POVERTY STATISTICS AND INDICATORS: HOW OFTEN SHOULD THEY BE MEASURED?

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INTRODUCTION

In 1999, the Asian Development Bank declared the reduction of poverty in its borrowing countries as its overarching goal (ADB, 1999). Part of the operational strategy developed to achieve this goal is the forging of a Poverty Reduction Partnership Agreement (PRPA) with each borrowing country. Through a synergy of the inputs of government, civil society and funding agencies, PRPA sets out a ten-year vision and agreed targets for poverty reduction. Most of the targets are represented by quantitative outcome or output indicators. For example, those used in the PRPA signed by the Government of Bangladesh and ADB in April 1999 are shown in Table 1. In the language of the Bangladesh PRPA, these poverty indicators are of two types. One type consists of income (or expenditure) indicators, e.g. headcount ratio or the proportion of persons below the poverty line. A second type measures the human (or non-income) dimensions of poverty, e.g. education and health indicators.

One target is to reduce poverty incidence from 46.5% in 1996 by ¼(or 35%) in 2005 and by ½(or 23%) in 2010. Others are 100% primary education completion rate in 2010, eliminating gender disparity in access to education in 2005, reducing maternal mortality rate by 35 % in 2005 and by 75% in 2010, and so on. Under the agreement, the Government will establish a monitoring system to generate annual estimates of the selected indicators, while ADB agrees to provide technical assistance for setting up and implementing such a monitoring system.

Other donors have similar initiatives. The UNDP's *Human Development Report* presents annual updates of indicators and composite indexes based on them, e.g. human development index. In the World Bank/IMF Poverty Reduction Strategy Paper (PRSP) that is being required initially from highly indebted poor countries, the monitoring of goals for poverty reduction will be through a range of indicators, including outcome indicators like those in Table 1. The plan includes the preparation of annual PRSP progress reports by the national authorities. While the plan does not specifically call for annual updating of outcome indicators, some country PRSP's do (see e.g. Tanzania in http://www.worldbank.org/hipc/). The UN's Common Country Assessment (CCA) Framework contains a long list of indicators mutually agreed to be used by some 15 UN system organizations (UN, 1999). These indicators are to be disaggregated by sex, sectors and smaller areas deemed important by stakeholders. In particular, poverty indicators are time series to begin from 1990 and continuously monitored against milestones leading to 2015 goals. Again, while the CCA has no specific recommendations concerning the frequency of updating of the suggested indicators, the assistance given to countries sometimes result in annual monitoring, hence annual updating of outcome indicators. An example is

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UNICEF's program in Bangladesh to monitor progress towards the goals of the World Summit for Children. An annual Multiple Indicators Cluster Survey (MICS) was launched, the results from which are presented in a yearly publication, *On the Road to Progress*: *Achieving the Goals for Children in Bangladesh,* which shows annual time series, with some disaggregated up to urban and rural segments of districts and by sex. The International Development Research Center (IDRC) of Canada is funding a multi-country project called Micro Impacts of Macroeconomic and Adjustment Policies (MIMAP) that involves the production of poverty-related indicators for small areas like districts divided further into urban and rural segments.

This note examines the scientific support for the recommendation to monitor poverty annually, at national and subnational levels, through the above indicators. This is done by analyzing the changes vis-à-vis the errors in the indicators and assessing the likelihood of isolating the real signals (changes) from noise (error). Empirical results from two developing countries – Bangladesh and Philippines - are used. The note concludes with recommendations towards establishment of an inferentially sound and sustainable poverty monitoring system.

Table 1. Indicators and Targets in the PRPA Between Bangladesh and ADB

Indicator	Benchmark (latest year)	Mid-term target (2005)	Long-term target (2010)
Persons below poverty line (%)	46.5 (1995-96)	35	23
Completed primary education (%)	n.a.[a/]	not specified	100
Children aged 6-10 years not in school (%)	18 (1997)	9	not specified
Gender disparity in access to education	n.a.[a/]	complete elimination	complete elimination
Maternal mortality rate (per 100,000 live births)	440 (1997)	286	110
Infant mortality rate (per 1000 live births)	66 (1997)	46	23
Under 5 mortality rate) (per 1000 live births)	112 (1997)	78	39
Malnourished children under 5: moderate and severe underweight (%)	58 (1996)	46	35
Proportion of women without access to reproductive health services	n.a.[a/]	not specified	not specified

[a/] Not available from official sources or indicator still to be defined.

MONITORING INCOME MEASURES OF POVERTY

Estimating Poverty Incidence in Bangladesh

Bangladesh uses different survey data sets and definitions to measure income poverty. The earliest estimates were attempted soon after independence, in 1973/74, although for a

reasonably useful and comparable series, 1983/84 is a better starting point. Even then, the interpretation and replicability of the series were problematic due to the lack of documentation of the data collection, definitions and estimation methods used. (WB 1998). Many of these deficiencies were rectified in the 1995/96 Household Expenditure Survey (HES) of the Bangladesh Bureau of Statistics (BBS), which received financial and technical support from ADB and World Bank respectively. The so-called direct calorie intake (DCI) and cost of basic needs (CBN) methods were both used in estimating poverty indicators. Two poverty lines were derived for each method, namely a lower poverty line and an upper poverty line (see Box 1). The latter is closer to the conventionally accepted meaning of absolute poverty, which is the kind referred to in vision statements such as "a world free of poverty", "eradicating absolute poverty in the year 2010", and the like.

There is an ongoing 2000 HES by BBS, with financial and technical assistance from the World Bank. It may be safely assumed that the World Bank recommended CBN method will be employed again, although it should be possible to generate DCI-based estimates as well. However, there has been a change in the method of data collection between the 1995/96 and 2000 surveys, with the latter requiring a twelve month continuous data capture.

