**Poverty Assessment Tool Accuracy Submission: Addendum for New Poverty Lines**
**USAID/IRIS Tool for Bangladesh**
**Submitted: July 12, 2010**

In order to improve the functionality of the existing PAT for Bangladesh, the IRIS Center has updated the tool with the following features:

- Re-ran the models at the $1.25/day line, using the new purchasing power parity (PPP) rates lines released by the World Bank
- Calibrated the model to also allow predictions at the $2.50/line
- Used household per capita expenditures based on the $1.25/day model to predict at the $0.75/day and $1.00/day line; used household per capita expenditures based on the $2.50/day model to also predict at the $2.00/day line
- Incorporated the prediction models into a CSPro data entry template. This CSPro template closely resembles the paper questionnaire and allows the entry, storage, and retrieval of household demographics. The output of the data entry template has been expanded from the current data entry template in Epi Info, permitting poverty prediction at five poverty lines. In addition, poverty status at the five poverty lines is cross tabulated with regional location, the household head's characteristics, household size, and housing conditions. This additional information provided is intended for indicative purposes rather than statistical inference. Please see attached document with screenshots of this template.
- Revised the paper questionnaire to reflect best practice in survey design

The data source used for the PAT in Bangladesh remains the same as when the tool was originally submitted for certification, as has the general tool construction process, aside from a more rigorous screening process to ensure that the variables are in line with the project's current best practices on practical indicators. Because of these similarities, this document should be viewed as an addendum to the original tool's certification document. The document proceeds by detailing how the new $1.25 PPP was applied and the results at the $1.25/day and $2.50/day lines. Accompanying this document are the revised questionnaire and screenshots of the CSPro data entry template and output.

**Updating the poverty line**

The tool originally predicted poverty outreach at the international poverty line of $1.08/day in 1993 PPP terms. With the release of the 2005 PPP rates and the adoption of the $1.25/day line in 2005 PPP terms by the World Bank, it seemed prudent to update the PAT to the new line, as well as update the tool to permit predictions at multiple poverty lines: $0.75, $1.00, $1.25, $2.00, and $2.50.

The legislation governing the development of USAID tools defines the "very poor" as either the bottom (poorest) 50 percent of those living below the poverty line established by the national government or those living on the local equivalent of less than the international poverty line ($1.25/day in 2005 PPP terms)[1]. The applicable poverty line

[1] The congressional legislation specifies the international poverty line as the "equivalent of $1 per day (as calculated using the purchasing power parity (PPP) exchange rate method)." USAID and IRIS interpret

for USAID tool development is the one that yields the higher household poverty rate for a given country.

In Bangladesh the applicable threshold is the international poverty line of $1.25/day in 2005 PPP terms. The value of this line at the time of the survey is 10,673 Takas per capita per year. This line identifies 49.1% of households as "very poor."[2]

By comparison, Bangladesh's national poverty identifies 39.9% of the population as "very poor." The poorest half of this group therefore represents 20.0% of the total population, less than the percentage living below the $1.25/day line."

**Results for $1.25/day model**

Table 1 summarizes the accuracy results achieved by each of the eight estimation methods in predicting household poverty relative to the new $1.25/day poverty line. For Bangladesh, the most accurate method, on the basis of BPAC, is the 2-step LP regression. However, the 1-step OLS regression is only slightly less accurate in terms of BPAC (and actually more accurate in terms of PIE) and requires only 15 indicators. Following precedent from previous decisions made in consultation with USAID, the 1-step OLS was selected as the best model, taking into consideration both accuracy and practicality. Table 2 presents a 2x2 matrix of the poverty status predicted by the model versus the true poverty status according to the expenditure benchmark. Table 3 provides the regression results from the $1.25/day model.

