

# Simple Poverty Scorecard<sup>®</sup>

## Pakistan

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This document and related tools are in English at [SimplePovertyScorecard.com](http://SimplePovertyScorecard.com).

### **Abstract**

The Simple Poverty Scorecard<sup>®</sup> uses 10 low-cost indicators from the 2001 Pakistan Integrated Household Survey to estimate the likelihood that a household has consumption below a given poverty line. Field workers can collect responses in about ten minutes. Accuracy is reported for a range of poverty lines. The scorecard is a practical way for pro-poor programs in Pakistan to measure poverty rates, to track changes in poverty rates over time, and to segment clients for differentiated treatment.

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## Simple Poverty Scorecard<sup>®</sup>

|                       |                                    |                   |
|-----------------------|------------------------------------|-------------------|
| Interview ID: _____   | <u>Name</u>                        | <u>Identifier</u> |
| Interview date: _____ | Participant: _____                 | _____             |
| Country: <u>PAK</u>   | Field agent: _____                 | _____             |
| Scorecard: <u>001</u> | Service point: _____               | _____             |
| Sampling wgt.: _____  | Number of household members: _____ |                   |

| Indicator   | Response                           | Points | Score |
|---|------------------------------------|--------|-------|
| 1. Do all children ages 6 to 17 attend school?                | A. No, or five or more children    | 0      |       |
|   | B. Yes, and three or four children | 10     |       |
|   | C. Yes, and two children           | 15     |       |
|   | D. Yes, and one child              | 20     |       |
|   | E. No children ages 6 to 17        | 23     |       |
| 2. What is the household's main source of drinking water?     | A. Hand pump                       | 0      |       |
|   | B. Other                           | 7      |       |
| 3. Does the household own a refrigerator or freezer?          | A. No                              | 0      |       |
|   | B. Yes                             | 15     |       |
| 4. What type of toilet is used by the household?              | A. Other                           | 0      |       |
|   | B. Flush connected to pit          | 7      |       |
|   | C. Flush connected to public sewer | 10     |       |
| 5. Does the household own a cooking stove?                    | A. No                              | 0      |       |
|   | B. Yes                             | 9      |       |
| 6. How many household members have salaried employment?       | A. None                            | 0      |       |
|   | B. One, or two                     | 3      |       |
|   | C. Three or more                   | 9      |       |
| 7. Does the household own any type of land?                   | A. No                              | 0      |       |
|   | B. Yes                             | 7      |       |
| 8. If the household is rural, then does it own any buffaloes? | A. Rural, but no buffaloes         | 0      |       |
|   | B. Urban (regardless of buffaloes) | 1      |       |
|   | C. Rural, and has buffaloes        | 4      |       |
| 9. Does the household own any motorcycles or scooters?        | A. No                              | 0      |       |
|   | B. Yes                             | 11     |       |
| 10. Does the household own any radios or cassette players?    | A. No                              | 0      |       |
|   | B. Yes                             | 5      |       |

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**Score:**

# Simple Poverty Scorecard<sup>®</sup>

## Pakistan

### 1. Introduction

This paper presents the Simple Poverty Scorecard<sup>®</sup>. Pro-poor programs in Pakistan can use it to estimate the likelihood that a household has consumption below a given poverty line, to measure groups' poverty rates at a point in time, to track changes in groups' poverty rates over time, and to segment participants for differentiated treatment.

Indicators were derived from the 15,503 households in the 2001 Pakistan Integrated Household Survey (PIHS). Selection criteria included:

- Inexpensive to collect, easy to answer quickly, and simple to verify
- Liable to change over time as poverty status changes
- Strongly correlated with poverty

All points are positive integers, and scores range from 0 (most-likely “poor”) to 100 (least-likely “poor”). The scorecard is easy to understand, and field workers can compute scores by hand, on paper, in real time.

A participant's score corresponds to a “poverty likelihood”, that is, the probability of being poor. For a group, the overall poverty rate (the so-called “head-count index”) is the average poverty likelihood of the individuals in the group. For a group over time, progress (or regress) is the change in its average poverty likelihood.

The Simple Poverty Scorecard<sup>®</sup> should qualify for certification for the reporting required of USAID's microenterprise partners. In particular, it is highly practical to use. Also, it accurately and objectively estimates the likelihood of having income below the national poverty line. With 90-percent confidence, a household's estimated poverty likelihood is accurate within 10 percentage points, and a group's estimated overall poverty rate is accurate within  $\pm 1.1$  percentage points ( $n = 16,384$ ).

## 2. Data and poverty lines

The analysis uses the 15,503 households in the 2001 PIHS from Pakistan's Federal Bureau of Statistics. This is the best, most recent household consumption survey for Pakistan. This paper divides households into three random samples (Figure 1), with one-half used for constructing the scorecard, one-fourth used for associating scores with estimated poverty likelihoods, and the final one-fourth used for measuring the accuracy of estimates derived from the scorecard.

Pakistan's official poverty line in 2000–01 was Rs748.57 per adult equivalent per month (World Bank, 2004). Although derived from age- and sex-specific caloric guidelines (Figure 2), the poverty line does not presume that people would spend all of their first Rs748.57 on food. Rather, it is the amount of consumption (on both food and non-food) observed among people who just meet the caloric guidelines. Each household's poverty line was taken as the sum of the individual poverty lines of its members.

Applying the official poverty line to the 2001 PIHS gives an overall poverty rate of 40.3 percent, or 51.3 million people. The rural poverty rate is 46.6 percent, while urban is 24.5 percent. This paper presents a single scorecard for use anywhere in Pakistan, as studies of India and Mexico (Schreiner, 2006 and 2005a) found only small returns to segmenting scorecards by rural and urban.

### 3. Scorecard construction

About 400 potential poverty indicators were prepared, including:

- Household and housing characteristics (such as cooking fuel and type of floor)
- Individual characteristics (such as age and highest grade completed)
- Household consumption (such as milk and meat)
- Household durable goods (such as electric fans and stoves)

Each indicator's ability to predict poverty was tested first with the entropy-based "uncertainty coefficient" (Goodman and Kruskal, 1979). This resembles a correlation coefficient, but it is applied to categorical indicators (such as "type of floor") rather than continuous ones (such as "square meters of floor space"). About 150 indicators were then selected for further analysis. Figure 3 lists the top 73, ranked by uncertainty coefficient. Responses are ordered by strength of association with poverty.

Many indicators in Figure 3 are similar in terms of their link with poverty. For example, households with a flush toilet connected to a public sewer are also more likely than other households to have piped water. If a scorecard already includes "flush toilet connected to public sewerage", then "piped drinking water" is more or less superfluous. Thus, many indicators strongly linked with poverty are not included because similar indicators are already included.

The Simple Poverty Scorecard<sup>®</sup> also aims to measure *changes* in poverty through time. Thus, some powerful indicators (such as education of the female head/spouse) that are unlikely to change as poverty changes were omitted in favor of slightly less-powerful indicators (such as the presence of a radio) that are more likely to change. No

indicators of past consumption (such as “In the past two weeks, did anyone in the household eat any tomatoes”) were selected because they cannot be directly observed nor verified.

Finally, some indicators were not selected because they are difficult to collect (“Have you received or contributed to Zakat, Usher, or Nazrana?”), difficult to compute (“What is the ratio of adults to children in the household?”) or too sensitive (“Who decides whether the female head/spouse uses contraception?”).

The scorecard itself was constructed using Logit regression. Indicator selection combined statistics with the judgment of an analyst with expertise in scoring and development. Starting with a scorecard with no indicators, each candidate indicator was added, one-by-one, to a one-indicator scorecard, using Logit to derive weights. The improvement in accuracy for each indicator was recorded using the “c” statistic.<sup>1</sup>

After all indicators had been tested, one was selected based on several criteria (Schreiner *et al.*, 2004; Zeller, 2004). These included the improvement in accuracy, the likelihood of acceptance by users (determined by simplicity, cost of collection, and “face

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<sup>1</sup> Higher “c” indicates greater ability to rank households by poverty status. For a Logit regression with a categorical outcome (such as poor/not poor), “c” is a general measure of explanatory power, much like  $R^2$  in a least-squares regression on a continuous outcome. “c” is equal to the Mann-Whitney statistic (also known as the Wilcoxon rank-sum statistic) that indicates how much two distributions overlap (here, the distributions are of the estimated poverty likelihoods for poor and non-poor households). “c” is also equivalent to the area under an ROC curve—discussed in more detail later—that plots the share of poor and non-poor households versus all households ranked by score. Finally, “c” can also be seen as the share of all possible pairs of poor and non-poor households in which the poor household has a lower score. The more often the poor household has the lower score, the better the ranking by poverty status.

validity” in terms of experience, theory, and common sense), the ability of the indicator to change values as poverty status changes over time, variety vis-à-vis other indicators already in the scorecard, and ease of observation/verification.

The selected indicator was then added to the scorecard, and the previous steps were repeated until 10 indicators were selected. Finally, the Logit coefficients were transformed into non-negative integers such that the lowest possible score is 0 (most likely poor) and the highest is 100.

This statistical algorithm is the Logit analogue to the stepwise “MAXR” in, for example, Zeller, Alcaraz and Johannsen (2005) and IRIS (2005a and 2005b). The procedure here diverges from naïve stepwise in that expert judgment and non-statistical criteria are used to select from among the most-predictive indicators. This improves robustness and, more importantly, helps ensure that the indicators are simple and sensible, increasing the likelihood of acceptance by users.



## 4. Scorecard use

As explained in Schreiner (2005b), the central challenge is not to maximize accuracy but rather to maximize the likelihood of programs' using scoring appropriately. When scoring projects fail, the culprit is usually not inaccuracy but rather the failure of users to accept scoring and to use it properly (Schreiner, 2002). The challenge is not technical but human and organizational, not statistics but change management. Accuracy is easier—and less important—than practicality.

The scorecard here was designed to help users to understand and trust it (and thus use it properly). While accuracy matters, it must be balanced against simplicity, ease-of-use, and “face validity”. In particular, programs are more likely to collect data, compute scores, and pay attention to the results if, in their view, scoring avoids creating “extra” work and if the whole process generally seems to make sense.

This practical focus naturally leads to a one-page scorecard that allows field workers to score households by hand in real time because it features:

- Only 10 indicators
- Only observable, categorical indicators (“flooring material”, not “value of house”)
- User-friendly weights (non-negative integers, no arithmetic beyond simple addition)

Among other things, this simplicity enables “rapid targeting”, such as determining (in a day) who in a village qualifies for, say, work-for-food, or ration cards.

The scorecard is ready to be photocopied. A field agent collecting data and computing scores on paper would:

- Read each question off the scorecard
- Circle the response and the corresponding points
- Write the points in the far-right column
- Add up the points to get the total score
- Implement program policy based on the score

#### 4.1 Scores and poverty likelihoods

A score is not a poverty likelihood (that is, the probability of being poor), but each score is associated with an estimated poverty likelihood via a simple table (Figure 5). For example, scores of 20–24 correspond to a poverty likelihood of 57.6 percent.

Scores (sums of weights) are associated with estimated poverty likelihoods (probabilities of being poor) via the “bootstrap” (Efron and Tibshirani, 1993):

- From the first one-fourth hold-out sample, draw a new sample of the same size *with replacement*
- For people in a given score range, compute the share who are poor
- Repeat the previous two steps 10,000 times
- For a given score range, define the poverty likelihood as the average of the shares of people who are poor in that score range across the 10,000 samples

These resulting poverty likelihoods are objective, that is, based on data. This process would produce objective poverty likelihoods *even if the scorecards themselves were constructed without data*. In fact, scorecards of objective, proven accuracy are often constructed *only* with qualitative judgment (Fuller, 2006; Caire, 2004; Schreiner *et al.*, 2004). Of course, the scorecard here uses data. While its construction—like any

statistical analysis—was partially informed by the analyst’s judgment, the explicit acknowledgment of this fact is irrelevant for the objectivity of the poverty likelihoods. After all, objectivity depends on using data to associate scores with poverty likelihoods, not on pretending to avoid the use of judgment during scorecard construction.

Figure 6 depicts the precision of estimated poverty likelihoods as point estimates with 90-, 95-, and 99-percent confidence intervals. This is a standard, widely understood way to measure accuracy. The confidence intervals here were derived empirically from the 10,000 bootstrap samples described above. For a given score, the lower (upper) bound on the  $x$ -percent confidence interval is the value less (greater) than  $(100-x)/2$  percent ( $(100+x)/2$  percent) of the bootstrapped likelihoods.

For example, the average poverty rate across bootstrap samples for people with scores of 20–24 is 57.6 percent (this is the poverty likelihood in Figure 5). In 90 percent of samples, the poverty rate is between 52.8–62.4 percent (Figure 6). In 95 percent of samples, the share is 51.9–63.2; in 99 percent of samples, the share is 49.9–64.9.

For estimated and true poverty likelihoods, Figure 7 depicts mean absolute differences and confidence intervals from bootstrapping the second one-fourth hold-out sample from the 2001 PIHS. The mean absolute difference is 5.8 percentage points.

This discussion so far looks at whether estimated poverty likelihoods are close to true poverty likelihoods. There is another aspect of accuracy, one associated with targeting: how well the poor are concentrated in low scores. A perfect scorecard would assign all the lowest scores to poor people (and all the highest scores to non-poor

people). In reality, no scorecard is perfect, so some poor people have high scores, and vice versa.

ROC curves are standard tools for showing how well the poor are concentrated in lower scores (Baulch, 2003; Wodon, 1997). They plot the share of poor and non-poor households against the share of all households ranked by score.

What does the ROC curve in Figure 8 mean? Suppose a program sets a cut-off so as to target the lowest-scoring  $x$  percent of people. The ROC curve then shows the share of the poor (northwest curve) and non-poor (southwest curve) targeted. Greater ability to rank-order—with less leakage and less undercoverage—is shown by curves that are closer to the northwest and southeast corners of the graph.

In Figure 8, the northwest (southeast) curve depicts accuracy among the poor (non-poor). As a benchmark, the external trapezoid shows the accuracy of a hypothetical perfect scorecard that assigns all of the lowest scores to poor people. The diagonal line represents random targeting.

The curves for the scorecard show, for example, that targeting the 20 percent of households with the lowest scores would target 37 percent of all the poor and 8 percent of all the non-poor. In contrast, randomly targeting 20 percent of cases would target 20 percent of the poor and 20 percent of the non-poor.

