Constructing Pragmatic Socioeconomic Status Assessment Tools to Address Health Equality Challenges

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ABSTRACT

Background: A key challenge for equality evaluation and monitoring, mainly in developing countries, is assessing socioeconomic status (SES) of individuals. This difficulty along with low technical competency, have resulted in many health information collected in these countries which are devoid of suitable SES indices. However, simplifying data collection requirements for estimating economic parameters seems to guarantee their wide adoption by survey and health information system (HIS) designers, resulting in immediate production of equity-oriented policy-relevant information. The goal of this study is obtaining adequate number of variables, which their combination can provide a valid assessment of SES in Iranian population.

Methods: The data source was Living Standards Measurement Study of Iran (2006). Data of 27,000 households on the ownership of 33 household assets was used for this analysis. Households of this study were divided into 5 groups in terms of SES status using principle component analysis. Then selection was made among the 33 variables so that a combination with minimum necessary number for obtaining SES status is reached. Agreement of the new combination (including minimum number of variables) with full variable combination (including all 33 variables) was assessed using weighted kappa.

Results: A minimum set of six variables including having kitchen, bathroom, vacuum cleaner, washing machine, freezer and personal computer could successfully discriminate SES of the population. Comparing this 6 item-index with the whole 33 item-index revealed that 65% of households were in the same quintiles, with a weighted kappa statistics of 0.76. For households in different quintiles, movement was generally limited to one quintile, with just 2% of households moving two or more quintiles.

Conclusions: The proposed simple index is completely applicable in current Iran's society. It can be used in different survey and studies. The development is quite simple and can be done on a yearly basis using the updated National level data. Having such standardized simplified and up to date SES indices and incorporating them into all health data sources can potentially ease the measurement and monitoring of equity of health services and indices.

Key words: Equality, Iran, socioeconomic status measurement

INTRODUCTION

There is growing evidence of inequalities within countries.[1] Concerns have been raised that general deveopments may not necessarily reduce such inequalities[2] and therefore regular data monitoring is required.[3,4] A key challenge for equality evaluation and monitoring, mainly in developing countries, is assessing the socioeconomic status (SES).

Measuring household economic status in developing countries poses considerable problems. Data on two frequently used indicators of wealth, household income and expenditure levels, are often unavailable or unreliable.[5] Moreover, in countries where a large part of the population works in self-subsistence agriculture of the informal sector, expressing income or expenditure levels in monetary values can be extremely time-consuming and suffers important reliability problems.

In this setting, the assets that households have acquired are a good indicator of their 'long-run' economic status.[6,7] The World Bank has developed a tool to measure the relative economic position of households using data on durable consumer goods, housing quality, water and sanitary facilities and other amenities.[8] These assets are combined into an index of economic status using principal component analysis (PCA). The PCA method has been shown to provide a measure of economic status that has a higher predictive value, than other proxies such as an index based on the value of goods owned, or occupation.[7]

The limitation of existing asset indicators is that they often comprise many assets and therefore it is impractical to add them to the already lengthy health study questionnaires, or to administer them in facilities where patients may be in life-threatening conditions or when resources to administer SES measurements are limited. Therefore, we sought to develop and validate a tool with a limited number of indicators to allow easy and quick administration. We also aimed to develop a pragmatic tool that can be rapidly used to calculate a score in the field.

METHODS

Data

The National Statistical Office (NSO) of Iran provides each year an estimate of the national demographic characteristics, annual income, annual consumption expenditure, ownership of assets and housing quality. The Living Standards Measurement Study (LSMS) data is obtained using each year a survey of about 27,000 nationally representative households (14,000 rural and 13,000: Urban) from 28 provinces, sampled proportional to the size of the province population. We used the dataset of year 2006 for our analyses.

Statistical analysis

In the dataset of NSO we found 33 variables which could be informative of SES [Table 1]. First we aimed at developing a composite wealth index from these variables. We used the World Bank technique of developing wealth index by principal component analysis (PCA) and setting the first extracted principal component as the wealth index. In this technique weights of items in the composite wealth score areactually the factor scores. A factor score is a measure of the strength of the association of an item with the first principal component. We did not use the sampling of the survey during the PCA procedure, but we considered them when constructing population wealth quintiles.

