

Predicting Antenatal Care Utilization in the Philippines: A Chi-Squared Automatic Interaction Detector Analysis

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ABSTRACT

Complications associated with pregnancy and childbirth are still considered as leading causes of deaths in the reproductive age group of women in many developing countries. This problem may be addressed when pregnant women utilize antenatal care services. However, despite the benefits of this service to the mother and child, it is not fully utilized in the Philippines. Using the 2013 National Demographic and Health Survey, an exhaustive chi-squared automatic interaction detector model- a data mining approach was employed to analyze the predictors of antenatal care (ANC) utilization of reproductive women age 15 to 49 in the Philippines. Findings reveal that the most significant predictor of ANC utilization was the region where a woman resides. Women who were living in NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western and Central Visayas, Davao and Caraga had the highest likelihood of utilizing ANC than those who lived in MIMAROPA, Eastern Visayas, Zamboanga, Northern Mindanao and SOCCSKSARGEN with the lowest in ARRM. The second most influential factor is the woman's religious affiliation. If a woman is a Muslim, her utilization is lower than a Christian, regardless of what her socio-economic status is or in what wealth quintile she belongs. The result further shows that wealth quintile and educational attainment are also significant predictors. Policy makers and health providers should intensify their efforts to address differentials between these groups of women and to widen the campaign of at least four antenatal visits during pregnancy as a requirement in all parts of the country.

Keywords: *Antenatal Care Utilization, E-CHAID, National Demographic and Health Survey, women, prenatal*

INTRODUCTION

Over the past decades, the world has seen the tremendous efforts to increase the utilization of antenatal care (ANC) because of its potential benefits to the health of the mother and the child (Gayawan, 2013). ANC, defined as the care provided to a woman during her pregnancy, is an essential component of reproductive health care. ANC can serve as a platform for the delivery of highly-effective health interventions that can reduce preventable maternal and newborn deaths (UN 2014, USAID 2015). ANC services offer pregnant women an entry point to the health care system, providing appropriate screening, intervention, and treatment throughout pregnancy, and encouraging women to seek a skilled birth attendant for their delivery (Lincetto et al. 2006). Furthermore, using ANC allows women to receive information about improving maternal health through proper nutrition and self-care during pregnancy; and throughout the postpartum period, such as the benefits of exclusive breastfeeding and counseling on family planning methods (WHO 2007). As such, the World Health Organization (WHO) recommends that each woman receive a minimum of four ANC visits as this will ensure better results on both parties.

There have been numerous studies of the determinants of ANC use in low- and middle-income countries. Melese, Darak and Tefera (2015) for instance, contended that utilizing maternal health care services, such as antenatal, professionals' assistance during delivery and postnatal care contributes to a significant role in the reduction of maternal and child mortality. This findings of their study indicated that utilization of said services was influenced by place of residence, wealth status, women's and husband's education and parity. Also, both religious affiliation and age of women were also prominent predictors on the utilization of the ANC and skilled-birth assistance during delivery.

Sharma, Shawangdee, and Sirirassamee (2007) examined the association of access to health and women's status with the utilization of prenatal, delivery, and postnatal care during the Safe Motherhood Program period in Nepal. Multiple logistic regression analysis indicated that the utilization of maternal health services increased over a period. Program interventions such as outreach worker's visits, radio information disseminated through various mass media sources and raising women's status through education were able to explain the observed change in utilization. Health worker's visits and educational status of women showed a significant association, but radio programmes and other mass

media information were only partially successful in increasing the use of maternal health services. Also, socioeconomic and demographic variables such as household economic status, number of living children and place of residence showed a stronger association with the use of maternal health services than did intervention programmes.

