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Alternative Means Testing Options Using CBMS

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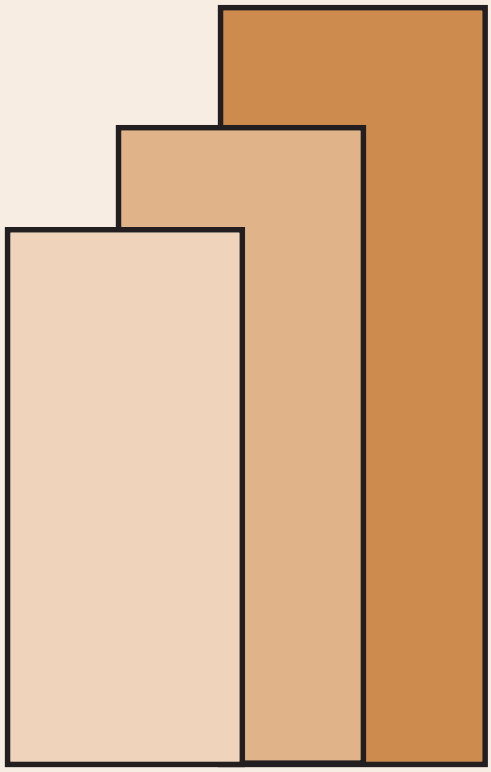

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Abstract

The study proposes an alternative means to the present manner of identifying eligible Philhealth beneficiaries through the use of three criteria, namely: income, ownership of assets and socioeconomic characteristics, and electricity consumption. The information/data gathered in evaluating the criteria are sourced with the use of the community-based monitoring system (CBMS) approach.

Given that many of the poor households may not have verifiable records/documents regarding the first criterion—income—the study recommends the adoption of a two-stage screening method using the other two criteria. Households are first classified on the basis of socioeconomic variables that are predictors of income-based poverty status. This is followed by a second stage screening based on electricity consumption for those who passed the first screening.

The proposed methodology addresses the problem of undercoverage/exclusion of possible eligible beneficiaries from the program that is evident in the present manner of identifying beneficiaries.

Keywords: community-based monitoring system**,** Philhealth indigent program, income-based poverty, assets ownership, electricity consumption, targetting of beneficiaries.

Alternative Means Testing Options Using CBMS

Celia M. Reyes*

1. Objective of the study

The primary objective of this study is to develop alternative means testing options for identifying beneficiaries of the Philhealth Indigent Program. The data will come from the Community-Based Monitoring System that is being implemented by local government units.

2. Philhealth Indigent Program

The Philhealth Indigent Program aims to provide health insurance privileges to the marginalized sector of Philippine society. Beneficiaries are identified through a survey called CBIS-MBN, using the Family Data Survey Form (FDSF), conducted by the local Social Welfare Development Office.

The current practice of having a two stage screening process to identify eligible beneficiaries to the Philhealth Indigent Program may lead to significant exclusion and consequently undercoverage. Currently, poor barangays are identified and then poor families in these poor barangays are selected. Poor barangays are identified by the Municipal/City Social Worker. Then primary data collection is undertaken in all families in these "poor" barangays". Families whose reported incomes fall below a certain threshold are then classified as eligible.

In this scheme, poor families in "non-poor" barangays are excluded from the program.

3. Proposed approach to Identifying Philhealth Beneficiaries

Executive Order 276 (January 2004) directs the Philhealth to assist in the identification of indigent families and to target the enrollment of a total of the five (5) million indigent families nationwide. It also directs the issuance of Philhealth Identification Cards to duly qualified beneficiaries.

3.1 Targeting Efficiency

There are two basic questions that we are faced with in implementing a targeted program. First, to what extent can we reach the poor (is there a problem of undercoverage)? Second, are any benefits leaking to non-poor or non-eligible persons or households (is there a leakage problem)?

The results of the Annual Poverty Indicators Survey (APIS) for 2002 show that 31.2 percent of the families have at least one member who had health insurance plan. In particular, Table 1 shows that 27.5 percent of the families have access to Philhealth. Moreover, only 6.5 percent of the lowest 40 percent of the families have access to Philhealth, while 41.4 percent of the highest 60 percent of the families have access to Philhealth.

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Access to Philhealth is higher in the urban areas at 38.2 percent than in the rural areas. Only 16.8 percent of the families in the rural areas have access to Philhealth. In terms of differential access across income groups, 9.0 percent of the lowest 40 percent of the families have access while 45.3 percent of the highest 60 percent have access in the urban areas. In the rural areas, 5.7 percent of the lowest 40 percent of the families have access while 33.7 percent of the highest 60 percent have access.

Table 1. **Families with at Least One Member Who Had Health Insurance, by Type of Health Insurance Plan, by Income Stratum, Region and Urban-Rural Residence, 2002**

Region and Income Stratum	Total Families ('000)	Families with at least One Member who Had Health Insurance Plan		Type of Health Insurance Plan (Percent to Total Families)				
		Number ('000)	Percent	PhilHealth	Health Maintenance Organization	Private Health Insurance Co.	Community/ Cooperative	Others
PHILIPPINES	15,925	4,977	31.2	27.5	1.2	5.1	4.2	1.3
Lowest 40%	6,370	565	8.9	6.5	0.1	0.5	1.9	0.5
Highest 60%	9,555	4,412	46.2	41.4	1.9	8.1	5.7	1.8
Urban	7,949	3,373	42.4	38.2	1.9	7.6	5.1	1.8
Lowest 40%	1,553	182	11.7	9	0.2	0.7	2.1	0.6
Highest 60%	6,396	3,191	49.9	45.3	2.3	9.3	5.8	2
Rural	7,976	1,603	20.1	16.8	0.5	2.5	3.3	0.8
Lowest 40%	4,817	383	7.9	5.7	-	0.5	1.8	0.5
Highest 60%	3,159	1,221	38.6	33.7	1.1	5.6	5.5	1.3
NCR	2,318	1,047	45.2	41.3	3.3	8.6	3.5	2.1
Lowest 40%	123	6	5.3	3.2	0.6	-	2.1	-
Highest 60%	2,194	1,041	47.4	43.4	3.4	9.1	3.5	2.2

Notes: "-" denoted count or less than 0.05 percent; A respondent can specify more than one type of health insurance plan. Percentages do not add up to 100.