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this to mean the international poverty line used by the World Bank to track global progress toward the Millennium Development Goal of cutting the prevalence of extreme poverty in half by 2015. This poverty line has recently been recalculated by the Bank to accompany new, improved estimates of PPP. The applicable 2005 PPP rate for Bangladesh is 25.493872 Takas.

[2] The World Bank's PovcalNet estimates an poverty headcount of 50.5% using a different data set and population weights.

*Table 1: In-sample Accuracy Results for Prediction at the Legislative Poverty*

| **Bangladesh (PPP)**<br>$1.25/day line*<br>Share of "very poor": 49.1% | **Total Accuracy** | **Poverty Accuracy** | **Under-coverage** | **Leakage** | **PIE** | **BPAC** |
|---|---|---|---|---|---|---|
| **Single-step methods** | | | | | | |
| OLS | **77.22** | **77.30** | **22.70** | **23.72** | **0.50** | **76.28** |
| Quantile regression (estimation point: 54) | 77.10 | 77.30 | 22.70 | 23.98 | 0.62 | 76.02 |
| Linear Probability | 79.47 | 84.18 | 15.82 | 26.02 | 5.01 | 73.98 |
| Probit | 79.85 | 82.65 | 17.35 | 23.72 | 3.13 | 76.28 |
| | | | | | | |
| **Two-step methods** | | | | | | |
| OLS – 60 percentile cutoff | 79.72 | 80.10 | 19.90 | 21.43 | 0.75 | 78.57 |
| Quantile (estimation points: 54, 29) 60 percentile cutoff | 78.97 | 79.34 | 20.66 | 22.19 | 0.75 | 77.80 |
| LP – 48 percentile cutoff | 81.73 | 82.14 | 17.86 | 19.39 | 0.75 | 80.61 |
| Probit – 48 percentile cutoff | 80.35 | 78.57 | 21.43 | 18.62 | -1.38 | 75.77 |
| * $1.25/day poverty line is 10,673 Taka per capita per year in April 2004 prices. The international poverty line is based on World Bank's calculations and the recent 2005 PPP exchange rates. | | | | | | |

*Table 2: Poverty Status of Sample Households, as Estimated by Model and Revealed by the Benchmark Survey*

| | **Number of households identified as very poor by the tool** | **Number of households identified as not very-poor by the tool** |
|---|---|---|
| **Number of "true" very poor households (as determined by benchmark survey)** | 303<br>(37.9%) | 89<br>(11.1%) |
| **Number of "true" not very-poor households (as determined by benchmark survey)** | 93<br>(11.6%) | 314<br>(39.4%) |

***Table 3: Regression Estimates using 1-step OLS Method for Prediction at the $1.25/day Poverty Line***

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 24 | 117.86488 | 4.91104 | 36.21 | <.0001 |
| Error | 774 | 104.96315 | 0.13561 | | |
| Corrected Total | 798 | 222.82804 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 0.36825 | R-Square | 0.5289 |
| Dependent Mean | 9.33363 | Adj R-Sq | 0.5143 |
| Coeff Var | 3.94546 | | |