In another study, Nzioki, Onyango and Ombaka (2015) utilized a binary logistic regression model to assess the influence of socio-demographic characteristics on MCH service utilization. Results indicated that women with secondary education and above, women in households earning more than 1 US Dollar a day and women in employment or operating business were more likely to utilize MCH services. Women over 26 years of age and those with three children and above were less likely to utilize MCH services except for utilization of Family Planning services in which Women with three children and above were more likely to utilize Family Planning services compared to these with two children and below. Increasing the number of women with a secondary level of education and above, creating initiatives to empower people especially those living in rural semi-arid regions economically, and developing and implementing age-specific health education programs may improve utilization of MCH services in Mwingi district and another semi- arid regions in Kenya.

In summary, the above studies and many others have identified the predictors for low utilization of maternal health care services employing inferential statistics specifically using regression analyses.

The advent of powerful computers and the emergence of internet and e-commerce have made the pattern recognition a vital research tool (Chan et al. 2006), particularly among business and marketing researchers (Nong, 2003). Pattern recognition, popularly known as data mining (DM) is the extraction of hidden predictive information from large databases ((Han, Kamber & Pei, 2011). With the increasingly large amount of scientific, medical, demographic and financial data stored in databases, DM techniques and automated tools that can intelligently assist people in transforming these data into something that will benefit a company, an institution or an industry (Han, Kamber, & Pei, 2011) become a necessity.

One commonly used DM technique is chi-squared automatic interaction detector (CHAID), which has been used to segment a heterogeneous population into homogeneous subgroups. However, little is known about the use of these techniques on this significant issue and concern- maternal and child health. No previous study, to the researcher's

knowledge, has examined the utilization of ANC using the National Demographic and Health Survey (NDHS) data using data mining.

To identify the determinants that affected women’s utilization of ANC, the Anderson’s Behavioral Model for Healthcare Use was reviewed. Please see Figure 1. Anderson’s Behavioral Model has been used extensively to understand utilization in different health care settings (Babitsch, 2012). Numerous studies have made use of this conceptual model to study the determinants of antenatal care utilization (Beeckman 2010, Guliani H 2014, Babitsch 2012, Chakraborty 2003).

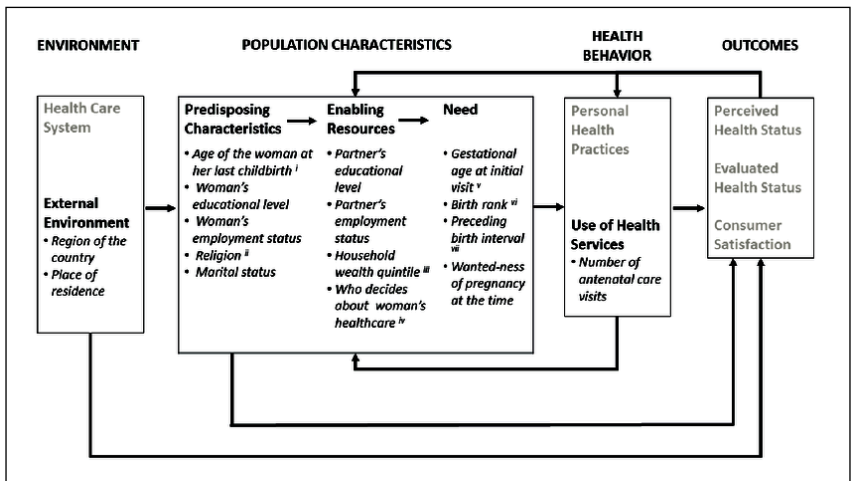


Figure 1. Anderson’s Behavioral Model for Healthcare Utilization
Source: Anderson 1995 (Hodgins, 2014).

From this model, several variables were adopted, and variables from different studies that were present in the NDHS data were considered. Hence, Figure 2 that follows provides the conceptual framework of the present study.