Source: National Statistics Office, 2002 Annual Poverty Indicators Survey (APIS)

In the National Capital Region, 41.3 percent of the families have access to Philhealth. Yet, only 3.2 percent among the lowest 40 percent have access. The access of the highest 60 percent is considerably higher at 43.4 percent.

Using the data from APIS 2002, it is estimated that 31.8 percent of the families are income poor or have incomes below the poverty threshold. Table 2 shows that only 7.1 percent of the poor families have access to Philhealth. On the other hand, 37 percent of the nonpoor have access to Philhealth.

Table 2. Proportion of families who have access to Philhealth, 2002

Poverty status	Proportion of Families	
	With access to Philhealth	Without access to Philhealth
Poor	7.1	92.9
Nonpoor	37.0	63.0
Total	27.5	72.5

Source of basic data: APIS 2002, NSO.

Case of Pasay City

In Pasay City, 79.1% of households with income below the poverty threshold are not covered by the Philhealth Program in 2005 (refer to Table 3).

Table 3. Access to Philhealth Program of Income-Poor Households in Zone 19, Pasay City

Brgy	HHs with income below poverty threshold	HHs with access to Philhealth with income below poverty threshold	
		Magnitude	Proportion
Zone 19	1249	261	20.9
179	157	15	9.6
185	160	17	10.6
178	184	26	14.1
182	107	20	18.7
180	96	18	18.8
184	318	90	28.3
186	123	40	32.5
181	104	35	33.7

Source: CBMS Survey 2005

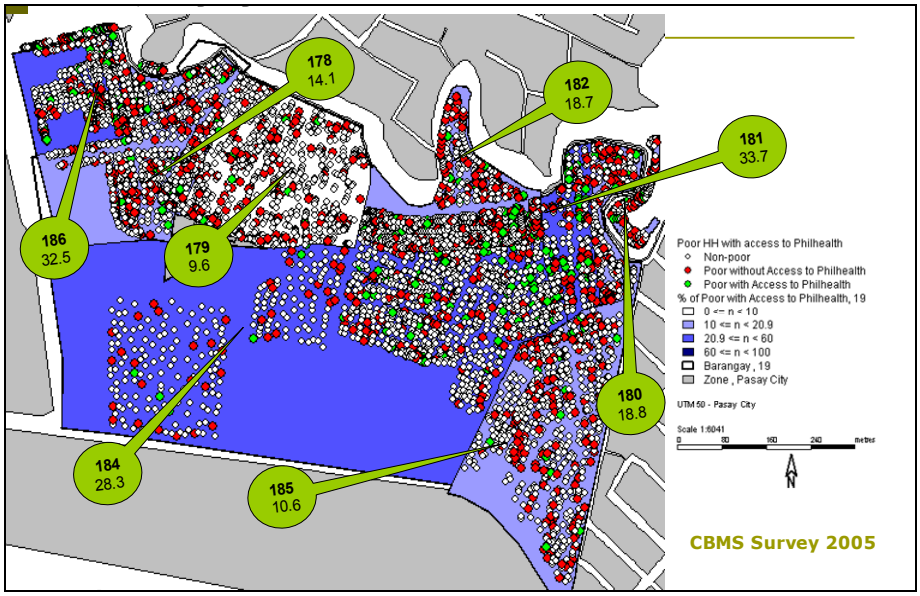

Figure 1
Proportion of Income-Poor Households
With Access to Philhealth
Zone 19, Pasay City, 2005

Philhealth coverage is also very low for subsistence-poor households at 78.7 percent. Table 4 shows that only 21.3 percent of the households whose incomes are not adequate to meet basic food needs are covered by Philhealth. Moreover, the proportion of subsistence poor households who have access to Philhealth varies widely from a low of 4.8 percent to a high of 35 percent. Barangay 179, with the lowest coverage of the subsistence poor, at 4.8 percent, is one of the poorest barangays in Pasay City.

Table 4. Access to Philhealth Program of Subsistence-Poor Households in Zone 19, Pasay City

Brgy	HHs with income below food threshold	HHs with access to Philhealth with income below food threshold	
		Magnitude	Proportion
Zone 19	488	104	21.3
179	62	3	4.8
185	67	4	6.0
180	34	7	20.6
178	67	14	20.9
182	46	12	26.1
184	114	30	26.3
181	58	20	34.5
186	40	14	35.0