From 1994 to 1998, BBS had conducted seven Poverty Monitoring Surveys (PMS) to monitor the situation at the national, urban and rural levels. These surveys employed smallish samples and were funded by the Government. (Mujeri, undated). In 1999, with financial and technical assistance from IDRC-Canada and Center on Integrated Rural Development for Asia and the Pacific respectively, the PMS sample was increased to 16,000 households. This PMS was intended to provide a wide range of poverty indicators disaggregated for the 21 regions of Bangladesh in addition to the rural-urban and national aggregates produced in the previous surveys. PMS shares with HES the objectives of building capacity, mainstreaming and institutionalizing poverty monitoring and analysis in Bangladesh. Both surveys are conducted by BBS. PMS, however, uses a different method for assessing poverty incidence, a so-called food and energy intake (FEI) method (see Box 1).

Estimates of headcount ratios from the two surveys and three methods are shown in Table 2a. DCI estimates are generally lower than CBN estimates, with over five percentage points separation in 1995/96 based on the upper poverty line. The two methods essentially tell a different story. The DCI estimates show a decline from 1983-84 to 1988-89 and no change from that point onwards. There was a 1.25 percentage point average annual decline in poverty incidence during the twelve year period. On the other hand, the CBN estimates exhibit a roller coaster behavior. It is tempting to speculate that the sharp decline from 1983-84 to 1985-86 may not be real, as it is too much to expect such large decrease in two years. (indeed we shall see later that such magnitude can be attributed to sampling error in this type of survey); in which case the CBN estimates show a less than half percentage point annual decline in poverty incidence during a twelve year period. The lower poverty lines show even bigger discrepancies between the two methods.

The number of poor persons corresponding to the headcount ratios are shown in Table 2b. The DCI method shows only a one million reduction in twelve years, while the CBN method shows that the number of poor increased by nine million. Thus, while different methods and data sets may throw more light on the poverty situation and keep poverty researchers busy, for medium to long term monitoring of poverty, it is important that the Government, donors and other stakeholders agree on only one metric (combination of data collection and estimation method) – and stick to it. It is also highly doubtful that BBS and the Government would be

willing to take over and sustain more than one large survey system and two or three methods to use on each one.

Box 1. Three Methods of Estimating Poverty Incidence in Bangladesh

BBS uses two methods for estimating poverty lines from its household surveys. In the direct calorie intake (DCI) method, any household whose calculated kilo-calorie intake per capita is less than a predetermined threshold (2112 for urban and 2122 for rural) is considered poor. All the members of a poor household are counted as poor. The threshold is lowered to 1805 kcal to estimate the hard core or extremely poor. The method is simple to implement. However, it does not explicitly take into account expenditures for clothing, shelter, education, medicines, and other non-food essentials. For this reason, it has been argued that the method measures under nutrition more than poverty incidence.

For its Poverty Monitoring Surveys (PMS), BBS applies a so-called food and energy intake (FEI) method. Daily per capita kcal intake (x) and monthly per capita expenditure (y) are calculated from each sample household. A simple linear regression of the natural log of y on x, $\ln y = a + bx + r$, with r as residual, is fitted to the household values. The poverty line is estimated by substituting 2112 or 2122 kcal in place of x in the fitted equation. Households, or more precisely members of households, whose monthly per capita expenditures are less than the estimated poverty line are considered poor. Simplicity is one virtue of this method. Through y, the estimated poverty line includes both food and non-food expenditures. On the other hand, y is allowed to range over the entire sample, including the expenditures of the affluent households. Also, the method does not seem to suggest an alternative procedure in domains where the simple log-linear model does not provide a good fit. Furthermore, it does not ensure comparability; e.g. if the food preference of urban dwellers is such that the price per calorie is higher than that of rural households, then the urban poverty line will be higher even for the same amount of calories consumed.

In the World Bank's cost of basic needs (CBN) method, a food bundle is chosen based on actual consumption patterns, e.g. from a consumption or expenditure survey. The bundle values, $F_1, F_2, \ldots F_n$ are expressed as per capita quantities that collectively provide 2122 kcal per day. The unit prices of these food items are not used directly to estimate the food poverty line, but are first adjusted through regression, controlling for total consumption, education and occupation in such a manner that the resulting adjusted prices $P_1, P_2, \ldots, P_n$ are supposed to represent the 'prices paid by the poor'. The food poverty line is $F_1P_1 + F_2P_2 + \ldots + F_nP_n$. In Bangladesh, different prices were used for 14 regions, leading to as many food poverty lines. The next step is to compute a cost of basic non-food needs which when added to the corresponding food poverty line gives a (total) poverty line. Two poverty lines corresponding to lower and upper nonfood costs were derived. A lower cost of non-food expenditure is computed from the subsample of households whose per capita total expenditure = food poverty line. An upper cost is derived from the subsample whose per capita food expenditure = food poverty line. In practice, these non-food components of the poverty line are estimated through regression or non-parametric techniques. While the CBN method eschews the major weaknesses of the DCI and FEI methods, its implementation, however, is more complicated.

Table 2a. Bangladesh Headcount Ratios (%)

	Upper Poverty Line		Lower Poverty Line		
Year	DCI	CBN	FEI	DCI	CBN
1983-84	62.6	58.5	-	36.8	40.9
1985-86	55.7	51.7	-	26.9	33.8
1988-89	47.8	57.1	-	28.4	41.3
1991-92	47.5	58.8	-	28.0	42.7
1995-96	47.5	53.1	-	25.1	35.6
1999	-	-	44.7	-	-

Sources: WB, From Counting the Poor to Making the Poor Count (1998), except FE1 estimate which is from F. Ahmed, Poverty Incidence in Bangladesh (May 2000).
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Table 2b. Bangladesh Poor (Millions)

	Upper Poverty Line		Lower Poverty Line			Memo: Total
Year	DCI	CBN	FEI	DCI	CBN	Population
1983-84	59	55	-	35	39	95
1985-86	56	52	-	27	34	100
1988-89	50	60	-	30	44	106
1991-92	53	66	-	31	48	112
1995-96	58	64	-	30	43	121
1999	-	-	57	-	-	128

The 46.5% poverty incidence benchmark mentioned in the PRPA between Bangladesh and ADB implies the choice of DCI[2]. The World Bank favors CBN and has expressed confidence that it will be adopted as the official method by BBS and the Government (WB, 1998). However, no official methodology has been adopted, and recent BBS publications carry the DCI estimates (e.g. Bangladesh Data Sheet 1999; document submitted for subscription to IMF's General Data Dissemination Standard, November 1999).