All analyses were performed using STATA/SE. Using PCA method on all 33 asset ownership and housing quality indicators a proxy wealth index was constructed. For selecting the best indicators for constructing the simple asset index, wealth index was regressed onto the 33 asset indices using forward selection method. Variables were selected

Table 1: List of indicators ordered based on their priority in entrance to the linear regression model

Rank	Asset	Rank	Asset	Rank	Asset
1	Washing machine	11	Mobile	21	Radio
2	Bathroom	12	Sewing	22	BW TV
3	Kitchen	13	Telephone	23	Bicycle
4	Freezer	14	Car	24	Central heating
5	Vacuum	15	Cooler	25	Fan
6	Computer	16	Recorder	26	Electricity
7	Gas	17	Oven	27	Motorcycle
8	Area	18	Video	28	Cent cool
9	Rooms	19	Piped water	29	Refrigerator
10	Color TV	20	Internet	30	Internet

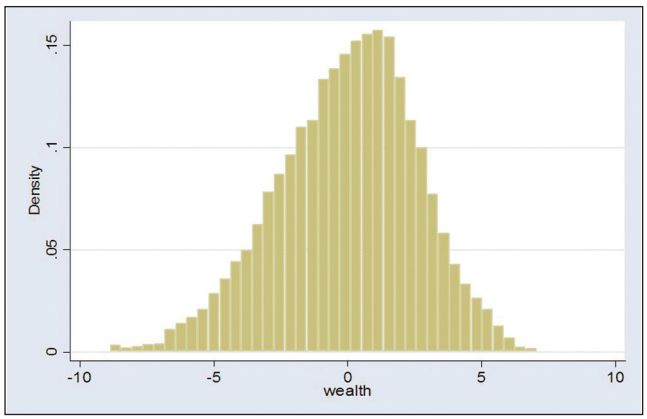

Figure 1: The histogram of the constructed wealth index

Table 2: The first five indices constructed by the first 5 to 9 indicators in comparison with the base ranking

Index	Pearson's r	Spearman's r	Percent agreement	Kappa
5 asset	0.91	0.88	59.87	0.49
6 asset	0.90	0.89	63.00	0.54
7 asset	0.91	0.90	61.48	0.52
8 asset	0.94	0.91	66.00	0.57
9 asset	0.94	0.91	89.00	0.61

for PCA using their order of entrance into the linear regression model by forward method. The first index was constructed by the first 5 assets then increased up to 9 assets [Table 2]. Again PCA was used for weight calculations.

Three measures computed for checking the validity of the constructed simple index, Pearson's correlation coefficient between the new index and the 33-item wealth index, Spearman's correlation coefficient of quintiles produces by new index and main wealth index and percent agreement in the two wealth quintile assignments and its weighted kappa statistic.

RESULTS

The constructed wealth index on 33 asset indicators present in the data set had showed a principal component's eigenvalue equal to 6.76, which could explain about 20.5% of the variance in the data. The distribution of the constructed index was rather normal without truncation or clumping, which is illustrated in Figure 1.

Regressing the asset indicators onto the constructed 33-item proxy wealth index using

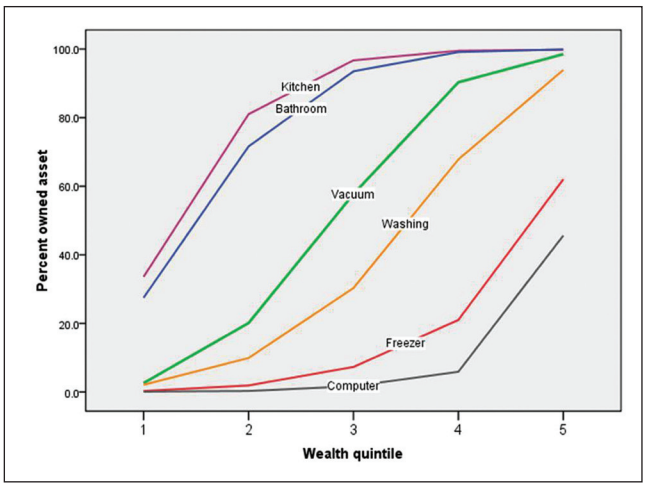

Figure 2: The distribution of asset items' ownership in each quintile of the community

