X}_i \hat{Y}_i} \right]$$

$y_{i-ha} = 1$ if the j^{th} woman in the a^{th} primary sampling unit (PSU) in the h^{th} stratum of the i^{th} province who have a comprehensive knowledge on HIV. Otherwise, zero.

w_{haj} is the final weight associated for woman j in the PSU a in the stratum h in the province i

a_h is the household number

x_{i-ha} is the total number of women ages 15 to 49 years at h^{th} stratum

y_{i-ha} is the total number of women ages 15 to 49 years with comprehensive knowledge on HIV at h^{th} stratum

\hat{X}_{i-h} is the total number of women ages 15 to 49 years at a^{th} PSU

\hat{Y}_{i-h} is the total number of women ages 15 to 49 years with comprehensive knowledge on HIV at a^{th} PSU

\hat{X}_i is the total number of women ages 15 to 49 years

\hat{Y}_i is the total number of women ages 15 to 49 years with comprehensive knowledge on HIV

The lower the value of the computed coefficient of variation, the more precise the estimate. The Esri established thresholds of reliability are based on the usability of the estimates (American Community Service, 2014).

Table 1. CV Thresholds and Definition

CV Range	Classification	Definition
≤ 12.0%	High Reliability	Sampling error is small relative to the estimate and the estimate is reasonably reliable.
12.1% - 40.0%	Medium Reliability	Use with caution
> 40.0%	Low Reliability	Sampling error is large relative to the estimate. The estimate is considered very unreliable.

Region XIII-Caraga and Region XI-Davao Region also have higher percentages with more than 30.0 percent. Whereas Region I-Ilocos Region (195 or 15.5%) and Region IX-Zamboanga Peninsula (120 or 15.8%) showed the lowest percentage.

3.2 Estimation of Comprehensive Knowledge of Women Ages 15 to 49 Years on HIV

Table 2. Number and Percentage Distribution of Provinces by CV Range

CV Range	Classification	Provinces	
		Number	Percent
Total		87	100.0
≤ 12.0%	High Reliability	36	41.4
12.1% - 40.0%	Medium Reliability	51	58.6
> 40.0%	Low Reliability	0	0.0

The H-T Estimator for proportion yields 36 reasonably reliable provincial estimates and 51 estimates that are moderately reliable or will be used with caution. No provincial estimates were generated with more than 40.0 percent of CV.

The table below shows the top 10 provinces with highest percentages of women age 15 to 49 years with comprehensive knowledge on HIV/AIDS of not less than 37.0 percent. Most of these provinces have moderately reliable estimates.

Provinces of Surigao del Sur (Region XIII-Caraga) and Benguet (CAR) have the highest percentages with 61.9 percent and 52.9 percent, respectively.

Moreover, the result shows that four provinces included in the top 10 came from CAR.

Table 3. Top 10 Provinces with Highest Percentage of Women with Comprehensive Knowledge on HIV/AIDS: 2017

Region	Province	Population of Women with Comprehensive Knowledge on HIV/AIDS		CV (%)	Classification
		No.	%		
1. Region XIII-Caraga	Surigao del Sur	83	61.9	6.4	High
2. Cordillera Administrative Region	Benguet	135	52.9	10.2	High
3. Cordillera Administrative Region	Ifugao	17	42.8	12.2	Medium
4. Region XII-SOCCSKSARGEN	Cotabato City	39	42.3	12.1	Medium
5. Region VI-Western Visayas	Guimaras	16	42.1	7.6	High
6. MIMAROPA	Romblon	25	41.8	12.1	Medium
7. Region XI-Davao Region	Davao del Norte	121	40.7	14.4	Medium
8. Region IVA-CALABARZON	Cavite	566	40.2	13.0	Medium
9. Cordillera Administrative Region	Mountain Province	11	37.5	20.0	Medium
10. Cordillera Administrative Region	Abra	19	37.2	13.3	Medium

The next table shows the top 10 provinces with the lowest percentages. Most of these provinces are located in Region II-Cagayan Valley and Autonomous Region in Muslim Mindanao (ARMM).

Provinces of Tawi-tawi and Sulu of ARMM and Davao Occidental of Region XI-Davao Region have the lowest percentage with no more than 10 percent.