The Sampling Error in Poverty Incidence Estimates

All of the available DCI and CBN headcount ratios, such as those in Tables 2a & b, are without estimates of sampling error. In this respect, the FEI estimates from the 1999 PMS are an exception.

The 1999 PMS sample was drawn following the Integrated Multi-purpose Survey Design adopted by BBS for its major household-based surveys. Enumeration areas constructed from the 1991 population census served as primary sampling units (PSUs). Each region was considered a stratum, which was further stratified into urban and rural. Three hundred and five

[2] We cannot trace the source or reason for the one percentage point difference between the Tables 1 and 2a values.

hundred sample PSUs were allocated proportionately to the urban strata and rural strata, respectively, which were selected systematically with a random start. A simple random sample of 20 households was drawn from each sample PSU, bringing the total sample size to 16,000. This sample is twice the size of the HES sample; hence, other things being equal, PMS should yield estimates with higher precision. Table 3 shows the poverty incidence estimates for Bangladesh and the regions, along with their relative errors or coefficients of variation, and 95% confidence intervals.[3]

Table 3. Headcount Ratios (H), Coefficients of Variation (CV) and Confidence Bounds (2SE) from the 1999 PMS, Bangladesh

Region	Sample Size (Households)	Headcount Ratio (%)	CV (%)	2SE
Barisal	700	50.6	6.9	7.0
Patuakhali	320	39.7	16.9	13.4
Chittagong	1400	42.2	8.8	7.4
Chittagong H.T.	180	42.2	23.0	19.4
Comilla	940	44.2	7.0	6.2
Noakhali	560	46.9	11.5	10.8
Sylhet	820	40.5	10.5	8.5
Dhaka	3220	43.4	5.8	5.0
Faridpur	720	52.7	9.3	9.8
Jamalpur	400	49.8	11.2	11.2
Kishoregonj	500	39.2	13.0	10.2
Mymensingh	520	55.8	7.9	8.8
Tangail	360	45.5	11.2	10.2
Khulna	860	41.5	8.2	6.8
Jessore	600	43.0	10.2	8.8
Kushtia	360	34.3	14.6	10.0
Rajshahi	980	41.5	8.7	7.2
Rangpur	1060	51.9	6.0	6.2
Dinajpur	520	38.5	10.4	8.0
Pabna	540	46.9	12.7	11.9
Bogra	440	45.9	13.1	12.0
Bangladesh	**16000**	**44.7**	**2.0**	**1.8**

Source: F. Ahmed (May 2000).

The CV of the national estimate is a respectable 2 per cent. This gives a 95 percent confidence interval of ±1.8 percentage points around 44.7 per cent. An inference from this is that a similar survey done at time t into the future very likely would be unable to differentiate between noise (sampling error) and signal (change in poverty incidence), if the latter is less than 1.8 percentage points. [4] And the history of poverty monitoring in Bangladesh has shown an

[3] A 95% confidence interval is H ± 1.96SE, where SE is standard error. In practice, 2 is often used in place of 1.96. For 90%, replace 1.96 with 1.64. CV = SE/H, hence it is adequate to present H and either SE or CV. SE is needed to compute confidence intervals. Being unitless, CV is useful in comparing the relative errors of variables.

[4] This is a necessary, hopefully not misleading, simplification. The value 1.8 is a confidence interval for a point estimate, not for a difference between two time periods. The sampling error of a difference involves two sampling errors and a correlation coefficient between the two surveys (see Box 2). Unfortunately, if

annual average reduction of 1.25 percentage points by the DCI method and 0.5 percentage point by the CBN method. These call into question any program or recommendation to update poverty incidence estimates annually or even every two years.

Other things being equal, sampling errors increase as sample sizes shrink. (See Box 2.) This mathematical truth tends to be ignored by recommendations to bring the monitoring down to smaller domains or subpopulations. The 1999 Bangladesh PMS, for instance, was meant to monitor poverty for every urban and rural segment of each region. Table 3 shows, however, that the confidence intervals at the regional levels are quite high, ranging from ±5 to ±19 percentage points. Even in Dhaka, which represents the best situation with 3220 sample households, the 95% confidence interval is ±5 percentage points wide. This means that, following scientific inference procedures, only an improvement from 43.4% to 38.4% or lower poverty incidence will lead to a conclusion that the fight against poverty is being won. Thus, the frequency of updating the estimate should be based on an educated guess regarding the number of years it would take to reduce the proportion of poor by five percentage points. (It is to be noted that household income and expenditure surveys in many developing countries have national sample size in the neighborhood of four to seven thousand households. Hence, if the PMS is any guide, the CVs of such surveys could be in the neighborhood of 3-4 percent at the national level – and higher for subnational levels).

The dearth of developing countries publishing sampling errors of their poverty indicators makes the Bangladesh 1999 PMS a valuable case. It is tempting, therefore, to generalize to other countries. The practice by most Asian developing countries to update (income/expenditure) poverty indicators every three to five years may have been decided by cost considerations and by placing these indicators within the class of social statistics, which as a group is recognized to change slowly, hence measured less frequently.[5] The PMS results show that it was also a correct decision from a scientific or inferential point of view. There is no point in monitoring more frequently if the change in poverty incidence is small and the chance of detecting it is slight. The other side of this same coin is the difficulty of explaining to stakeholders, including the powers that be, that the (costly) monitoring process failed to show any advance on the war on poverty (true negative), the estimates showed a decline in poverty but that this was within the probable level of error of the estimate (false positive), or worse, that poverty incidence increased, but then again this can be explained entirely by the sampling error (false negative). Thus, in addition to cost and sustainability considerations, decisions regarding the frequency of monitoring and the indicators to use should be based also on the intrinsic power and limits of the modern scientific method.