Source: CBMS Survey 2005

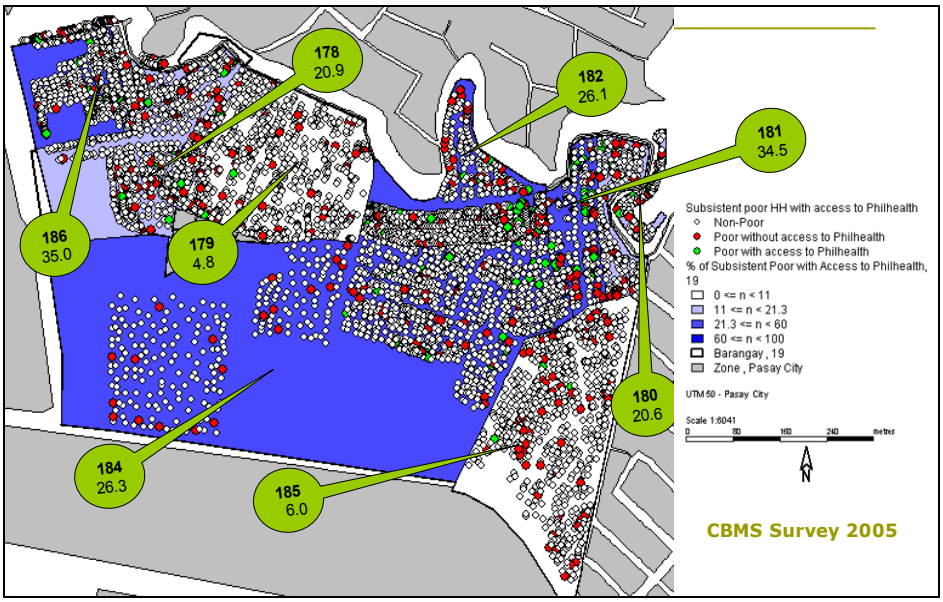

Figure 2

Proportion of Subsistence-Poor Households with Access to Philhealth Zone 19, Pasay City, 2005

3.2 Proposed Approach

We propose the following approach:
Use CBMS as the source of the data that will be used to identify the indigents.
Adopt a scheme that combines the different indicators in CBMS to identify the poor.

Why use CBMS? We propose the use of CBMS for several reasons: (i) CBMS is now being implemented in over 6000 barangays in 22 provinces; (ii) more provinces are set to implement CBMS within the next 12 months; (iii) it is envisioned that there will be nationwide implementation by 2010; (iv) LGUs bear the cost of implementing CBMS, making the system more sustainable than nationally or donor driven initiatives; and (v) it is being endorsed by NAPC, DILG and NEDA.

What is CBMS? CBMS is an organized way of collecting information at the local level for use of local government units, national government agencies, non-government organizations, and civil society for planning, program implementation and monitoring. It is a tool intended for improved governance and greater transparency and accountability in resource allocation.

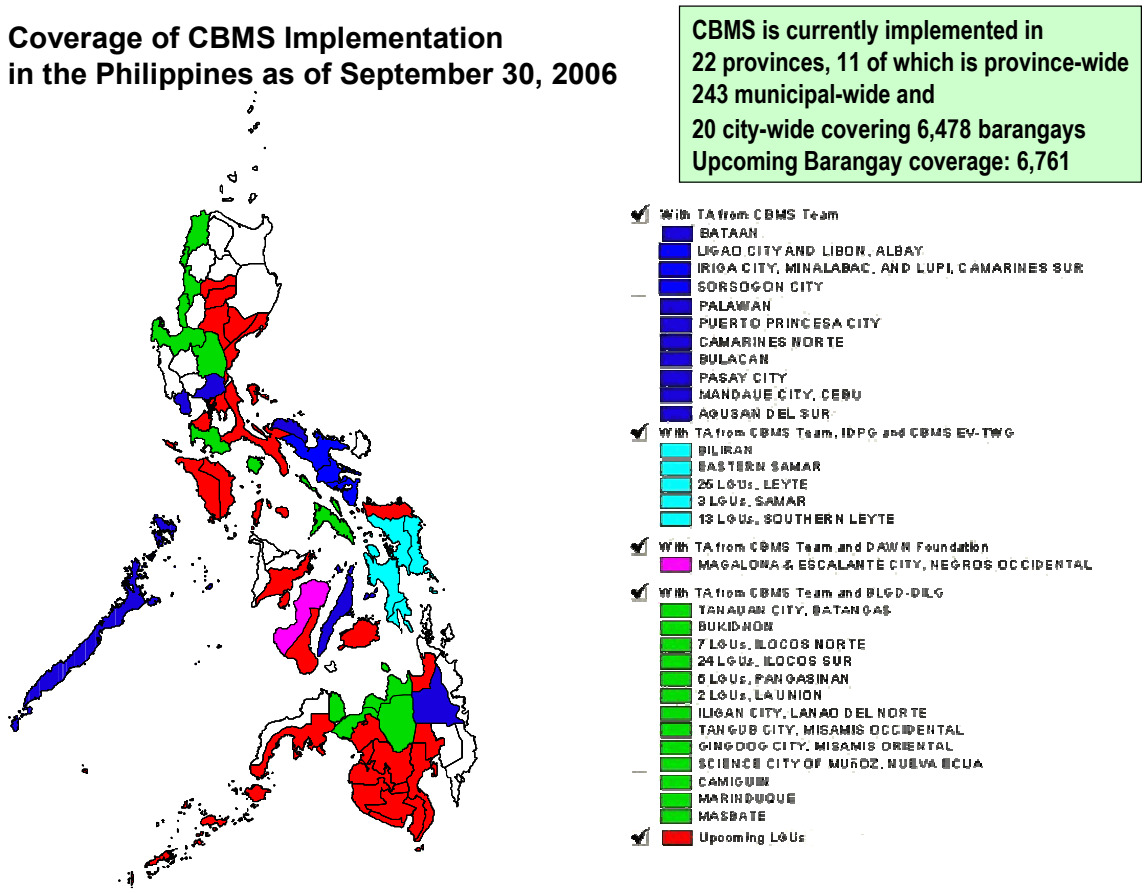

Figure 3

Coverage of CBMS Implementation
As of September 30, 2006

CBMS involves the complete enumeration of all households. LGUs take the lead in the data collection and processing, serve as the repository of the database and use the data in the formulation of annual development and investment plans. Members of the community are likewise involved in the whole CBMS process.

Data are submitted to the next higher geopolitical level, allowing for the establishment of databanks at each geopolitical level. It uses a mapping software (NRDB) to generate CBMS-based poverty mapping and for storing and displaying household- and individual-level information. There are 14 core indicators that are being measured to determine the welfare status of the population (refer to Table 5. These indicators capture the multidimensional aspects of poverty.

