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**PARAMETRIC SURVIVAL ANALYSIS OF BREAST CANCER
REGISTRY DATA**

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Abstract

Survival analysis of Metro Manila population-based breast cancer registry data was done by fitting three parametric distribution models namely Weibull, Gompertz and Lognormal distributions in a proportional hazards survival regression analysis. The three models are compared using R-language application to determine the goodness of fit.

Residual Plots and Deviance Statistics show that the Gompertz and Weibull Models have better fit compared with the lognormal model. Interpreting the hazards ratios using the gompertz model shows that extent of the disease is inversely related with survival. Those who have regional involvement of the disease have 3.3 times risk of dying compared with those with localized disease; and those with distant metastasis have 11.8 times the risk of dying compared with the localized group (p -values <0.001). The effect of treatment was modified by age of diagnosis of the patient. Treatment was found to be a risk factor with those who developed the disease when they were 21-39 years of age but a protective factor for those when they were 40 years and older.

Keywords and phrases: survival analysis, breast cancer, gompertz, weibull, lognormal

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**Comparing Two Classification Methods:
Analysis of Health and Nutrition Indicators from the 1999
Multiple Indicator Cluster Survey**

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Comparing Two Classification Methods: Analysis of Health and Nutrition Indicators from the 1999 Multiple Indicator Cluster Survey

by

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ABSTRACT

Cluster Analysis and Multidimensional Scaling were used to analyze the Health and Nutrition Indicators of the 1999 Multiple Indicator Cluster Survey (MICS). The MICS attempted to measure how the Philippines, as a participant to the World Summit for Children in 1990, had fared in implementing target goals for the survival, development, and protection of children at end – decade. This study determined which method provided better classification of health and nutrition variables. Regression and correlation analyses were used to assess the classification results.

KEYWORDS: Multidimensional Scaling, Cluster Analysis, Multiple Indicator Cluster Survey (MICS)

1. Introduction

There is growing international awareness that health is vital in achieving sustainable development and reduction in poverty. Only with a healthy, well-nourished and educated population can a country secure economic growth.

September 1990 marked the Universal Declaration on the Survival, Protection, and Development of Children. Major goals like the reduction of infant and maternal mortality rates, malnutrition, and increased access to basic education and safe drinking water were formulated. The Philippines, as one of the countries that took part in the declaration, “vowed to implement appropriate strategies in its national plan of action to meet these goals by the end of the decade.” (MICS Executive Summary, 1999)

Ten years after the declaration, the Philippines conducted the Multiple Indicator Cluster Survey (MICS) as an end decade review. The survey showed that though there was an increased participation in basic education, registration of births, procurement of health services among women and a sufficient consumption of iodized salt, barely fifty (50) percent participated in the government’s *Sangkap Pinoy* program. The results opened even more challenges.

Although the social and economic development status of the country has improved, the rate of improvement is still relatively slower than desired. The Filipino health condition, compared with its other neighboring ASEAN countries, has lagged behind. The MICS is an opportunity to look into the relationships of health and nutrition indicators. These relationships are hoped to provide significant information to our policy – makers, health – planners, and program implementers.

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2. Methodology

The Multiple Indicator Cluster Survey (MICS) conducted among 7,680 households nationwide, consisted of different modules. For substantive relevance to the study, the following modules were included for analysis: (1) Household Membership, (2) Education, (3) Socio-Economic, (4) Salt and Iodization, (5) Maternal and Infant Health, (6) Care of Cough, (7) Vitamin A and (8) Birth Registration and Anthelmintics. Originally 100 variables were created. Using the principle of parsimony and substantive relevance, 25 variables were removed based on correlation results, retaining 75 variables for further analysis. (Refer to Appendix 1 for list of the variables and the definition of each variable)

Two multivariate classification techniques were used – Multidimensional Scaling (MDS) and Cluster Analysis (CA) to draw out the relationships of health and nutrition indicators. These techniques classified the indicators by grouping them based on the characteristics they possessed. Though the primary intention of this paper was to identify which classification method combined the indicators *better*, it cannot be undermined that the generated relationships of the health and nutrition indicators provided more information and implications thus were also discussed in this paper.