Figure 8 also reports two other common measures of rank-ordering. The first is the Kolmogorov-Smirnov (KS) statistic, defined as the maximum distance between the poor and non-poor curves (here 47.5). Higher KS implies better rank-ordering.

The second measure is the ratio of the area inside the ROC curves to the area inside the trapezoid of a hypothetical perfect scorecard (here 60.5). Again, greater area within the curves implies better rank-ordering.

## 4.2 Estimates of overall poverty rates

The estimated overall poverty rate is the average of the estimated poverty likelihoods of individuals.

For example, suppose a program has 3,000 participants on Jan. 1, 2006 and that 1,000 have scores of 20, 1,000 have scores of 30, and 1,000 have scores of 40. The poverty likelihoods that correspond to these scores are 57.6, 36.2, and 17.9 percent (Figure 5). The overall poverty rate is the participants' average poverty likelihood, that is,  $1,000 \times (57.6 + 36.2 + 17.9) \div 3,000 = 37.2$  percent.

To test accuracy and precision, the scorecard was applied to 10,000 bootstrap replicates from the second one-fourth hold-out sample, comparing the estimated overall poverty rates with the true values. The mean difference was 4.3 percentage points, with a standard deviation of 0.68. The 90-percent confidence interval around the mean was  $\pm 1.1$  percentage points, the 95-percent interval was  $\pm 1.3$  percentage points, and the 99-percent interval was  $\pm 1.7$  percentage points.

In practice, this means that subtracting 4.3 percentage points from a group's average poverty likelihood would produce an unbiased estimate that, in 99 of 100 cases, would be within  $\pm 1.7$  percentage points of the true overall poverty rate.

### 4.3 Change over time

For a given group, change in poverty over time is estimated as the change in the average poverty likelihood.

Continuing the previous example, suppose that on Jan. 1, 2007, the same 3,000 people (some of whom may no longer be participants) are now in groups of 500 with scores of 20, 25, 30, 35, 40, and 45 (by Figure 5, poverty likelihoods of 57.6, 34.5, 36.2, 24.6, 17.9, and 13.5 percent). Their average poverty likelihood is now 30.7 percent, an improvement of  $37.2 - 30.7 = 6.5$  percentage points. In other words, 6.5 of every 100 in this group left poverty. Among those who were poor to start with, about one in six ( $6.5 \div 37.2 = 17.4$  percent) left poverty.

Of course, the scorecard does not indicate what *caused* progress; it just measures the change, regardless of cause.

## 5. Setting targeting cut-offs

How can the scorecard be used for targeting? Potential participants with scores at or below a targeting cut-off are labeled *targeted* and treated—for program purposes—as if they were poor. Those with higher scores are *non-targeted* and treated—again, for program purposes—as if they were non-poor.

*Poverty status* (consumption below a poverty line) is distinct from *targeting status* (score below a cut-off). Poverty status is a fact whose determination requires an expensive survey. In contrast, targeting status is a policy choice whose determination requires a cut-off and an inexpensive estimate of poverty likelihood. Indeed, the purpose of scoring is to infer poverty status without incurring the cost of direct measurement.

No scorecard is perfect, so some of the truly poor will not be targeted, and some of the truly non-poor will be targeted. Targeting is accurate to the extent that poverty status matches targeting status. In turn, this depends on the selection of a targeting cut-offs and how it balances accuracy for the poor versus non-poor. The standard approach uses a *classification matrix* and a *net-benefit matrix* (Adams and Hand, 2000; Hoadley and Oliver, 1998; Greene, 1993).

## 5.1 Classification matrix

Given a targeting cut-off, there are four possible classification results:

|                   |            |              |                                 |
|-------------------|------------|--------------|---------------------------------|
| A. Truly poor     | correctly  | targeted     | (score at or below the cut-off) |
| B. Truly poor     | mistakenly | non-targeted | (score above cut-off)           |
| C. Truly non-poor | mistakenly | targeted     | (score at or below cut-off)     |
| D. Truly non-poor | correctly  | non-targeted | (score above cut-off)           |

These four possibilities can be shown as a general classification matrix (Figure 9). Accuracy improves as there are more cases in A and D and fewer in B and C.

Figure 10 shows the number of people in each classification by score in the second one-fourth hold-out sample. For example, with a cut-off of 20–24, there are:

|         |                |            |              |
|---------|----------------|------------|--------------|
| A. 32.8 | truly poor     | correctly  | targeted     |
| B. 10.9 | truly poor     | mistakenly | non-targeted |
| C. 13.2 | truly non-poor | mistakenly | targeted     |
| D. 43.1 | truly non-poor | correctly  | non-targeted |

Targeting accuracy (and errors of undercoverage and leakage) depends on the cut-off. For example, if the cut-off were increased to 25–29, more poor (but less non-poor) are correctly targeted:

|         |                |            |              |
|---------|----------------|------------|--------------|
| A. 35.9 | truly poor     | correctly  | targeted     |
| B. 7.8  | truly poor     | mistakenly | non-targeted |
| C. 19.0 | truly non-poor | mistakenly | targeted     |
| D. 37.3 | truly non-poor | correctly  | non-targeted |

Whether a cut-off of 20–24 is preferred to 25–29 depends on net benefit.



## 5.2 Net-benefit matrix

Each of the four classification results is associated with a net benefit (Figure 11):

|  |                           |            |              |
|--|---------------------------|------------|--------------|
| $\alpha$ . Benefit                     | per truly poor person     | correctly  | targeted     |
| $\beta$ . Cost (negative net benefit)  | per truly poor person     | mistakenly | non-targeted |
| $\gamma$ . Cost (negative net benefit) | per truly non-poor person | mistakenly | targeted     |
| $\delta$ . Benefit                     | per truly non-poor person | correctly  | non-targeted |

Each net benefit  $\alpha$ ,  $\beta$ ,  $\gamma$ , and  $\delta$  corresponds to one of the quadrants in the general classification matrix in Figure 9. For example,  $\alpha$  is the net benefit associated with each truly poor person who is correctly targeted in quadrant A, and  $\beta$  is the cost (negative net benefit) associated with each truly poor person incorrectly targeted in quadrant B.

Given a net-benefit matrix and a classification matrix, total net benefit is the sum of the net benefit per person in each quadrant multiplied by the number of people in the quadrant, summed across all four quadrants:

$$\text{Total net benefit} = \alpha \cdot A + \beta \cdot B + \gamma \cdot C + \delta \cdot D.$$

To set an optimal cut-off, a program would:

- Select a net-benefit matrix based on its values and mission
- Compute total net benefits for each cut-off with the net-benefit matrix and Figure 10
- Select the cut-off with the highest total net benefit

The only non-trivial step is selecting a net-benefit matrix. Some common net-benefit matrices are discussed below. In general, however, each program should thoughtfully decide for itself how much it values successful targeting versus errors of undercoverage and leakage. Of course, any program that targets already uses (if only implicitly) a net-benefit matrix. It is healthy to go through a process of thinking explicitly and intentionally about the value of possible targeting outcomes.

For example, suppose a program places great importance on correctly targeting the poor, even at the cost of accidentally targeting more non-poor. It could reflect this valuation by increasing the weight on quadrant A (by increasing its net benefit  $\alpha$ ), and/or by decreasing the weight on quadrant B (by decreasing its net benefit  $\beta$ ). The examples of net-benefit matrices discussed next represent different valuations of correctly/incorrectly targeting the poor/non-poor.

### 5.2.1 “Total Accuracy”

As an example, suppose a program selects the net-benefit matrix that corresponds to the “Total Accuracy” criterion (Figure 12, IRIS, 2005b). Then total net benefit is the number of people correctly classified:

$$\begin{aligned} \text{Total net benefit} &= 1 \cdot A + 0 \cdot B + 0 \cdot C + 1 \cdot D, \\ &= A + D. \end{aligned}$$

This values correct classifications of the poor and non-poor equally. Grootaert and Braithwaite (1998) and Zeller, Alcaraz, and Johannsen (2005) use “Total Accuracy” to evaluate their poverty-assessment tools.

Figure 13 shows “Total Accuracy” for all cut-offs. Total net benefit is greatest (75.9) for a cut-off of 20–24; at that point, poverty segment matches poverty status for three out of four people.

“Total Accuracy” weighs the poor and non-poor the same. If most people are non-poor and/or if a scorecard is more accurate for the non-poor, then “Total Accuracy”

might look good even if few poor people are correctly classified. Development programs, however, probably value correct targeting more for the poor than for the non-poor.

A simple, transparent way to reflect this valuation is to increase the relative net benefit  $\alpha$  of correctly classifying the poor. For example, if a program values correctly targeting the poor twice as much as correctly not targeting the non-poor, then  $\alpha$  should be set twice as high as  $\delta$  in the net-benefit matrix. Then the new optimal cut-off is 30–34, the cut-off point where  $\alpha \cdot A + \delta \cdot D = 2 \cdot A + D$  is highest.

### 5.2.2 “Poverty Accuracy”

A criterion that values only correctly classifying the poor is “Poverty Accuracy” (Figure 14, IRIS, 2005b):

$$\begin{aligned} \text{Total net benefit} &= 1 \cdot A + 0 \cdot B + 0 \cdot C + 0 \cdot D, \\ &= A. \end{aligned}$$

Of course, correctly targeting the poor is rarely the sole criteria. In fact, Figure 13 shows that “Poverty Accuracy” is greatest with a cut-off of 95–100. While targeting everyone does ensure that all poor people are targeted and so minimizes *undercoverage* of the poor (second-to-last column of Figure 13), it also targets all the non-poor and so maximizes *leakage* (the last column of Figure 13).

### 5.2.3 “Non-poverty Accuracy”

“Non-poverty Accuracy” counts only correct classifications of the non-poor (total net benefit is D). This is maximized by setting a cut-off of 0–4 and thus not targeting anyone (minimum leakage but maximum undercoverage).

#### 5.2.4 “BPAC”

IRIS (2005b) proposes a new measure of accuracy called the “Balanced Poverty Accuracy Criterion”. BPAC balances two goals:

- Accuracy of the estimated overall poverty rate
- “Poverty Accuracy”

According to IRIS (2005b), the first goal is optimized when undercoverage B is balanced by leakage C, and the second goal is optimized by maximizing A. If  $B > C$ , then BPAC’s net-benefit matrix is Figure 15. In essence, BPAC maximizes A while making B and C as close to each other as possible:

$$\begin{aligned}\text{Total net benefit} &= 1 \cdot A + 1 \cdot B + (-1) \cdot C + 0 \cdot D, \\ &= A + (B - C).\end{aligned}$$

If  $C > B$ , then total net benefit under BPAC is  $A + (C - B)$ .

BPAC was invented because IRIS does not estimate poverty likelihoods. Instead, IRIS estimates consumption and then labels as poor those households with estimated consumption less than the poverty line. In this set-up, the overall poverty rate is estimated as the share of people targeted, and this estimate is most accurate (that is, closest to the true value) when undercoverage B equals leakage C.

For a scorecard (like the one here) that estimates poverty likelihoods, however, BPAC is not meaningful. This is because the estimated overall poverty rate is the average of participants' estimated poverty likelihoods. These estimates are independent of whatever targeting cut-off a program might set. In contrast, the targeting errors of undercoverage B and leakage C depend directly on the cut-off. Thus, for scorecards that estimate poverty likelihoods, getting B close to C is not related to optimizing the accuracy of the estimated overall poverty rate and so is not related to BPAC's goals.

## 6. Training, quality-control, and MIS

The technical aspects of scorecard construction and accuracy just discussed are important, but gaining the trust and acceptance of managers and field workers is even more important (Schreiner, 2002).

In particular, the field workers who collect indicators must be trained. If they put garbage in, the scorecard will put garbage out. To prevent abuse, on-going quality control of data is required.

Programs should record in their MIS at least the poverty likelihood along with an identifier for each client. Ideally, they would also record the score, the indicators, and the values of the indicators. This will allow quick computation of average poverty likelihoods (as well as other analyses), both for a point in time and for changes through time (Matul and Kline, 2003).

## 7. Calibrating the scorecard for the very poor

The Simple Poverty Scorecard<sup>®</sup> can be used to track outreach not only to the poor but also to the *very poor*, that is, the poorest half of the poor below the national poverty line. This is the relevant group for USAID certification.

### 7.1 Poverty likelihoods

As before, scores are associated with the probability of being very poor by bootstrapping 10,000 samples from first one-fourth hold-out sample from the 2001 PIHS. The poverty likelihood for a given score is then taken as the average of the shares of people with that score who are very poor across the 10,000 samples.

Columns 2–4 in Figure 16 are the poverty likelihoods for the three classes for all scores. For example, if a potential participant has a score of 10–14, the probability of being very poor is 44.5 percent, the probability of being poor is 24.6 percent, and the probability of being non-poor is 30.9 percent.

Columns 5–7 in Figure 16 are the share of targeted participants by poverty status and by cut-off. For example, for a cut-off of 10–14, 52.5 percent of those targeted would be very poor, 23.9 percent would be poor, and 23.6 percent would be non-poor.

Each person is associated with three poverty likelihoods. For example, a person with a score of 10 may be targeted as very poor, but the likelihood of truly being very poor is not 100 percent but rather 44.5 percent (from Figure 16). The same person has a 24.6-percent likelihood of being truly poor, and a 30.9-percent likelihood of being truly

non-poor. Each person has one targeting status (for program purposes), one true poverty status (in reality), and three estimated poverty likelihoods (one for each possible poverty status).

As before, these poverty likelihoods are objective, that is, based on data. They are valid even though the scorecard was not constructed originally to predict the likelihood of being very poor. It works because the likelihood of being very poor is highly correlated with having a low score (high likelihood of being poor). A scorecard could be built specifically for the very poor, but it would add cost and complexity.

Figure 17 shows the precision of estimated poverty likelihoods for being very poor as point estimates with 90-, 95-, and 99-percent confidence intervals. For example, the average poverty rate (the poverty likelihood) across bootstrap samples for people with scores of 10–14 was 44.5 percent. In 90 percent of 10,000 bootstraps from the second one-fourth hold-out sample, the share was between 40.2–48.9 percent. In 95 percent of samples, the share was between 39.3–49.8, and in 99 percent of samples, the share was between 37.7–51.6.

For estimated and true poverty likelihoods, Figure 18 depicts mean absolute differences and confidence intervals from 10,000 bootstraps on the second one-fourth hold-out sample. Weighting by the people in a score range, the mean absolute difference is 4.9 percentage points, with a 90-percent interval of  $\pm 3.6$  percentage points.

The other aspect of accuracy is how well the very poor are concentrated in low scores. Once again, an ROC curve is a useful way to look at this.