Table 5. Core Local Poverty Indicators

Basic Needs		Indicator
Health	1	Proportion of child deaths aged 0-5 years old
	2	Proportion of women deaths due to pregnancy-related causes
Nutrition	3	Proportion of malnourished children aged 0-5 years old
Shelter	4	Proportion of households living in makeshift housing
	5	Proportion of households classified as squatters/informal settlers
Water and Sanitation	6	Proportion of households without access to safe water supply
	7	Proportion of households without access to sanitary toilet facilities
Basic Education	8	Proportion of children 6-12 years old not in elementary school
	9	Proportion of children 13-16 years old not in secondary school
Income	10	Proportion of households with income below poverty threshold
	11	Proportion of households with income below subsistence threshold
	12	Proportion of households which experienced food shortage
Employment	13	Proportion of persons who are unemployed
Peace and Order	14	Proportion of persons who were victims of crime

4. Identifying Philhealth Beneficiaries

Eligibility Criteria for Identifying the Poor

A combination of self-targeting and proxy means tests are recommended to be used in selecting beneficiaries for the Philhealth for the indigent program.

It is highly recommended that beneficiaries of the Philhealth indigent program have to apply for inclusion in the program. This is already a form of self-assessment of eligibility for the program. This is consistent with objective of minimizing leakages. It is assumed that those who are non-poor will compare the opportunity costs of lining up to get the benefits versus the benefits from the program. To ensure that the problem of undercoverage as a result of this scheme, a dissemination strategy should be adopted that would inform the poor that such a program exists. For the means test, the following principles are being recommended:

a. Use indicators that can be verified by local program implementers.
b. Apply a method that is simple enough that LGUs and Philhealth provincial staff can implement it.
c. Adopt a monitoring system that will generate the data on a regular and frequent enough basis to allow updating of eligibility status.

Moreover, there should be mechanisms to withdraw program support in the event that the beneficiary is found to have provided false information. He/she will also be excluded from future Philhealth indigent program.

Means testing options

Three means testing options are considered. The households are proposed to be classified on the basis of the following:

i. income
ii. ownership of assets and socio-economic characteristics
iii. electricity consumption

A household is classified as poor or non-poor based on these three criteria. If the household is classified as non-eligible based on any of the categories, then that household is deemed not eligible for the Philhealth indigent program. If there is no income tax return or pay slips, the basis of the classification will just be the second and third criteria. This is likely especially for low-income households who are often employed in the informal sector and therefore may not have pay slips. Also, low-income households are also exempt from paying taxes and are not required to file income tax returns. If there is no electricity in the area, household cost for use of generators may be considered as the proxy for electricity bill.

Updating

Updating can be done every three years in line the conduct of the CBMS survey.

4.1 Income

Per capita income is computed based on total income reported in the CBMS survey divided by the household size. This is then compared with the per capita threshold for the city or municipality where the household resides. The NSCB releases the official poverty thresholds. In cases when the official poverty thresholds are not available, the most recent official poverty thresholds are updated using the consumer price index for the province, disaggregated by urban/rural.

The reported income can be verified from the income tax return or from pay slips. Per capita income net of tax is obtained by dividing taxable income by the family size. This is then

compared with per capita poverty threshold. In the absence of income tax return or pay slips, this classification will not be used.

It is likely that the poor would not have verifiable income documents and so the other two criteria, socio-economic index and electricity consumption, will be used.

4.2 Ownership of assets and socio-economic characteristics

It has been established in many previous studies that income is highly correlated with ownership of assets, access to basic amenities and housing structure and tenure. For this study, the Family Income and Expenditure Survey data for 2000[1] is used as the basis for establishing correlations between income and ownership of assets. Basis for inclusion are based on the frequency distribution by decile. Thus, assets or characteristics that can distinguish between the rich and the poor are included.

Tables 6a and 6b show the proportion of households in each income decile who own the different types of consumer durables. All the assets reveal a monotonic relationship with income, i.e., the proportion of households who own a particular asset increases as one goes up the income ladder. Refrigerator, in particular, exhibits big changes in proportions as income increases. These suggest the usefulness of these indicators in identifying the income-poor households.

Table 6a. Proportion of households who own assets, by income decile

National Income Decile	Proportion of households who own						
	Radio	Television	VTR/VHS/ VCD/DVD	Stereo	Refrigerator/ Freezer	Washing Machine	Airconditioner
First Decile	51.63	11.58	0.97	3.11	2.20	0.33	0.12
Second Decile	61.51	20.84	2.32	5.88	5.16	1.33	0.48
Third Decile	65.89	30.88	3.68	7.72	8.44	3.47	0.72
Fourth Decile	69.96	44.21	6.91	11.76	14.81	5.88	1.03
Fifth Decile	72.43	56.50	10.41	14.75	22.84	11.58	1.33
Sixth Decile	75.75	69.26	18.91	21.99	35.02	19.10	1.96
Seventh Decile	77.74	79.10	27.11	27.08	49.07	29.22	2.80
Eight Decile	79.88	86.09	39.22	35.41	62.23	41.93	4.34
Ninth Decile	81.79	92.40	53.65	46.53	77.65	56.79	8.93
Tenth Decile	82.96	95.84	70.14	62.75	89.62	70.02	26.21
All	71.95	58.67	23.33	23.70	36.70	23.96	4.79

Source of basic data: FIES 2000, NSO

[1] The FIES Public Use File 2000 is the most recent available dataset. The available PUF for FIES 2003 does not contain the urban/rural variable that is necessary for this analysis.