3. Results and discussions

Three clusters and three dimensions were produced for each classification technique (Refer to Table 1, page 14, for the variables in each cluster and dimension). Regression analysis was performed to evaluate the relationship of the variables within a cluster or a dimension to a selected dependent variable. Regression analysis provided an objective means of assessing the predictive power (accuracy) of a set of independent variables in explaining a dependent variable. In doing regression analysis, the nature of the research influenced the selection of a dependent variable. Moreover, the choice of independent variables should have some conceptual or empirical link with the dependent variable to avoid inclusion of spurious determinants. The present study sought to assess which classification method grouped the variables better, without establishing any *a priori* relationship among all the variables.

The dependent variables were chosen based on substantive relevance to health and nutrition and the results of MICS 1999. These variables were the core health and nutrition indicators:

- (a) *IRON* (Percentage of Children given Iron Supplement)
- (b) *SALT1* (Coded 1 if Household used Iodized Salt or 0 otherwise)
- (c) *IRONSIX* (Percentage of Women who had a Daily Intake of Iron Supplement for Six Months or more During Pregnancy)
- (d) *VITAMINA* (Percentage of Children who received Vitamin A).

Cluster 1 and Dimension 1 used *IRON* as the dependent variable. On the other hand, Cluster 2 and Dimension 2 used *SALT1* as dependent variable. Logistic regression may provide indicators that could explain low appreciation for iodized salt, which is a cheap yet very important factor for the mental development of a child. Cluster 3 and Dimension 3 used *IRONSIX* as the dependent variable. Performing a regression analysis using *IRON* and *IRONSIX* as dependent variables may provide significant correlates on the low iron supplementation among pregnant women, which is essential to both the mother and the child during pregnancy. Lastly, *VITAMINA* was used as dependent variable for Cluster 1 and Dimension 2. The results may bring light to the low turn-out of

Vitamin A utilization, a freely distributed micronutrient that decreases the chance of children going blind.

Cluster Analysis - Regression Results

3.1a Cluster 1 (Dependent Variable: IRON)

Cluster 1 has 18 variables. Performing a stepwise regression yielded only 14 variables with an *R*-square of 40.7% and an adjusted *R*-square of 40.6%. The estimated regression model is

$$\widehat{Iron} = 17.895 + 0.193Read1 - 0.163Chesprob + 0.066Otheras + 0.205Utrapnc - 0.084Educ4 + 0.46Symptom - 0.022Deworm - 0.039Midd + 0.028Irondp + 0.043Less5lbs - 0.039Head + 0.028Clear - 0.049Utrandd - 0.008Vitamina$$

The model shows that iron supplementation (IRON) was higher with the following household characteristics:

- (a) more people being able to read easily (READ1)
- (b) more unregistered births due to other reasons aside from economic and personal reasons (OTHERAS)
- (c) more pregnant women who had pre-natal care under untrained *hilot* (UTRAPNC)
- (d) more pregnant women who had symptoms which caused them to seek health care (SYMPTOM)
- (e) more women who had iron during pregnancy (IRONDP)
- (f) more children who were less than 5.5 lbs (LESS5LBS) and
- (g) more women who had clear vision during pregnancy (CLEAR)

On the other hand, the model shows low iron supplementation in households with the following characteristics:

- (a) more children below 5 years old coughing due to chest problems (CHESPROB)
- (b) more members of the household who did not attend school due to personal reasons (EDUC4)
- (c) more children who received antihelminthics medicine (DEWORM)
- (d) more women who were attended by midwives during delivery (MIDDD)
- (e) more women who had blurred vision, dizziness, and headache during pregnancy (HEAD)
- (f) more women who were attended by untrained *hilot* during delivery (UTRANDD)
- (g) more children below 5 years old who took Vitamin A supplementation (VITAMINA)

3.1b Cluster 1 (Dependent Variable: VITAMINA)

Only five variables were retained with an *R*-square and adjusted *R*-square of 5.4% and 5.3% respectively. The estimated regression model is

$$\widehat{Vitamina} = 47.358 + 0.142Read1 + 0.155Irondp + 0.071Deworm + 0.046Midd - 0.074Iron$$

The model shows that Vitamin A supplementation is higher when more members of the family can read easily (READ1), when more mothers took iron supplementation during pregnancy (IRONDP), when more children had taken antihelminthics (DEWORM),

and when more pregnant women got midwives during delivery (MIDDD). Vitamin A supplementation is low when more children took iron supplementation (IRON).