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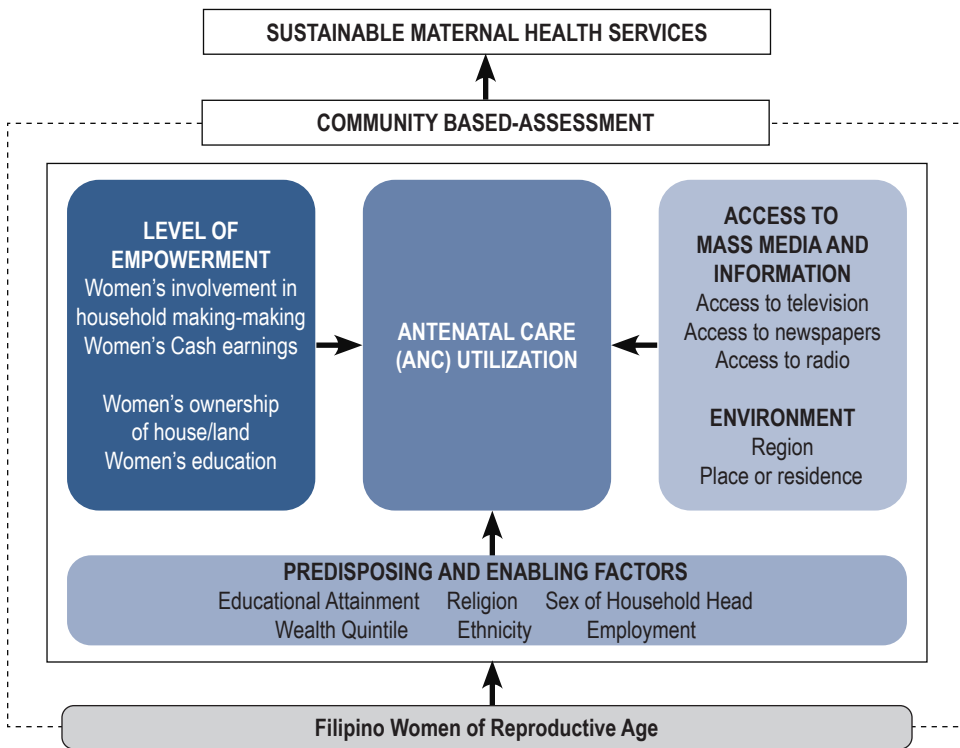


Figure 2. Conceptual Framework

Research Questions

This study was an attempt to determine factors influencing successful utilization of antenatal care (ANC) service of women in reproductive age in the Philippines. Specifically, this study was conducted to answer the following questions:

1. What percent distribution of women age 15-49 who had given births in the five years preceding the survey and who were successfully interviewed have utilized antenatal care (ANC) service according to their background characteristics?
2. What factors predict the successful utilization of antenatal care (ANC) services?
3. What characteristics do Filipino women in reproductive age have a high likelihood of utilizing the antenatal care service?

METHODOLOGY

Participants of the Study

The 2013 National Demographic and Health Survey (NDHS) data of the Philippines which was released later part of 2014 was used to extract information regarding women age 15-49 years old. Sixteen thousand one hundred fifty-five (16,155) women designed to represent the women population of the country were surveyed. Respondents who were not subjected to Women's Safety Module Interview, where data on measures of women's autonomy and status were raised and who have not given birth for the past five years were excluded from the present study due to the inability in making complete information. For women who had more than one births, information in her last pregnancy was taken. The filtered data retained satisfying the inclusion criteria were 5,301 women who are approximately 33% of the total women surveyed.

Of the 5,301 women over half of the women aged 15-49 (50.4%) are under 30. Two out of three (65.3%) women are married, over a quarter (26.4%) are living together with a man while the remaining 8.3% are either never in a union, widowed or separated. Concerning the women's education, almost one in two women (48.9%) have secondary education, over a quarter (28.1%) have a higher education while one-fifth (21.1%) have some form of primary education. Approximately 2% of the women have no formal education. With regard to religion, about 4 out of 5 women (82.1%) are Christians; much lower proportions are Muslims (9.4%) and 7.7% from other religion. More than half of the women are living in rural areas (58%) while the remaining number of women are living in rural areas. Majority of the respondents (28.8%) belong to the lowest quintile while 13% belong to the highest quintile.