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countries computing sampling errors are rare, those that compute correlation coefficients rarer still. The standard error (and confidence interval) of a difference is reduced to that of a point estimate when the sampling errors are assumed to be equal and the correlation coefficient is ½

[5] The duration of the required survey, from planning to the final report, is also a key consideration. Planning for a nationwide income and expenditure survey could take up to one year. The data collection normally takes one year in order to adequately capture seasonality. Countries use different approaches: the Philippines uses two survey rounds each one covering one semester, while data collection in Bangladesh is spread over twelve months. Data processing and report writing take another 1-2 years: the Philippines poverty report from the 1997 survey came out in 1999 and the World Bank report on the 1995-96 Bangladesh survey came out in mid-1998.

Box 2. The Sampling Error in Estimates of Rates and Proportions

Headcount ratio, literacy and enrollment rates, and health and mortality rates are proportions. For example, based on a definition or methodology, a certain proportion (P) of the population is poor and the rest not poor (Q = 1 – P). From a simple random sample of size n, the observed proportion of poor (p) is used to estimate P. For large populations, the sampling error of p relative to P, which is also called the coefficient of variation (CV), is $\{Q/Pn\}^{1/2}$. The CV is sometimes expressed in per cent, especially when p is also expressed in percent. The ratio Q/P, hence the CV, rises exponentially as the event gets rarer, i.e. as P gets smaller. This is seen in the following illustrative computations:

P x 100%	=	50.0	20.0	2.0	0.2	0.1
$\{Q/P\}^{1/2}$ x 100%	=	100	200	700	2234	3161
$\{Q/(Px8000)\}^{1/2}$ x 100%	=	1.1	2.2	7.8	25.0	35.3
$\{Q/(Px16000)\}^{1/2}$ x 100%	=	0.8	1.6	5.5	17.7	25.0

Bangladesh's 440 maternal deaths per 100,000 live births (or 0.44%) and the Philippines' 0.22% can be considered rare events; also, 3.5% infant mortality and 4.8% under five mortality in the Philippines are relatively rare events (see table 5 in text). These estimates from surveys can be expected to have high CVs even when the sample size is as large as 16,000 (last line of numbers above).

When monitoring, the interest shifts to making inference statements about the change in the proportions, $P_1 - P_2$, between time 1 and time 2. (Or it could be the difference in the proportions between two subpopulations.) The sampling error of the difference, $p_1 - p_2$, takes the form $\sqrt{\frac{\sigma_1^2 + \sigma_2^2 - 2\rho\sigma_1\sigma_2}{n}}$, assuming the same sample size *n*, and where σ_1^2 and σ_2^2 are the variances of the individual proportions and ρ is the correlation between the observations in the two time periods, which is usually positive. To take the CV, this sampling error is divided by an even smaller value, $P_1 - P_2$ ($\neq 0$). Thus, the CV can be very large as to render the monitoring useless, unless the sampling error is reduced. For the sake of illustration, assume that $\sigma_1 = \sigma_2 = \sigma$. The sampling error becomes s.e. = $\sqrt{2}\sigma\{(1-\rho)/n\}^{\frac{1}{2}}$ which is inversely related to ρ. The correlation is highest when the two samples are identical (panel) and lowest when they are completely different. Respondent fatigue or conditioning, however, has to be considered when deciding what proportion of the sample is to be retained for the succeeding survey rounds. The correlation is also weakened by time, as well as by physical distance between the observational units. Thus, careful designing and planning of surveys do matter very much.

Sampling Errors in Smaller Domains: Philippines

In the Philippines, poverty estimates are updated every three years and, until 1997, were disaggregated down to the 16 regions (but, unfortunately, without accompanying error estimates). The main instrument used for this activity is the Family Income and Expenditure Survey (FIES) of the National Statistics Office.

An IDRC-funded MIMAP project in the Philippines aims to analyze and establish methodologies for monitoring poverty down to the level of communities[6]. Under this project, the 1991 and 1994 FIES data were used to produce headcount ratios and their errors for the 20 cities of the Philippines, excluding Metropolitan Manila (Table 4). With this smallish samples, seeing extraordinary changes in the estimates would not be surprising; e.g. a 22.5 percentage points reduction in Cabanatuan City, which is inconceivable to actually happen within three years. Indeed, the 95% confidence interval in the 1994 estimate is (8.4, 57.6) which spans the 1991 estimate. With the level of errors such as those in Table 4, making useful inferences regarding time-induced changes, as well as geographic differences in poverty incidence, is problematic.

Table 4. Headcount Ratios and CVs in Philippine Cities

City	1991			1994		
	n[a/]	H	CV	n	H	CV
Angeles	52	28.4	36.7	117	22.9	35.3
Olongapo	40	49.6	38.3	102	35.5	37.0
Iloilo	79	13.4	47.4	136	12.7	54.8
Bacolod	88	29.1	35.7	160	27.8	38.1
Cebu	163	14.5	51.1	263	15.4	53.8
Zamboanga	91	32.7	39.6	189	36.5	54.6
Butuan	46	53.7	24.2	103	54.2	20.1
Cagayan	95	36.7	53.1	175	44.2	38.5
Davao	195	32.2	38.3	362	18.4	67.7
Iligan	42	46.8	45.4	85	56.8	24.8
Baguio	43	17.6	80.6	90	16.1	37.0
Cabanatuan	64	55.5	28.6	127	33.0	37.2
San Fernando	40	21.0	46.4	69	8.5	56.6
Tarlac	41	51.3	26.0	76	48.9	25.5
Batangas	41	35.7	46.6	83	34.3	39.4
Lipa	46	36.7	31.6	79	28.8	42.5
San Pablo	45	33.1	23.4	65	16.6	54.5
Lucena	34	27.2	26.4	68	20.5	20.5
Mandaue	41	11.5	71.5	41	22.0	36.6
General Santos	46	33.8	36.1	112	27.8	35.0

[a/] Number of sample households.
Source: E.B. Barrios (1998).