However, it should be stressed that the model has a low *R-square*. This indicates that there are other variables not included in the model which may help explain low utilization of Vitamin A among Filipino households.

3.1c Cluster 2 (Dependent Variable: SALT1)

A logistic regression was utilized for Cluster 2 when the dependent variable was SALT1. There were 37 variables entered in the analysis. Six variables were retained and the estimated model is

$$P = 1 / \{1 + \exp [-(1.5438 + 0.3519Radio + 1.0379Phone + 0.792Pc + 0.1660Room3 + 0.0065Pncx4 - 0.0042Vita1)]\}$$

The odds ratios ($\exp(b)$) of a household not using iodized salt were higher by almost three-fold when a household did not own a phone and a personal computer. Similarly, households that did not own a radio, did not have three bedrooms, and with pregnant women who did not receive pre-natal care at least ten times, more likely did not use iodized salt. However, households with children below 5 years old who received Vitamin A earlier, most likely used iodized salt.

The results indicate that the usage or consumption of iodized salt is still a function of socio-economic class. A program similar to the promotion of iodized salt usage needs to be intensified specially among economically vulnerable groups.

3.1d Cluster 3 (Dependent Variable: IRONSIX)

Of the twenty (20) variables included in Cluster 3, only ten (10) were retained with a total *R-square* of 12.6% and adjusted *R-square* of 12.5%. The estimated regression model is

$$\widehat{Ironsix} = 53.970 + 0.140Pnc1 - 0.101Pncx1 + 0.058Twomen - 0.086Reladd - 0.055Tranpnc - 0.100Otherdd - 0.029Educ3 - 0.039Vitapub - 0.031Hombi + 0.034Educ2$$

The model shows that utilization of iron for six months among pregnant women was higher in households with more women who received early pre-natal during the first three months of pregnancy (PNC1) and more members of the family who did not attend school because of work (EDUC2).

In contrast, low utilization of salt for six months among pregnant women was more evident in households with the following characteristics:

- (a) more women who had pre-natal care not more than 3 times (PNCX1)
- (b) more pregnant women who were assisted only by the relatives during delivery (RELADD)
- (c) more pregnant women who went to a trained hilot for pre-natal care (TRANPNC)
- (d) more pregnant women who were assisted by other individuals aside from medical people, hilot, relatives during delivery (OTHERDD)
- (e) more members of the family who did not attend school because of lack of-interest (EDUC3)
- (f) more mothers who took Vitamin A from public facilities (e.g. hospital and health centers) (VITAPUB)
- (g) more pregnant women who gave birth only at home (HOMBI)

Multidimensional Scaling - Regression Results

3.2a Dimension 1 (Dependent Variable: IRON)

Dimension 1 has 25 variables. Only 14 variables were retained with a total R -square of 35.1% and adjusted R -square of 35%. The estimated model is

$$\widehat{Iron} = 29.787 - 0.228Chesprob + 2.070Hhsize + 0.098Pnc1 + 0.089Midd - 0.191Educ4 - 0.107Less5lbs - 0.052Study6 - 0.043Blurred + 0.028Study4 - 0.087Dkdd - 0.020Child2 - 0.035Educ2 - 0.069Utrapnc + 0.015Breath$$

Iron supplementation was higher in households where more women received pre-natal care during the first three months of pregnancy (PNC1), had midwives during delivery (MIDDD), where more children finished 3rd year or 4th year (STUDY4), and where more children 5 years younger breathed faster than usual when they had cough (BREATH).

On the other hand, iron supplementation was less evident in the following households with:

- more children below 5 years old experienced coughing due to chest problems (CHESPROB)
- more members of the household who did not attend school for personal reasons (EDUC4)
- more children below 5 years old who were below 5.5 lbs (LESS5LBS)
- more children who finished non-degree curriculum (e.g. madrasa) (STUDY6)
- pregnant women who had blurred vision during pregnancy (BLURRED)
- pregnant women who did not know who assisted them during pregnancy (DKDD)
- more children aged 5 to 17 years old in a household (CHILD2)
- more children who did not attend school due to work (EDUC2) and
- more pregnant women who received pre-natal care from untrained hilot (UTRAPNC).