Figure 19 plots the share of the very poor against the share of the not very poor, ranked by score. For example, targeting the 25 percent of cases with the lowest scores would target 53 percent of all the very poor and 18 percent of all the not very poor.

In terms of the Kolmogorov-Smirnov statistic, the maximum distance between the curves is 46.6. In terms of the ratio of the area inside the scorecard curves to the area inside the trapezoid of a hypothetical perfect scorecard, the value is 57.4.

## **7.2 Overall poverty rates for the very poor**

The average of estimated poverty likelihoods for a group is their estimated overall (very poor) poverty rate. To measure the accuracy and precision of this estimate, the scorecard was applied to 10,000 bootstrap replicates from the second one-fourth hold-out samples from the 2001 PIHS, and then the estimated overall poverty rates were compared with the true values. The mean difference was 5.7 percentage points, with a standard deviation of 0.60. The 90-percent confidence interval around the mean was  $\pm 1.0$  percentage points, the 95-percent interval was  $\pm 1.2$  percentage points, and the 99-percent interval was  $\pm 1.5$  percentage points.

Thus, subtracting 5.7 percentage points to a group's average poverty likelihood would produce an unbiased estimate that, in 99 of 100 cases, would be within  $\pm 1.5$  percentage points of the true overall (very poor) poverty rate. This estimate is both accurate and precise.

### 7.3 Targeting the very poor

As before, targeting involves using a classification matrix and a net-benefit matrix to select a cut-off. The wrinkle is that there are now three poverty statuses:

- Very poor: Poorest half of those with consumption at or below the poverty line
- Poor: Least-poor half of those with consumption at or below poverty
- Non-poor: Consumption above poverty

There are also three targeting segments:

- Very poor: Score at or below the very poor/poor cut-off
- Poor: Score above the very poor/poor cut-off and at or below the poor/non-poor cut-off
- Non-poor: Score above the poor/non-poor cut-off

There are two cut-offs (very poor/poor and poor/non-poor) and 9 classification results (Figure 20):

|                    |                         |           |
|--------------------|-------------------------|-----------|
| A. Truly very poor | correctly targeted as   | very poor |
| B. Truly very poor | incorrectly targeted as | poor      |
| C. Truly very poor | incorrectly targeted as | non-poor  |
| D. Truly poor      | incorrectly targeted as | very poor |
| E. Truly poor      | correctly targeted as   | poor      |
| F. Truly poor      | incorrectly targeted as | non-poor  |
| G. Truly non-poor  | incorrectly targeted as | very poor |
| H. Truly non-poor  | incorrectly targeted as | poor      |
| I. Truly non-poor  | correctly targeted as   | non-poor  |

The general classification matrix (Figure 20) and the net-benefit matrix (Figure 21) are combined as before to define total net benefit:

$$\text{Total net benefit} = \alpha \cdot A + \beta \cdot B + \gamma \cdot C + \delta \cdot D + \varepsilon \cdot E + \zeta \cdot F + \eta \cdot G + \theta \cdot H + \iota \cdot I.$$

Figure 22 shows classification results for all possible pairs of cut-off scores in the second one-fourth hold-out sample. For example, suppose a program defined:

- Very poor/poor cut-off of 10–14 (so scores of 0–14 are targeted as very poor)
- Poor/non-poor cut-off of 20–24 (so scores of 15–24 are targeted as poor, and scores of 25–100 are targeted as non-poor)

As with any scorecard and cut-offs, there is both successful targeting and errors. For the example cut-offs of 10–14 and 20–24, targeting would be correct for 60 percent of the very poor, 25 percent of the poor, and 76 percent of the non-poor (Figure 23).

The program chooses a set of cut-offs to optimize the benefits of correct classifications, net of the costs (negative benefits) of incorrect classifications. For example, suppose the net-benefit matrix is Figure 24, representing one way to reflect:

- Greater importance of correctly targeting the very poor and poor
- Greater cost of gross errors such as targeting the truly very poor as non-poor

Given the classification results in Figure 23 and net benefits in Figure 24, total net benefit for the cut-off pair of 10–14 and 20–24 is +584 (Figure 25).

Is this the best pair of cut-offs? The answer requires applying the net-benefit matrix to the classification results for all 190 possible pairs (Figure 22). It turns out that total net benefit is highest for cut-offs 20–24 and 30–34, giving a net benefit of 952.

## 8. Conclusion

Pro-poor programs in Pakistan can use the Simple Poverty Scorecard<sup>®</sup> to segment clients for differentiated services as well as to estimate:

- The likelihood that a household has consumption below a given poverty line
- The poverty rate of a population at a point in time
- The change in the poverty rate of a population between two points in time

The scorecard is inexpensive to use and can be understood by non-specialists. It is designed to be practical for local, pro-poor organizations in Pakistan that want to improve how they monitor and manage their social performance.

The scorecard is built and tested using data on 15,503 households from the 2001 PIHS. The scorecard is calibrated to estimate the likelihood of being poor (consumption below the national poverty line) or very poor (poorest half of the poor).

Out-of-sample bootstrap tests show that the estimates are both accurate and precise. For individual poverty likelihoods (whether poor or very poor), estimates are within 10 percentage points of the true value with 90-percent confidence ( $n = 16,384$ ). For a group's overall poverty rate (again, whether poor or very poor), estimates are within 1.1 percentage points of the true value.

For targeting, programs can use the classification results reported here to select the best cut-off for their particular values and mission.

Accuracy is important, but ease-of-use is even more important; a perfectly accurate scorecard is worthless if programs feel daunted by its complexity and so never even try to use it. For this reason, the scorecard here is kept simple, using 10 indicators

that are inexpensive to collect and that are straightforward to observe and verify. Points are either zeros or positive integers, and scores range from 0 (most likely poor) to 100 (least likely poor). Scores are related to poverty likelihoods via a simple look-up table, and targeting cut-offs are also simple to apply. Thus, users can not only understand the scorecard, but they can also use it to compute scores in the field, by hand, in real time.

In summary, the Simple Poverty Scorecard<sup>®</sup> is a practical, objective way for pro-poor programs in Pakistan to estimate consumption-based poverty rates, track changes in poverty rates over time, and segment participants for differentiated services. The same approach can be applied to any country with similar data.

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**Figure 1: Households surveyed, people represented,  
and overall poverty rates**

| <b>Sub-sample</b>                   | <b>Households</b> | <b>People</b> | <b>% poor</b> |
|-------------------------------------|-------------------|---------------|---------------|
| Constructing scorecards             | 7,715             | 63,942,568    | 40.2          |
| Associating scores with likelihoods | 3,939             | 32,844,834    | 41.5          |
| Testing accuracy                    | 3,849             | 30,385,549    | 39.4          |
| Source: 2001 PIHS.                  | 15,503            | 127,172,951   | 40.3          |



**Figure 2: Equivalence factors for age/sex-specific official poverty lines**

| <b>Sex/age</b>           | <b>Calories/day</b> | <b>Equivalence factor</b> |
|--------------------------|---------------------|---------------------------|
| <b><u>Children</u></b>   |                     |                           |
| <1                       | 1,010               | 0.4298                    |
| 1-4                      | 1,304               | 0.5549                    |
| 5-9                      | 1,768               | 0.7523                    |
| <b><u>Males</u></b>      |                     |                           |
| 10-14                    | 2,816               | 1.1983                    |
| 15-19                    | 3,087               | 1.3136                    |
| 20-39                    | 2,760               | 1.1745                    |
| 40-49                    | 2,640               | 1.1234                    |
| 50-59                    | 2,460               | 1.0468                    |
| 60 or more               | 2,146               | 0.9132                    |
| <b><u>Females</u></b>    |                     |                           |
| 10-14                    | 2,464               | 1.0485                    |
| 15-19                    | 2,322               | 0.9881                    |
| 20-39                    | 2,080               | 0.8851                    |
| 40-49                    | 1,976               | 0.8409                    |
| 50-59                    | 1,872               | 0.7966                    |
| 60 or more               | 1,632               | 0.6945                    |
| <b>National average:</b> | <b>2,350</b>        | <b>1.0000</b>             |

Source: World Bank, 2004.

**Figure 3: Poverty indicators ranked by uncertainty coefficient**

| <u>Uncertainty coefficient</u> |    | <u>Indicator (Responses ordered starting from the one most-closely linked with poverty)</u>  |
|--------------------------------|----|--|
| 1.                             | 95 | Do all children of ages 6 to 17 attend school? (No; Yes; No children in this age range)  |
| 2.                             | 84 | Does the household own a refrigerator or freezer? (No; Yes)  |
| 3.                             | 83 | How many people of ages 0 to 17 live in the household? (7 or more; 6; 5; 4; 3; 2; 1; 0)  |
| 4.                             | 77 | What type of toilet is used by the household? (All others; Flush connected to pit; Flush connected to public sewerage)                                   |
| 5.                             | 76 | Does the household own a washing machine or clothes dryer? (No; Yes)   |
| 6.                             | 74 | Do all girls of ages 6 to 17 attend school? (No; Yes; No girls in this age range)  |
| 7.                             | 71 | Do all boys of ages 6 to 17 attend school? (No; Yes; No boys in this age range)  |
| 8.                             | 68 | What is the highest education level completed by any family member? (None or grades 1 to 3; Grades 4 to 7; Grades 8 to 9; Grade 10; Grade 11 or more)    |
| 9.                             | 66 | Does the household own any fans (ceiling, table, pedestal, or exhaust)? (0; 1; 2; 3; 4 or more)  |
| 10.                            | 65 | In the past month, did anyone in the household spend anything on telephone, telegraph, postal, fax, e-mail, internet, etc.? (No; Yes)                    |
| 11.                            | 63 | What is the highest education level completed by the male head/spouse? (None or grades 1 to 3; Grades 4 to 7; Grades 8 to 9; Grade 10; Grade 11 or more) |
| 12.                            | 57 | What is the household's main source of drinking water? (Hand pump; All other sources)  |
| 13.                            | 57 | Does the household own a television (No; Yes)  |
| 14.                            | 56 | In the past two weeks, did anyone in the household eat any chicken? (No; Yes)  |
| 15.                            | 56 | In the past month, did anyone in the household use any shampoo (No; Yes)   |
| 16.                            | 55 | Does the household own a cooking stove? (No; Yes)  |
| 17.                            | 52 | Does the household have a direct telephone connection (No; Yes)  |
| 18.                            | 51 | In the past two weeks, did anyone in the household eat any ginger? (No; Yes)   |
| 19.                            | 50 | In the past two weeks, did anyone in the household eat any curd or yoghurt? (No; Yes)  |
| 20.                            | 49 | Can the female head/spouse both read and write with understanding in some language? (No; Yes)  |
| 21.                            | 46 | Did the female head/spouse ever attend school? (No; Yes)   |
| 22.                            | 47 | Does the household own any agricultural land? (Rural, no; Urban, no or yes; Rural, yes)  |
| 23.                            | 44 | What kind of connection does the residence have with a drainage or sewerage system? (None; Open drain; Underground or covered drains)                    |
| 24.                            | 43 | Do all girls of ages 12 to 17 attend school? (No; Yes; No girls in this age range)   |
| 25.                            | 43 | In the past two weeks, did anyone in the household eat any tomatoes? (No; Yes)   |
| 26.                            | 43 | In the past month, did the household use any piped gas? (No; Yes)  |

**Figure 3 (cont.): Poverty indicators ranked by uncertainty coefficient**

| <u>Uncertainty coefficient</u> |    | <u>Indicator (Responses ordered starting from the one most-closely linked with poverty)</u>   |
|--------------------------------|----|---|
| 27.                            | 42 | In the past month, did anyone in the household use any cooking oil? (No; Yes)   |
| 28.                            | 42 | Do all boys of ages 12 to 17 attend school? (No; Yes; No boys in this age range)  |
| 29.                            | 42 | Does the household have a direct electrical connection? (No; Yes)   |
| 30.                            | 41 | Does anyone in the household attend a private school or have a private tutor? (No; Yes)   |
| 31.                            | 41 | In the past two weeks, did anyone in the household consume any non-alcoholic beverages (carbonated beverages, non-medicated squashes and syrups, sugarcane juice and other fresh juices, packed fruit juices, mineral water, etc.)? (No; Yes) |
| 32.                            | 39 | How many acres of agricultural land does the household own? (Rural, <8 acres; Urban, any amount; Rural, ≥8 acres)   |
| 33.                            | 38 | In the past month, did anyone in the household rent or buy a newspaper, magazine, novel, or book (not for school)? (No; Yes)  |
| 34.                            | 37 | Does the household keep 1 or more buffalos or camels, 2 or more cattle, 5 or more sheep or goats, 20 or more poultry birds, or fish in a fish farm? (Rural, no; Urban, no or yes; Rural, yes)   |
| 35.                            | 36 | Does the household raise any poultry? (Rural, no; Urban, no or yes; Rural, yes)   |
| 36.                            | 35 | In the past year, did the household pay any license fees for TV, VCR, dish antenna, etc.? (No; Yes)   |
| 37.                            | 35 | In the past two weeks, did anyone in the household consume any mutton? (No; Yes)  |
| 38.                            | 34 | In the past two weeks, did anyone in the household consume any apples? (No; Yes)  |
| 39.                            | 34 | Does the household own a buffalo? (Rural, no; Urban, no or yes; Rural, yes)   |
| 40.                            | 33 | Can the male head/spouse both read and write with understanding in some language? (No; Yes)   |
| 41.                            | 32 | In the past two weeks, did anyone in the household consume any bananas? (No; Yes)   |
| 42.                            | 32 | In the past months, did anyone in the household consume any biscuits (sweet or saltish)? (No; Yes)  |
| 43.                            | 32 | In the past two weeks, did anyone in the household consume any meat, poultry, or fish? (No; Yes)  |
| 44.                            | 32 | In what type of area does the household live? (Rural; Urban)  |
| 45.                            | 32 | Does the household rent-in any agricultural land? (Rural, no; Urban, no or yes; Rural, yes)   |
| 46.                            | 32 | Does the household own any cattle, buffalo, or camels? (Rural, no; Urban, no or yes; Rural, yes)  |
| 47.                            | 32 | Does the household own any horses, asses, or mules? (Rural, no; Urban, no or yes; Rural, yes)   |
| 48.                            | 32 | Does the household own any cattle? (Rural, no; Urban, no or yes; Rural, yes)  |
| 49.                            | 32 | Does the household own any sheep or goats? (Rural, no; Urban, no or yes; Rural, yes)  |
| 50.                            | 32 | Does the household own any goats? (Rural, no; Urban, no or yes; Rural, yes)   |
| 51.                            | 32 | Does the household own any irrigated agricultural land? (Rural, no; Urban, no or yes; Rural, yes)   |
| 52.                            | 32 | How children aged 17 or younger are there per adult aged 18 or older? (>0.5; ≤0.5)  |
| 53.                            | 31 | In the past months, did anyone in the household consume any eggs? (No; Yes)   |
| 54.                            | 31 | Does the household own any sheep? (Rural, no; Urban, no or yes; Rural, yes)   |
| 55.                            | 30 | In the past year, did anyone in the household acquire any gold, silver, jewelry, stones, etc.? (No; Yes)  |
| 56.                            | 29 | Does the household own any sewing or knitting machines? (No; Yes)   |
| 57.                            | 29 | In the past two weeks, did anyone in the household consume any bread, buns, or Sheermal? (No; Yes)  |