INDICATORS OF THE NON-INCOME DIMENSIONS OF POVERTY

The list of indicators or statistics that may be used to analyze the so called human dimensions of poverty is long; (see e.g. UN's CCA). For brevity's sake we consider in this note the subset prescribed in the Bangladesh PRPA, shown in Table 1. These are all social indicators of education, health, nutrition, and gender equality. These are also all rates or proportions of some base populations or cohorts (Box 2). We find that the published

[6] As mentioned earlier, the Bangladesh 1999 PMS is also part of this network of IDRC-supported multi-country MIMAP projects.

Bangladesh official statistics are not accompanied by estimates of sampling error; however, some signs of non-sampling error might be gathered from them. We turn to another developing country, the Philippines, for information on the sampling errors in these social indicators.

Sources of Social indicators

Population and housing censuses are major sources of social indicators; however, these are conducted at 10 year intervals. At the other extreme are the vital or civil registration systems (VRS or CRS) whereby, in theory, all births, deaths, marriages, etc. are recorded year round. These systems, however, are known to suffer from serious under-reporting, hence they are seldom used as lone sources of population growth rates and mortality rates.[7] Administrative reporting systems, such as those in the ministries of education and health, represent a third source. The usual problems with the statistics derived from administrative records are incompleteness, long processing delays and conceptual (in)comparability with statistics from the other sources. Enrollment and other educational system records are potentially complete and very good sources of education statistics and indicators; the main impediment here, however, is the absence in many developing countries of an efficient and reasonably timely data management and reporting system.

Sample surveys round out the sources of primary data for social indicators. These vary in number and frequency across countries, depending on the stage of development of the national statistical system and the level of support it gets from its government (Box 3). For example, the Philippines undoubtedly conducts more sample surveys in the social sector than Bangladesh. The difference in periodicity can be very significant also, e.g. labor force surveys and business establishments surveys are done quarterly in the Philippines compared with once in two to four years in Bangladesh. The Philippines surveys are government-funded generally, while a higher proportion of Bangladesh surveys are subsidized by foreign assistance.

Sampling Errors in Social Indicators: Philippines

The Philippines has been conducting national demographic surveys (later merged with health surveys) every five years since 1968. The last National Demographic and Health Survey (NDHS) was conducted in 1998, on a sample of 13,000+ households that had 14,000+ women of childbearing age. Data for the years 1991-1997 were gathered during the 1998 survey, 1987-1993 for the 1993 survey, and so on. In this way, each survey can provide estimates for individual years as well as averages for the reference period of five or six years. Likewise, since there are overlaps of two years in the reference periods of successive surveys, some information about recall or memory error (one kind of so-called non-sampling errors) can be obtained from these surveys. More importantly, the 1998 NDHS report (NSO, 1999) includes the sampling errors of over 40 indicators at the national as well as urban, rural and regional levels of disaggregation.

[7] For example, the Philippines has a relatively well developed CRS, in which there is a full time civil registrar in each of the 1,600 towns, whose duty includes sending a copy of every form he/she fills up to the head of the National Statistics Office. The latter has a dual appointment as the country's Civil Registrar General. Still, as of this writing, NSO has been using TV and radio ads to enjoin public cooperation with its "Unregistered Children Project". Under-registration of infant and child deaths may be more serious than of births. There is little point, for instance, in reporting the death of an unregistered child.

Box 3. Defining a Statistical Program through Designated Statistics

Statistical systems (SS) of developing countries suffer in varying degrees from weak coordination, inadequate government support, delays and duplications alongside many gaps in the national statistical database, limited technical capability, and lack of autonomy or independence to release their own products. The consensus seems to be that SS that are centralized tend to suffer less than those that are decentralized. However, because of practical difficulties, switching to another form of SS is seldom seriously pursued as a means for improvement.

The Philippines SS is highly decentralized. After more than 30 years of experimentation, the present mechanism for coordination that was put in place in 1987 seems to work reasonably well. A National Statistical Coordination Board (NSCB) [the Board] with the Planning Secretary as chair, Budget Department Undersecretary as vice-chair, and undersecretaries of data user and producer departments plus local government and private sector representatives as members, holds quarterly meetings. The key to an active Board is an NSCB Technical Secretariat [the Secretariat] headed by a professional statistician of Undersecretary rank who is also *ex-officio* secretary to the Board. The Secretariat does not have any primary data collecting responsibilities (so it does not compete with the other SS members), but is responsible for the compilation of the national income and social accounts (which gives it current knowledge of the condition of the database of the national socio-economy). The Secretariat's technical capability is augmented by inter-agency committees and technical working groups in areas such as survey design, agriculture statistics, population statistics, poverty assessment, etc. The Secretariat's composition and function enable it to prepare useful agenda and programs to feed to the Board.

The Philippines SS long-term program is embodied in Executive Order No. 352 of the President of the Republic entitled, "Designation of Statistical Activities that will Generate Critical Data for Decision-Making of the Government and the Private Sector". The E.O., which may be viewed in http://www.nscb.gov.ph/pss, includes a list of Designated Statistics presented as a table. The table has the following columns: (i) census/survey; (ii) agency; (iii) frequency of conduct; (iv) geographic disaggregation; (v) schedule of data dissemination. Here is a sample entry : (i) Rice and Corn Survey; (ii) Bureau of Agricultural Statistics; (iii) quarterly; (iv) national, regional, provincial; (v) 40 days after the reference quarter. This mandates BAS, one of two primary data producing agencies of the SS, to conduct the specified survey, produce estimates down to the provinces and release the results 40 days after the quarter. Another example is: (i) Establishments Survey; (ii) National Statistics Office; (iii) quarterly; (iv) national, regional; (v) 45 days after the reference quarter (preliminary); 60 days (final). Here, the other main primary data producing agency (NSO) is assigned the responsibility to do a quarterly survey, with the results disaggregated by region and released within two months.