3.2b Dimension 2 (Dependent Variable: SALT1)

A logistic regression was performed when the dependent variable was SALT1. Of the thirty variables included for analysis, only ten were retained in the last iteration with a predictive accuracy of 76.64%. The resulting estimated model, which was chosen based on predictive accuracy, is

$$P = 1 / \{1 + \exp [- (- 3.4810 + .0065Read1 + 0.33712Radio + 0.3175Room3 + 0.4876Room4 + 0.7717Walls1 + 0.2638Saltre1 + 0.0048Clear + 0.0046Irondp - 0.0177Otherdd + 0.00143Vitaano)] \}$$

The odds ratios ($\exp(b)$) of using salt were higher when more pregnant women in a household had other people, aside from their relatives and health personnel, assisting them during delivery. The odds of a household not using salt however were higher by more than two fold if the house was not made up of concrete walls (WALLS1). Likewise, households with the following characteristics have a higher predicted probability of not using salt:

- with members of the family who were not able to read easily (READ1)
- which did not own a radio (RADIO1)
- which did not have three rooms (ROOM3)
- which did not own four rooms (ROOM4)
- which did not consume salt for cooking (SALTRE1)
- with mothers who did not have a clear vision during pregnancy (CLEAR)
- with mothers who did not take iron during pregnancy (IRONDP)

- (h) with mothers who took Vitamin A supplement from other places aside from government and non-government agencies and institutions (VITAANO)

3.2c Dimension 2 (Dependent Variable: VITAMINA)

The stepwise regression resulted to a ten-variable model with an *R*-square of 5.5% and an adjusted *R*-square of 5.4%. The estimated model is

$$\widehat{Vitamina} = 0.112Read1 + 0.150Irondp + 0.036Birth - 0.099Tranpnc + 2.647Roof1 - 4.613Boat + 0.072Pnc3 - 0.113Utrandd - 0.085Face - 0.026Study3$$

The results show that Vitamin A supplementation was higher in households with the following characteristics:

- (a) more family members who could read easily (READ1)
- (b) more pregnant women who took iron supplements during pregnancy (IRONDP)
- (c) more women giving birth (BIRTH)
- (d) having concrete roofs (ROOF1)
- (e) women receiving pre-natal care only during 7 months and onwards (PNC3)

If a household had more pregnant women who received pre-natal care from trained hilot (TRANPNC), who were assisted by untrained hilot during delivery (UTRANDD), and who had swollen hand and/or face during pregnancy, then utilization of Vitamin A was low. This was evident as well for households who owned a boat (BOAT) and with more family members who finished Grade 7 to 2nd year high school (STUDY3).

3.2d Dimension 3 (Dependent Variable: IRONSIX)

Fifty (50) percent of the variables in Dimension 3 had been dropped after performing a stepwise regression leaving only 10 variables with an *R*-square and adjusted *R*-square of 10.7% and 10.6% respectively. The estimated model is

$$\widehat{Ironsix} = 55.849 - 0.181Pncx1 - 0.053Hombi + 0.068Twomen - 0.090Reladd + 0.058Pncx2 + 0.077Bleed - 0.050Educ3 + 0.061Head - 0.028Child1 + 0.033Advised$$

Iron supplementation for six months among pregnant mothers was higher in households with more mothers who sought advice for their children's coughing (ADVISED) and with more women who had symptoms of bleeding (BLEED) and headache during pregnancy (HEAD).

Low iron supplementation for six months would more likely occur in households with the following attributes:

- (a) more pregnant women receiving pre-natal care not more than 3 times (PNCX1)
- (b) women who gave birth only in their homes (HOMBI)
- (c) pregnant women who were just assisted by relatives during delivery (RELADD)
- (d) more pregnant women receiving pre-natal care more than 3 times but not more than 6 times (PNCX2)
- (e) more household members who did not attend school because of lack of interest (EDUC3)
- (f) more children below 5 years old (CHILD1)

Correlation Results

The results of the correlation analyses performed for each cluster and dimension provide further information on the relationships of the health and nutrition indicators grouped together by the classification methods.

Correlation within Cluster 1, Cluster 2, and Cluster 3

For Cluster 1, results show that iron supplementation among children below 5 years old (IRON) was associated with ability to read easily (READ1) but negatively correlated with children who had coughing because of chest problems (CHESPROB). Ability to read easily (READ1) was correlated with mothers who had iron during pregnancy (IRONDP), children who took Vitamin A supplements (VITAMINA) but negatively correlated with children who were below 5.5 lbs during birth (LESS5LBS).