**Figure 3 (cont.): Poverty indicators ranked by uncertainty coefficient**

|     |    |   |
|-----|----|---|
| 58. | 29 | Does the household own a machine for sewing or knitting? (No; Yes)  |
| 59. | 28 | In the past two weeks, did anyone in the household consume any iodised salt? (No; Yes)  |
| 60. | 28 | How many rooms does the house have, including bedrooms and living rooms but excluding storage rooms, bathrooms, toilets, kitchens, and rooms for business? (1 or 2; 3; 4 or more) |
| 61. | 27 | Does the household own a scooter or a motorcycle? (No; Yes)   |
| 62. | 22 | In the past year, did anyone in the household buy a Burka, Chadar, Ajrak, etc.? (No; Yes)   |
| 63. | 19 | Does the household own a radio or cassette player? (No; Yes)  |
| 64. | 17 | In the past two weeks, did anyone in the household consume any Desi ghee? (No; Yes)   |
| 65. | 14 | Does the household own a car or other motor vehicle? (No; Yes)  |
| 66. | 12 | Does the household own a VCR, VCP, receiver, or decoder? (No; Yes)  |
| 67. | 9  | Does the household own land of any type? (No; Yes)  |
| 68. | 4  | How many household members have salaried employment? (0; 1; 2 or more)  |
| 69. | 3  | In the past two weeks, did anyone in the household consume any eggs? (No; Yes)  |
| 70. | 3  | In the past two weeks, did anyone in the household consume any apples? (No; Yes)  |
| 71. | 2  | In the past month, did anyone in the household use any gas from a cylinder? (No; Yes)   |
| 72. | 1  | Does anyone in the household owe a debt on a loan? (Yes; No)  |
| 73. | 1  | Does the household own a bicycle? (No; Yes)   |

Source: Based on 2001 PIHS.

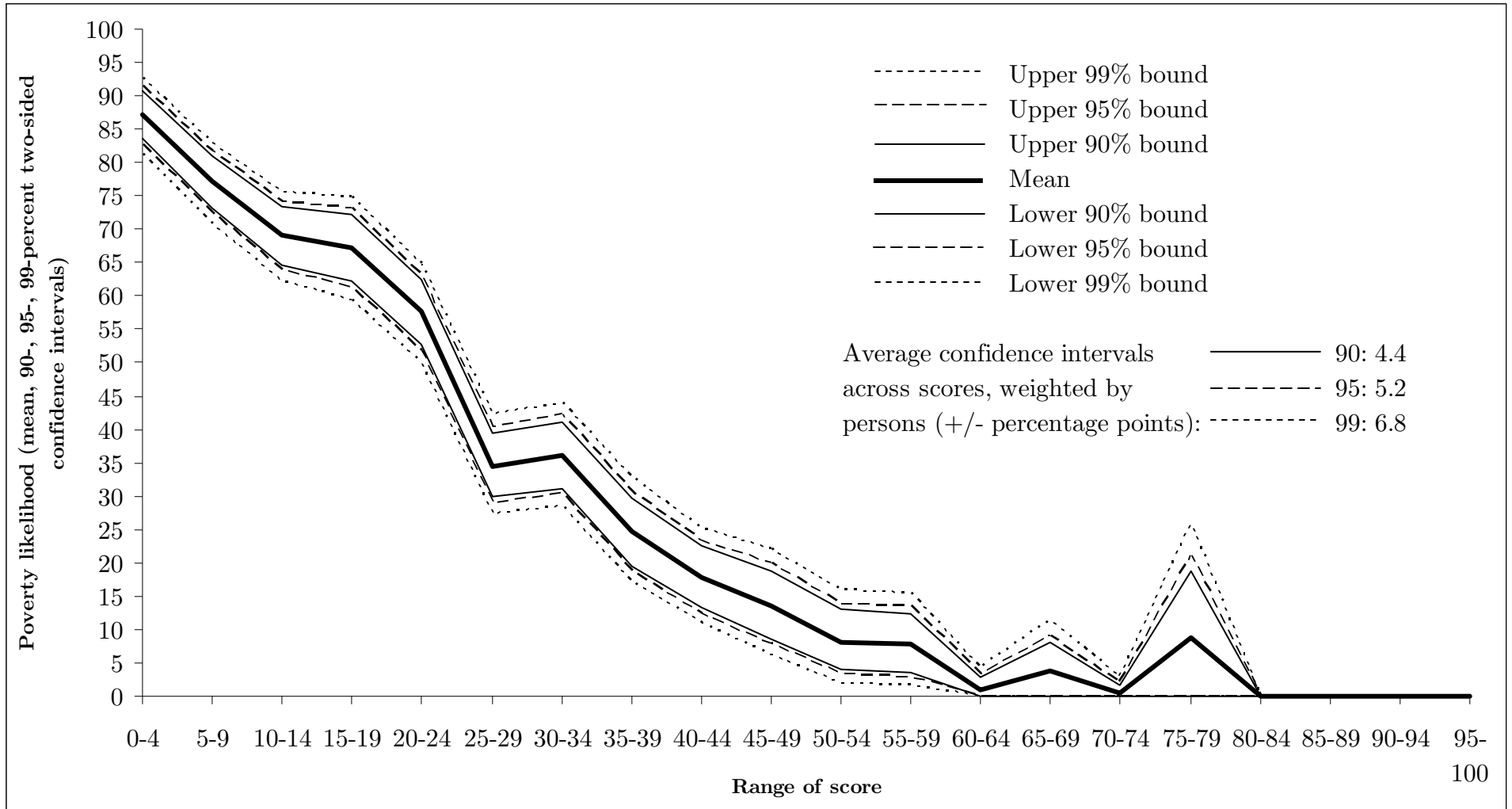
**Figure 5: Scores and poverty likelihoods**

| Score  | Poverty likelihood<br>for people with<br>score in range (%) | % of people<br><=score<br>who are poor | % of people<br>>score<br>who are non-poor |
|--------|---|--|---|
| 0-4    | 87.3  | 87.3                                   | 59.9                                      |
| 5-9    | 77.1  | 81.6                                   | 64.2                                      |
| 10-14  | 69.1  | 76.4                                   | 70.0                                      |
| 15-19  | 67.3  | 74.6                                   | 74.4                                      |
| 20-24  | 57.6  | 71.3                                   | 79.8                                      |
| 25-29  | 34.5  | 65.4                                   | 82.6                                      |
| 30-34  | 36.2  | 61.2                                   | 87.4                                      |
| 35-39  | 24.6  | 57.2                                   | 90.8                                      |
| 40-44  | 17.9  | 54.0                                   | 93.3                                      |
| 45-49  | 13.5  | 51.6                                   | 95.3                                      |
| 50-54  | 8.2   | 49.4                                   | 96.5                                      |
| 55-59  | 7.8   | 48.1                                   | 97.8                                      |
| 60-64  | 1.0   | 46.2                                   | 97.0                                      |
| 65-69  | 3.8   | 45.4                                   | 97.4                                      |
| 70-74  | 0.5   | 44.5                                   | 95.2                                      |
| 75-79  | 8.7   | 44.1                                   | 100.0                                     |
| 80-84  | 0.0   | 43.8                                   | 100.0                                     |
| 85-89  | 0.0   | 43.8                                   | 100.0                                     |
| 90-94  | 0.0   | 43.7                                   | 100.0                                     |
| 95-100 | 0.0   | 43.7                                   | 100.0                                     |

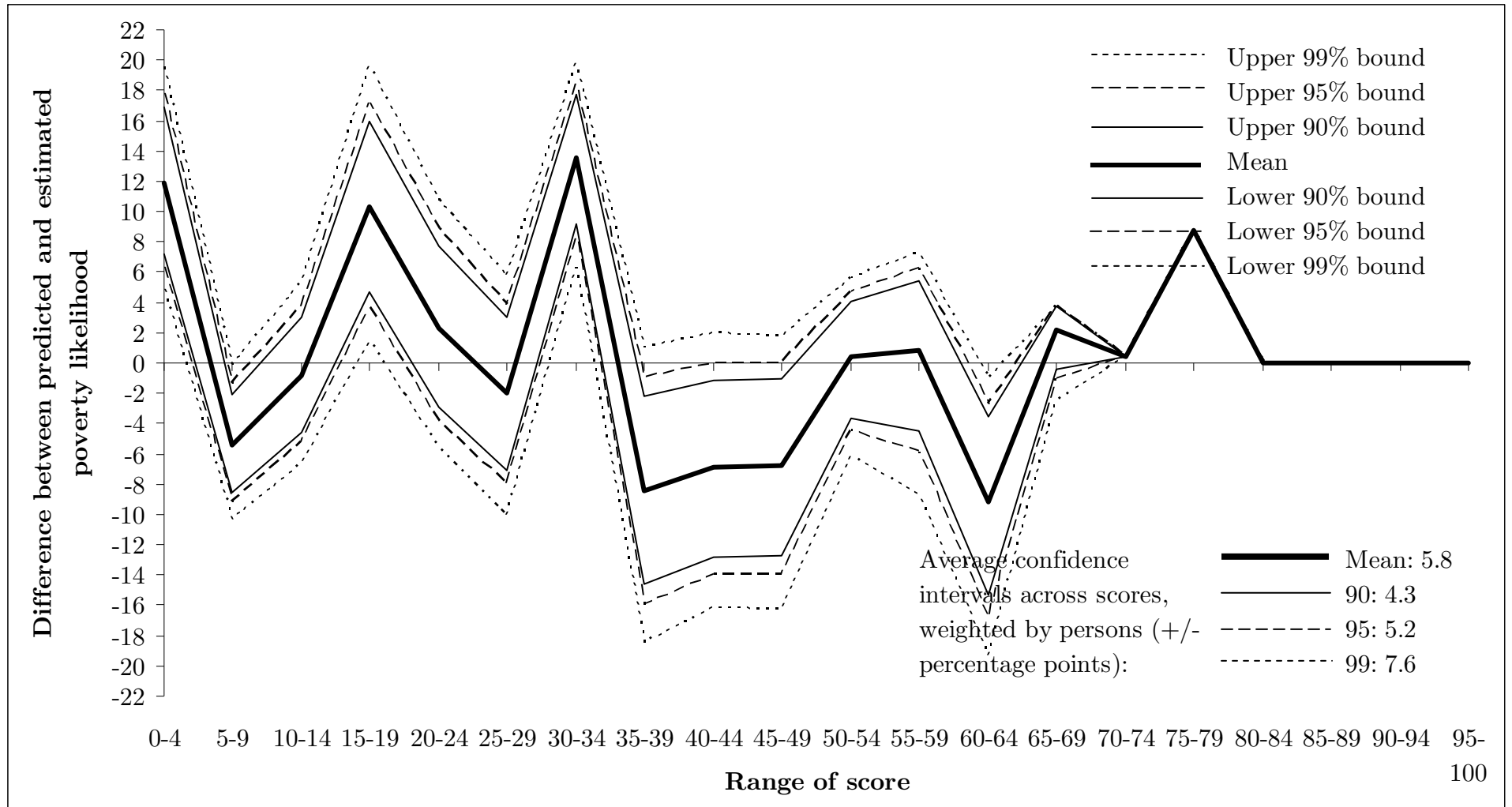
Surveyed cases weighted to represent the Pakistani population.

Source: Based on the 2001 PIHS.

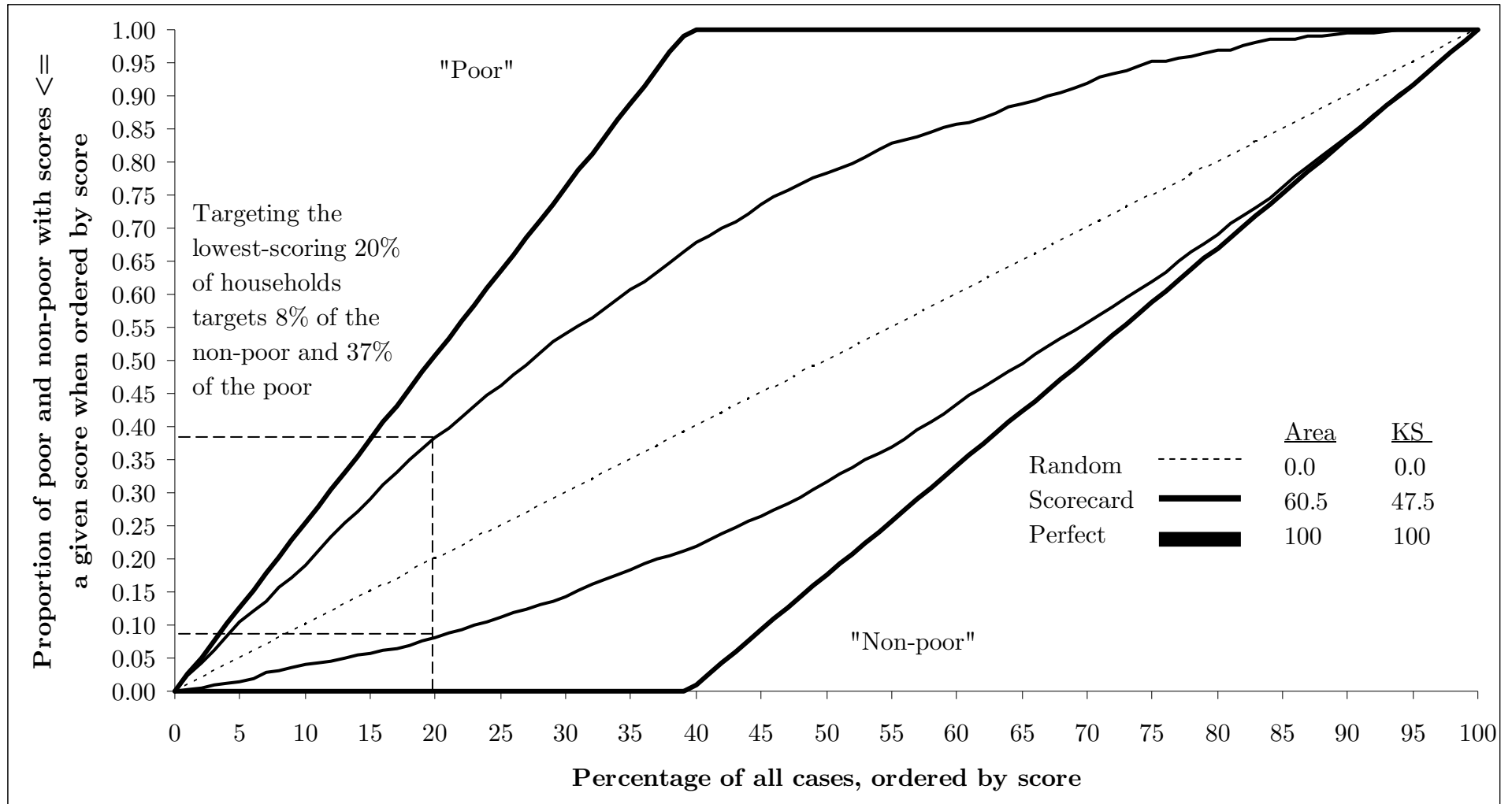
**Figure 6: Confidence intervals for estimated poverty likelihoods associated**