Source of Data and Collection Procedures

The dataset of this study was obtained from the 2013 National Demographic and Health Survey (NDHS) of the Philippines carried out by the Philippine Statistics Authority (PSA). The NDHS is part of the worldwide MEASURE Demographic and Health Surveys program, which is designed to collect information on a variety of health-related topics including fertility, family planning, and maternal and child health (PSA and ICF International, 2014). Information about the DHS Program was obtained from ICF International, 530 Gaither Road, Suite 500, Rockville, MD 20850, USA. The researcher communicated first to the DHS Program

using <http://www.dhsprogram.com> to avail of the said data. After she registered and provided the program with the description of the study, evaluation by the committee was done, and approval was granted to the researcher. She was then given access to download the zipped data in different formats.

The data consisted of almost 4,500 variables related to fertility, family planning, and health of the women and children of the country for use by the government in monitoring the progress of its programs on population, family planning, and health. This large data was “cleaned” first to prepare for modeling.

Statistical Analysis

The filtered data were analyzed using the decision tree technique, a data mining approach. The decision tree technique generates rules for the classification of a dataset and uses a tree-shaped structure to represent sets of decisions. Specific decision tree methods include Classification and Regression Trees (CART) for regression-type problems and CHAID for building classification trees (IBM Corp., 2012; Melchoir, Huba, Gallagher, et al., 2001; Biggs, Deville & Suen, 1991; Hoare, 2004). In this present study, Exhaustive CHAID algorithm analysis performed using IBM SPSS version 21 was utilized to build the decision tree models. CHAID decision trees are nonparametric procedures that make no assumptions of the underlying data.

Moreover, this technique uses a systematic algorithm to detect the strongest association between predictors and outcome variables (i.e., health outcomes) through a comprehensive search of the predictors and the level of predictors from the entire set that shows the most differentiation on the outcome variable. The degree of differentiation is depicted sequentially in a decision tree format to show the optimally split predictors. Thus, homogeneous groups could be identified in terms of their observed levels on the outcome variable. The alpha level for all statistical tests was 0.05, corrected for the number of statistical tests within each predictor using a Bonferroni correction.

RESULTS AND DISCUSSIONS

The analysis of this study is based on 5, 301 women respondents who had given at least one birth within five years preceding the survey. Information presented in Table 1 shows that almost all women (95%) received ANC from a skilled provider for four or more times.

Regarding education, the table shows that generally, women with the highest education have the highest utilization of ANC (97.7%). The proportion of Christians women who obtain ANC is 97.5% which is higher than the proportion of Muslim women who utilized the said service. Women who came from urban places have higher utilization of services compared with those living in rural areas. Similarly, the proportion of women receiving the services are the lowest in women who belong to the lowest quintile. Higher utilization shows on upper quintiles. For all services, women who belong to households where the female is the head consistently shows higher maternal health services utilization. Women who are either employed has more or less the same extent of services use. Across regions and ethnic groups, Davao topped for ANC utilization. Kapangpanans showed the highest utilization while ARMM and the Tausog group showed the lowest regarding the utilization of maternal health services. Across regions, only ARMM (64.8%) had a proportion of women who received ANC lower than 90%; other regions ranged from 91.6% in SOCCSKSARGEN to 98.7% in Davao.

Utilization of health services also differs from the way women were grouped according to their exposure to mass media and information and level of empowerment. High proportions of women who have average access to mass media (75.2%) and with a high level of empowerment (72%) have higher utilization of the maternal health service compared with their counterparts who have no access to mass media (17.8%) and who have low empowerment level (55.7%).