Table 4. Top 10 Provinces with Lowest Percentage of Women with Comprehensive Knowledge on HIV: 2017

Region	Province	Population of Women with Comprehensive Knowledge on HIV/AIDS		CV (%)	CV Classification
		No.	%		
1. Autonomous Region in Muslim Mindanao	Tawi-Tawi	2	3.4	37.1	Medium
2. Autonomous Region in Muslim Mindanao	Sulu	19	7.3	35.3	Medium
3. Region XI-Davao Region	Davao Occidental	6	8.5	21.3	Medium
4. Region II-Cagayan Valley	Isabela	41	10.0	14.7	Medium
5. Region II-Cagayan Valley	Quirino	4	10.3	19.2	Medium
6. Region VI-Western Visayas	Iloilo	42	10.9	15.4	Medium
7. Region I-Ilocos	Pangasinan	88	11.7	25.4	Medium
8. Region II-Cagayan Valley	Cagayan	30	12.0	24.7	Medium
9. Region VII-Central Visayas	Negros Oriental	40	12.3	27.8	Medium
10. Region V-Bicol	Catanduanes	8	12.5	20.1	Medium

4. Summary and Conclusion

The estimates derived through H-T Estimator revealed that the most of the women ages 15 to 49 years who live near the metro cities, City of Manila, Cebu City, and Davao City, have more comprehensive knowledge on HIV.

Moreover, only few women between ages 15 to 49 living in the provinces of ARMM have comprehensive knowledge on HIV. According to National Trade Union Center (2010), the legislators of the region lambasted the pilot testing of sex education module of the Department of Education. Imposition of sexual education among young people can equip them with better knowledge, information and skills, and help them make informed decisions about sexual choices (UNAIDS, 2009).

Although in 2012, the Republic Act No. 10354 or The Responsible Parenthood and Reproductive Health Act of 2012 has been passed, the government of ARMM passed its own reproductive health law which is known as the Reproductive Health Care Act of 2012 for the ARMM (Muslim Mindanao Act. No. 2921). The statistics on reproductive health and related matters still remains low in this region. Ms. Junice Lirza Melgar, co-founder and executive director of *Likhaan* Center for Women's Health, said that the education on sex is more focused on contraceptive and not life as perspective.

Philippines is just one of the conservative countries in the issues of sex. The implementation of sex education in this kind of country is challenging to the lawmakers and legislators as many may interfere to this act, especially the religious sectors. UNFPA Country Representative, Mr. Klaus Beck, said that sex education is commonly perceived as immoral, irreligious that it promotes sex rather than delay it.

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Appendix 1. NDHS Survey Results

Table 5. Number of Women ages 15 to 49 Years with Comprehensive Knowledge on HIV by Region, Philippines: 2017

Region	Total	Women Ages 15 to 49 Years			
		Do not have comprehensive knowledge on HIV or have not heard of HIV/AIDS		Have comprehensive knowledge on HIV	
		No.	%	No.	%
Philippines	25,074	18,913	75.4	6,161	24.6
National Capital Region	4,400	3,102	70.5	1,297	29.5
Cordillera Administrative Region	440	245	55.8	195	44.2
Region I-Ilocos	1,258	1,063	84.5	195	15.5
Region II-Cagayan Valley	802	707	88.1	95	11.9
Region III-Central Luzon	2,453	1,780	72.6	673	27.4
Region IVA-CALABARZON	4,016	2,865	71.4	1,150	28.6
Region IVB-MIMAROPA	621	469	75.4	153	24.6
Region V-Bicol Region	1,551	1,244	80.2	307	19.8
Region VI-Western Visayas	1,498	1,233	82.3	265	17.7
Region VII-Central Visayas	1,607	1,249	77.7	358	22.3
Region VIII-Eastern Visayas	997	779	78.1	218	21.9
Region IX-Zamboanga Peninsula	764	644	84.2	120	15.8
Region X-Northern Mindanao	998	806	80.7	192	19.3
Region XI-Davao Region	1,203	840	69.8	363	30.2
Region XII-SOCCSKSARGEN	1,038	804	77.4	234	22.6
Region XIII-Caraga	648	449	69.2	199	30.8
Autonomous Region in Muslim Mindanao	780	634	81.3	146	18.7

Note: Details may not add up to total due to rounding off.