**Figure 7: Differences between estimated and true poverty likelihoods**



**Figure 8: ROC curve of ability to rank-order households by poverty status**





**Figure 9: General classification matrix**

|                            |                 | <u>Targeting segment</u>                              |  |
|----------------------------|-----------------|---|--|
|                            |                 | <u>Targeted</u>                                       | <u>Non-targeted</u>                                      |
| <u>True poverty status</u> | <u>Poor</u>     | <b>A.</b><br>Truly poor<br>correctly<br>targeted      | <b>B.</b><br>Truly poor<br>mistakenly<br>non-targeted    |
|                            | <u>Non-poor</u> | <b>C.</b><br>Truly non-poor<br>mistakenly<br>targeted | <b>D.</b><br>Truly non-poor<br>correctly<br>non-targeted |

**Figure 10: People by targeting classification and score**

|              | <b>A.</b>                                    | <b>B.</b>   | <b>C.</b>   | <b>D.</b>  |
|--------------|--|---|---|--|
|              | <b>Truly poor<br/>correctly<br/>targeted</b> | <b>Truly poor<br/>mistakenly<br/>non-targeted</b> | <b>Truly non-poor<br/>mistakenly<br/>targeted</b> | <b>Truly non-poor<br/>correctly<br/>non-targeted</b> |
| <b>Score</b> |  |   |   |  |
| 0-4          | 6.7  | 37.0  | 1.0   | 55.3   |
| 5-9          | 14.1   | 29.6  | 3.2   | 53.1   |
| 10-14        | 22.6   | 21.1  | 7.0   | 49.3   |
| 15-19        | 27.6   | 16.1  | 9.4   | 46.9   |
| 20-24        | 32.8   | 10.9  | 13.2  | 43.1   |
| 25-29        | 35.9   | 7.8   | 19.0  | 37.3   |
| 30-34        | 39.2   | 4.5   | 24.9  | 31.5   |
| 35-39        | 41.1   | 2.6   | 30.7  | 25.6   |
| 40-44        | 42.2   | 1.5   | 35.9  | 20.4   |
| 45-49        | 42.9   | 0.8   | 40.2  | 16.1   |
| 50-54        | 43.3   | 0.4   | 44.4  | 11.9   |
| 55-59        | 43.5   | 0.2   | 47.0  | 9.3  |
| 60-64        | 43.5   | 0.2   | 50.6  | 5.7  |
| 65-69        | 43.6   | 0.1   | 52.4  | 3.9  |
| 70-74        | 43.6   | 0.1   | 54.4  | 1.9  |
| 75-79        | 43.7   | 0.0   | 55.4  | 0.9  |
| 80-84        | 43.7   | 0.0   | 56.1  | 0.2  |
| 85-89        | 43.7   | 0.0   | 56.1  | 0.2  |
| 90-94        | 43.7   | 0.0   | 56.3  | 0.0  |
| 95-100       | 43.7   | 0.0   | 56.3  | 0.0  |

Figures normalized to sum to 100.

Source: Based on the 2001 PIHS.

Figure 11: General net-benefit matrix

|                            |                 | <u>Targeting segment</u> |                     |
|----------------------------|-----------------|--------------------------|---------------------|
|                            |                 | <u>Targeted</u>          | <u>Non-targeted</u> |
| <u>True poverty status</u> | <u>Poor</u>     | $\alpha$                 | $\beta$             |
|                            | <u>Non-poor</u> | $\gamma$                 | $\delta$            |

Figure 12: “Total Accuracy” net-benefit matrix

|                            |                 | <u>Targeting segment</u> |                     |
|----------------------------|-----------------|--------------------------|---------------------|
|                            |                 | <u>Targeted</u>          | <u>Non-targeted</u> |
| <u>True poverty status</u> | <u>Poor</u>     | 1                        | 0                   |
|                            | <u>Non-poor</u> | 0                        | 1                   |

**Figure 13: Total net benefit for some common net-benefit matrices**

| Score  | <u>Total Accuracy</u><br>(A + B) |   | <u>Poverty Accuracy</u><br>$100*A / (A+B)$ |   | <u>Non-poverty Accuracy</u><br>$100*D / (C+D)$ |   | <u>Undercoverage</u><br>$100*B / (A+B)$ |    | <u>Leakage</u><br>$100*C / (A+C)$ |   |
|--------|----------------------------------|---|--|---|--|---|---|----|-----------------------------------|---|
|        | 1                                | 0 | 1  | 0 | 0  | 0 | 0                                       | -1 | 0                                 | 0 |
|        | 0                                | 1 | 0  | 0 | 0  | 1 | 0                                       | 0  | -1                                | 0 |
| 0-4    | 62.0                             |   | 15.3                                       |   | 98.3   |   | 84.7                                    |    | 12.7                              |   |
| 5-9    | 67.3                             |   | 32.3                                       |   | 94.3   |   | 67.7                                    |    | 18.4                              |   |
| 10-14  | 71.9                             |   | 51.7                                       |   | 87.6   |   | 48.3                                    |    | 23.6                              |   |
| 15-19  | 74.5                             |   | 63.2                                       |   | 83.3   |   | 36.8                                    |    | 25.4                              |   |
| 20-24  | 75.9                             |   | 75.1                                       |   | 76.5   |   | 24.9                                    |    | 28.7                              |   |
| 25-29  | 73.2                             |   | 82.1                                       |   | 66.3   |   | 17.9                                    |    | 34.6                              |   |
| 30-34  | 70.6                             |   | 89.7                                       |   | 55.9   |   | 10.3                                    |    | 38.8                              |   |
| 35-39  | 66.7                             |   | 94.0                                       |   | 45.4   |   | 6.0                                     |    | 42.8                              |   |
| 40-44  | 62.6                             |   | 96.6                                       |   | 36.2   |   | 3.4                                     |    | 46.0                              |   |
| 45-49  | 59.0                             |   | 98.2                                       |   | 28.6   |   | 1.8                                     |    | 48.4                              |   |
| 50-54  | 55.2                             |   | 99.0                                       |   | 21.2   |   | 1.0                                     |    | 50.6                              |   |
| 55-59  | 52.8                             |   | 99.5                                       |   | 16.5   |   | 0.5                                     |    | 51.9                              |   |
| 60-64  | 49.2                             |   | 99.6                                       |   | 10.1   |   | 0.4                                     |    | 53.8                              |   |
| 65-69  | 47.5                             |   | 99.8                                       |   | 7.0  |   | 0.2                                     |    | 54.6                              |   |
| 70-74  | 45.5                             |   | 99.8                                       |   | 3.3  |   | 0.2                                     |    | 55.5                              |   |
| 75-79  | 44.6                             |   | 100.0                                      |   | 1.6  |   | 0.0                                     |    | 55.9                              |   |
| 80-84  | 43.9                             |   | 100.0                                      |   | 0.4  |   | 0.0                                     |    | 56.2                              |   |
| 85-89  | 43.9                             |   | 100.0                                      |   | 0.3  |   | 0.0                                     |    | 56.2                              |   |
| 90-94  | 43.7                             |   | 100.0                                      |   | 0.1  |   | 0.0                                     |    | 56.3                              |   |
| 95-100 | 43.7                             |   | 100.0                                      |   | 0.0  |   | 0.0                                     |    | 56.3                              |   |

All figures in percentage units.

Figure 14: “Poverty Accuracy” net-benefit matrix

|                            |                 | <u>Targeting segment</u> |                     |
|----------------------------|-----------------|--------------------------|---------------------|
|                            |                 | <u>Targeted</u>          | <u>Non-targeted</u> |
| <u>True poverty status</u> | <u>Poor</u>     | 1                        | 0                   |
|                            | <u>Non-poor</u> | 0                        | 0                   |

**Figure 15: Net-benefit matrix for BPAC**

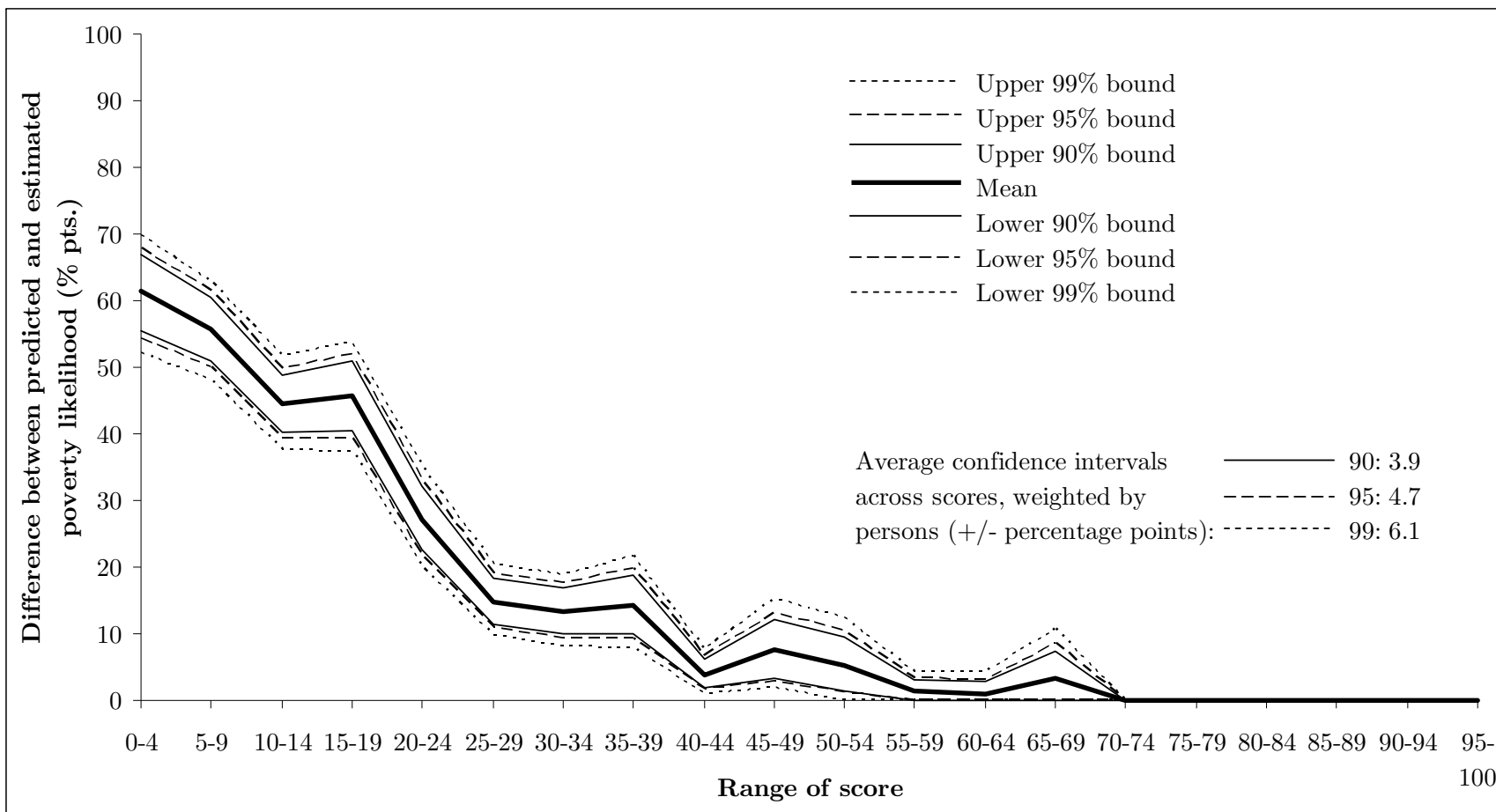
|                            |                 | <u>Targeting segment</u> |                     |
|----------------------------|-----------------|--------------------------|---------------------|
|                            |                 | <u>Targeted</u>          | <u>Non-targeted</u> |
| <u>True poverty status</u> | <u>Poor</u>     | 1                        | 1                   |
|                            | <u>Non-poor</u> | -1                       | 0                   |