The Designated Statistics list: (a) is made dynamic by a provision in the EO 352 authorizing changes through NSCB resolutions; (b) distributes responsibility to the members of the SS, thereby minimizing duplications and gaps; (c) specifies periodicities and levels of disaggregation of the statistics; (d) informs the public when the statistics will be released; and (e) allows, by implication and in practice, the producers to directly release their respective statistics. It is also a useful document in securing a budget for statistics, a process which is made easier by having the Budget Department Undersecretary as Board vice-chair. And, being an Executive Order, the Designated Statistics carry the force of law.

It behooves donors to consider the impact of their technical cooperation proposals on the designated statistics or long-term statistical program of the recipient country. In particular, poverty monitoring activities that are not integrated in the designated statistics list do not stand any chance of being owned, funded and sustained by the country.

As mentioned previously, error estimates are required for reaching scientifically sound inferences from surveys. Consider maternal mortality rate (MMR), a relatively rare event that is also well known to be difficult to record accurately; e.g. misclassification to another cause of

death.[8] The 1993 survey yielded an average annual MMR of 209 per 100,000 live births for the period 1987-1993. The MMR from the 1998 survey was 172 for the period 1991-1997; hence, it is tempting to conclude that there has been a decline – a seemingly sizable 37 fewer maternal deaths per 100,000 live births. It will be without scientific support, however, since a 90% confidence interval around the 1998 estimate is (129, 215), which encompasses 209. (A 95 % confidence interval is even wider).

Table 5 shows the CVs of a subset of 1998 NDHS indicators included in, or related to, the indicators in the Bangladesh PRPA. The numbers show the predictable increase in CVs as the domain (and sample) sizes fall from national to urban-rural, to regions. The region level CVs, particularly those of the mortality rates, are quite high as to put into serious question the value of frequent updating of these indicators. These are more useful in differentiating among the regions and identifying those that seriously lag behind; e.g. the very low contraception use and maternal medical care in the Autonomous Region of Moslem Mindanao (ARMM) and the very high mortality rates in Eastern Visayas. However, there is also no need to frequently reconfirm such obvious inequalities.

On Selecting Indicators

The mortality rates in Table 5 have much higher CVs than contraceptive use and maternal health care. This points to the prospect of choosing so-called poverty correlates with lower CVs, as proxies to indicators with high inherent variability and serious measurement problems, such as maternal mortality. Consider the trend in contraceptive use from 1968-1998, for example (Figure 1). The low sampling error gives rise to a narrow confidence interval, which lends support to a five year, perhaps even shorter, monitoring at the national, urban and rural levels.

As another example, the trend in Philippine infant mortality from 1978-1998 is shown in Figure 2. The slow reduction in infant mortality and the wide confidence interval suggest that five year monitoring is an exercise in futility even at the national level – more so since declining infant mortality will mean higher sampling error. One option is to consider "under 5 mortality" which is the sum of infant (below one year) and child (from 1 to below 5 years) mortalities, in place of the latter two indicators. Being bigger, under 5 mortality rate, *ceteris paribus,* will have a smaller sampling error. This is confirmed in the Philippines 1998 NDHS (Table 6). Furthermore, it will be freer from transference errors, which are errors in counting true cases of infant deaths as child deaths and vice versa.

It is to be noted that discussion up to this point has been confined to the PRPA indicators in Table 1, which are output or impact indicators. It does not mean, however, that monitoring should be limited to these types of indicators. In fact, in the early stages of the monitoring process, and for more frequent, e.g. annual monitoring, it makes better sense to use input or intermediate output indicators, particularly flow types that are less problematic to measure. GDP growth, changes in annual expenditure on basic education and health care, jobs for the poor, social safety net programs, number of schools built and teachers trained, and the like are obvious examples.

[8] To improve data quality, the 1998 NDHS expands coverage by using a method called "sisterhood approach" in which respondents are also asked about maternal deaths of their siblings from their natural mother.

In general, analysis of the variabilities and correlations among available social indicators could lead to the identification of a subset that is better suited for monitoring the human dimensions of poverty.

Table 5. Selected Philippine Social Indicators and their CVs, 1998

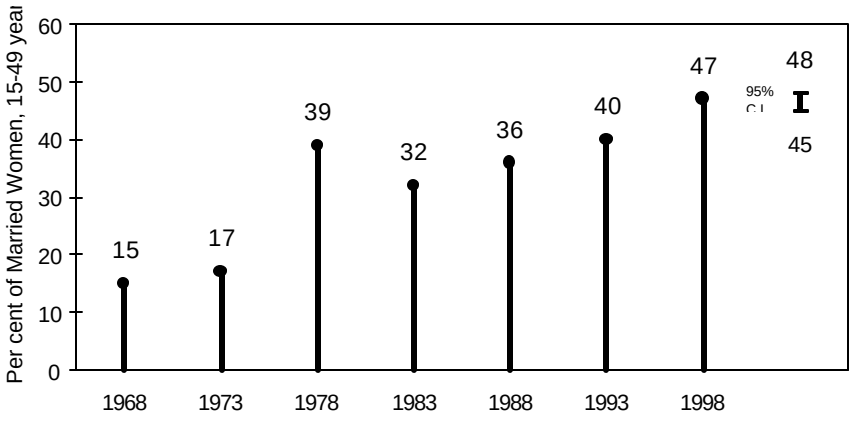
Area	Sample Size (Households)	IMR		Under 5 MR		Contraceptive User		Received Medical Care at Birth	
		Value	CV(%)	Value	CV(%)	Value	CV(%)	Value	CV(%)
Philippines	13,708	35	6.6	48	5.9	47	1.4	56	1.8
Urban	5,822	31	8.4	46	7.2	51	1.8	79	1.5
Rural	7,886	40	5.4	62	5.1	42	2.3	38	3.7
Regions:									
Metro Manila	1,169	24	23.8	39	19.2	49	4.3	92	1.7
Cordillera	735	42	19.5	52	19.7	42	10.8	48	6.2
Ilocos	730	42	18.5	51	18.9	43	5.5	66	6.8
Cagayan	726	37	18.8	53	16.8	48	5.7	42	14.0
C. Luzon	911	29	22.3	39	20.1	55	4.8	84	3.1
S. Tagalog	1,189	35	11.1	53	10.4	45	3.6	60	5.4
Bicol	816	31	16.8	52	17.6	36	5.4	44	10.4
W. Visayas	913	26	20.3	42	18.4	45	5.4	48	6.7
C. Visayas	905	34	24.4	38	17.7	52	5.6	56	7.9
E. Visayas	913	61	12.3	85	11.3	38	5.7	28	10.0
W. Mindanao	884	45	13.8	75	11.7	44	7.2	40	10.8
N. Mindanao	732	41	16.5	65	14.4	54	5.4	34	11.8
S. Mindanao	919	41	16.0	61	16.1	55	3.6	47	9.0
C. Mindanao	707	48	20.8	76	18.1	45	8.3	43	9.7
ARMM	729	55	18.5	98	16.3	16	18.5	16	19.6
CARAGA	730	53	16.9	82	13.6	49	5.8	40	9.7