| Indicator | Coefficient | Standard Error | t | P>\|t\| |
|---|---|---|---|---|
| Intercept | 9.4549 | 0.1721 | 54.9400 | <.0001 |
| Household head age | 0.0087 | 0.0064 | 1.3600 | 0.1750 |
| Household head age squared | -0.0001 | 0.0001 | -1.1600 | 0.2460 |
| Household size | -0.1163 | 0.0186 | -6.2400 | <.0001 |
| Household size squared | 0.0022 | 0.0011 | 2.0400 | 0.0417 |
| Division is in Dhaka | 0.1273 | 0.0527 | 2.4200 | 0.0159 |
| Division is in Chittagong | 0.2567 | 0.0551 | 4.6600 | <.0001 |
| Division is in Khulna | -0.1569 | 0.0851 | -1.8400 | 0.0655 |
| Division is in Rajshani | -0.1231 | 0.0522 | -2.3600 | 0.0186 |
| Location is in rural | -0.0377 | 0.0574 | -0.6600 | 0.5119 |
| Household (HH) owns a black and white TV | 0.1046 | 0.0419 | 2.5000 | 0.0127 |
| Number of rooms | 0.0847 | 0.0178 | 4.7600 | <.0001 |
| Toilet is shared pit toilet | -0.1342 | 0.0411 | -3.2700 | 0.0011 |
| Meals are cooked in a separate kitchen | 0.1079 | 0.0326 | 3.3100 | 0.0010 |
| Cooking fuel is purchased bamboo, wood or sawdust | 0.1345 | 0.0449 | 3.0000 | 0.0028 |
| Main entrance does not have a lock | -0.1761 | 0.0429 | -4.1100 | <.0001 |
| Main entrance lock is wood or metal bar to close from inside only or security key lock/ metal frame with padlock | -0.1665 | 0.0439 | -3.7900 | 0.0002 |
| Number of blankets and quilts owned | 0.0449 | 0.0094 | 4.7700 | <.0001 |
| Number of cattle and buffalo owned | 0.0447 | 0.0130 | 3.4400 | 0.0006 |
| Number of milk cows and heifers owned | 0.0611 | 0.0147 | 4.1600 | <.0001 |
| Number of radios owned | 0.0955 | 0.0309 | 3.1000 | 0.0020 |
| Number of saris owned | 0.0133 | 0.0029 | 4.6300 | <.0001 |
| Household head is male | 0.1244 | 0.0450 | 2.7700 | 0.0058 |
| Share of household members excluding household head that has no education or only read in class 1 | -0.6055 | 0.0860 | -7.0400 | <.0001 |
| Share of household members excluding household head that did not complete primary school | -0.4704 | 0.0913 | -5.1500 | <.0001 |

**Results for $2.50/day model**

Table 4 summarizes the predictive accuracy results for the $2.50/day poverty line using the OLS model specification from the $1.25/day poverty line. However, the OLS model performs poorly, with a PIE of over 5. For this reason, the 1-step Quantile model was instead used for the $2.50/day poverty line. This approach allows the same indicators to be used as the OLS model for the $1.25/day extreme poverty line, but allows the model to be calibrated to select the percentile with the best accuracy performance. This methodology allows the content and length of the questionnaire to remain the same, but permits greater accuracy in predicting at the $2.50/day poverty line. Table 5 presents a 2x2 matrix of the poverty status predicted by the model versus the true poverty status according to the expenditure benchmark. Table 6 provides the regression results from the $2.50/day model.

***Table 4: Accuracy Results Obtained for Prediction at the $2.50/day Poverty Line***

| **Bangladesh**<br>$2.50/day Line<br>Share of Poor: 87.2% | **Total Accuracy** | **Poverty Accuracy** | **Under-coverage** | **Leakage** | **PIE** | **BPAC** |
|---|---|---|---|---|---|---|
| **Single-step methods** | | | | | | |
| OLS regression | 89.99 | 97.56 | 2.44 | 9.04 | 5.76 | 90.96 |
| Quantile (estimation point : 72) | **90.11**\| | **94.69** | **5.31** | **6.02** | **0.63** | **93.97** |

***Table 5: Poverty Status of Sample Households, as Estimated by Model and Revealed by the Benchmark Survey, at $2.50 Poverty Line***

| | **Number of households identified as poor by the tool** | **Number of households identified as not poor by the tool** |
|---|---|---|
| **Number of "true" poor households (as determined by benchmark survey)** | 660<br>(82.6%) | 37<br>(4.6%) |
| **Number of "true" not poor households (as determined by benchmark survey)** | 42<br>(5.3%) | 60<br>(7.5%) |

***Table 6: Regression Estimates using 1-step Quantile Method for Prediction at the $2.50 Poverty Line***

BANGLADESH 1-STEP MAXR/QUANT
Regression results, estimation point of 72 percentile