For Cluster 2, results show the salt iodization among households was evident in households with a radio (RADIO), a phone (PHONE), a personal computer (PC), three rooms (ROOM3), and with mothers who received pre-natal care more than 10 times (PNCX4).

For Cluster 3, results show that mothers who have received pre-natal care during their early months of pregnancy (PNC1) were more likely to have had iron supplements for six month (IRONSIX). They were less likely to have given birth only at their homes (HOMBI) and received pre-natal care for not more than three times (PNCX1).

Correlation within Dimension 1, Dimension 2, and Dimension 3

For Dimension 1, households with children who had cough due to chest problems (CHESPROB), children less than 5.5 lbs during birth (LESS5LBS), and with mothers who had blurred vision during pregnancy (BLURRED) tended to have low iron supplementation among children (IRON). Mothers who experienced blurred vision during pregnancy (BLURRED) tended to have children who breathed faster than usual when coughing (BREATH).

For Dimension 2, households who had used iodized salt (SALT1) were more likely to have members of the family who could read easily (READ1), owned a radio (RADIO), have three to four rooms (ROOM3 and ROOM4), and have better walled houses (WALLS1). At the same time, pregnant women who had clear vision during pregnancy (CLEAR) tended to have used iodized salt (SALT1).

In addition, children who received Vitamin A supplementation (VITAMINA) were more likely to have members of the household who could read easily (READ1), had mothers who took iron during pregnancy (IRONDP), and had concrete roofs for a house (ROOF1). Households who had members who could read easily (READ1) tended to have mothers who took iron during pregnancy (IRONDP).

For Dimension 3, results indicate that women who gave birth only at home (HOMBI) were more likely to have received pre-natal care for only three times (PNCX1). Mothers who took iron supplements for six months (IRONSIX) tended to have not given birth at home (HOMBI) and had received pre-natal care more than 3 times (PNCX1).

DISCUSSION

Which is better?

Two multivariate classification methods have been used to determine the underlying structures of the variables of the 1999 Multiple Indicator Cluster Survey (MICS). These classification techniques, Cluster Analysis and Multidimensional Scaling, provide meaningful relationships among the indicators.

Table 1 shows a comparison of the variables under Cluster 1 and Dimension 1, between Cluster 2 and Dimension 2 and between Cluster 3 and Dimension 3.

Comparing Cluster 1 from Dimension 1 provide significant information regarding the low iron supplementation among Filipino children. The results show that pre-natal care, antihelminthics, blurredness of vision or night blindness, symptoms that may lead to a harmful pregnancy, low birth weight and evidences of acute respiratory infections (ARI) suggest possible effects of low iron and vitamin A supplementation in mothers and children. These results clearly support numerous studies that have already shown the adverse effects of the inadequacies of these micronutrients on a pregnant mother and a growing child.

Cluster 2 and Dimension 2 suggest that socio-economic indicators, a mother's knowledge of symptoms that may occur during pregnancy and her experience during the last pregnancy and health care access and provision like pre-natal care could provide insights as to what correlates to watch out in dealing with salt iodization program.

Cluster 3 and Dimension 3 show that locality, a mother's access to pre-natal care and medical services and socio-economic indicators may help provide explanations to the problem of low utilization of iron among pregnant women.

It is interesting to note that both cluster analysis and multidimensional scaling results similarly share a mixture of variables from each module grouped in a cluster or dimension. It is very clear that there are common indicators that the government needs to redirect its energies to for the success in the implementation of health programs with respect to the core health and nutrition variables.

In order to validate the grouping of each classification method, regression and correlation analyses were performed using each of the clusters and dimensions with *IRON*, *SALT1*, *IRONSIX* and *VITAMINA* as dependent variables. For regression analysis, dependent variables were selected using the core health and nutrition indicators.