**Figure 16: Poverty likelihoods for the very poor, poor, and non-poor by score**

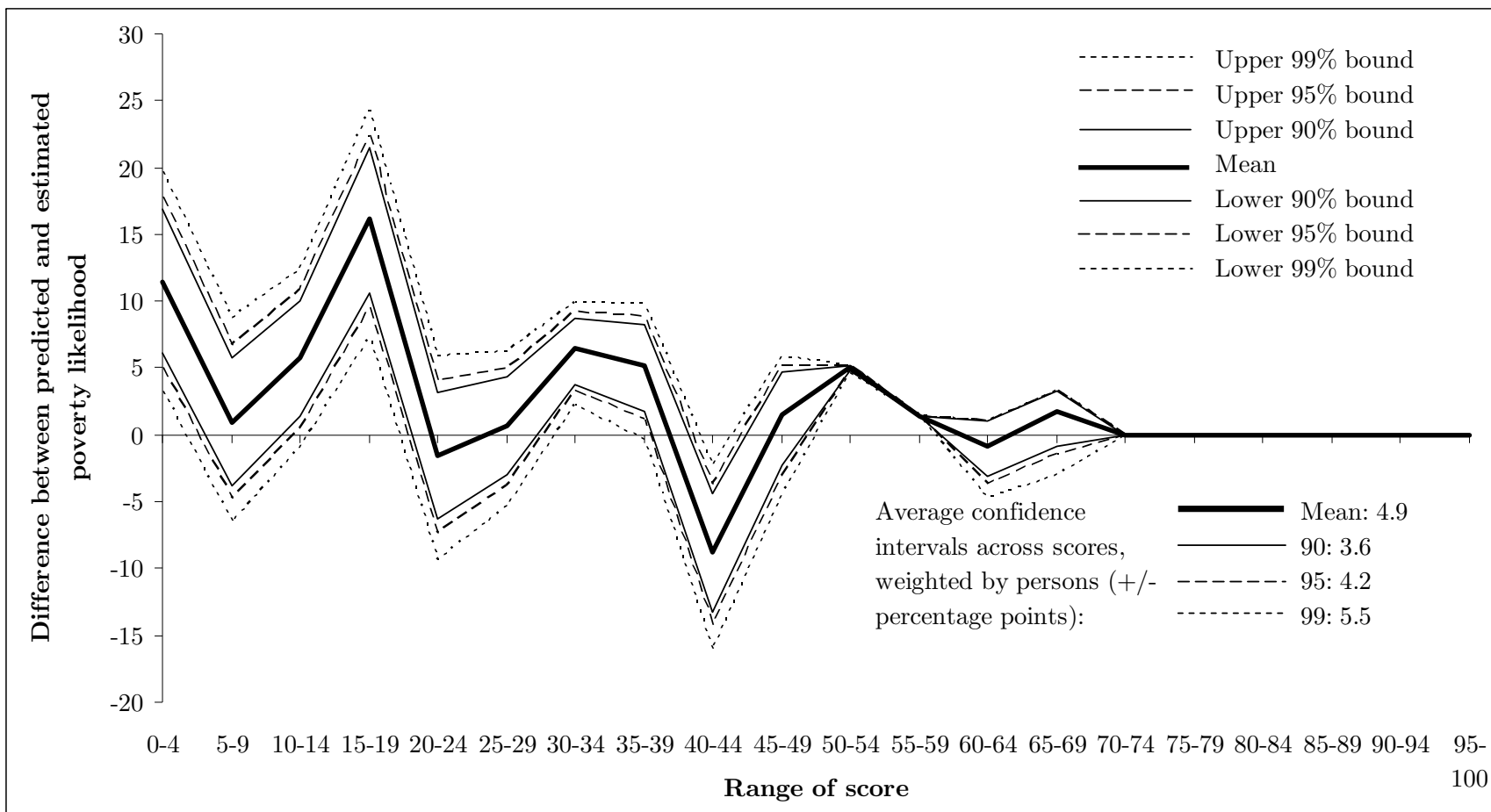
| Score  | Poverty likelihood in score range |      |          | Share of cases $\leq$ score |      |          |
|--------|-----------------------------------|------|----------|-----------------------------|------|----------|
|        | Very Poor                         | Poor | Non-poor | Very Poor                   | Poor | Non-poor |
| 0-4    | 61.3                              | 26.0 | 12.7     | 61.3                        | 26.0 | 12.7     |
| 5-9    | 55.8                              | 21.4 | 22.9     | 58.2                        | 23.4 | 18.4     |
| 10-14  | 44.5                              | 24.6 | 30.9     | 52.5                        | 23.9 | 23.6     |
| 15-19  | 45.7                              | 21.6 | 32.7     | 51.2                        | 23.4 | 25.4     |
| 20-24  | 27.3                              | 30.4 | 42.4     | 46.4                        | 24.8 | 28.7     |
| 25-29  | 14.8                              | 19.8 | 65.5     | 41.4                        | 24.0 | 34.6     |
| 30-34  | 13.2                              | 22.9 | 63.8     | 37.3                        | 23.8 | 38.8     |
| 35-39  | 14.3                              | 10.3 | 75.4     | 34.8                        | 22.4 | 42.8     |
| 40-44  | 3.9                               | 14.0 | 82.2     | 32.3                        | 21.7 | 46.0     |
| 45-49  | 7.6                               | 6.0  | 86.5     | 30.9                        | 20.8 | 48.4     |
| 50-54  | 5.2                               | 3.0  | 91.8     | 29.5                        | 19.8 | 50.6     |
| 55-59  | 1.4                               | 6.4  | 92.3     | 28.6                        | 19.4 | 51.9     |
| 60-64  | 1.0                               | 0.0  | 99.0     | 27.6                        | 18.7 | 53.8     |
| 65-69  | 3.3                               | 0.5  | 96.2     | 27.1                        | 18.3 | 54.6     |
| 70-74  | 0.0                               | 0.5  | 99.6     | 26.5                        | 17.9 | 55.5     |
| 75-79  | 0.0                               | 8.7  | 91.3     | 26.2                        | 17.8 | 55.9     |
| 80-84  | 0.0                               | 0.0  | 100.0    | 26.1                        | 17.7 | 56.2     |
| 85-89  | 0.0                               | 0.0  | 100.0    | 26.1                        | 17.7 | 56.2     |
| 90-94  | 0.0                               | 0.0  | 100.0    | 26.0                        | 17.7 | 56.3     |
| 95-100 | 0.0                               | 0.0  | 100.0    | 26.0                        | 17.7 | 56.3     |



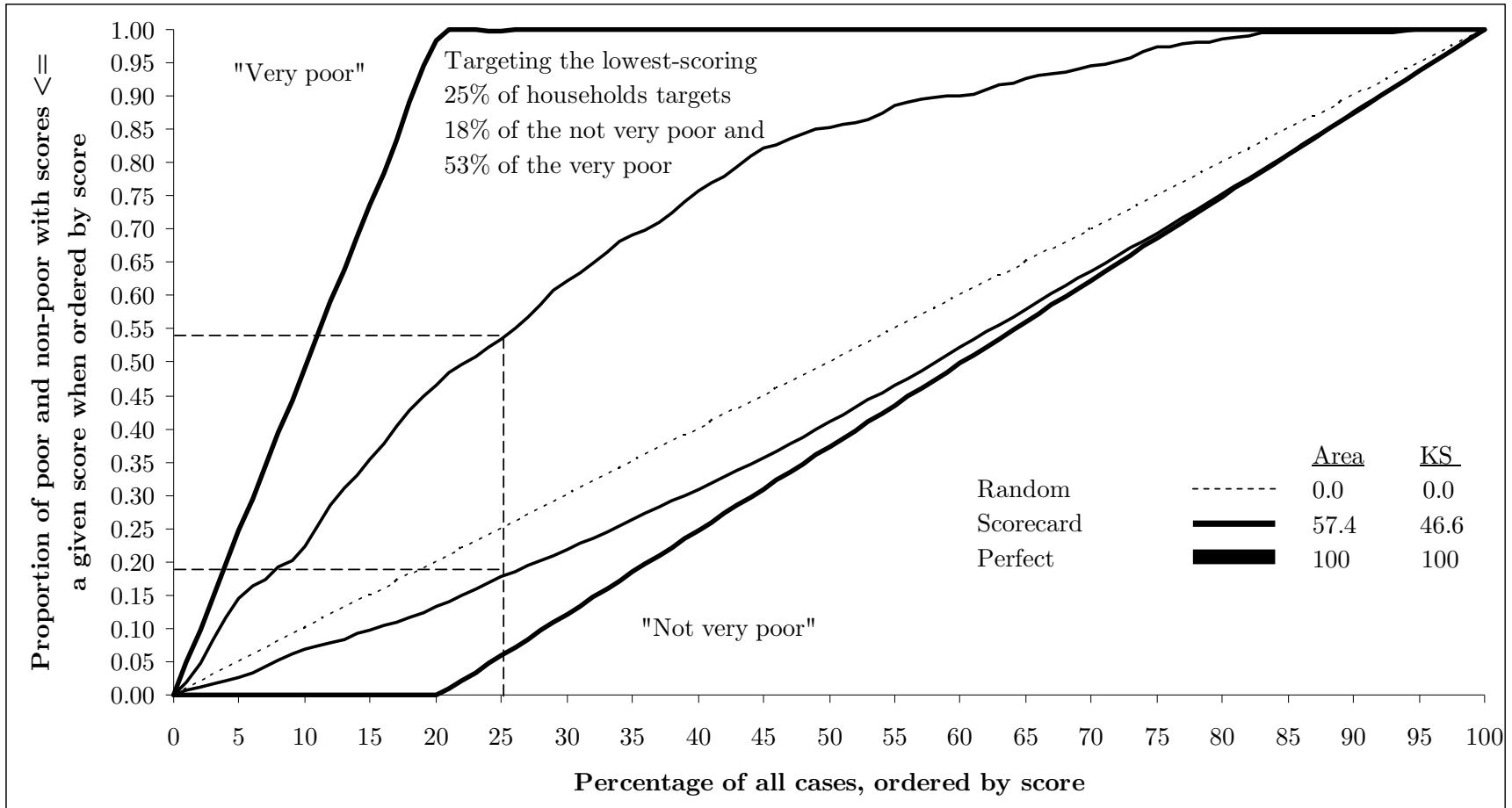
**Figure 17: Confidence intervals for estimated poverty likelihoods for being very poor associated with scores**



**Figure 18: Differences between estimated and true poverty likelihoods for the very poor**



**Figure 19: ROC curve of ability to rank-order households by very poor versus not very poor poverty status**



**Figure 20: Classification matrix, three segments**

|                     |                  | <u>Targeting segment</u>  |   |   |
|---------------------|------------------|---|---|---|
|                     |                  | <u>Very Poor</u>  | <u>Poor</u>   | <u>Non-poor</u>   |
| True poverty status | <u>Very Poor</u> | <b>A.</b><br>Truly very poor<br>correctly<br>targeted as very poor  | <b>B.</b><br>Truly very poor<br>incorrectly<br>targeted as poor | <b>C.</b><br>Truly very poor<br>incorrectly<br>targeted as non-poor |
|                     | <u>Poor</u>      | <b>D.</b><br>Truly poor<br>incorrectly<br>targeted as very poor     | <b>E.</b><br>Truly poor<br>correctly<br>targeted as poor        | <b>F.</b><br>Truly poor<br>incorrectly<br>targeted as non-poor      |
|                     | <u>Non-poor</u>  | <b>G.</b><br>Truly non-poor<br>incorrectly<br>targeted as very poor | <b>H.</b><br>Truly non-poor<br>incorrectly<br>targeted as poor  | <b>I.</b><br>Truly non-poor<br>correctly<br>targeted as poor        |

**Figure 21: Net-benefit matrix, three segments**

|                            |                  | <u>Targeting segment</u> |             |                 |
|----------------------------|------------------|--------------------------|-------------|-----------------|
|                            |                  | <u>Very Poor</u>         | <u>Poor</u> | <u>Non-poor</u> |
| <u>True poverty status</u> | <u>Very Poor</u> | α                        | β           | γ               |
|                            | <u>Poor</u>      | δ                        | ε           | ζ               |
|                            | <u>Non-poor</u>  | η                        | θ           | ι               |

**Figure 22: Classification results, very poor/poor cut-offs from 0 to 44 and poor/non-poor cut-offs from 5 to 49**

|                                |              | Upper bound, poor segment |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     |     |       |       |       |       |       |     |
|--------------------------------|--------------|---------------------------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|-------|-----|-----|-------|-------|-------|-------|-------|-----|
|                                |              | 5-9                       |     |       | 10-14 |     |       | 15-19 |     |       | 20-24 |       |       | 25-29 |       |       | 30-34 |     |     | 35-39 |     |     | 40-44 |       |       | 45-49 |       |     |
| Upper bound, very poor segment | <u>0-4</u>   | 143                       | 164 | 484   | 143   | 329 | 319   | 143   | 432 | 216   | 143   | 508   | 140   | 143   | 547   | 101   | 143   | 584 | 64  | 143   | 618 | 30  | 143   | 625   | 23    | 143   | 637   | 11  |
|                                |              | 60                        | 63  | 414   | 60    | 154 | 323   | 60    | 203 | 274   | 60    | 287   | 190   | 60    | 340   | 137   | 60    | 404 | 73  | 60    | 428 | 49  | 60    | 455   | 22    | 60    | 464   | 13  |
|                                |              | 30                        | 67  | 1,614 | 30    | 182 | 1,499 | 30    | 256 | 1,425 | 30    | 373   | 1,308 | 30    | 548   | 1,134 | 30    | 726 | 956 | 30    | 904 | 777 | 30    | 1,062 | 619   | 30    | 1,192 | 489 |
|                                | <u>5-9</u>   |                           |     |       | 306   | 166 | 319   | 306   | 269 | 216   | 306   | 344   | 140   | 306   | 383   | 101   | 306   | 420 | 64  | 306   | 454 | 30  | 306   | 461   | 23    | 306   | 473   | 11  |
|                                |              |                           |     |       | 123   | 91  | 323   | 123   | 140 | 274   | 123   | 224   | 190   | 123   | 277   | 137   | 123   | 341 | 73  | 123   | 365 | 49  | 123   | 392   | 22    | 123   | 401   | 13  |
|                                |              |                           |     |       | 97    | 115 | 1,499 | 97    | 189 | 1,425 | 97    | 306   | 1,308 | 97    | 480   | 1,134 | 97    | 658 | 956 | 97    | 837 | 777 | 97    | 995   | 619   | 97    | 1,125 | 489 |
|                                | <u>10-14</u> |                           |     |       |       |     |       | 472   | 103 | 216   | 472   | 178   | 140   | 472   | 218   | 101   | 472   | 255 | 64  | 472   | 289 | 30  | 472   | 296   | 23    | 472   | 307   | 11  |
|                                |              |                           |     |       |       |     |       | 215   | 49  | 274   | 215   | 133   | 190   | 215   | 185   | 137   | 215   | 249 | 73  | 215   | 274 | 49  | 215   | 301   | 22    | 215   | 310   | 13  |
|                                |              |                           |     |       |       |     |       | 212   | 74  | 1,425 | 212   | 191   | 1,308 | 212   | 365   | 1,134 | 212   | 543 | 956 | 212   | 722 | 777 | 212   | 880   | 619   | 212   | 1,010 | 489 |
|                                | <u>15-19</u> |                           |     |       |       |     |       |       |     |       | 575   | 75    | 140   | 575   | 115   | 101   | 575   | 151 | 64  | 575   | 185 | 30  | 575   | 193   | 23    | 575   | 204   | 11  |
|                                |              |                           |     |       |       |     |       |       |     | 263   | 84    | 190   | 263   | 137   | 137   | 263   | 201   | 73  | 263 | 225   | 49  | 263 | 252   | 22    | 263   | 261   | 13    |     |
|                                |              |                           |     |       |       |     |       |       |     | 286   | 117   | 1,308 | 286   | 292   | 1,134 | 286   | 470   | 956 | 286 | 648   | 777 | 286 | 806   | 619   | 286   | 936   | 489   |     |
| <u>20-24</u>                   |              |                           |     |       |       |     |       |       |     |       |       |       | 650   | 39    | 101   | 650   | 76    | 64  | 650 | 110   | 30  | 650 | 118   | 23    | 650   | 129   | 11    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       | 347   | 53    | 137   | 347   | 117   | 73  | 347 | 141   | 49  | 347 | 168   | 22    | 347   | 177   | 13    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       | 402   | 175   | 1,134 | 402   | 353   | 956 | 402 | 531   | 777 | 402 | 689   | 619   | 402   | 820   | 489   |     |
| <u>25-29</u>                   |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       | 690   | 37    | 64  | 690 | 71    | 30  | 690 | 78    | 23    | 690   | 90    | 11    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       | 400   | 64    | 73  | 400 | 88    | 49  | 400 | 115   | 22    | 400   | 124   | 13    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       | 577   | 178   | 956 | 577 | 356   | 777 | 577 | 514   | 619   | 577   | 645   | 489   |     |
| <u>30-34</u>                   |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     | 727 | 34    | 30  | 727 | 41    | 23    | 727   | 53    | 11    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     | 464 | 24    | 49  | 464 | 51    | 22    | 464   | 60    | 13    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     | 755 | 178   | 777 | 755 | 336   | 619   | 755   | 467   | 489   |     |
| <u>35-39</u>                   |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     | 760 | 7     | 23    | 760   | 19    | 11    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     | 488 | 27    | 22    | 488   | 36    | 13    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     | 933 | 158   | 619   | 933   | 289   | 489   |     |
| <u>40-44</u>                   |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     |     |       |       | 768   | 11    | 11    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     |     |       |       | 515   | 9     | 13    |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     |     |       |       | 1,091 | 131   | 489   |     |
| <u>45-49</u>                   |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     |     |       |       |       |       |       |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     |     |       |       |       |       |       |     |
|                                |              |                           |     |       |       |     |       |       |     |       |       |       |       |       |       |       |       |     |     |       |     |     |       |       |       |       |       |     |