.72 Quantile regression — Number of obs = 799
Raw sum of deviations 297.4386 (about 9.5979128)
Min sum of deviations 194.9487 — Pseudo R2 = 0.3446

| Indicator | Coefficients | Standard Error | t | P>\|t\| | 95% conf | Interval |
|---|---|---|---|---|---|---|
| Intercept | 9.6848 | 0.2284 | 42.4100 | 0.0000 | 9.2365 | 10.1330 |
| Household head age | 0.0091 | 0.0087 | 1.0400 | 0.3010 | -0.0081 | 0.0262 |
| Household head age squared | -0.0001 | 0.0001 | -0.8000 | 0.4220 | -0.0002 | 0.0001 |
| Household size | -0.1255 | 0.0215 | -5.8300 | 0.0000 | -0.1678 | -0.0833 |
| Household size squared | 0.0021 | 0.0010 | 2.1200 | 0.0340 | 0.0002 | 0.0040 |
| Division is in Dhaka | 0.0559 | 0.0701 | 0.8000 | 0.4250 | -0.0817 | 0.1936 |
| Division is in Chittagong | 0.2711 | 0.0735 | 3.6900 | 0.0000 | 0.1267 | 0.4154 |
| Division is in Khulna | -0.2356 | 0.1142 | -2.0600 | 0.0390 | -0.4597 | -0.0115 |
| Division is in Rajshani | -0.1345 | 0.0702 | -1.9200 | 0.0560 | -0.2723 | 0.0033 |
| Location is in rural | -0.0602 | 0.0801 | -0.7500 | 0.4520 | -0.2174 | 0.0969 |
| Household (HH) owns a black and white TV | 0.0431 | 0.0563 | 0.7700 | 0.4440 | -0.0674 | 0.1536 |
| Number of rooms | 0.1201 | 0.0243 | 4.9400 | 0.0000 | 0.0724 | 0.1679 |
| Toilet is shared pit toilet | -0.1617 | 0.0564 | -2.8600 | 0.0040 | -0.2724 | -0.0509 |
| Meals are cooked in a separate kitchen | 0.1109 | 0.0443 | 2.5000 | 0.0130 | 0.0239 | 0.1980 |
| Cooking fuel is purchased bamboo, wood or sawdust | 0.1264 | 0.0595 | 2.1300 | 0.0340 | 0.0097 | 0.2432 |
| Main entrance does not have a lock | -0.0775 | 0.0569 | -1.3600 | 0.1740 | -0.1893 | 0.0342 |
| Main entrance lock is wood or metal bar to close from inside only or security key lock/ metal frame with padlock | -0.1017 | 0.0589 | -1.7300 | 0.0850 | -0.2173 | 0.0139 |
| Number of blankets and quilts owned | 0.0430 | 0.0123 | 3.5100 | 0.0000 | 0.0190 | 0.0671 |
| Number of cattle and buffalo owned | 0.0444 | 0.0179 | 2.4800 | 0.0130 | 0.0093 | 0.0796 |
| Number of milk cows and heifers owned | 0.0485 | 0.0207 | 2.3400 | 0.0200 | 0.0078 | 0.0893 |
| Number of radios owned | 0.1238 | 0.0417 | 2.9700 | 0.0030 | 0.0420 | 0.2056 |
| Number of saris owned | 0.0147 | 0.0036 | 4.0600 | 0.0000 | 0.0076 | 0.0219 |
| Household head is male | 0.0551 | 0.0598 | 0.9200 | 0.3570 | -0.0622 | 0.1724 |
| Share of household members excluding household head that has no education or only read in class 1 | -0.6245 | 0.1154 | -5.4100 | 0.0000 | -0.8510 | -0.3979 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Share of household members excluding household head that did not complete primary school | -0.4754 | 0.1214 | -3.9100 | 0.0000 | -0.7138 | -0.2370 |