Table 6b. Proportion of households who own assets, by income decile

National Income Decile	Proportion of households who own						
	Sala set	Dining set	Car, jeep, motorcycle	Telephone/ Cellphone	Computer	Oven	Motorcycle
First Decile	9.20	8.29	0.03	0.03	0.00	0.03	0.51
Second Decile	16.23	11.92	0.03	0.18	0.03	0.00	0.51
Third Decile	23.16	16.59	0.12	0.27	0.06	0.12	1.30
Fourth Decile	31.33	24.67	0.27	0.78	0.06	0.30	1.99
Fifth Decile	38.85	31.43	0.69	1.78	0.09	0.51	2.65
Sixth Decile	48.63	40.75	1.09	4.71	0.30	0.90	4.46
Seventh Decile	59.80	51.51	2.50	9.56	0.63	2.50	5.58
Eight Decile	69.62	62.32	5.16	17.74	1.99	4.52	8.75
Ninth Decile	79.70	74.13	11.94	36.40	4.40	7.87	12.73
Tenth Decile	88.69	86.40	32.55	61.93	17.89	23.77	15.72
All	46.52	40.80	5.44	13.34	2.55	4.05	5.42

Source of basic data: FIES 2000, NSO

Access to basic amenities is also positively correlated with income. As can be seen from Table 7, the proportion of households who have access to sanitary toilet facilities, electricity and safe water supply increases as one goes up the income ladder. While there is only a small proportion of households who live in makeshift housing or are informal settlers, we still find the same positive monotonic relationship between income and not living in makeshift housing and income and not informal settlers. We also find that the proportion of households whose heads are not engaged in agriculture increases as one goes up the income ladder.

Table 7. Proportion of households with access to basic amenities, by income decile

National Income Decile	Proportion of households					
	with sanitary toilet facilities	with access to electricity	with access to safe water supply	not living in makeshift housing	HHs who are not informal settlers	HH head not engaged in agri
First Decile	35.28	29.31	3.08	96.11	95.90	24.00
Second Decile	42.75	45.31	7.51	97.04	95.32	34.57
Third Decile	50.66	54.67	10.19	97.44	96.20	41.25
Fourth Decile	60.13	67.40	13.33	97.35	95.48	49.43
Fifth Decile	69.08	77.71	18.82	97.89	95.60	59.43
Sixth Decile	76.17	86.27	27.99	97.98	96.32	67.66
Seventh Decile	82.54	90.59	33.99	98.31	96.86	73.46
Eight Decile	89.65	94.96	41.18	98.46	96.83	79.31
Ninth Decile	93.88	97.56	52.02	99.10	98.22	85.10
Tenth Decile	96.95	99.22	67.18	99.76	98.94	90.80
Total	69.71	74.30	27.53	97.94	96.57	60.50

Source of basic data: FIES 2000, NSO.

Given these results, the following variables are considered in determining the poverty status of the household:

1. Television
2. VCD/VHS/DVD
3. Computer
4. Refrigerator
5. Washing Machine
6. Microwave oven
7. Telephone
8. Airconditioner
9. Car/Jeep/Motor Vehicle
10. Sanitary toilet facilities
11. Electricity
12. Safe water supply
13. Makeshift housing
14. Informal settlers
15. Household head not engaged in agriculture.

Weighting system

The objective is to combine the different variables into a composite index that can be used as the basis for classifying households into poor or non-poor. One option is to assume equal weights for all of these assets and characteristics. Its simplicity makes it very easy to implement and understand. However, this is arbitrary.

Another option is to assign weights to the different variables. Weights for the various assets can be obtained from the logistic regression using FIES data. A logit regression is used to determine which of the consumer durables, access to basic amenities and housing characteristics are significant in determining poverty status based on income.

Model[2]

The dependent variable in the logistic regression model is binary, which takes on two values. Let *Y* be the random binary variable whose value is either 0 or 1. The probability *P(Y=1)* is given by

$$P(Y=1) = p = \frac{e^{\beta X}}{1+e^{\beta X}}, \qquad (1)$$

where: β = vector of coefficients, and;
X = vector of independent variables.

The above equation represents what is known as the (cumulative) **logistic distribution function**. If *P(Y=1)*, the probability that an event occurs, is given by (1), then, *1 – P(Y=1)*, the probability that an event does not occur, is

$$1 - P(Y=1) = 1 - p = \frac{1}{1+e^{\beta X}} \qquad (2)$$

[2] The derivation of the logistic regression model is taken from Gujarati (1995) and Sharma (1996).

Therefore, equations (1) and (2) can be written as

$$\frac{P(Y=1)}{1-P(Y=1)} = \frac{p}{1-p} = \frac{e^{\beta X}}{1+e^{\beta X}} \bullet \frac{1+e^{\beta X}}{1} = e^{\beta X} \qquad (3)$$

Equation (3) is simply the *odds ratio* in favor of an event occurring – the ratio of the probability that an event will occur to the probability that it does not occur.

Recall that: $\ln\left(e^{x}\right) = x$. Therefore, taking the natural logarithm of equation (3) will result in

$$\ln\left(\frac{P(Y=1)}{1-P(Y=1)}\right) = \ln\left(\frac{p}{1-p}\right) = \beta X \qquad (4)$$

Thus, the dependent variable is now a linear function of the independent variables. The left-hand side of the equation (4) is called the **logit**, and hence the name **logit model**.

4.2.1 Logit Regression Results

The objective is to find good predictors of the poverty status of the family using the logit model described in the previous section. Using the FIES 2000 dataset consisting of close to 49,000 sample families, the poverty status based on income (hpovstatus = 1 if non-poor and 0 if poor) is regressed against variables indicating ownership of various appliances (1 indicating that the family owns the appliance), housing tenurial status (1 if not informal settler), housing materials (0 if makeshift and 1 if not makeshift), access to basic amenities, and kind of business of head of family (whether engaged in agriculture or not).