Figures in units of 10,000 people.

**Figure 22 (cont.): Classification results, very poor/poor cut-offs from 0 to 49 and poor/non-poor cut-offs from 50 to 100**

|                                |       | Upper bound, poor segment |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |        |       |       |     |       |       |     |       |     |     |     |   |
|--------------------------------|-------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-----|-------|-------|-----|-------|-----|-----|-----|---|
|                                |       | 50-54                     |       |       | 55-59 |       |       | 60-64 |       |       | 65-69 |       |       | 70-74 |       |       | 75-79 |       |       | 80-84 |       |       | 85-89 |       |       | 90-94 |       |       | 95-100 |       |       |     |       |       |     |       |     |     |     |   |
| Upper bound, very poor segment | 0-4   | 143                       | 644   | 4     | 143   | 645   | 3     | 143   | 646   | 2     | 143   | 648   | 0     | 143   | 648   | 0     | 143   | 648   | 0     | 143   | 648   | 0     | 143   | 648   | 0     | 143   | 648   | 0     | 143    | 648   | 0     | 143 | 648   | 0     | 143 | 648   | 0   |     |     |   |
|                                |       | 60                        | 468   | 9     | 60    | 473   | 3     | 60    | 473   | 3     | 60    | 474   | 3     | 60    | 474   | 3     | 60    | 477   | 0     | 60    | 477   | 0     | 60    | 477   | 0     | 60    | 477   | 0     | 60     | 477   | 0     | 60  | 477   | 0     | 60  | 477   | 0   |     |     |   |
|                                |       | 30                        | 1,319 | 362   | 30    | 1,399 | 283   | 30    | 1,508 | 173   | 30    | 1,562 | 119   | 30    | 1,625 | 57    | 30    | 1,655 | 27    | 30    | 1,675 | 6     | 30    | 1,675 | 6     | 30    | 1,676 | 5     | 30     | 1,680 | 2     | 30  | 1,681 | 0     | 30  | 1,681 | 0   |     |     |   |
|                                | 5-9   | 306                       | 480   | 4     | 306   | 481   | 3     | 306   | 482   | 2     | 306   | 484   | 0     | 306   | 484   | 0     | 306   | 484   | 0     | 306   | 484   | 0     | 306   | 484   | 0     | 306   | 484   | 0     | 306    | 484   | 0     | 306 | 484   | 0     | 306 | 484   | 0   | 306 | 484 | 0 |
|                                |       | 123                       | 405   | 9     | 123   | 411   | 3     | 123   | 411   | 3     | 123   | 411   | 3     | 123   | 411   | 3     | 123   | 414   | 0     | 123   | 414   | 0     | 123   | 414   | 0     | 123   | 414   | 0     | 123    | 414   | 0     | 123 | 414   | 0     | 123 | 414   | 0   |     |     |   |
|                                |       | 97                        | 1,252 | 362   | 97    | 1,332 | 283   | 97    | 1,441 | 173   | 97    | 1,495 | 119   | 97    | 1,557 | 57    | 97    | 1,587 | 27    | 97    | 1,608 | 6     | 97    | 1,609 | 5     | 97    | 1,609 | 5     | 97     | 1,613 | 2     | 97  | 1,614 | 0     | 97  | 1,614 | 0   |     |     |   |
|                                | 10-14 | 472                       | 315   | 4     | 472   | 316   | 3     | 472   | 317   | 2     | 472   | 319   | 0     | 472   | 319   | 0     | 472   | 319   | 0     | 472   | 319   | 0     | 472   | 319   | 0     | 472   | 319   | 0     | 472    | 319   | 0     | 472 | 319   | 0     | 472 | 319   | 0   | 472 | 319 | 0 |
|                                |       | 215                       | 314   | 9     | 215   | 319   | 3     | 215   | 319   | 3     | 215   | 319   | 3     | 215   | 320   | 3     | 215   | 323   | 0     | 215   | 323   | 0     | 215   | 323   | 0     | 215   | 323   | 0     | 215    | 323   | 0     | 215 | 323   | 0     | 215 | 323   | 0   |     |     |   |
|                                |       | 212                       | 1,137 | 362   | 212   | 1,217 | 283   | 212   | 1,326 | 173   | 212   | 1,380 | 119   | 212   | 1,442 | 57    | 212   | 1,472 | 27    | 212   | 1,493 | 6     | 212   | 1,494 | 5     | 212   | 1,494 | 5     | 212    | 1,498 | 2     | 212 | 1,499 | 0     | 212 | 1,499 | 0   |     |     |   |
|                                | 15-19 | 575                       | 211   | 4     | 575   | 213   | 3     | 575   | 214   | 2     | 575   | 216   | 0     | 575   | 216   | 0     | 575   | 216   | 0     | 575   | 216   | 0     | 575   | 216   | 0     | 575   | 216   | 0     | 575    | 216   | 0     | 575 | 216   | 0     | 575 | 216   | 0   | 575 | 216 | 0 |
|                                |       | 263                       | 265   | 9     | 263   | 270   | 3     | 263   | 270   | 3     | 263   | 271   | 3     | 263   | 271   | 3     | 263   | 274   | 0     | 263   | 274   | 0     | 263   | 274   | 0     | 263   | 274   | 0     | 263    | 274   | 0     | 263 | 274   | 0     | 263 | 274   | 0   |     |     |   |
|                                |       | 286                       | 1,063 | 362   | 286   | 1,143 | 283   | 286   | 1,252 | 173   | 286   | 1,306 | 119   | 286   | 1,369 | 57    | 286   | 1,399 | 27    | 286   | 1,419 | 6     | 286   | 1,420 | 5     | 286   | 1,420 | 5     | 286    | 1,424 | 2     | 286 | 1,425 | 0     | 286 | 1,425 | 0   |     |     |   |
|                                | 20-24 | 650                       | 136   | 4     | 650   | 137   | 3     | 650   | 139   | 2     | 650   | 140   | 0     | 650   | 140   | 0     | 650   | 140   | 0     | 650   | 140   | 0     | 650   | 140   | 0     | 650   | 140   | 0     | 650    | 140   | 0     | 650 | 140   | 0     | 650 | 140   | 0   | 650 | 140 | 0 |
|                                |       | 347                       | 181   | 9     | 347   | 187   | 3     | 347   | 187   | 3     | 347   | 187   | 3     | 347   | 187   | 3     | 347   | 190   | 0     | 347   | 190   | 0     | 347   | 190   | 0     | 347   | 190   | 0     | 347    | 190   | 0     | 347 | 190   | 0     | 347 | 190   | 0   |     |     |   |
|                                |       | 402                       | 946   | 362   | 402   | 1,026 | 283   | 402   | 1,135 | 173   | 402   | 1,189 | 119   | 402   | 1,252 | 57    | 402   | 1,282 | 27    | 402   | 1,302 | 6     | 402   | 1,304 | 5     | 402   | 1,304 | 5     | 402    | 1,307 | 2     | 402 | 1,308 | 0     | 402 | 1,308 | 0   |     |     |   |
|                                | 25-29 | 690                       | 97    | 4     | 690   | 98    | 3     | 690   | 99    | 2     | 690   | 101   | 0     | 690   | 101   | 0     | 690   | 101   | 0     | 690   | 101   | 0     | 690   | 101   | 0     | 690   | 101   | 0     | 690    | 101   | 0     | 690 | 101   | 0     | 690 | 101   | 0   | 690 | 101 | 0 |
|                                |       | 400                       | 128   | 9     | 400   | 134   | 3     | 400   | 134   | 3     | 400   | 134   | 3     | 400   | 134   | 3     | 400   | 137   | 0     | 400   | 137   | 0     | 400   | 137   | 0     | 400   | 137   | 0     | 400    | 137   | 0     | 400 | 137   | 0     | 400 | 137   | 0   |     |     |   |
|                                |       | 577                       | 772   | 362   | 577   | 851   | 283   | 577   | 960   | 173   | 577   | 1,015 | 119   | 577   | 1,077 | 57    | 577   | 1,107 | 27    | 577   | 1,127 | 6     | 577   | 1,129 | 5     | 577   | 1,129 | 5     | 577    | 1,132 | 2     | 577 | 1,134 | 0     | 577 | 1,134 | 0   |     |     |   |
|                                | 30-34 | 727                       | 60    | 4     | 727   | 61    | 3     | 727   | 62    | 2     | 727   | 64    | 0     | 727   | 64    | 0     | 727   | 64    | 0     | 727   | 64    | 0     | 727   | 64    | 0     | 727   | 64    | 0     | 727    | 64    | 0     | 727 | 64    | 0     | 727 | 64    | 0   | 727 | 64  | 0 |
|                                |       | 464                       | 64    | 9     | 464   | 70    | 3     | 464   | 70    | 3     | 464   | 70    | 3     | 464   | 70    | 3     | 464   | 73    | 0     | 464   | 73    | 0     | 464   | 73    | 0     | 464   | 73    | 0     | 464    | 73    | 0     | 464 | 73    | 0     | 464 | 73    | 0   |     |     |   |
|                                |       | 755                       | 594   | 362   | 755   | 673   | 283   | 755   | 782   | 173   | 755   | 837   | 119   | 755   | 899   | 57    | 755   | 929   | 27    | 755   | 949   | 6     | 755   | 951   | 5     | 755   | 951   | 5     | 755    | 954   | 2     | 755 | 956   | 0     | 755 | 956   | 0   |     |     |   |
|                                | 35-39 | 760                       | 26    | 4     | 760   | 27    | 3     | 760   | 28    | 2     | 760   | 30    | 0     | 760   | 30    | 0     | 760   | 30    | 0     | 760   | 30    | 0     | 760   | 30    | 0     | 760   | 30    | 0     | 760    | 30    | 0     | 760 | 30    | 0     | 760 | 30    | 0   | 760 | 30  | 0 |
|                                |       | 488                       | 40    | 9     | 488   | 46    | 3     | 488   | 46    | 3     | 488   | 46    | 3     | 488   | 46    | 3     | 488   | 49    | 0     | 488   | 49    | 0     | 488   | 49    | 0     | 488   | 49    | 0     | 488    | 49    | 0     | 488 | 49    | 0     | 488 | 49    | 0   |     |     |   |
|                                |       | 933                       | 415   | 362   | 933   | 495   | 283   | 933   | 604   | 173   | 933   | 658   | 119   | 933   | 721   | 57    | 933   | 751   | 27    | 933   | 771   | 6     | 933   | 773   | 5     | 933   | 773   | 5     | 933    | 776   | 2     | 933 | 777   | 0     | 933 | 777   | 0   |     |     |   |
| 40-44                          | 768   | 19                        | 4     | 768   | 20    | 3     | 768   | 21    | 2     | 768   | 23    | 0     | 768   | 23    | 0     | 768   | 23    | 0     | 768   | 23    | 0     | 768   | 23    | 0     | 768   | 23    | 0     | 768   | 23     | 0     | 768   | 23  | 0     | 768   | 23  | 0     | 768 | 23  | 0   |   |
|                                | 515   | 13                        | 9     | 515   | 19    | 3     | 515   | 19    | 3     | 515   | 19    | 3     | 515   | 19    | 3     | 515   | 22    | 0     | 515   | 22    | 0     | 515   | 22    | 0     | 515   | 22    | 0     | 515   | 22     | 0     | 515   | 22  | 0     | 515   | 22  | 0     |     |     |     |   |
|                                | 1,091 | 257                       | 362   | 1,091 | 337   | 283   | 1,091 | 446   | 173   | 1,091 | 500   | 119   | 1,091 | 563   | 57    | 1,091 | 593   | 27    | 1,091 | 613   | 6     | 1,091 | 615   | 5     | 1,091 | 615   | 5     | 1,091 | 618    | 2     | 1,091 | 619 | 0     | 1,091 | 619 | 0     |     |     |     |   |
| 45-49                          | 779   | 7                         | 4     | 779   | 8     | 3     | 779   | 9     | 2     | 779   | 11    | 0     | 779   | 11    | 0     | 779   | 11    | 0     | 779   | 11    | 0     | 779   | 11    | 0     | 779   | 11    | 0     | 779   | 11     | 0     | 779   | 11  | 0     | 779   | 11  | 0     |     |     |     |   |
|                                | 524   | 4                         | 9     | 524   | 10    | 3     | 524   | 10    | 3     | 524   | 10    | 3     | 524   | 10    | 3     | 524   | 13    | 0     | 524   | 13    | 0     | 524   | 13    | 0     | 524   | 13    | 0     | 524   | 13     | 0     | 524   | 13  | 0     | 524   | 13  | 0     |     |     |     |   |
|                                | 1,222 | 127                       | 362   | 1,222 | 206   | 283   | 1,222 | 315   | 173   | 1,222 | 370   | 119   | 1,222 | 432   | 57    | 1,222 | 462   | 27    | 1,222 | 482   | 6     | 1,222 | 484   | 5     | 1,222 | 484   | 5     | 1,222 | 487    | 2     | 1,222 | 489 | 0     | 1,222 | 489 | 0     |     |     |     |   |

Figures in units of 10,000 people.