Appendix 2. Small Area Estimates

Table 6. Number of Women ages 15 to 49 Years with Comprehensive Knowledge on HIV by Province, Philippines: 2017

Region	Province	Total	Women Ages 15-49 with Comprehensive Knowledge on HIV		CV (%)	CV Classification
			No.	%		
National Capital Region	First District	913	230	25.2	11.6	High
National Capital Region	Second District	1,257	365	29.0	9.3	High
National Capital Region	Third District	952	301	31.6	8.9	High
National Capital Region	Fourth District	1,278	402	31.4	3.4	High
Cordillera Administrative Region	Abra	52	19	37.2	13.3	Medium
Cordillera Administrative Region	Benguet	255	135	52.9	10.2	High
Cordillera Administrative Region	Ifugao	40	17	42.8	12.2	Medium
Cordillera Administrative Region	Kalinga	41	7	18.1	11.3	High
Cordillera Administrative Region	Mountain Province	29	11	37.5	20.0	Medium
Cordillera Administrative Region	Apayao	23	5	20.9	13.2	Medium
Region I-Ilocos Region	Ilocos Norte	179	27	14.9	16.4	Medium
Region I-Ilocos Region	Ilocos Sur	159	51	32.1	10.2	High
Region I-Ilocos Region	La Union	170	30	17.5	10.2	High
Region I-Ilocos Region	Pangasinan	750	88	11.7	25.4	Medium
Region II-Cagayan Valley	Batanes	4	1	18.4	25.1	Medium
Region II-Cagayan Valley	Cagayan	249	30	12.0	24.7	Medium
Region II-Cagayan Valley	Isabela	411	41	10.0	14.7	Medium
Region II-Cagayan Valley	Nueva Vizcaya	98	19	19.9	10.2	High
Region II-Cagayan Valley	Quirino	42	4	10.3	19.2	Medium
Region III-Central Luzon	Bataan	191	40	21.2	10.7	High
Region III-Central Luzon	Bulacan	668	197	29.4	11.4	High
Region III-Central Luzon	Nueva Ecija	408	119	29.0	10.0	High
Region III-Central Luzon	Pampanga	601	174	29.0	10.4	High

Region	Province	Total	Women Ages 15-49 with Comprehensive Knowledge on HIV		CV (%)	CV Classification
			No.	%		
Region III-Central Luzon	Tarlac	303	44	14.5	25.6	Medium
Region III-Central Luzon	Zambales	236	87	36.9	7.4	High
Region III-Central Luzon	Aurora	45	12	26.8	9.6	High
Region IVA-CALABARZON	Batangas	584	119	20.3	15.0	Medium
Region IVA-CALABARZON	Cavite	1,407	566	40.2	13.0	Medium
Region IVA-CALABARZON	Laguna	883	196	22.2	11.4	High
Region IVA-CALABARZON	Quezon	360	108	30.0	5.8	High
Region IVA-CALABARZON	Rizal	781	162	20.7	10.8	High
MIMAROPA	Marinduque	63	10	15.2	14.1	Medium
MIMAROPA	Occidental Mindoro	108	26	24.0	13.1	Medium
MIMAROPA	Oriental Mindoro	157	29	18.7	17.4	Medium
MIMAROPA	Palawan	233	63	26.9	11.0	High
MIMAROPA	Romblon	60	25	41.8	12.1	Medium
Region V-Bicol Region	Albay	326	77	23.6	11.1	High
Region V-Bicol Region	Camarines Norte	170	30	17.5	11.7	High
Region V-Bicol Region	Camarines Sur	558	101	18.2	17.9	Medium
Region V-Bicol Region	Catanduanes	62	8	12.5	20.1	Medium
Region V-Bicol Region	Masbate	225	38	17.0	13.1	Medium
Region V-Bicol Region	Sorsogon	208	52	25.2	9.5	High
Region VI-Western Visayas	Aklan	130	37	28.5	14.1	Medium
Region VI-Western Visayas	Antique	99	22	21.9	15.8	Medium
Region VI-Western Visayas	Capiz	177	35	20.0	9.9	High
Region VI-Western Visayas	Iloilo	386	42	10.9	15.4	Medium
Region VI-Western Visayas	Negros Occidental	668	112	16.8	16.9	Medium
Region VI-Western Visayas	Guimaras	38	16	42.1	7.6	High
Region VII-Central Visayas	Bohol	211	46	21.8	14.8	Medium
Region VII-Central Visayas	Cebu	1,050	268	25.5	8.1	High