The variable Y is described as:

$$\text{hpovstatus} = \begin{cases} 1, \text{ if household is nonpoor} \\ 0, \text{ otherwise} \end{cases}$$

The variables used in the vector X, however, are described below:

$$\text{hwtv} = \begin{cases} 1, \text{ if household owns television set} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwvtr} = \begin{cases} 1, \text{ if household owns VCD/VHS/DVD} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwref} = \begin{cases} 1, \text{ if household owns refrigerator} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwwash} = \begin{cases} 1, \text{ if household owns washing machine} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwaircon} = \begin{cases} 1, \text{ if household owns airconditioner} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwcar} = \begin{cases} 1, \text{ if household owns car/jeep/motor vehicle} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwphone} = \begin{cases} 1, \text{ if household owns telephone} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwcomputer} = \begin{cases} 1, \text{ if household owns computer} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwoven} = \begin{cases} 1, \text{ if household owns microwave oven} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hmksft} = \begin{cases} 1, \text{ if household does not live in makeshift housing} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hsquat} = \begin{cases} 1, \text{ if household is not an informal settler} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{htoilet} = \begin{cases} 1, \text{ if household has access to sanitary toilet facilities} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{helec} = \begin{cases} 1, \text{ if household has access to electricity} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hwater} = \begin{cases} 1, \text{ if household has access to safe water supply} \\ 0, \text{ otherwise} \end{cases}$$

$$\text{hnagri} = \begin{cases} 1, \text{ if household head is not engaged in agriculture} \\ 0, \text{ otherwise} \end{cases}$$

Cons = constant term

The results are as follows:

Table 8. Results of the logit regression model

hpovstatus	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
hwtv	.5611079	.037877	14.81	0.000	.4868703	.6353454
hwvtr	.69582	.0705026	9.87	0.000	.5576374	.8340026
hwref	.9719396	.0525887	18.48	0.000	.8688678	1.075011
hwwash	.845901	.0745165	11.35	0.000	.6998513	.9919506
hwaircon	.3347771	.1563701	2.14	0.032	.0282974	.6412567
hwcar	1.366696	.3042936	4.49	0.000	.7702918	1.963101
hwphone	1.787902	.2033881	8.79	0.000	1.389268	2.186535
hwcomputer	.3373174	.5235379	0.64	0.519	-.688798	1.363433
hwoven	1.375037	.4205102	3.27	0.001	.5508518	2.199221
hmkshft	.4636163	.088499	5.24	0.000	.2901615	.637071
hsquat	.1601172	.0722491	2.22	0.027	.0185116	.3017228
htoilet	.4606159	.0315428	14.60	0.000	.3987933	.5224386
helec	.4821787	.0369664	13.04	0.000	.4097259	.5546314
hwater	.4489743	.046286	9.70	0.000	.3582553	.5396932
hnagri	.444243	.030408	14.61	0.000	.3846444	.5038417
_cons	-1.432421	.1127046	-12.71	0.000	-1.653318	-1.211524

Source of basic data: FIES 2000, NSO.

The results lend support to the hypothesis that owning electrical appliances are positively correlated with being non-poor. Also those who live in makeshift housing or are informal settlers tend to be poor. Access to basic amenities such as piped water, water-sealed toilets and electricity are also positively correlated with being non-poor. If the family is engaged in agriculture, then that family tends to be poor.

All the coefficients have the correct sign. Moreover, with the exception of computer, all are statistically significant at the 5% level.

An alternative specification including urbanity variable yields similar results except that the urbanity variable is statistically insignificant. Given this, the specification presented above is retained as the model for estimating the weights for the variables.

To get an indication of the performance of the model, we can see how well it does in terms of classifying the families. Various cut-offs are tried in classifying whether a family is poor or non-poor. If a family has a probability of being non-poor greater than or equal to the specified cut-off, then that family is classified as non-poor.

Sensitivity is a measure of the probability of the family being classified as non-poor given that the family is actually non-poor while specificity is a measure of the probability of the family being classified as poor given that the family is actually poor. The table shows that there is a trade-off between the two, although not exactly of the same amount. The higher the probability cut-off, the lower is the sensitivity and the higher is the specificity of the model.

Of the total 33,155 households, the model correctly classifies 25,646 of the households, or an accuracy of 77.35 percent. It correctly classifies as non-poor those who are actually non-poor, 86.72 percent of the time as indicated by the sensitivity index. It correctly classifies as poor those who are actually poor 55.28 percent of the time as shown by the specificity index. Using this cut-off will lead to low leakage rate but high exclusion rate.

With a cut-off of 0.7, the specificity increases to 83.66 percent, but this is achieved at a lower sensitivity of 69.21 percent. This leads to a lower predictive accuracy of 73.51percent. Using a cut-off of 0.8 further increases the specificity to 91.33 percent but this also reduces the sensitivity to 59.45 percent. The overall predictive accuracy is 68.95 percent.

Table 9. Predictive accuracy for probability cut-off of 0.50

	True		
Classified	Non Poor (D)	Poor (~D)	Total
Not Eligible(+)	20186	4417	24603
Eligible(-)	3092	5460	8552
Total	23278	9877	33155

Classified + if predicted Pr(D) >= .5
True D defined as hpovstatus != 0

Sensitivity	Pr(+| D)	86.72%
Specificity	Pr(-|~D)	55.28%
Positive predictive value	Pr(D| +)	82.05%
Negative predictive value	Pr(~D| -)	63.84%
False + rate for true ~D	Pr(+|~D)	44.72%
False - rate for true D	Pr(-| D)	13.28%
False + rate for classified +	Pr(~D| +)	17.95%
False - rate for classified -	Pr(D| -)	36.16%
Correctly classified		77.35%