Table 1 Comparison of Health and Nutrition Membership within a Cluster/Dimension

Cluster 1 and Dimension 1				Cluster 2 and Dimension 2						Cluster3 and Dimension 3			
Cluster 1 Variables	Modul	Dimension 1 Variables	Modul	Cluster 2 Variables	Modul	Cluster 2 Variables	Modul	Dimension 2 Variables	Modul	Cluster 3 Variables	Modul	Dimension 3 Variables	Modul
READ1	1	HHSIZE	1	HHSIZE	1	PALE	5	READ1	1	URBANIT	1	URBANITY	1
EDUC4	2	CHILD2	1	CHILD1	1	NOSYM	5	STUDY2	2	Y	1	TWOMEN	1
CLEAR	5	EDUC2	2	STUDY1	2	COUGH	6	STUDY3	2	TWOMEN	1	CHILD1	1
IRONDP	5	EDUC4	2	STUDY2	2	BREATH	6	STUDY5	2	CHILD2	2	EDUC3	2
UTRAPNC	5	STUDY1	2	STUDY3	2	CNCP	6	RADIO	3	EDUC2	2	ELECTRIC	3
SYMPTOM	5	STUDY4	2	STUDY4	2	OTHEPR	6	BOAT	3	EDUC3	2	PHONE	3
HEAD	5	STUDY6	2	STUDY6	2	O	6	ROOM1	3	STUDY5	3	PC	3
MIDDD	5	TRACTOR	3	RADIO	3	ADVISED	7	ROOM3	3	ELECTRI	3	MOTOR	3
UTRANDD	5	BLURRED	5	PHONE	3	VITA1	7	ROOM4	3	C	3	IRONSIX	5
DKDD	5	UTRAPNC	5	PC	3	VITA3	7	ROOF1	3	BOAT	3	PNCX1	5
SMALL	5	PNC1	5	MOTOR	3	VITAANO	8	WALLS1	3	ROOF1	4	PNCX2	5
LESS5LBS	5	PNCX5	5	TRACTO	3	COST	8	SALT1	4	WALLS1	5	BLEED	5
IRON	5	SYMPTOM	5	R	3	BIRTH		SALTRE1	4	SALTRE1	5	HEAD	5
CHESPROB	6	PALE	5	ROOM1	3			BIRTH	5	IRONSIX	5	HOMBI	5
VITAMINA	7	NOSYM	5	ROOM3	3			CLEAR	5	TRANPNC	5	RELADD	5
VITA4	7	MIDDD	5	ROOM4	4			IMOBILE	5	PNC1	5	CNCP	6
OTHERAS	8	DKDD	5	SALT1	5			UNADAPT	5	PNC3	5	ADVISED	6
DEWORM	8	SMALL	5	BLURRE	5			IRONDP	5	PNCX1	5	VITA1	7
		LESS5LBS	5	D	5			TRANPNC	5	HOMBI	5	COST	8
		IRON	5	IMOBILE	5			NONEPNC	5	RELADD	6	OTHERAS	8
		COUGH	6	UNADAP	5			PNC3	5	OTHERD			
		BREATH	6	T	5			PNCX4	5	D			
		CHESPRO	6	NONEPN	5			FACE	5	VITAPUB			
		B	7	C	5			UTRANDD	5				
		VITA3	8	PNCX2	5			OTHERDD	5				
		DEWORM		PNCX4	5			OTHEPRO	6				
				PNCX5				VITAMINA	7				
				BLEED				VITA4	7				
				FACE				VITAPUB	7				
								VITAANO	7				

It should be noted that this study did not involve *a priori* conditions. The combination of variables were due to the classification procedures and hence the researcher, did not have a direct hand in choosing which variables had to go together or otherwise. The choice of the “best” model in a regression analysis involved some measures of fit like *R*-square and the adjusted *R*-square.

The regression models did not contain the same set of independent variables for a specific dependent variable. However, the basic idea is: if indeed a classification method had performed better over the other, then it should have grouped together variables which could predict better the dependent variable as shown by a higher adjusted *R*-square, lower standard errors and a parsimonious and easier-to-interpret model.

Table 2 shows a summary of results for both Cluster Analysis and Multidimensional Scaling. In terms of model parsimony, Cluster Analysis was more parsimonious. The adjusted *R*-square values were higher for Cluster Analysis except when VITAMINA was the dependent variable. Performing a logistic regression with SALT1 as dependent variable shows a higher over-all predictive power when variables were obtained using Cluster Analysis compared to when Multidimensional Scaling was used. Lower standard errors were also observed in Cluster Analysis compared to those in Multidimensional Scaling. Lower standard errors provide narrower confidence interval and better predictive accuracy. While high standard errors indicate much sample-to-sample variation and hence a higher likelihood that any one sample estimate will be far from the true parameter value.