Notes: IMR = infant mortality rate per 1000 live births, contraceptive use = proportion of married women 15-49 years old using any method, last indicator refers to percentage of women who received medical attention for deliveries in last 5 years.

Table 6. Infant, Child and Under Five Mortalities and CVs, 1998 NDHS, Philippines

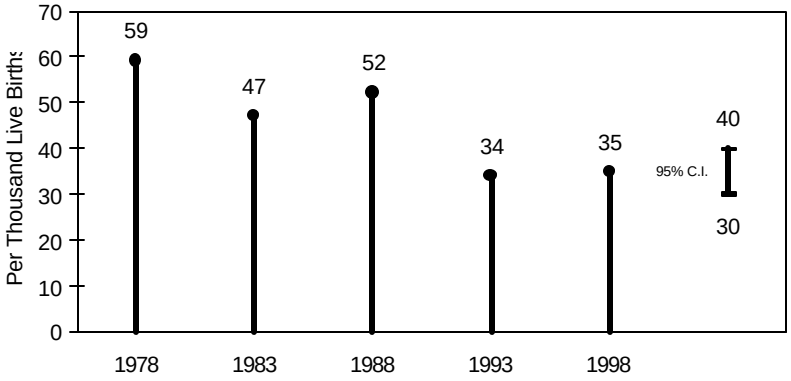
Indicator	Philippines		Urban		Rural	
	Value	CV(%)	Value	CV(%)	Value	CV(%)
IMR	35	6.6	31	8.4	40	5.4
Child MR	14	11.0	15	12.1	23	8.4
Under 5 MR	49	5.9	46	7.2	62	5.1

Figure 1. Trends in Contraceptive Use: Philippines, 1968 - 1998



Source: National Statistics Office, *National Demographic and Health Survey 1998.*

Figure 2. Trends in Infant Mortality Rates: Philippines, 1978 - 1998



Source: National Statistics Office, *National Demographic and Health Survey 1998.*

Intimations of a Different Kind of Error

Errors not due to having just a sample instead of the whole population are collectively called non-sampling errors. For example, even in an attempted complete enumeration census there will be errors due to undercount, double count, misreporting by respondent or interviewer,

data entry and processing errors, and all the way to non-response and mistakes. All these could also be present in samples.

Estimates of non-sampling error are even rarer in practice than sampling errors. Their study requires careful scientific planning, such as embedding an experiment in a survey, or doing a post enumeration survey after a census. When available, indications, rather than precise estimates can be useful, e.g. comparing two different sources, comparing a country's estimates with those of 'similarly situated' countries, or appraising whether the levels or trends shown by the estimates match rational expectation.

In the Philippines, a comparison of infant mortality rates from the National Demographic Surveys and the Civil Registration System led to the following results (NSO, 1999).

Year	1978	1983	1988	1993
Survey estimate	59	47	52	34
CRS estimate	57	45	38	24

As in any developing country, the Philippines CRS records are incomplete (see footnote 7). This is confirmed by the daily throng at the Civil Registrar General's office seeking official CRS certificates (e.g. for passport and visa application purposes), some of whom find that they did not have records. The gravity of the under-registration (of mortality rates especially) is shown by the above results, and it seems to get worse instead of better. For this reason, surveys remain as the official sources of vital statistics.

In Bangladesh, inter-census social statistics are derived from several sources. Since 1983, births, deaths, marriages and migration have been collected through a sample vital registration system (SVR) implemented by BBS. Until 1995, SVR had a sample of 250 primary sampling units (PSU) which are compact areas with approximately 250 households. From 1996, the sample has been doubled to 500 PSUs with about 675,000 households which comprise 0.5 percent of the population. A dual recording system is used to collect data. In the first system, a local registrar recruited in each sample PSU is paid a nominal monthly honorarium to record vital events continuously as they happen. In the second system, BBS enumerators visit the sample PSUs every quarter to collect the same information retrospectively by interview. The two record sets are matched and the unmatched cases are referred back to the local registrars for verification. Although "births of children are generally not registered, despite there being a law mandating it" (BBS and UNICEF, 1999, p.9), BBS claims that this dual recording method effectively corrects for under-reporting, and that SVR is able to produce quarterly estimates at the level of urban districts and rural districts with CV$\leq$ 5 %. [See e.g. Government submission to IMF as a requirement to subscription to GDDS, November 1999]. However, no CV or any SVR error estimates have been published or publicly released.

Another source of social statistics is the Multiple Indicators Cluster Survey (MICS) funded by UNICEF and implemented under the supervision of BBS. MICS has been conducted annually since 1993, to monitor progress towards goals agreed under the 1990 World Summit for Children. It employs an intricate sampling procedure and, with 60,000 sample households, is intended to provide annual estimates for each of the country's 64 districts. The 1998 MICS report (BBS and UNICEF, 1999) mentions that standard errors and confidence intervals were calculated for the indicators at the district level; however, none of these were included in the

report itself. With continued UNICEF support, BBS will conduct the seventh and final MICS in 2000.[9]

BBS also conducts a Child Nutrition Survey at less frequent intervals, the last one being in 1995-96. The Ministry of Health and Family Welfare conducts surveys on health and nutrition at even less frequent intervals, the last one in 1998.