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Table 1
Utilization of ANC by Selected Socioeconomic Variables

	Antenatal Care Utilization	
	No. of Women	%
Educational Attainment		
No Education	60	1.19
Primary	1007	20.02
Secondary	2509	49.87
Higher	1455	28.92
Religion		
Christianity	4284	85.15
Islam	359	7.14
Others	388	7.71
Place of Residence		
Urban	2151	42.75
Rural	2880	57.25
Wealth Quintile		
Poorest	1344	26.71
Poorer	1121	22.28
Middle	1000	19.88
Richer	874	17.37
Richest	692	13.75
Sex of Household Head		
Male	4357	86.6
Female	674	13.4
Employment		
Not Employed	2444	48.58
Employed	2587	51.42
Region		
NCR	617	12.26
CAR	206	4.09
I - Ilocos Region	232	4.61
II - Cagayan Valley	246	4.89
III - Central Luzon	388	7.71
IVA - CALABARZON	471	9.36
IVB - MIMAROPA	196	3.9
V - Bicol	296	5.88
VI - Western Visayas	322	6.4
VII - Central Visayas	305	6.06
VIII - Eastern Visayas	194	3.86
IX - Zamboanga Peninsula	300	5.96
X - Northern Mindanao	231	4.59
XI - Davao	293	5.82
XII - SOCCSKSARGEN	219	4.35
XIII - Caraga	292	5.8
ARMM	223	4.43

	Antenatal Care Utilization	
	No. of Women	%
Ethnicity		
Tagalog	1285	25.55
Cebuano	1053	20.94
Ilocano	449	8.93
Ilonggo	439	8.73
Bicolano	286	5.69
Waray	173	3.44
Kapampangan	82	1.63
Maranso	120	2.39
Tausog	65	1.29
Others	1077	21.42
Access to Mass Media		
No access	204	4.05
Low	1697	33.73
Average	3130	62.21
Level of Empowerment		
Low	460	9.14
Moderate	2570	51.08
High	2001	39.77
Total	5031	

Table 2 shows the summary model of the ANC utilization. The Specification section provides information on the settings used to generate the tree model. The Results section displays information on the number of total and terminal nodes, the depth of the tree (number of levels below the root node), and the independent variables included in the final model.

The 10 independent variables were specified, but only four were included in the final model. The variables for a place of residence, sex of household head, access to mass media, the level of empowerment occupation and ethnicity did not make a significant contribution to the model, so they were automatically dropped from the final model.

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Table 2
Summary Model for ANC Utilization

	Growing Method	EXHAUSTIVE CHAID
<i>Specifications</i>	Dependent Variable	UTILIZATION OF ANTENATAL SERVICES
	Independent Variables	Educational Level, Place of Residence, Region, Sex of Household Head, Wealth Quintile, Access to Mass Media, Level of Empowerment, Religion, Occupation, Ethnicity
	Validation	Cross Validation
	Maximum Tree Depth	3
	Minimum Cases in Parent Node	400
	Minimum Cases in Child Node	200
<i>Results</i>	Independent Variables Included	Region, Religion, Wealth Quintile, Educational Level
	Number of Nodes	10
	Number of Terminal Nodes	6
	Depth	3

The tree diagram (Figure 3) that follows is a graphic representation of the tree model for the ANC Utilization. This tree diagram shows that out of 5,301 sampled women in the country, 5,031 (94.9%) have received/ utilized ANC services while only 270 (5.1%) have not received it. The most significant predictor of ANC utilization in the Philippines was the region where a woman resides. Women who were living in NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western and Central Visayas, Davao and Caraga had the highest likelihood of utilizing ANC (97.9%) than those who lived in MIMAROPA, Eastern Visayas, Zamboanga, Northern Mindanao and SOCCSKSARGEN(94.1%). The lowest is in ARRM with only 64.8% chance of utilization. Among this first group of women, the second most influential factor was related to woman’s religious affiliation. If a woman is a Christian, this significantly increased chances of higher ANC utilization (98.2%). If a woman is a Muslim, her utilization is lower (94.7%) than a Christian, regardless of what her socio-economic status is or what wealth quintile she belongs. The third factor was wealth quintile. If a woman resides either in NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western and Central Visayas, Davao and Caraga, a Christian, and belongs to either richer, poorer, richest, or middle wealth quintile, the likelihood of successful utilization of ANC was 98.6%. However, if a woman was on the

same group of regions, a Christian yet belonging to the poorest quintile, the likelihood of successful ANC utilization is 96.6%.