Table 10. Predictive accuracy for probability cut-off of 0.70

```
                -------- True --------

Classified     |     Non Poor   Poor  |      Total
                        (D)      (~D)
---------------+----------------------+------------
Not Eligible(+)|     16110      1614  |      17724
Eligible(-)    |      7168      8263  |      15431
-====----------+----------------------+------------
   Total       |     23278      9877  |      33155

Classified + if predicted Pr(D) >= .7
True D defined as hpovstatus != 0
-------------------------------------------------
Sensitivity                     Pr( +| D)   69.21%
Specificity                     Pr( -|~D)   83.66%
Positive predictive value       Pr( D| +)   90.89%
Negative predictive value       Pr(~D| -)   53.55%
-------------------------------------------------
False + rate for true ~D        Pr( +|~D)   16.34%
False - rate for true D         Pr( -| D)   30.79%
False + rate for classified +   Pr(~D| +)    9.11%
False - rate for classified -   Pr( D| -)   46.45%
-------------------------------------------------
Correctly classified                        73.51%
```

Table 11. Predictive accuracy for probability cut-off of 0.80

```
                -------- True --------

Classified     |     Non Poor   Poor  |      Total
                        (D)      (~D)
---------------+----------------------+------------
Not Eligible(+)|  3838           856  |      14694
Eligible(-)    |  9440          9021  |      18461
---------------+----------------------+------------
   Total       | 23278          9877  |      33155

Classified + if predicted Pr(D) >= .8
True D defined as hpovstatus != 0
-------------------------------------------------
Sensitivity                     Pr( +| D)   59.45%
Specificity                     Pr( -|~D)   91.33%
Positive predictive value       Pr( D| +)   94.17%
Negative predictive value       Pr(~D| -)   48.87%
-------------------------------------------------
False + rate for true ~D        Pr( +|~D)    8.67%
False - rate for true D         Pr( -| D)   40.55%
False + rate for classified +   Pr(~D| +)    5.83%
False - rate for classified -   Pr( D| -)   51.13%
-------------------------------------------------
Correctly classified                        68.95%
```

The results of the simulations corresponding to the different cut-offs are presented in Table 12. Using the higher cut-off will result to a higher leakage rate but lower exclusion rate. It is recommended that cut-off of 0.8 be used since at this cut-off the poor are correctly classified as poor more than 90 percent of the time. This implies that the exclusion will be less than 10 percent. This leakage can then be reduced by the other criteria that will be used such as income and electricity consumption.

Table 12. Sensitivity and Specificity at various probability cut-offs

Item		Probability Cutoff						
		0.5	0.55	0.6	0.65	0.7	0.75	0.8
Sensitivity	Pr(+| D)	86.72%	80.43%	79.00%	74.62%	69.21%	67.39%	59.45%
Specificity	Pr(-|~D)	55.28%	68.37%	71.42%	77.26%	83.66%	85.26%	91.33%
Positive predictive value	Pr(D| +)	82.05%	85.70%	86.69%	88.55%	90.89%	91.51%	94.17%
Negative predictive value	Pr(~D| -)	63.84%	59.71%	59.06%	56.37%	53.55%	52.60%	48.87%
False + rate for true ~D	Pr(+|~D)	44.72%	31.63%	28.58%	22.74%	16.34%	14.74%	8.67%
False - rate for true D	Pr(-| D)	13.28%	19.57%	21.00%	25.38%	30.79%	32.61%	40.55%
False + rate for classified +	Pr(~D| +)	17.95%	14.30%	13.31%	11.45%	9.11%	8.49%	5.83%
False - rate for classified -	Pr(D| -)	36.16%	40.29%	40.94%	43.63%	46.45%	47.40%	51.13%
Correctly classified		77.35%	76.84%	76.74%	75.41%	73.51%	72.72%	68.95%

Note: Classified + if predicted Pr(D)>=*(Probability Cut-off)*

Application to CBMS data

The regression coefficients derived from the logit model serve as the weights for these variables. These coefficients can then be applied to the dataset from the LGU to come up with the composite index for economic status.

4.3 Electricity Consumption

Electricity consumption has been used as a good indicator of the economic status of the household. The idea is that a poor household will have very few electrical appliances and light bulbs. Thus, electricity consumption will be closely correlated with poverty status.

The key is to find that threshold of electricity consumption that can serve as the cut-off between the poor and the non-poor. Assuming that poor households would have the barest of appliances and lighting fixtures, we can derive the appropriate cut-off. For instance, if we assume that the household used three light bulbs at an average of 8 hours each day and a radiocasette for 6 hours each day, the electricity bill for the month would be around P100. (refer to Table 13). The electricity usage of specific appliances are obtained using the Meralco Appliance Calculator from the website of Meralco, http://e-services.Meralco.com.ph.

Table 13. Electricity Usage for Monthly Electricity Bill of P100

	Hours used	Cost per Month
Light Bulb (25w)	8	22.85
Light Bulb (25w)	8	22.85
Light Bulb (25w)	8	22.85
Radio cassette rec.	6	34.27
Electricity Bill (in pesos)		**102.82**

If we assume that in addition to the light bulbs and the radiocasette, the household uses a television and electric fan, we arrive at an electricity bill of around P200 per month (refer to Table 14).

Table 14. Electricity Usage for Monthly Electricity Bill of P200

	Hours used	Cost per Month
Light Bulb (25w)	6	17.14
Light Bulb (25w)	6	17.14
Light Bulb (25w)	6	17.14
Light Bulb (25w)	6	17.14
Light Bulb (25w)	6	17.14
Radio cassette rec.	6	34.27
TV set (14") color	6	54.84
Electric fan (stand,desk)	6	20.56
Electricity Bill (in Pesos)		**195.37**

Tables 15, 16 and 17 illustrate possible electricity usage for electricity bills amounting to P300, P400 and P500 , respectively.