Some official social indicators of Bangladesh in recent years are presented in Table 7.

Table 7. Some Official Sociodemographic Indicators of Bangladesh

Indicator	Fiscal Year (e.g., 1994 = 1 July to 30 June 1994) 1994	1995	1996	1997	1998
Pop'n growth rate (%)	1.88	1.81	1.75	1.55	1.50
Infant mortality rate (per 1000 live births)	77	71	67	60	57
Child mortality (1-4 years) (per 1000 children)	12	12	12	8	6
Maternal mortality (per 100,000 live births)	450	450	400	350	300
Crude birth rate (per 1000 population)	28	26	26	21	20
Crude death rate (per 1000 population)	9	8	8	6	5
Literacy rate (7+ years; %)	42	44	45	47	49
School attendance (5-24 years; %)	47	49	50	52	56

Sources: BBS, Bangladesh at a Glance, June 1999 and Bangladesh Data Sheet 1999.
Note: Values have been rounded off and may not be exactly equal to those in the original sources.

After declining by a mere 0.13 percentage point from 1994 to 1996, the official estimates of annual population growth rate showed a ¼percentage point reduction in the next two years, from 1.75% in 1996, to 1.50% in 1998.[10] Moreover, most of the decline is recorded to have happened between 1996 and 1997. The importance of population growth rate estimates and their implied population sizes cannot be exaggerated, as they figure in the estimation of many of the other socio-demographic indicators and are vital inputs to planning.

The other social indicators show similar extraordinary improvements between 1996 and 1997. Child mortality remained at 12 per 1000 children between 1994 and 1996, then dipped to 8 in 1997; maternal mortality from 450 per 100,000 live births in 1994-1995 to 440 in 1996, and

[9] It is not certain whether the Government will take over the funding, and be able to sustain both MICS and SVR beyond 2000.
[10] The 2001 Population and Housing Census, if done well, can be used to check on the accuracy of the SVR estimates.

then to 350 in 1997; crude birth rate from 28 per 1000 population in 1994 to 26 in 1996, to 21 in 1997; etc. If accurate, such magnitudes can only mean a fundamental change in the country's socio-demographic dynamics. This should normally trigger a search for a cause or causes. However, the possibility that the changes are due to errors should be ruled out first. Users will benefit from seeing the sampling errors associated with these indicators. Furthermore, one should also entertain the likelihood that the changes can be attributed partly or mainly to non-sampling errors, and a similar search for likely causes should likewise be made. What readily come to mind are the change in government in 1996 and BBS's lack of authority to release its products. Lately, not even the Secretary for Statistics exercised such authority, as the adoption and release of official statistics required ministerial approval.

SUMMARY AND RECOMMENDATIONS

The international statistical system has evolved data systems, frameworks and standards in which most economic and financial statistics are compiled annually, some quarterly and others even more frequently. Social and demographic statistics, which do not change as fast, are updated less frequently. Many are updated through decennial censuses or large quinquennial surveys. Since sample surveys cannot provide adequately accurate statistics for small areas, generating these kinds of statistics remain one of the main reasons for doing censuses. This 'order of things' is undergoing change in the developing countries, due to pressure to produce social indicators (including poverty indicators) more frequently and for progressively smaller subpopulations. The pressure to change is by and large driven by donors whose information needs in fact extend beyond poverty monitoring, to project (i.e. small area) targeting, formulation and evaluation. Since donor agencies are populated by generalists who tend to hire consultants who are generalists and talk to generalists in places like finance and planning ministries, it was inevitable that the specialists' views regarding the proposed change, as well as the impact on the national data producers, may not have received adequate consideration.

The inherent variation in social data and the national statistical system capability limitations in the developing countries result in sampling errors of social indicators that do not justify more frequent updating than previously practiced; i.e. every five years or so at the national, urban-rural and similarly large geographic subdivisions and less frequently (such as during censuses) for progressively smaller subpopulations. This does not mean, however, that the poverty monitoring could not be done more often. However, instead of (final) outcome or impact indicators, input and intermediate output indicators can be used during the earlier stages of the monitoring process. Analysis of the relationships between input and output indicators, and of the inherent variances in them, will help in the selection of a parsimonious set for the monitoring system.

A poverty monitoring system should be based on explicitly defined methodologies and indicators that remain consistent and comparable across time and space. If the experience in Bangladesh is to be a measure, there is great need for more effective donor coordination of the assistance to build capacity for such a monitoring system. To increase the odds for country ownership and continuation of the system, the recipient country should be encouraged to develop a long term statistical program (if there is none), with the poverty monitoring data collection requirements integrated in such a program (Box 3); instead of supporting different initiatives, donors should be one with the country in the method and indicators to use, with the choice guided by simplicity and economy, hence country affordability; and country ownership

should not just mean data collection responsibility, but also authorship of the country's poverty reports.

As a standard for good practice, countries should be encouraged to routinely publish error estimates from surveys. Donors should do the same in the surveys and survey reports that they support. The availability of error estimates promote more informed and correct use of the survey results, particularly in monitoring. Error estimates also tell whether the surveys in particular, and statistical system capacity in general, are improving.

Additional resource demands towards expanding a country's social database would impact negatively on the economic database, more so if there is demand to expand the latter also, (e.g. from annual to quarterly national income accounting, from quarterly to monthly price indexes). This is because the responsibility for both economic and social databases commonly fall on one agency (the national statistical office), resources for which have not increased significantly in recent years. In this regard, the exploitation of administrative data sources, such as education and health, as sources of statistics, should be part of an overall statistical system capacity building. The emphasis should be in improving reporting/recording rates and building from them a simple, completely demand-driven database and reporting system. It is useful to be reminded that developing countries are littered with failed, overly ambitious and complicated management information system and databank projects.

Last but not least, long-term statistical capacity building means building leadership and technical capacity to improve and continuously update the country's statistical database. It includes helping the national statistical system gain the needed stature to independently release the database.

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