**Figure 22 (cont.): Classification results, very poor/poor cut-offs from 50 to 94 and poor/non-poor cut-offs from 55 to 100**

|                                |              | <u>55-59</u> |    |     | <u>60-64</u> |     |     | <u>65-69</u> |     |       | <u>70-74</u> |     |       | <u>75-79</u> |     |       | <u>80-84</u> |     |       | <u>85-89</u> |     |       | <u>90-94</u> |     |       | <u>95-100</u> |     |       |       |     |       |       |     |       |       |     |       |       |     |       |       |     |       |     |   |     |     |   |   |
|--------------------------------|--------------|--------------|----|-----|--------------|-----|-----|--------------|-----|-------|--------------|-----|-------|--------------|-----|-------|--------------|-----|-------|--------------|-----|-------|--------------|-----|-------|---------------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-----|---|-----|-----|---|---|
| Upper bound, very poor segment | <u>50-54</u> | 786          | 1  | 3   | 786          | 2   | 2   | 786          | 4   | 0     | 786          | 4   | 0     | 786          | 4   | 0     | 786          | 4   | 0     | 786          | 4   | 0     | 786          | 4   | 0     | 786           | 4   | 0     | 786   | 4   | 0     | 786   | 4   | 0     | 786   | 4   | 0     | 786   | 4   | 0     |       |     |       |     |   |     |     |   |   |
|                                |              | 528          | 5  | 3   | 528          | 5   | 3   | 528          | 6   | 3     | 528          | 6   | 3     | 528          | 9   | 0     | 528          | 9   | 0     | 528          | 9   | 0     | 528          | 9   | 0     | 528           | 9   | 0     | 528   | 9   | 0     | 528   | 9   | 0     | 528   | 9   | 0     | 528   | 9   | 0     | 528   | 9   | 0     |     |   |     |     |   |   |
|                                |              | 1,349        | 80 | 283 | 1,349        | 189 | 173 | 1,349        | 243 | 119   | 1,349        | 305 | 57    | 1,349        | 335 | 27    | 1,349        | 356 | 6     | 1,349        | 357 | 5     | 1,349        | 361 | 2     | 1,349         | 361 | 2     | 1,349 | 362 | 0     | 1,349 | 362 | 0     | 1,349 | 362 | 0     | 1,349 | 362 | 0     | 1,349 | 362 | 0     |     |   |     |     |   |   |
|                                | <u>55-59</u> |              |    |     | 788          | 1   | 2   | 788          | 3   | 0     | 788          | 3   | 0     | 788          | 3   | 0     | 788          | 3   | 0     | 788          | 3   | 0     | 788          | 3   | 0     | 788           | 3   | 0     | 788   | 3   | 0     | 788   | 3   | 0     | 788   | 3   | 0     | 788   | 3   | 0     | 788   | 3   | 0     | 788 | 3 | 0   |     |   |   |
|                                |              |              |    |     | 534          | 0   | 3   | 534          | 0   | 3     | 534          | 1   | 3     | 534          | 3   | 0     | 534          | 3   | 0     | 534          | 3   | 0     | 534          | 3   | 0     | 534           | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534 | 3 | 0   |     |   |   |
|                                |              |              |    |     | 1,428        | 109 | 173 | 1,428        | 164 | 119   | 1,428        | 226 | 57    | 1,428        | 256 | 27    | 1,428        | 276 | 6     | 1,428        | 278 | 5     | 1,428        | 281 | 2     | 1,428         | 281 | 2     | 1,428 | 281 | 2     | 1,428 | 283 | 0     | 1,428 | 283 | 0     | 1,428 | 283 | 0     | 1,428 | 283 | 0     |     |   |     |     |   |   |
|                                | <u>60-64</u> |              |    |     |              |     |     | 789          | 2   | 0     | 789          | 2   | 0     | 789          | 2   | 0     | 789          | 2   | 0     | 789          | 2   | 0     | 789          | 2   | 0     | 789           | 2   | 0     | 789   | 2   | 0     | 789   | 2   | 0     | 789   | 2   | 0     | 789   | 2   | 0     | 789   | 2   | 0     | 789 | 2 | 0   |     |   |   |
|                                |              |              |    |     |              |     |     | 534          | 0   | 3     | 534          | 1   | 3     | 534          | 3   | 0     | 534          | 3   | 0     | 534          | 3   | 0     | 534          | 3   | 0     | 534           | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534   | 3   | 0     | 534 | 3 | 0   | 534 | 3 | 0 |
|                                |              |              |    |     |              |     |     | 1,537        | 54  | 119   | 1,537        | 117 | 57    | 1,537        | 147 | 27    | 1,537        | 167 | 6     | 1,537        | 169 | 5     | 1,537        | 172 | 2     | 1,537         | 172 | 2     | 1,537 | 173 | 0     | 1,537 | 173 | 0     | 1,537 | 173 | 0     | 1,537 | 173 | 0     | 1,537 | 173 | 0     |     |   |     |     |   |   |
|                                | <u>65-69</u> |              |    |     |              |     |     |              |     |       | 791          | 0   | 0     | 791          | 0   | 0     | 791          | 0   | 0     | 791          | 0   | 0     | 791          | 0   | 0     | 791           | 0   | 0     | 791   | 0   | 0     | 791   | 0   | 0     | 791   | 0   | 0     | 791   | 0   | 0     | 791   | 0   | 0     | 791 | 0 | 0   |     |   |   |
|                                |              |              |    |     |              |     |     |              |     | 534   | 0            | 3   | 534   | 3            | 0   | 534   | 3            | 0   | 534   | 3            | 0   | 534   | 3            | 0   | 534   | 3             | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3   | 0 | 534 | 3   | 0 |   |
|                                |              |              |    |     |              |     |     |              |     | 1,592 | 62           | 57  | 1,592 | 92           | 27  | 1,592 | 113          | 6   | 1,592 | 114          | 5   | 1,592 | 117          | 2   | 1,592 | 117           | 2   | 1,592 | 119   | 0   | 1,592 | 119   | 0   | 1,592 | 119   | 0   | 1,592 | 119   | 0   | 1,592 | 119   | 0   | 1,592 | 119 | 0 |     |     |   |   |
| <u>70-74</u>                   |              |              |    |     |              |     |     |              |     |       |              |     | 791   | 0            | 0   | 791   | 0            | 0   | 791   | 0            | 0   | 791   | 0            | 0   | 791   | 0             | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     | 534   | 3            | 0   | 534   | 3            | 0   | 534   | 3            | 0   | 534   | 3            | 0   | 534   | 3             | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3     | 0   | 534   | 3   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     | 1,654 | 30           | 27  | 1,654 | 50           | 6   | 1,654 | 52           | 5   | 1,654 | 55           | 2   | 1,654 | 55            | 2   | 1,654 | 57    | 0   | 1,654 | 57    | 0   | 1,654 | 57    | 0   | 1,654 | 57    | 0   | 1,654 | 57    | 0   |       |     |   |     |     |   |   |
| <u>75-79</u>                   |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     | 791   | 0            | 0   | 791   | 0            | 0   | 791   | 0            | 0   | 791   | 0             | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     | 537   | 0            | 0   | 537   | 0            | 0   | 537   | 0            | 0   | 537   | 0             | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     | 1,684 | 20           | 6   | 1,684 | 22           | 5   | 1,684 | 25           | 2   | 1,684 | 25            | 2   | 1,684 | 27    | 0   | 1,684 | 27    | 0   | 1,684 | 27    | 0   | 1,684 | 27    | 0   | 1,684 | 27    | 0   |       |     |   |     |     |   |   |
| <u>80-84</u>                   |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     | 791   | 0            | 0   | 791   | 0            | 0   | 791   | 0             | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     | 537   | 0            | 0   | 537   | 0            | 0   | 537   | 0             | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     | 1,704 | 2            | 5   | 1,704 | 5            | 2   | 1,704 | 5             | 2   | 1,704 | 6     | 0   | 1,704 | 6     | 0   | 1,704 | 6     | 0   | 1,704 | 6     | 0   | 1,704 | 6     | 0   |       |     |   |     |     |   |   |
| <u>85-89</u>                   |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     |       |              |     | 791   | 0            | 0   | 791   | 0             | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0     | 0   | 791   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     |       |              |     | 537   | 0            | 0   | 537   | 0             | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0     | 0   | 537   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     |       |              |     | 1,706 | 3            | 2   | 1,706 | 3             | 2   | 1,706 | 5     | 0   | 1,706 | 5     | 0   | 1,706 | 5     | 0   | 1,706 | 5     | 0   | 1,706 | 5     | 0   |       |     |   |     |     |   |   |
| <u>90-94</u>                   |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     |       |              |     |       |              |     |       |               |     |       |       |     |       |       |     |       |       |     |       |       |     | 791   | 0     | 0   | 791   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     |       |              |     |       |              |     |       |               |     |       |       |     |       |       |     |       |       |     |       |       |     | 537   | 0     | 0   | 537   | 0   | 0 |     |     |   |   |
|                                |              |              |    |     |              |     |     |              |     |       |              |     |       |              |     |       |              |     |       |              |     |       |              |     |       |               |     |       |       |     |       |       |     |       |       |     |       |       |     | 1,709 | 2     | 0   | 1,709 | 2   | 0 |     |     |   |   |

Figures in units of 10,000 people.



**Figure 23: Classification results, very poor 0–14, poor 15–24, and non-poor 25–100**

|                                  |       | People with score in range |     |            |     |                            |       |
|----------------------------------|-------|----------------------------|-----|------------|-----|----------------------------|-------|
| Segment                          | Score | Very Poor                  |     | Poor       |     | Non-poor                   |       |
| <b>Very poor</b><br><b>0-24</b>  | 0-4   | <b>472</b>                 | 143 | <b>215</b> | 60  | <b>212</b>                 | 30    |
|                                  | 5-9   | <b>60%</b>                 | 164 | <b>40%</b> | 63  | <b>12%</b>                 | 67    |
|                                  | 10-14 |                            | 166 |            | 91  |                            | 115   |
| <b>Poor</b><br><b>25-34</b>      | 15-19 | <b>178</b>                 | 103 | <b>133</b> | 49  | <b>191</b>                 | 74    |
|                                  | 20-24 | <b>23%</b>                 | 75  | <b>25%</b> | 84  | <b>11%</b>                 | 117   |
| <b>Non-poor</b><br><b>35-100</b> | 25-29 |                            | 39  |            | 53  | <b>1,308</b><br><b>76%</b> | 175   |
|                                  | 30-34 |                            | 37  |            | 64  |                            | 178   |
|                                  | 35-39 |                            | 34  |            | 24  |                            | 178   |
|                                  | 40-44 |                            | 7   |            | 27  |                            | 158   |
|                                  | 45-49 |                            | 11  |            | 9   |                            | 131   |
|                                  | 50-54 |                            | 7   |            | 4   |                            | 127   |
|                                  | 55-59 | <b>140</b>                 | 1   | <b>190</b> | 5   |                            | 80    |
|                                  | 60-64 | <b>18%</b>                 | 1   | <b>35%</b> | 0   |                            | 109   |
|                                  | 65-69 |                            | 2   |            | 0   |                            | 54    |
|                                  | 70-74 |                            | 0   |            | 0   |                            | 62    |
|                                  | 75-79 |                            | 0   |            | 3   |                            | 30    |
|                                  | 80-84 |                            | 0   |            | 0   |                            | 20    |
|                                  | 85-89 |                            | 0   |            | 0   |                            | 2     |
|                                  | 90-94 |                            | 0   |            | 0   |                            | 3     |
| 95-100                           |       | 0                          |     | 0          | 2   |                            |       |
| Total:                           |       |                            | 791 |            | 537 |                            | 1,711 |

Counts of people are in units of 10,000.

**Figure 24: An example net-benefit matrix reflecting common values**

|                            |                  | <u>Targeting segment</u> |             |                 |
|----------------------------|------------------|--------------------------|-------------|-----------------|
|                            |                  | <u>Very Poor</u>         | <u>Poor</u> | <u>Non-poor</u> |
| <u>True poverty status</u> | <u>Very Poor</u> | +3                       | -2          | -6              |
|                            | <u>Poor</u>      | -1                       | +2          | -2              |
|                            | <u>Non-poor</u>  | -2                       | -1          | +1              |

Note: This is an example. Each program should define its own net-benefit matrix.

**Figure 25: Computation of total net benefit for a cut-off pair of 10–14 and 20–24**

| Cell |                 |              | Persons | Net benefit/person | Net benefit |
|------|-----------------|--------------|---------|--------------------|-------------|
| A.   | Truly very poor | as very poor | 472     | +3                 | +1,416      |
| B.   | Truly very poor | as poor      | 178     | -2                 | -356        |
| C.   | Truly very poor | as non-poor  | 140     | -6                 | -840        |
| D.   | Truly poor      | as very poor | 215     | -1                 | -215        |
| E.   | Truly poor      | as poor      | 133     | +2                 | +266        |
| F.   | Truly poor      | as non-poor  | 190     | -2                 | -380        |
| G.   | Truly non-poor  | as very poor | 212     | -2                 | -424        |
| H.   | Truly non-poor  | as poor      | 191     | -1                 | -191        |
| I.   | Truly non-poor  | as non-poor  | 1,308   | +1                 | +1,308      |
|      |                 |              |         | Total net benefit: | +584        |

Note: Persons are counted in units of 10,000.