forward regression method produced an ordered list of indicators, which is presented in Table 1. The first indicators' list is: Washing machine, bath room, kitchen, freezer, vacuum cleaner and personal computer (PC). Their corresponding weights are .46, .41, .40, .37, .47, .32. This 6-item indicator was selected as the index with minimum number of indicators which had reasonable agreement. [Table 2]. Figure 2 presents the distribution of these items' ownership in each community quintiles.

Because of the similarity of the weights of indicators in the PCA model which are all around .4, we replaced these weights with 1 to compute the index as: Kitchen + bathroom + washing machine + vacuum cleaner + freezer + PC. Comparing this very simplified index with the 33-item wealth index was done by comparing agreement of quintiles; Table 3 presents it. About 65% of households were in the same quintiles, with a weighted kappa statistics of 0.76. For households in different quintiles, movement was generally limited to one quintile, with just 2% of households moving two or more quintiles. The relationship between this score and the quintile the household belongs to is summarized in Table 4.

DISCUSSION

Socioeconomic status (SES) is a concept used in most studies. Its measurement is important not only in studies related to social determinants of health or measuring health socioeconomic-inequalities,[9] but also in almost all studies due to its confounding role.[10,11] SES includes two wide and interconnected

Table 3: Comparison of the agreement between the quintiles produced based on the 33-item proxy wealth index and the very simplified (VS) 6-item proxy wealth index

		Quintiles of Wealth					
		1	**2**	**3**	**4**	**5**	**Total**
Quintiles of the 6-item Proxy Wealth Index	1	4496	1536	92	2	1	6127
	2	851	3016	1647	165	4	5683
	3	32	732	2561	1374	12	4822
	4	0	94	1020	3030	1279	5423
	5	0	1	59	808	3971	4839
Total		5379	5379	5379	5379	5379	26895

Table 4: The relationship between the simplified score and the quintile the household belongs to

Quintiles of VS	Score
1	0-1
2	2
3	3
4	4
5	5-6

axes: Class and status. Socio-economic class points to social groups resulting from interconnected economic, social and legal relationships in the population, while socioeconomic status is an accumulative concept referring to assets, income from assets and expenditures resulting from these incomes. SES is a combined indicator for social factors affecting health, which may include different factors including income, education, job, etc, and usually a combination of them is used for measuring effect of SES.[12] Thus, it cannot be said that an variable alone can represent this indicator.[13] For example, in various studies, effect of job on various aspects of health has been assessed as one of the best variables due to its relevance to other factors shaping SES.[14]

Other than known variables such as education and job, what is common is measuring this indicator using monetary indices such as income or expenditure. In most developed countries, SES indicator is household income or expenditures,[15-17] while measuring these variables in developing countries is not as easy as in the developed countries and requires other methods, since much part of community in these countries do not have fixed income and use different resources and do not have recorded expenditures.[18-20]

Considering these limitations, World Bank recommended using characteristics of residence place, facilities and living means as good indicators for long-term economic status of households and based on which relative indices of households' economic status can be made.[21,22] The problem with these indices is that these questions assess only part of wide range of SES and do not provide a perfect index. In addition, the number of these variables is large and adding them to health questionnaires or national reporting forms is usually impossible.[23]