Therefore, for this study, Cluster Analysis gave better classification of health and nutrition variables.

Table 2 Comparative Results of Cluster Analysis and Multidimensional Scaling

Measures of Fit	DEPENDENT VARIABLE							
	IRON		VITAMINA		SALT1		IRONSIX	
	Cluster 1	Dimension 1	Cluster 1	Dimension 2	Cluster 2	Dimension 2	Cluster 3	Dimension 3
Model Parsimony	14	14	5	10	6	10	10	10
Adjusted R-square	40.6	35	5.3	5.4	9.5	8.3	12.5	10.6
Predictive Accuracy					77.3	76.6		
Standard Errors	8.92	9.33	25.6	25.5			14.00	14.1

Conclusion

In the course of the search for a better classification method, one stark reality is shown by the results of the analysis: **those who have more access to better health care services are those who can afford them.** Those who can afford better health care services are more likely to own houses made of concrete walls and better roofing materials and have more than two rooms, households who own phones and personal computers which many Filipinos may not be able to afford. Even iodized salt, which is cheap, is more likely to be prevalent only in “better” walled-houses. Others who can not even pay for the child’s registration just take chances in seeking a midwife or a *hilot*, much worse, an untrained one.

In this study, it has been shown that pre-natal care is a very important correlate for iron supplementation. Women who received pre-natal care earlier in their pregnancy and received it many times, used iron supplements and more likely to have avoided night blindness during pregnancy. It is important to note that those who received more pre-natal care services more likely did not visit midwives but other better skilled medical practitioners (e.g. doctor). It can be surmised that those who received pre-natal care already late in their pregnancy and those who sought a midwife's assistance were more likely could not have afforded the services of the doctors. Many pregnant women visit midwives. These findings/results now necessitate the curricular review of the schools for midwifery. There is a need to emphasize the role of nutrition in the proper health care of pregnant woman.

Other results in this study support the results of most researches on Vitamin A supplementation. Children who took Vitamin A supplements are more likely to not have had trouble in breathing due to cough. It is interesting to note that Vitamin A supplementation is higher in households with more members who have no difficulty reading.

Challenges

In a fast-paced world, the slow and weak can be considered losers. Most of our ASEAN counterparts are continuously developing their human resources and becoming major players in the global market, while the Philippines have fallen behind. Though the Philippine government places the health of the Filipinos as one of its priorities, statistics have still shown that the issue of health is still very much a socio – economic issue.

Human resource, which serves as the backbone of any nation, plays a crucial role in the economic growth of any developing economy. For a country to move, the government has to really invest on its people. The programs and policies aimed at promoting the welfare of every individual must be in the pursuit of truly abridging the socio-economic gap experienced and felt by most Filipinos.

Unless the government puts a stop on this prevailing situation, not much success in its programs can ever be expected.

Appendix 1
List of Variables by Module

Module 1 HOUSEHOLD MEMBERSHIP

HHSIZE	Total number of household (HH) members
URBANITY	Type of Locality
TWOMEN	Percent of Eligible Women (15 to 49 yrs. old)
READ1	HH members who can read easily
READ2	HH members who can read moderately
READ3	HH members who can not read
CHILD1	Children below 4 yrs old
CHILD2	Children aged 5 to 17 yrs old

Module 2 EDUCATION

EDUC1	Did not attend school due to Education-related reason
EDUC2	Did not attend school due to Work
EDUC3	Did not attend school due to Lack-of-Interest
EDUC4	Did not attend school for Personal reasons
STUDY1	Children who finished Grades 1 to 3
STUDY2	Children who finished Grades 4 to 6
STUDY3	Children who finished Gr7 to 2nd yr HS
STUDY4	Children who finished 3rd Yr and 4th yr
STUDY6	Children who finished college education
STUDY7	Children who finished non-standard curriculum (e.g. Madrasa)

Module 3 SOCIO-ECONOMIC

ELECTRIC	Electricity
RADIO	Radio
TELEVISION	Television
PHONE	Telephone
PC	Personal Computer
MOTOR	Motorcycle
BOAT	Boat
TRACTOR	Tractor
ROOM1	House has 1 Room
ROOM2	House has 2 Rooms
ROOM3	House has 3 Rooms
ROOM4	House has 4 Rooms
FLOOR1	Floor is made of Earth Materials
FLOOR2	Floor is made of Synthetic Materials