Region	Province	Total	Women ages 15-49 with Comprehensive Knowledge on HIV		CV (%)	CV Classification
			No.	%		
Region VII-Central Visayas	Negros Oriental	322	40	12.3	27.8	Medium
Region VII-Central Visayas	Siquijor	24	5	18.9	7.9	High
Region VIII-Eastern Visayas	Eastern Samar	112	29	25.6	15.5	Medium
Region VIII-Eastern Visayas	Leyte	429	91	21.1	10.5	High
Region VIII-Eastern Visayas	Northern Samar	120	29	24.4	18.0	Medium
Region VIII-Eastern Visayas	Western Samar	182	37	20.4	14.9	Medium
Region VIII-Eastern Visayas	Southern Leyte	118	24	20.3	12.6	Medium
Region VIII-Eastern Visayas	Biliran	36	9	24.4	8.3	High
Region IX-Zamboanga Peninsula	Zamboanga Del Norte	161	22	13.9	28.5	Medium
Region IX-Zamboanga Peninsula	Zamboanga Del Sur	403	63	15.5	16.7	Medium
Region IX-Zamboanga Peninsula	Zamboanga Sibugay	170	25	14.9	13.2	Medium
Region IX-Zamboanga Peninsula	Isabela	29	10	34.2	13.4	Medium
Region X-Northern Mindanao	Bukidnon	239	50	21.0	18.3	Medium
Region X-Northern Mindanao	Camiguin	21	7	32.1	9.9	High
Region X-Northern Mindanao	Lanao Del Norte	206	48	23.1	13.0	Medium
Region X-Northern Mindanao	Misamis Occidental	137	24	17.5	17.5	Medium
Region X-Northern Mindanao	Misamis Oriental	395	64	16.2	6.5	High
Region XI-Davao Region	Davao Del Norte	298	121	40.7	14.4	Medium
Region XI-Davao Region	Davao Del Sur	551	155	28.2	19.5	Medium
Region XI-Davao Region	Davao Oriental	113	37	32.5	12.4	Medium
Region XI-Davao Region	Compostella Valley	173	44	25.3	16.0	Medium
Region XI-Davao Region	Davao Occidental	68	6	8.5	21.3	Medium
Region XII-SOCCSKSARGEN	North Cotabato	322	62	19.3	24.4	Medium
Region XII-SOCCSKSARGEN	South Cotabato	320	69	21.5	11.7	High
Region XII-SOCCSKSARGEN	Sultan Kudarat	202	46	22.8	14.6	Medium
Region XII-SOCCSKSARGEN	Sarangani	103	19	18.2	11.2	High
Region XII-SOCCSKSARGEN	Cotabato City	92	39	42.3	12.1	Medium

Region	Province	Total	Women ages 15-49 with Comprehensive Knowledge on HIV		CV (%)	CV Classification
			No.	%		
Region XIII-Caraga	Agusan Del Norte	199	52	26.1	10.5	High
Region XIII-Caraga	Agusan Del Sur	168	33	19.9	13.3	Medium
Region XIII-Caraga	Surigao Del Norte	123	27	21.8	12.1	Medium
Region XIII-Caraga	Surigao Del Sur	134	83	61.9	6.4	High
Region XIII-Caraga	Dinagat Islands	25	5	18.4	10.8	High
Autonomous Region in Muslim Mindanao	Basilan	71	17	23.5	17.2	Medium
Autonomous Region in Muslim Mindanao	Lanao Del Sur	211	50	23.9	10.1	High
Autonomous Region in Muslim Mindanao	Maguindanao	179	58	32.2	17.2	Medium
Autonomous Region in Muslim Mindanao	Sulu	262	19	7.3	35.3	Medium
Autonomous Region in Muslim Mindanao	Tawi-Tawi	57	2	3.4	37.1	Medium

Figure 2. Comprehensive Knowledge of Women Ages 15 to 49 Years on HIV by Province, Philippines: 2017