This study could identify 6 items as predictors of SES index, which have appropriate validity compared to 33 items and their combination method is simple so that respective community can be classified into 5 SES categories. In most studies in other developing countries addressing development of socioeconomic indices, national data such as LSMS were used, which is annually collected with the aid of World Bank. For example, Morris *et al*. investigating this data in Mali, Malawi and Ivory Coast studied validity of quick assessment indices of household income and wealth in African rural areas.[24] They used two methods. First was creating asset-based index, which was obtained by multiplying household access to each asset by reverse percentage of community having that asset and summing them. They investigated validity of this method by monetary value of household assets. When both variables were changed logarithmically, their correlation was obtained as 0.74 and 0.83 in Mali and Malawi, respectively. The other method used by these authors was selection of some questions for assessing total household expenditures. In this method, it was assumed that households with higher expenditures have higher SES. In this study, authors used statistical algorithm proposed by Mark *et al,* known as Max-r in order to reach a shortened list of expenditure questions which could give good assessment of household expenditures.[25] They could obtain a short list of 10 questions related to expenditures in Ivory Coast, results of which showed 0.79 correlation coefficient with total household expenditure.

In the present study, appropriate agreement was observed among 6 selected items with total SES variables. In addition, un-weighted combination of these items showed that it is possible to classify community at national level into 5 SES classes. It should be noted that selected sample which included over 27,000 families, is a national sample,

therefore the result is generalizable to national level data and not to any specified population. For example, having fridge freezer and PC in home for discriminating low SES classes do not have necessary power and having kitchen and bathroom are not discrimantory at high SES levels. Thus, if a study, say in the capital of the country is going to create discrimination at mid-high SES level, using assets such as having kitchen and bathroom would not be useful, while, in deprived rural communities such as Bashagard district and or Sistan-Baluchestan province, considering PC and fridge freezer do not have discrimination power.

Another limitation is speed of people adopting technology, which can make items combination and their discriminatiory power different over time. For example, by developing new generations of a product and lowering its cost, probably this combination changes and it is necessary to find new combinations of these variables in periodic studies such as LSMS.

One of advantages of this classification is its easy application for users and its understandability by all including policy makers.

The other important point is that in some countries like UK, there have been classifications for allocating resources and considering people health as early as about 100 years ago.[26] Certainly using this kind of classifications in these countries, which are used by other decision making systems, other than health, would be useful. However, on the other hand, if we accept that the aim of defining social variables in health arena is investigating their impact on health and classes needing various interventions, thus considering combination of indices in such a way that it can have the highest impact on health will be useful.

In a study in Bangladesh, the authors created an index for measuring women's SES so that they can assess and monitor socioeconomic inequality in health system in providing maternal service using this index.[27] Their goal was obtaining an index with limited number of questions so that they can measure it in the location of health service delivery. Questions were selected from demographic and health survey (DHS). First, the authors ranked households based on socioeconomic status using PCA. Then, they measure correlation of each variable used for creating PCA index with developed index. To this end, they classified samples in to five quintiles using index and investigated frequency of each variable in each quintile. Variables showing highest relationship with socioeconomic quintiles were selected and some scores were assigned to them, which were proportionate with importance level of variable in socioeconomic status.

In a study by Patel *et al*., for developing a simple index, which can be used for diving families with children suffering from diarrhea into 4 income classes, in a sample including 300 individuals referring to hospital, income and wealth level of 25 variables including living facilities were investigated and 8 questions were selected and the index was designed according to it, and based on which suggested income groups had 43% consistency with real income groups.[28]

Since the choice of assets and their weights are context specific, the proposed simple index is specific to current Iran's society and cannot be recommended for other time periods or other countries; however, there are now few countries in the world where such a survey (or censuses with asset items included in their questionnaires) has not been conducted repeatedly over the past decade. We think that presenting this idea may promote executives of other countries to adopt this method for constructing standardized pragmatic and quick means of assessing the poverty status in their country, which can be easily applied even in sub-district levels of data collection and equity monitoring.

CONCLUSIONS

To move forward quickly toward integrating equity into health information systems, a feasible, cost-effective and short-term recommendation is to construct standardized simplified SES indices and incorporate them into all sources. We propose that this simplification is able to improve potential for equity analysis and pro-equity policies, especially in developing countries.

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