Continuation Module 3

ROOF1	Roof is made of Concrete Materials
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ROOF2	Roof is made of Earth Materials
WALLS1	Wall is made of Concrete Materials
WALLS2	Wall is made of Earth Materials

Module 4 SALT AND IODIZATION

SALT1	Household used Iodized Salt for Cooking
SALT2	Household used Not Iodized Salt for Cooking
SALTRE1	Household used Iodized Salt as Table Salt
SALTRE2	Household used Non Iodized Salt as Table Salt

Module 5 MATERNAL AND INFANT HEALTH

BIRTH	Woman, aged 15-49 has given birth
CLEAR	Had clear vision during pregnancy (DP)
BLURRED	Had blurred vision during pregnancy
IMOBILE	Became immobile due to poor vision during pregnancy
UNADAPT	Inability to adapt to darkness during pregnancy
IRONDP	Took Iron supplement during pregnancy
IRONSIX	Took iron supplement for a period of 6 months
DOCPNC	Sought a doctor for pre-natal care (PNC)
MIDPNC	Sought a midwife for pre-natal care
TRANPNC	Sought a trained hilot for pre-natal care
UTRAPNC	Sought an untrained hilot for pre-natal care
NONEPNC	Sought no one for pre-natal care
PNC1	Received pre-natal care during 1 to 3 months
PNC2	Received pre-natal care during 4 to 6 months
PNC3	Received pre-natal care during 7 months onwards
PNCX1	Received pre-natal care 1 to 3 times
PNCX2	Received pre-natal care 4 to 6 times
PNCX3	Received pre-natal care 7 to 9 times
PNCX4	Received pre-natal care 10 to 12 times
PNCX5	Received pre-natal care more than 12 times
SYMPTOM	Had symptoms to cause the mother(s) to seek health care
BLEED	Symptom is bleeding
HEAD	Symptom is headache, dizziness, blurred vision
FACE	Symptom is swollen face and/or hands
PALE	Symptom is paleness
NOSYM	Symptoms not known
HOMBI	Gave birth at home
GOVHOSBI	Gave birth at a government facility
PRIHOSBI	Gave birth at a private facility

Continuation Module 5

DOCDD	Assisted by doctor during delivery (DD)
MIDDD	Assisted by midwife during delivery
TRANDD	Assisted by trained hilot during delivery

UTRANDD	Assisted by untrained hilot during delivery
DKDD	Assisted during delivery either untrained or trained hilot
RELADD	Assisted by relative during delivery
OTHERDD	Assisted by other persons during delivery
LARGE	Child's size was large when born
AVERAGE	Child's size was average when born
SMALL	Child's size was small when born
LESS5LBS	Weight of the child is less than 5.5 lbs or 2500 grams
IRON	Child was given iron supplement

Module 6 CARE OF COUGH

COUGH	Child had a cough any time in the last two weeks at the time of the interview
BREATH	Child breathed faster than usual when child had a cough
CLOGNOS	Reason for the cough was clogged nose
CHESPROB	Reason for the cough was chest problem
CNCP	Reason for the cough was both clogged nose and chest problem
OTHERPRO	Reason for the cough was brought about by other problems
ADVISED	Advice/treatment was sought for the cough outside the house

Module 7 VITAMIN A

VITAMINA	Child took Vitamin A capsule
VITA1	Child took Vitamin A 1 to 6 months ago
VITA2	Child took Vitamin A 7 to 12 months ago
VITA3	Child took Vitamin A 13 to 18 months ago
VITA4	Child took Vitamin A 19 to 24 months ago
VITAPUB	Vitamin A was taken from a public facility
VITAPRI	Vitamin A was taken from private facility
VITAANO	Vitamin A was taken from other facilities (e.g. church, friends)

Module 8 WEIGHT MONITORING AND ANTIHELMINTHICS

COST	Reason for not registering birth of the child: Birth certificates cost too much, late and didn't want to pay the fine and too far to get it
DONKNO	Reason for not registering birth of the child: Didn't know that it should be registered and where it should be registered
OTHERAS	There are other reasons for not registering birth of the child.
DEWORM	Child received de-worming (anthelmintics) medicine during the past six months