Table 15. Electricity Usage for Monthly Electricity Bill of P300

	Hours used	Cost per month
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
TV set (color 14")	8	95.50
Electric fan (stand, desk)	12	53.72
Electricity Bill (in Pesos)		**298.42**

Table 16. Electricity Usage for Monthly Electricity Bill of P400

	Hours used	Cost per month
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
Incandescent Bulb (25 watt)	8	29.84
TV set (color 14")	10	119.37
Electric fan (stand, desk)	16	71.62
Radio cassette recorder	6	59.68
Electricity Bill (in Pesos)		**399.87**

Table 17. Electricity Usage for Monthly Electricity Bill of P500

	Hours used	Cost per month
Incandescent Bulb (25 watt)	8	36.81
Incandescent Bulb (25 watt)	8	36.81
Incandescent Bulb (25 watt)	8	36.81
Incandescent Bulb (25 watt)	8	36.81
Incandescent Bulb (25 watt)	8	36.81
TV set (color 14")	12	176.71
Electric fan (stand, desk)	18	110.44
Radio cassette recorder	3	27.61
Electricity Bill (in Pesos)		**498.81**

Case of Pasay

The number of households in Pasay City who consume electricity of P100 or less per month is 3,953, representing 8.51 percent of the total number of households. About 8.9 percent consume electricity of more than P100 and less than P200 per month. This means that 17.38 percent of the households spend P200 or less on electricity. More than half of the households spend more than P500 per month on electricity. Table 18 shows the percentage distribution of households by electricity consumption per month.

Table 18. Percentage distribution of households by electricity consumption

Electricity Consumption per month	Frequency	Percentage	Cumulative Percentage
P100 or less	3,953	8.51	8.51
More than P100 – P200	4,118	8.87	17.38
More than P200 – P300	3,792	8.17	25.55
More than P300 – P400	2,298	4.95	30.50
More than P400 – P500	5,381	11.59	42.09
More than P500	26,887	57.91	100.00
Total	46,429	100.00	

Table 19 shows the average monthly electricity bill by decile. The lowest 10 percent of the households in terms of electricity bill spends on the average P53. The second lowest decile spends on the average P218 per month on electricity. The highest decile spends on the average P5,043 on electricity.

Table 19. Average monthly electricity bill by decile

Decile	Average electricity bill (in pesos)
1	53
2	218
3	339
4	490
5	615
6	878
7	1,030
8	1,335
9	1,798
10	5,043
All	1,180

4.4 Application to Pasay City

Ranking of households using the three criteria

The rankings of households using the three criteria are examined to see if there is correlation among the rankings. Spearman's rho rank correlation and Kendall's tau rank correlation tests indicate significant positive correlation among the ranks of the households based on the three criteria. This lends support to using electricity as a second stage screening variable.

Estimate of eligible beneficiaries for the Philhealth Indigent program

Using the data from Pasay City, the proportion of households that can be considered poor based on each of the criteria are shown below. If we use income as the criterion for choosing the

beneficiaries for the Philhealth indigent program, then we have a target population of 13.24 percent of the total number of households. If we use the socioeconomic index as the basis for identifying eligible beneficiaries, then the target population is 19.62 percent. On the other hand, if we use electricity consumption, wherein a household who consumes P100 or less of electricity per month is considered poor, then the target population is 8.51 percent. If we use as the P200 electricity consumption as the cut-off, then the eligible population is 17.38 percent.

Since the use of the socioeconomic index may lead to leakage, a second stage screening is recommended. The electricity consumption of those who are determined poor based on the socioeconomic index is examined. The data indicate that if we use the cut-off of P500 electricity bill, the eligible population is 15.92 of all households. If P400 is used as the cut-off, then the proportion of eligible households goes down to 13.2 percent. Similarly, if the cut-off is reduced to P300, the eligible population is further reduced to 11.72 percent of the total number of households. If the cut-off is reduced to P200, then the corresponding proportion drops further to 8.68 percent. Finally, if the proportion is reduced to P100, then the proportion of eligible households goes down to 4.58 percent.

The two-stage screening method can be used to prioritize the eligible beneficiaries of the Philhealth Indigent Program. It is recommended that the socioeconomic index using a probability cut-off of 0.8 be used at the first stage. Then the electricity consumption is used as the second filter. It is recommended that a cut-off of P100 monthly electricity bill be used to identify the poor and therefore are eligible for the Philhealth for the Indigent Program. In cases where there are still funds available to support the enrollment of more people, a higher cut-off for electricity consumption of P200 can be used.

Table 20. Estimate of Eligible Households

Criterion	Freq.	Percent
per capita income	6,148	13.24
socioeconomic index	9,108	19.62
electricity consumption (P100 or less)	3,953	8.51
electricity consumption (P200 or less)	8,071	17.38
electricity consumption (P300 or less)	11,863	25.55
electricity consumption (P400 or less)	14,161	30.50
electricity consumption (P500 or less)	19,542	42.09
socioecon index and electricity of P100 or less	2,126	4.58
socioecon index and electricity of P200 or less	4,032	8.68
socioecon index and electricity of P300 or less	5,442	11.72
socioecon index and electricity of P400 or less	6,128	13.20
socioecon index and electricity of P500 or less	7,393	15.92

5. Concluding Remarks

The present method of identifying the eligible beneficiaries for the Philhealth Indigent Program using reported income can be improved by adopting the methodology proposed here. Three criteria are used as the basis for identifying eligible beneficiaries: income, socioeconomic index and electricity consumption. Since many poor people may not have verifiable income records, it

is recommended that a two-stage screening using the other two criteria be adopted. Households are first classified using socioeconomic variables that are predictors of income-based poverty status. A second stage screening based on electricity consumption is then applied to those who passed the first screening.

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