For women who were living in MIMAROPA, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao and SOCCSKSARGEN, the second predictor to ANC utilization was educational level. A woman would have a higher likelihood of successful ANC visits if she attained at least secondary level.

A woman who lives in the Autonomous Region in Muslim Mindanao has a significantly decreased chance for a successful ANC utilization of 64.8%.

For this exhaustive CHAID analysis, the four major factors to influence the utilization of antenatal care services were a region, religion, educational level, and wealth quintile. Other variables such as place of residence, sex of household head, access to mass media, the level of empowerment, occupation, and ethnicity did not reach significance level.

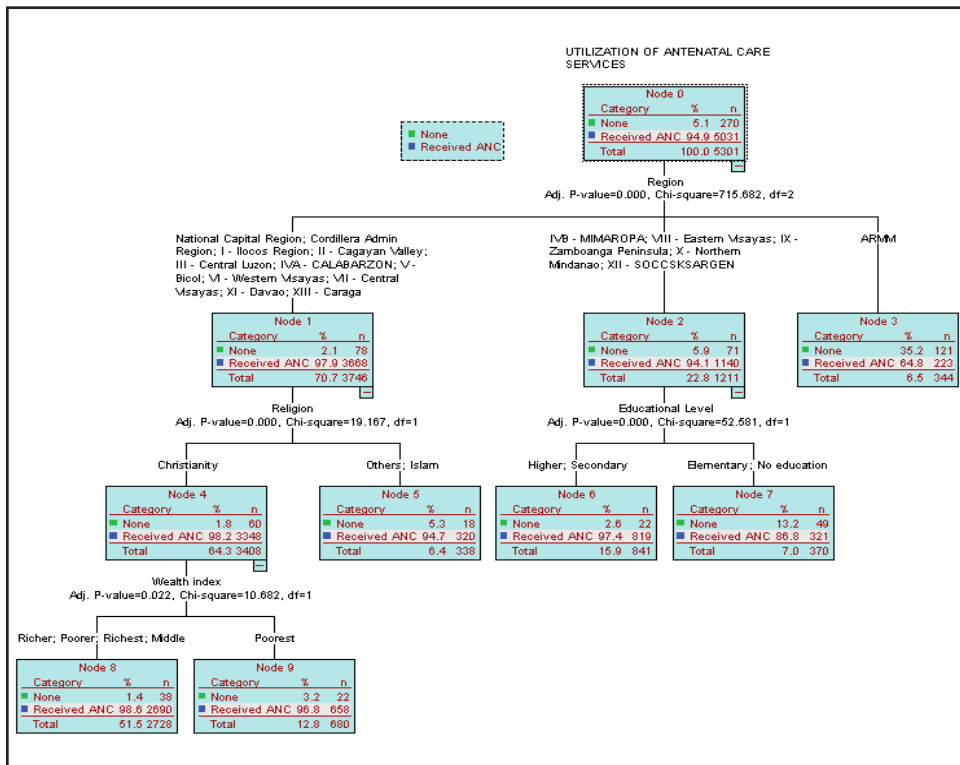


Figure 3. Graphical Model of ANC Utilization in the Philippines

Successful ANC Utilization

Table 3 shows the subgroups sorted by a gain score (successful ANC utilization rate) revealing from highest to lowest the top three successful groups that have significantly higher competitive ANC utilization rates than the competitive ANC utilization rate (94.9%) of the overall sample. The following is a brief description of these three homogeneous subgroups with higher than average competitive ANC utilization rates:

Table 3
Gains Chart of Top Three Successful End Groups

Group	Node	n(cases)	Percent (Total Sample)	n(successful)	Percent (successful sample)	Gain (percent) Success rate	Index (%)
1	8	2728	51.50%	2690	53.50%	98.60%	103.90%
2	6	841	15.90%	819	16.30%	97.40%	102.60%
3	9	680	12.80%	658	13.10%	96.80%	102.00%

Note: The gain percent represents successful ANC utilization rate.

Group 1. This group represents the 2,728 women who resided either in NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western and Central Visayas, Davao and Caraga. These women were Christians, and they belong to either to wealthiest, more impoverished, richer and middle wealth quintile. These 2,728 women represent 51.5% of the overall women sample while 2,690 women represent 53.5% of all women who received ANC services in the overall sample. The competitive utilization rate for these women was 98.6%. An index score of the ratio of these two percentages indicates the comparison between the proportion of women who utilized ANC in this group as compared to the proportion of women who utilized ANC in the overall sample. For this group, the index score was 104% (53.5/51.5) and reveals that the proportion of women who found competitive ANC utilization in this group is approximately 104% better than the competitive utilization rate for the overall sample.

Group 2. This group represents 841 women who resided in MIMAROPA, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, and SOCCSKSARGEN and who have an educational background of high school or some higher education. Of this number, 819 utilized ANC. The competitive utilization rate for this group was 97%, and the index score

was approximately 103% indicating that the utilization rate of the women in this group is 103% better than the utilization rate of the overall sample.

Group 3. This group represents 680 women who resided in NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western and Central Visayas, Davao and Caraga. These women were Christians, and they belong to the poorest wealth quintile. There were 658 who had at least four ANC visits during their pregnancy. The competition utilization rate for this group was 97%, and the index score was approximately 102% which means that the successful utilization rate of this group was 102% better than the ANC utilization rate of the overall sample.

Unsuccessful ANC Utilization

Subgroups sorted by a gain score (unsuccessful ANC utilization rate) are presented in Table 4.

Table 4
Gains Chart of Top Three Unsuccessful End Groups

Group	Node	n (cases)	Percent (Total Sample)	N (unsuccessful)	Percent (unsuccessful sample)	Gain (percent) unsuccessful rate	Index (%)
1	3	344	6.5%	121	44.8%	35.2%	690.6%
2	7	370	7.0%	49	18.1%	13.2%	260.0%
3	5	338	6.4%	18	6.7%	5.3%	104.6%

Note: The gain percent represents unsuccessful competitive ANC utilization rate.

Group 1. Group 1 represents 344 women who were residing in Autonomous and Muslim Mindanao. This 344 is 6.5% of the overall women sample. One hundred twenty-one of these women has not utilized ANC services which represent 44.8% of all women sample who have not also utilized ANC. The competitive unsuccessful utilization rate was 35.2%, and the index score was 690% indicating that their unsuccessful utilization rate was 6.9 times higher than the average of the overall sample.

Group 2. This group represents 370 women residing in MIMAROPA, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, and SOCCSKSARGEN, who have no education or have attained some primary education. This figure represents 7% of the overall women sample,

and the unsuccessful competitive utilization rate was 13%. The index score was 260% indicating that their unsuccessful ANC utilization rate was 2.6% times higher than the average of the overall sample.

Group 3. This group represents 338 women who lived in NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western and Central Visayas, Davao and Caraga. These individuals were either from Islam and other religious affiliation different from Christianity. The successful competitive ANC utilization rate for this group is 95%, and the index score was 104% indicating that their unsuccessful utilization rate for this particular maternal health service is 1.04 times higher than the average of the overall sample.

Discussion

The data mining approach provides detailed information and insight into the relationship among demographic, socio-economic and cultural variables and maternal health service utilization through the segmentation of a sample into mutually exclusive subgroups. In this study, the results of the Exhaustive CHAID analyses revealed that the utilization of maternal health care services of Filipino women of reproductive age is influenced by many factors.

In this study, the results of the Exhaustive CHAID analysis revealed that women's residence as to region, religion, wealth quintile, and education influence ANC. Women had the highest probability of ANC utilization when she lived in either NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western Visayas Central Visayas, Davao or Caraga, a Christian and belonging to either poorer, middle, richer or richest wealth quintile. For women who were living in either MIMAROPA, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, and SOCCSKSARGEN, they have a higher likelihood of successful ANC utilization if they attained at least secondary level of education. A woman who lived in the Autonomous Region in Muslim Mindanao has a significantly decreased chance for a successful ANC utilization.

An important finding from this analysis is the central role, the region a woman resides in predicting her ANC utilization. Specifically, two in the top three successful groups with higher than average competitive ANC utilization rates, came from NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western Visayas or Central Visayas,

Davao or Caraga, while two groups from the top three unsuccessful groups with the highest unsuccessful utilization came from regions not mentioned above. Interestingly, NCR, CAR, Ilocos Region, Cagayan Valley, Central Luzon, CALABARZON, Bicol, Western and Central Visayas, Davao and Caraga are regions with developed cities.

Developed cities/urban places have a higher number of health centers, a higher number of skilled health professionals, and more significant budget allocation to health services. The second most influential factor is a woman's religious affiliation. Christian women have a higher likelihood of seeking antenatal care services than Muslim women. Religious laws or teachings influence the health-seeking behavior of an individual. For instance, in the Middle East and North Africa, it is necessary for a Muslim woman to have her husband or relative go with her outside the home (Newbrander, Natiq, Shahim, et al., 2014; Remien, Chowdhury, Mokhbat, et al., 2009).

Similarly, in Afghanistan, a husband's consent is sought whenever a woman leaves the house even in the case of an emergency (Newbrander, Natiq, Shahim et al., 2014). In Northern Ghana, even though Muslim women favor skilled birth attendants, health workers' insensitivity to their religious obligations, practices and maternity needs, significantly hinders their ability to use these services (Ganle, 2015). Therefore, reduced uptake of skilled delivery services in this regard is not necessarily due to religious but healthcare worker knowledge and attitudes.

The next factors influencing ANC utilization are education and socio-economic status (wealth quintile). This finding is consistent with the study of Shariff et al. (2002) and Molina, Nakamura, Kizuki and Seino (2013). In their study, they pointed out that the low utilization of maternal services seems to be due to low levels of household income (wealth quintile), high illiteracy and ignorance. In Babar's study (2004), he emphasized that low literacy level of the mother is one of the leading causes of poor utilization of primary health care services.

CONCLUSIONS

The current study has many strengths. The data utilized was a national survey data and a relatively large sample size with a high response rate. The demographic and health surveys are internationally validated and nationally adapted surveys. Therefore, the current findings are generalizable to the entire country. The analysis accounted for study

design and sampling procedure, which is more likely to yield accurate estimates. This study has also provided updated knowledge on factors associated with the utilization of antenatal care, skilled birth attendant, and postnatal care.

Nevertheless, the current study has several limitations. Cross-sectional nature of NDHS limits the capacity to draw any causal inferences. Also, as the survey asked the information retrospectively, this may have yielded some recall bias. Nevertheless, this bias is not considered problematic since this study included only women giving birth within five years preceding the survey.

Employing Exhaustive Chi-squared Automatic Interaction Detector (E-CHAID) may be used to predict antenatal care utilization and other maternal health services. In this study, it was found out that the factors that strongly influence ANC utilization in the country are the region where the woman resides, religion, wealth quintile, and educational level. The use of the decision tree provided information as to the groups of women who are marginalized, women who need greater attention from the government.

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